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EUROSYSTEM

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Foreword



The euro area economy has proved resilient so far this year, in the face of energy supply disruptions, trade frictions and extreme weather events. This resilience in part reflects drawdowns of petroleum reserves, which have kept energy markets more stable than they would otherwise have been, and optimism about the productivity-enhancing potential of artificial intelligence (AI), which has, despite recent volatility, supported financial market sentiment, investment and global growth.

AI promises not only to drive up long-term economic growth, however; it also raises risks. Operational risk for private firms and public authorities, for instance, is amplified by rising cyber threats and heavy reliance on a small cluster of third-party providers. While the technology may deliver large productivity gains, current valuations depend on very ambitious earnings expectations for AI-related firms. In parallel, those firms are continuing to increase the volume of debt on their balance sheets, while circular financing is making intrinsic demand hard to gauge.

Sovereign vulnerabilities are also building up, and debt levels are high in many advanced economies, including some euro area countries. At the same time, sovereign funding costs have risen. Fiscal consolidation is overdue and increasingly important in an environment where the presence of news-sensitive, leveraged investors in sovereign bond markets is growing.

Rising exposures to AI and sovereign debt warrant attention, with vulnerabilities being more pronounced in some segments of the non-bank financial sector. Even if banks are not exposed to a potential correction in AI-related assets in material terms, they could face spillovers via strong links with non-banks. Moreover, a prospective deterioration in macro-financial conditions due to the energy supply disruptions could lead to rising credit risk. Banks have weathered past shocks well overall, thanks in part to the regulatory reforms introduced since the global financial crisis. They remain strongly positioned to absorb shocks, with resilience underpinned by ample liquidity buffers, sizeable capital headroom and robust profitability.

This edition of the ECB's Financial Stability Review also includes three special features. The first of these discusses the financial stability implications of AI adoption in the financial industry and the real economy. The second explores the complex interplay between AI and cybersecurity, while the third assesses the financial stability implications of large initial public offerings.

The Financial Stability Review is prepared with the involvement of the ESCB Financial Stability Committee, which assists the decision-making bodies of the ECB in the fulfilment of their tasks. It is intended to foster awareness of systemic risks among policymakers, the financial industry and the public at large, with the ultimate goal of promoting financial stability.

Boris Vujčić
Vice-President of the European Central Bank

Overview

Risks from AI valuations, fiscal imbalances and geoeconomic tensions cloud the financial stability outlook

1 Valuations rely on ambitious earnings expectations for AI firms, leaving markets exposed to the risk of an abrupt repricing in a highly uncertain geoeconomic environment with rising AI-powered cyber threats



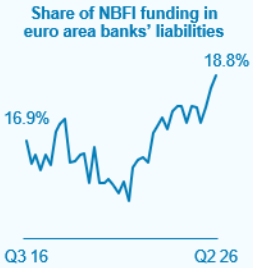
- Vulnerabilities are building as the scale of AI infrastructure spending outpaces what firms can fund from internal sources.
- A large portion of the funding gap is being closed in debt markets, with a growing share of issuance in euro increasing euro area investors' direct exposure.
- A possible further reassessment of the AI narrative and associated earnings expectations poses the risk of a sharp shift in market sentiment.
- Ambitious earnings expectations and extreme market concentration in US technology and AI-related firms heighten the risk of abrupt market repricing.
- AI expands the scope and speed of cyberattacks in an uncertain geoeconomic landscape, with concentrated third-party reliance posing potential systemic risks.

2 A challenging fiscal outlook in some major advanced economies could test investor confidence and lead to a further repricing of sovereign risk



- Fiscal imbalances in major advanced economies could lead to a global repricing of sovereign risk.
- Higher issuance needs and rising funding costs could further strain sovereigns with structurally high debt and deficits.
- Fiscal capacity to cushion the impact of the Middle East war on households and firms might be limited by stretched public finances in some countries.
- Cyclical headwinds, together with the risk of fiscal slippage and structural challenges such as ageing, may complicate the path towards fiscal consolidation.
- The growing presence of more procyclical investors such as hedge funds, along with the broader use of leveraged trading strategies, could amplify risks.

3 Uncertainties from AI, geopolitics and sovereigns expose banks and non-banks to market, credit and funding risks which could be amplified by interconnection across sectors



- Escalating geoeconomic tensions could affect growth, inflation and interest rates, increasing credit risk for exposures to trade- and energy-sensitive industries.
- A market repricing as result of a shift in the AI narrative or a further rise in sovereign yields may trigger sudden valuation losses on bank and non-bank portfolios.
- Structural liquidity and leverage fragilities in some non-bank entities, and bank exposures to leveraged non-banks, may exacerbate the risk of financial contagion.
- Strong linkages could cause any stress in the NBFI sector to spill over to euro area banks, especially via funding.
- The ability of banks to absorb future shocks is supported by robust earnings momentum coupled with ample capital and liquidity buffers.

Other cross-cutting and structural risks

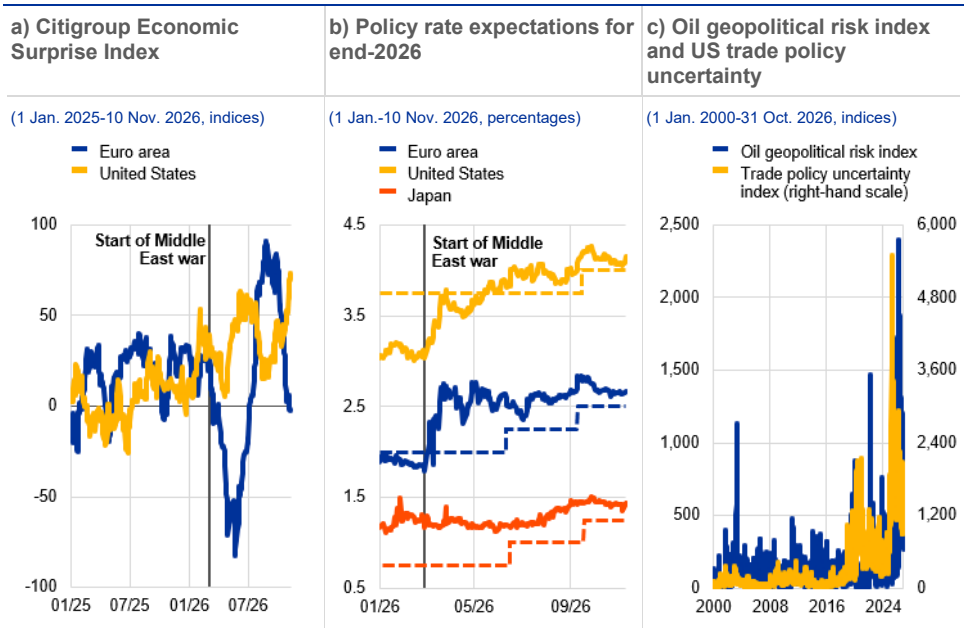
- Climate- and nature-related risks along the way to a low-carbon economy, including the more frequent materialisation of physical risks
- Risks stemming from global regulatory fragmentation and deregulation
- Risks associated with ageing populations

The financial stability outlook is clouded by risks from AI valuations, fiscal imbalances and geoeconomic tensions

The euro area economy has proved robust to recent shocks, but prolonged geoeconomic headwinds could yet test this resilience. The euro area economy has demonstrated remarkable resilience in the face of multiple challenges, including an energy shock, trade frictions and extreme climate-related events, with incoming economic data consistently exceeding market expectations between July and October this year (**Chart 1**, panel a). At the same time, rising energy prices have fuelled higher inflation. In response, major central banks worldwide have been tightening their monetary policy stances, with market participants expecting further interest rate hikes ahead (**Chart 1**, panel b). Higher inflation in combination with growing fiscal concerns has also translated into a considerable rise in long-term bond yields. Looking ahead, the resilience of the euro area economy to shocks could yet be tested as the factors cushioning the impact of energy supply disruptions, including the ability to draw on strategic oil reserves, fade, while trade policy uncertainty lingers at elevated levels despite coming down from earlier peaks (**Chart 1**, panel c). Any associated supply chain disruptions could pose upside risks to inflation and downside risks to economic growth, while they could also increase market volatility and challenge debt servicing capacity as financing costs rise.

Chart 1

The euro area economy has shown resilience to recent shocks, but tighter financial conditions and continued geoeconomic uncertainty are weighing on the outlook



Sources: Bloomberg Finance L.P., Iacoviello and Tong*, Baker, Bloom and Davis** and ECB calculations.
Notes: Panel a: the Citigroup Economic Surprise Index measures the extent to which economic data releases exceed or fall short of market expectations. Values above (below) zero represent positive (negative) economic surprises in sum. Panel b: dashed lines represent actual policy rates. Panel c: the oil geopolitical risk index is a sub-index of the AI-GPR Index, identifying articles that discuss oil or energy supply disruptions driven by geopolitical events. Indices are shown as seven-day moving averages.
*) Iacoviello, M. and Tong, J., "The AI-GPR Index: Measuring Geopolitical Risk using Artificial Intelligence", *EmergingTech Economic Research Network (EERN) Research & Insights*, Federal Reserve Research: Board of Governors, March 2026.
**) Baker, S., Bloom, N. and Davis, S., "Measuring Economic Policy Uncertainty", The Quarterly Journal of Economics, Vol. 131, No 4, November 2016, pp. 1593-1636.

The financial stability outlook is also being shaped by an optimistic narrative surrounding artificial intelligence (AI) that is partly offsetting the adverse impact of the energy shock. In fact, optimism over AI's potential to boost productivity has bolstered both financial market sentiment and economic growth (see **Section 1.1**). Such a transformative and general-purpose technological change does, however, also introduce potential systemic risks for financial stability. Markets remain vulnerable to broader sentiment shifts should news on the rate and form of AI adoption disappoint. Such disappointment could have adverse implications for corporate earnings expectations, with risks of spillovers across asset classes and geographies. Furthermore, AI financing remains opaque due to interlinked ownership structures and mutual purchasing and finance commitments inflating future revenues and heightening spillover risks from circular financing. At the same time, improved model capabilities have increased cyber risks and operational vulnerabilities more generally. These include those relating to the widespread reliance of financial and non-financial firms on a highly concentrated cluster of third-party providers (see **Special Feature B**).

In this context, three closely linked sources of risk and vulnerabilities for euro area financial stability stand out. First, financial market pricing rests on expectations of extraordinary earnings growth for AI firms, while the outlook for these firms and the global economy remains surrounded by significant risks. This leaves markets exposed to the possibility of an abrupt repricing which might be amplified by a highly uncertain geopolitical environment where AI-powered cyber threats are rising. Second, a challenging fiscal outlook in some major advanced economies could test investor confidence and lead to a further repricing of sovereign risk. Third, risks stemming from AI, geopolitics and sovereigns are exposing banks and non-banks alike to market, credit and funding risks which could be amplified by interconnection across sectors. In the current highly uncertain geoeconomic setting, the potential for these risks to materialise simultaneously, possibly amplifying each other further, increases the risks to financial stability.

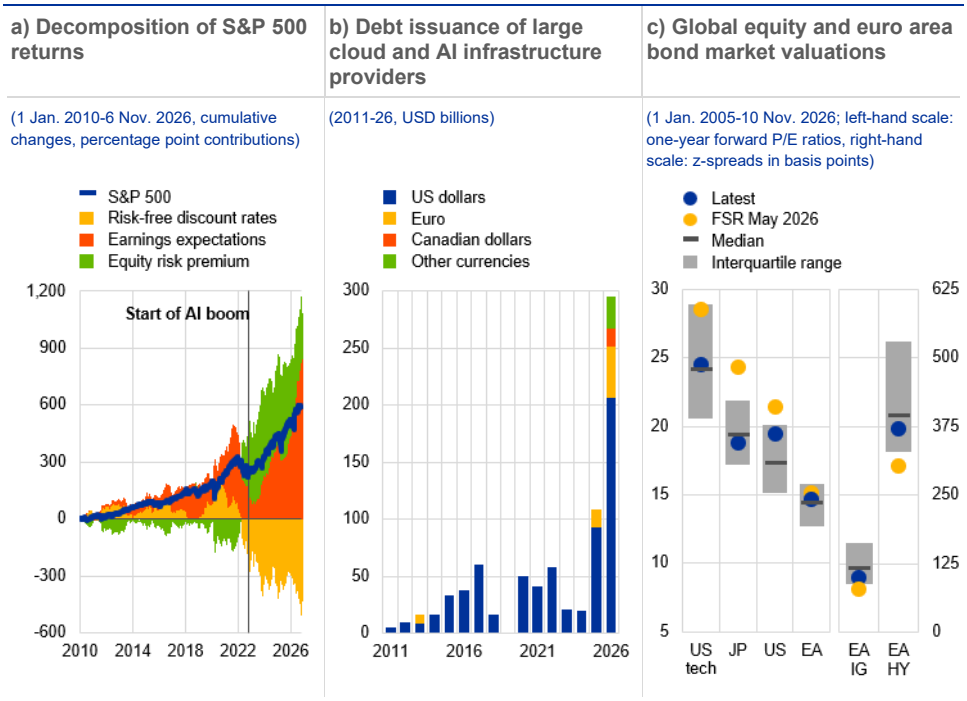
A shift in the AI narrative could trigger an abrupt market repricing in a highly uncertain geopolitical environment

AI remains the central theme shaping global equity markets. Despite some volatility over recent months, equity markets have posted strong gains in the year to date. These gains were based on market optimism about the profitability of AI-linked firms, despite growing calls for slowing AI development and tighter regulation to address rising cybersecurity concerns posed by frontier models (see **Special Feature B**). That said, investor focus has become more selective in the AI space, with a stronger distinction between firms producing hardware, model developers and hyperscalers and growing signs of a broader risk reversal for AI valuations (see **Chapter 2**). Equity market developments are increasingly driven by extraordinarily strong earnings expectations (**Chart 2**, panel a). While major US tech firms have largely met these expectations in the recent past, equity prices depend largely on their ability to keep doing so going forward. There are concerns that these

expectations may be exaggerated due to different forms of interlinkages – including ownership structures and circular financing – between AI-related firms (see **Box 3**). While the technology may turn out to be just as transformative as expected, it is also possible that cheaper, open-weight AI models will gain traction, jeopardising the profit trajectory for firms which are currently at the frontier. The AI investment boom is being funded in part by equity issuance, driving a significant surge of IPO volumes. This jump in issuance is now on track to surpass the dotcom bubble peak as a share of US GDP. Historically, such trends have often coincided with market peaks, signalling late-cycle exuberance (see **Special Feature C**).

Chart 2

Optimistic AI narratives have fuelled equity markets in recent years, but growing reliance on debt for infrastructure buildout raises the risk of repricing in both markets



Sources: LSEG, Bloomberg Finance L.P. and ECB calculations.
Notes: Panel a: the decomposition is based on a dividend discount model. The model includes share buybacks, discounts future cash flows with interest rates of appropriate maturity and covers three expected dividend growth horizons. The residual from decomposing the returns into earnings expectations and discount factors, shown in green, can be interpreted as the contribution from the equity risk premium. A higher contribution means a lower equity risk premium. Positive contributions can be interpreted as risk-on sentiment, supporting equity prices beyond the contributions from earnings expectations and discount rates. "Start of AI boom" refers to end-October 2022. Panel b: data as at 10 November 2026. Debt issuance by Microsoft Corp., Meta Platforms Inc., Alphabet Inc., Amazon.com Inc. and Oracle Corp. Other currencies include the Swiss franc, pound sterling, Japanese yen and Australian dollar. Panel c: for equities (bonds), the boxplot shows the interquartile range of one-year forward price/earnings ratios (the latest z-spread) relative to the distribution since 2005. The previous edition of the ECB's Financial Stability Review was published on 27 May 2026. JP stands for Japan; EA stands for euro area; IG stands for investment grade; HY stands for high yield.

Very large volumes of AI-related debt are being issued in global bond markets despite rising long-term yields. Much of the internal funding gap faced by AI firms is now increasingly being met in debt markets, with issuance for AI infrastructure buildout hitting new record highs this year (**Chart 2**, panel b). Further issuance is expected to be needed in the future to accommodate the cumulative capital expenditure of US big tech firms, projected to total USD 5.5 trillion by 2030. A significant share of recent AI-related issuance has been raised in euro, and euro area investors have increased their direct exposure (see **Box 4**). The scale and maturity profile of this debt has been raising concerns that it could drive long-term

yields further upwards, potentially crowding out other corporate and sovereign borrowers, although evidence of such effects remains limited to date. Already, inflationary pressures stemming from the energy shock triggered by the conflict in the Middle East and fiscal expansion in major advanced economies have pushed yields higher globally in recent months, driven by higher real rates and term premia (see **Section 2.2**). Higher yields can pose risks to asset valuations by raising the rate at which future cash flows are discounted, weighing most on AI-related equities where earnings only start to be reaped further into the future. Additionally, as investment is increasingly debt-financed, higher yields raise debt service costs, particularly for more leveraged segments of the AI ecosystem that rely on floating-rate or private credit financing.

The AI narrative is vulnerable to geopolitical and macroeconomic risks which could trigger an abrupt repricing in both bond and equity markets. Equity valuation measures, notably of US tech firms, have moderated considerably on the basis of ambitious earnings expectations (**Chart 2**, panel c). At the same time, euro area corporate bond spreads have recently widened (see **Box 2**), as issuers increasingly compete for investor demand and refinancing at lower rates is no longer available. These vulnerabilities are interlinked and could be exposed by a range of triggers. A re-escalation of trade tensions or sharply deteriorating energy market outlooks would push up yields and inflation, weighing on both AI valuations and the cost of financing. The resultant repricing risks triggering abrupt sentiment shifts, with spillovers across asset classes and regions. A sell-off in financial markets triggered by a stagflationary shock would likely be broad based, as stock-bond correlations tend to turn positive under such conditions, which can amplify losses in diversified portfolios, even if sovereign bonds still serve a hedging role in risk-off episodes driven by other types of shock (see **Chapter 2**). Furthermore, growing market concentration among AI-related firms and sectors leaves not only global equity markets but also bond and private markets sensitive to shocks emanating from individual firms. A sustained rise in energy prices might also weigh on the optimistic AI narrative, as AI infrastructure and data centres are highly energy-intensive and sensitive to energy cost shocks.

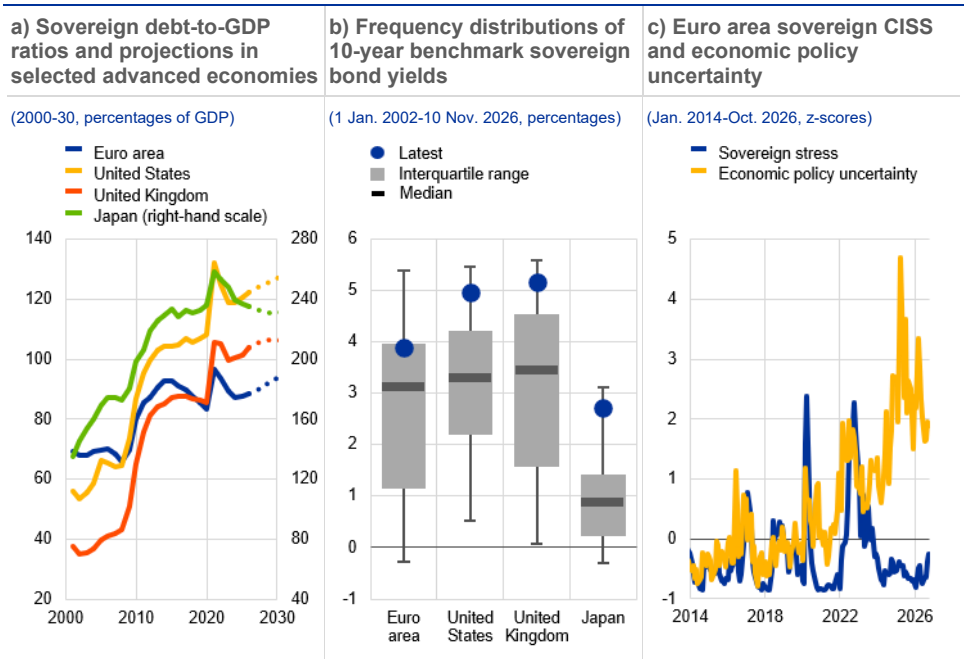
A challenging fiscal outlook could test investor confidence and lead to a repricing of sovereign risk

Rising concerns about the sustainability of sovereign debt in major advanced economies are among the factors driving up long-term yields and increase the risk of global spillovers. Sovereign debt levels are elevated in several euro area countries and many major advanced economies. They are projected to rise further in the coming years, nearing the peaks observed during the pandemic (**Chart 3**, panel a). Signs of investor unease have already emerged in some advanced economy sovereign bond markets. Longer-maturity sovereign yields have risen sharply, driven by expectations of higher financing needs, higher term premia and renewed inflation concerns, reaching their highest levels in over two decades in several places (**Chart 3**, panel b). While markets have continued to function in an

orderly manner, strains have prompted official action, including a US Treasury decision to increase buybacks of longer-dated bonds, although these only had short-lived impacts. Higher interest payments and structural headwinds to potential growth from weak productivity could further strain fiscal positions and rekindle market concerns about sovereign debt sustainability in highly indebted euro area countries. Stress in global benchmark bond markets or a highly indebted euro area country could prompt a broader reassessment of sovereign risk in the euro area as well. At the same time, and taking a longer-term perspective, market discipline can help contain vulnerabilities by providing price signals which encourage prudent fiscal policies and timely corrective policy adjustment.

Chart 3

Elevated funding needs, rising borrowing costs and fiscal slippage risks could strain already vulnerable governments and spark sovereign risk repricing



Sources: IMF, LSEG, Garcia-de-Andoain and Kremer*, Baker, Bloom and Davis** and ECB calculations.
Notes: Panel b: latest refers to the average over the latest five business days. "Euro area" shows the GDP-weighted average of individual euro area countries' yields. Panel c: both indices are computed as a GDP-weighted average for Germany, Spain, France and Italy. The sovereign Composite Indicator of Systemic Stress (CISS) combines data from the short end and the long end of the yield curve (two-year and ten-year bonds) for each country, i.e. two spreads between the sovereign yield and the euro swap interest rate, two realised yield volatilities and two bid-ask bond price spreads. The aggregation into country-specific sovereign CISS is based on time-varying cross-correlations between all homogenised individual stress indicators pertaining to each sovereign CISS variant following the CISS methodology developed by Holló et al.*** Z-scores are calculated from January 2000 onwards, Q2 2026 GDP data are used as a proxy for July to October 2026.
*) Garcia-de-Andoain, C. and Kremer, M., "Beyond spreads: measuring sovereign market stress in the euro area", *Working Paper Series*, No 2185, ECB, October 2018.
**) Baker, S.R., Bloom, N. and Davis, S.J., "Measuring Economic Policy Uncertainty", *The Quarterly Journal of Economics*, Vol. 131, Issue 4, November 2016, pp. 1593-1636.
***) Holló, D., Kremer, M. and Lo Duca, M., "CISS – a composite indicator of systemic stress in the financial system", *Working Paper Series*, No 1426, ECB, March 2012.

Sovereign risks could emerge from higher issuance needs and shifts in the investor base. High defence spending and major infrastructure investment plans in some large euro area countries, notably including Germany, have driven sovereign issuance in 2026 to its highest levels since the pandemic (see **Section 1.2**). With the Eurosystem reducing its presence in euro area bond markets and a risk of future crowding-out effects from rising corporate bond supply by AI firms, the ability of the investor base to absorb this additional supply will be key for ensuring the orderly

functioning of sovereign bond markets. Meanwhile, significant shifts in the investor base are under way, with foreign investors playing a growing role (see **Section 1.2**). Historical patterns suggest, however, that foreign investors tend to be flightier during periods of stress. Additionally, while supporting sovereign debt absorption and market liquidity in tranquil periods, the growing presence of more procyclical and often highly leveraged investors, such as hedge funds, in euro area sovereign bond markets may also amplify any sudden repricing of sovereign risk (see **Box 7**). Institutional investors' demand for longer-dated debt is changing too, including in the context of the recent reform of the Dutch pension system or more recently due to the increased home bias of Japanese investors as rising yields make their domestic assets more attractive. Together with rising yields at the long or ultra-long end of the maturity spectrum, this shift in investor demand makes issuance of shorter-dated debt more attractive for sovereigns while simultaneously increasing rollover risk.

Heightened policy and geopolitical uncertainty, alongside longer-term structural challenges, could exacerbate sovereign vulnerabilities. Fiscal fundamentals remain susceptible to slippage with upcoming elections in major euro area countries later in 2026 and 2027 (**Chart 3**, panel c). Fiscal consolidation is overdue and increasingly important in an environment of growing presence of news-sensitive, leveraged investors in sovereign bond markets. Also, high energy prices in the context of heightened geopolitical tensions could amplify demands for fiscal support measures to cushion the impact on vulnerable households and firms. More severe and prolonged energy supply disruptions and weaker growth prospects could trigger a reassessment of sovereign risk by market participants. This could further constrain fiscal space, limiting governments' ability to shield the economy from future shocks and to address structural challenges from digitalisation, low productivity, population ageing and climate change.

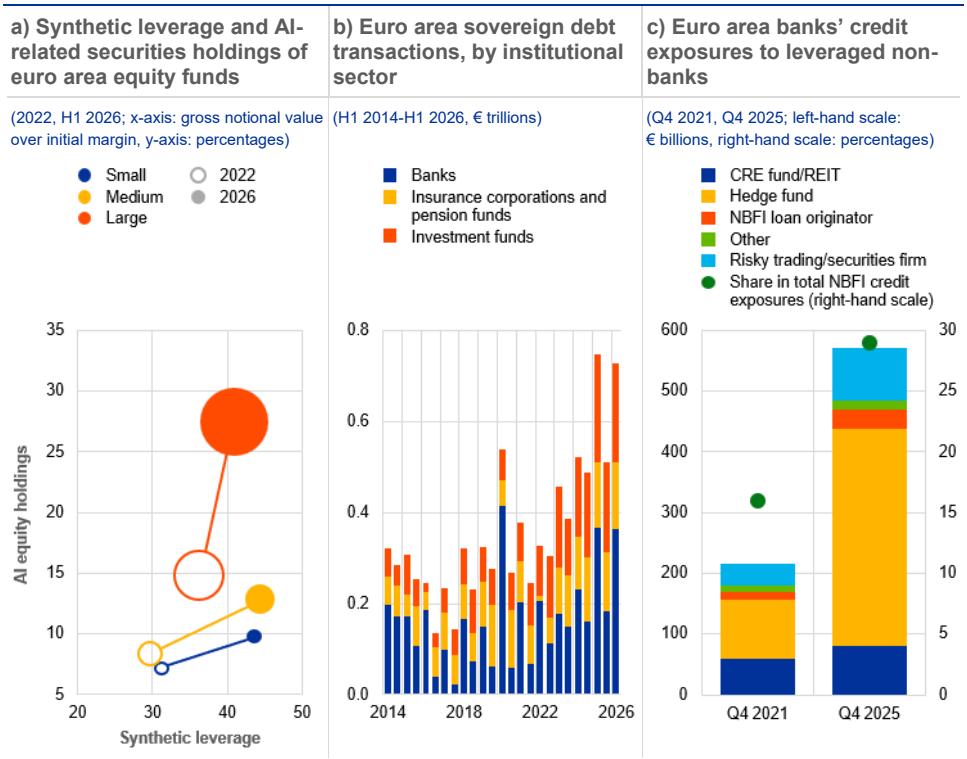
Uncertainties from AI, geopolitics and sovereigns expose banks and non-banks to market, credit and funding risks

The AI exposure of euro area banks and non-banks has increased, with non-bank vulnerabilities amplified by the interplay of rising portfolio concentration and leverage. Euro area non-banks have increased their exposures to AI significantly in recent years. This trend has started to extend beyond equities, with non-banks also purchasing debt issued by AI firms (see **Section 4.1**). A repricing in markets due to a possible reassessment of the AI narrative may trigger sudden valuation losses and spikes in investment fund share redemptions, increasing the risk of forced asset sales. High exposure concentration can be of particular concern when it meets growing leverage, as shown by the near collapse of Situational Awareness, a US hedge fund, in July 2026. Larger euro area equity funds have a higher share of their portfolios allocated to AI-related firms and are also increasingly exposed to risks from synthetic leverage in equity derivatives (**Chart 4**, panel a). AI exposures also remain heavily skewed towards US dollar-denominated assets, making the sector susceptible to valuation losses from any depreciation of that currency. Total direct AI-related lending by euro area banks has risen in recent years

too but, it remains rather limited. However, there are signs of deteriorating credit quality in exposures to software firms and semiconductor producers (see **Section 3.3**). In the medium term, the indirect effects of an AI-driven transformation in the real economy may pose greater challenges for euro area banks, particularly those with significant exposures to firms whose financial performance or competitive position could weaken as AI adoption spreads (see **Special Feature A**), possibly increasing corporate default risk. In the medium to longer term, the increased use of agentic AI tools may also challenge the funding structure of banks by reducing the stickiness of deposits.

Chart 4

Growing AI and sovereign exposures could pose risks, especially when paired with leverage, with cross-sectoral spillover potential given rising bank-non-bank linkages



Sources: ECB (EMIR, SHS, AnaCredit, RIAD), LSEG Lipper and ECB calculations.
Notes: Panel a: synthetic leverage is measured as the gross notional value of equity derivative positions divided by initial margin for each tercile, weighted by the group's assets under management. The vertical axis shows holdings of securities issued by firms involved in AI model development, chip production, cloud provision, data centres and related infrastructure, or utilities. Bubble size indicates the absolute gross notional amount of equity derivatives for each group. Panel b: transactions are defined as the sum of purchases minus sales of euro area sovereign debt securities, recorded at transaction value in euro including accrued interest. ICPFs stands for insurance corporations and pension funds. Panel c: intragroup exposures are excluded from leveraged NBFI exposures. CRE stands for commercial real estate; REIT stands for real estate investment trust.

Sovereign exposures of banks and certain non-banks have increased, exposing them to valuation losses from rising interest rates. In fact, non-banks have continued to be strong absorbers of new sovereign debt issuances (**Chart 4**, panel b). They have focused primarily on the short end of the yield curve while showing less appetite for longer maturities, given expectations of rising interest rates and fiscal concerns. Additionally, global hedge funds are highly active in European sovereign bond markets, using euro area sovereign bonds as collateral in repo markets and other leveraged trading strategies (see **Box 7**). They could amplify price swings in times of sudden and substantial bond price movements, increasing the

likelihood of sharp non-linear yield spikes. Banks' sovereign exposures have also increased in recent years, driven by a shift in the composition of their liquidity buffers (see **Section 3.2**). Rising sovereign exposures coupled with shifts in sovereign risk perceptions have reignited market concerns about the re-emergence of the sovereign-bank nexus. Much of this increase in sovereign holdings has, however, been driven by investments in non-domestic government bonds, which has reduced home bias. While this diversification somewhat mitigates concerns about the sovereign-bank nexus, higher sovereign exposures also expose euro area banks to valuation losses on their sovereign portfolios subject to mark-to-market accounting in the context of rising sovereign yields.

Banks and non-banks may see their credit risks increase if macro-financial conditions deteriorate markedly as a result of the Middle East war. The quality of euro area bank assets has remained sound, with the aggregate non-performing loan ratio touching a record low of 2.2% in September 2026, albeit with some variation at country and sector levels (see **Section 3.3**). Asset quality risks could increase as the full impact of the oil supply shock unfolds, however, especially for euro area firms operating in sectors that are concurrently energy, interest rate and trade sensitive (see **Section 1.3**). Moreover, cost pressures from rising energy prices and higher interest rates may be compounded by continued tariff-related uncertainty and the risk of broader supply chain disruptions. The resilience of euro area households could also be tested if stress in vulnerable parts of the corporate sector drives up unemployment. Also, cost-of-living pressures from higher energy prices and inflation may weaken households' debt servicing capacity, especially among lower-income groups. Banks could face higher provisioning costs as a result. Increasing credit risk as a result of a weaker economic outlook and renewed energy price pressures may also weigh on valuations in non-bank portfolios. Non-banks' holdings of highly valued equities and long-duration bonds are particularly vulnerable to rising interest rates and risk premia, and could suffer simultaneous losses.

Rising bank-non-bank interlinkages could facilitate cross-sectoral spillovers if market conditions turn volatile. The importance of non-bank funding for banks has continued to grow, exposing banks to rollover and redemption risks. These risks are especially pronounced for global systemically important banks which have substantial short-term liabilities towards non-banks. A growing share of these liabilities stems from cross-border activities, rendering banks more vulnerable to sudden funding withdrawals triggered by shocks affecting non-banks domiciled abroad. On the assets side, euro area banks' credit exposures to non-banks have also risen markedly, driven primarily by lending to investment funds in general and hedge funds in particular (**Chart 4**, panel c). Asset-price and liquidity shocks affecting non-banks may lead them to reduce funding to banks. At the same time, banks may curtail lending to such entities under stressed market conditions, forcing them to liquidate trading positions and amplifying volatile market movements.

Banks are well positioned to absorb potential adverse shocks, supported by strong profitability coupled with ample capital and liquidity buffers. Banks' return on equity has reached its highest level in a decade, with a positive earnings outlook in the context of rising interest rates also translating into higher bank

valuations (see **Section 3.1**). Bank resilience has also been underpinned by capital and liquidity ratios that are well above regulatory requirements, also thanks to the regulatory reforms implemented since the global financial crisis. Preserving bank resilience remains a key priority for macroprudential policy in the context of elevated geopolitical and trade policy uncertainty. Releasable capital buffers should be kept to ensure that relevant authorities are able to respond to severe shocks or bank capital constraints. Furthermore, existing borrower-based measures should be maintained to uphold lending standards and mitigate the build-up of vulnerabilities among borrowers (see **Section 3.5**). Completing the banking union and reducing the complexities of the existing regulatory and supervisory framework, without compromising bank resilience, will be key to enhancing the competitiveness of EU banks.

Persistent liquidity and leverage vulnerabilities in parts of the NBFI sector require a macroprudential policy response to safeguard market liquidity during periods of stress. Previous stress episodes, such as the March 2020 market turmoil or the liquidity stress in the UK gilt market in September 2022, have shown how NBFI vulnerabilities can be amplified if the NBFI sector holds similar concentrated positions and draws on the same sources of liquidity. This underscores the importance of appropriately calibrated measures to address vulnerabilities related to leverage, liquidity mismatches and margin preparedness as well as risks arising from crowded trades and concentrated positions. Progress will also depend on improving data availability and cross-border information sharing, which are essential for assessing sources of systemic risk arising from cross-border hedge funds in European sovereign bond markets. Also, accelerating progress on the EU's savings and investments union – by deepening equity markets, mobilising savings, reducing insolvency and tax barriers to cross-border investment as well as strengthening integrated supervision – will be essential to support EU-wide growth and competitiveness while safeguarding financial stability.

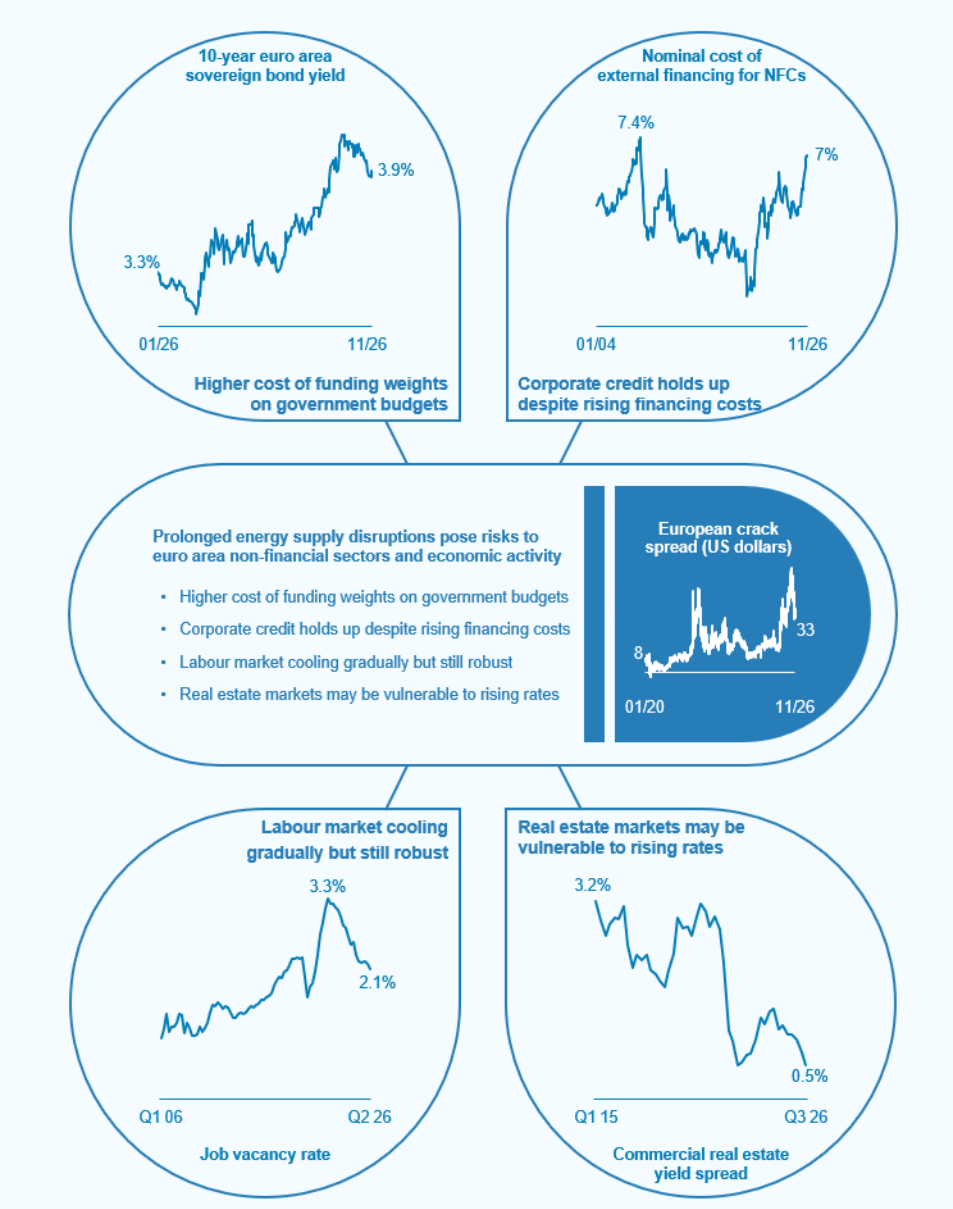
Financial stability vulnerabilities remain high, with risks from AI valuations, sovereigns and geopolitics looming

All in all, risks from AI valuations, sovereigns and geoeconomic tensions and are weighing on the outlook for euro area financial stability. The AI investment boom raises concerns around earnings expectations which might be disappointed, high market concentration, late-cycle exuberance reminiscent of past investment booms and growing cyber vulnerabilities in a fragile geopolitical landscape. AI-related debt issuance has surged, potentially contributing to rising global bond yields, which could crowd out other borrowers. Meanwhile, sovereign risks are growing as elevated debt levels, high issuance needs and rising yields challenge fiscal sustainability, putting global sovereign bond markets under pressure. Banks and non-banks alike have increased their AI and sovereign exposures, with risks of valuation losses being compounded by rising leverage and interlinkages across sectors. These vulnerabilities are strongly connected and at risk of materialising simultaneously. More generally, vulnerability constellations appear to be more

elevated for certain non-banks than they are for banks due to greater risk exposures and a less developed prudential framework for building resilience against shocks.

In addition, several cross-cutting structural challenges remain critical for financial stability, with the potential to amplify existing cyclical vulnerabilities. These include rising vulnerabilities associated with climate change and nature degradation, notably the materialisation of physical risks as evidenced by a series of extreme weather events this summer like wildfires, heatwaves and droughts. While these events likely had only a limited and temporary negative impact on overall economic activity in the euro area, the increasing frequency of physical climate risks is a growing concern. Additionally, further concerns include the risk that global regulatory fragmentation and deregulation could erode the achievements of the regulatory reforms since the global financial crisis, as well as challenges linked to ageing populations. The potential for cyclical and structural vulnerabilities to crystalise simultaneously and amplify each other heightens the materiality of risks to euro area financial stability.

1 Macro-financial and credit environment



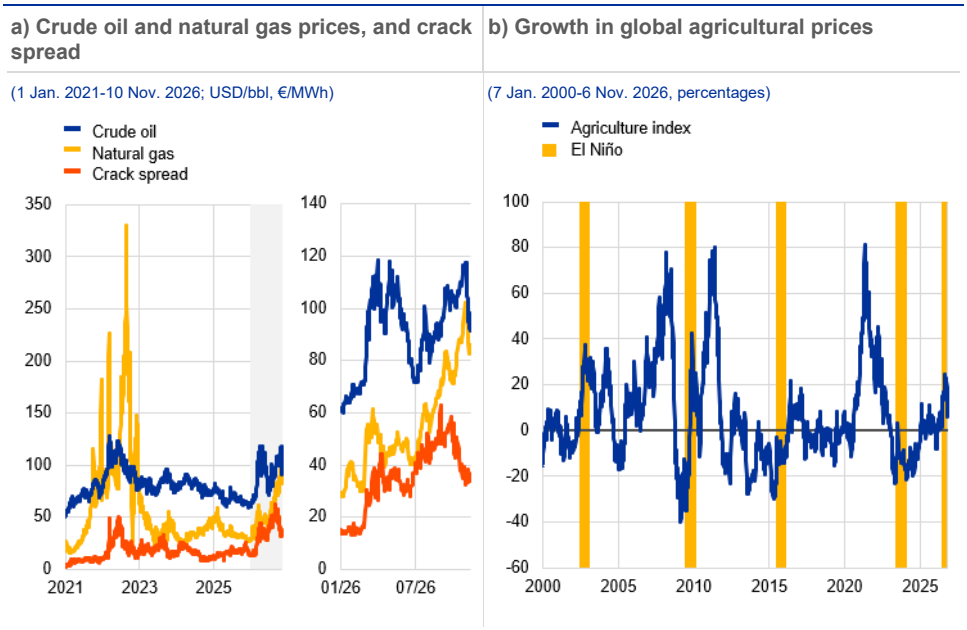
1.1 Euro area economy balances resilience and headwinds

A fragile geoeconomic environment is posing headwinds for the euro area economy, with disruptions to energy supplies especially concerning. A re-escalation of the conflict in the Middle East – after it had shown some signs of easing during the summer of 2026 – and the ongoing war between Russia and Ukraine are weighing on global energy markets. Supply disruptions have pushed up the prices of crude oil and natural gas. This is hitting Europe at a sensitive moment, as gas storage levels are historically low ahead of the winter, and European buyers need to

compete with Asia for deliveries of liquefied natural gas. Crude oil inventories have also declined. The impact of both conflicts on global refining capacity has resulted in a significant increase in the crack spread, which measures the differences between crude oil prices and wholesale petroleum product prices (**Chart 1.1**, panel a). In addition, climate change-related extreme weather events, such as the heatwaves and wildfires experienced in Europe over the summer, have dampened economic activity, with low water levels in key waterways disrupting shipping, among other things. Smaller crop yields have also resulted in higher food prices. Together with the El Niño weather phenomenon, which usually causes global agricultural goods prices to rise over the following 12 months, this could extend price pressures into 2027 (**Chart 1.1**, panel b).

Chart 1.1

Geopolitical conflicts and extreme weather events are driving energy and food price surges, adding to inflationary pressures and dragging on euro area economic activity



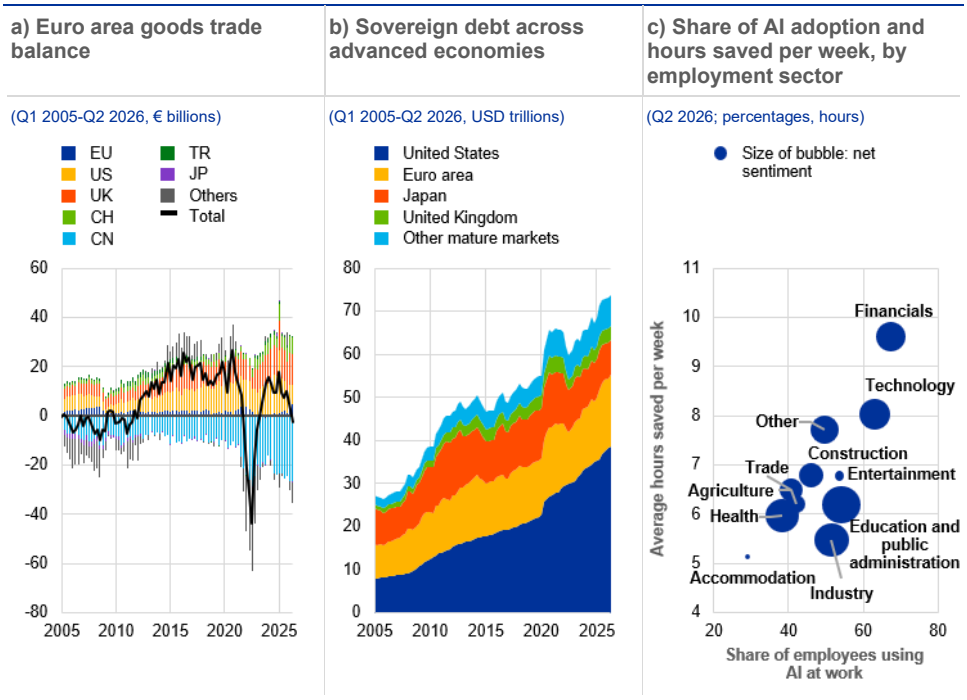
Sources: Bloomberg Finance L.P. and ECB calculations.
Notes: Panel a: the crack spread shown is the 3-2-1 spread based on European benchmarks. It assumes that three barrels of Brent crude oil are refined into two barrels of Eurobob gasoline and one barrel of gasoil/heating oil. Natural gas prices show the Dutch TTF natural gas forward day ahead. Crude oil prices and the crack spread are measured in US dollars per barrel, whereas natural gas prices are measured in euro per MWh. Panel b: the chart shows year-on-year growth rates in the Bloomberg Agriculture Spot Index, which measures the price movements of agricultural commodities included in the Bloomberg Commodity Index.

Investment in artificial intelligence (AI) infrastructure is supporting global growth, but trade frictions are persisting and debt sustainability concerns are on the rise. The buildout of AI infrastructure has become a key driver behind global growth and is acting as a counterweight to the adverse impact of energy supply disruptions. In particular, demand for AI-related technology products is bolstering global commerce. Nevertheless, euro area businesses continue to face challenges. First, tariff barriers have hampered trade in goods with the United States. Second, continued weak domestic demand in China is pushing Chinese products into euro area markets while constraining imports from the euro area (**Chart 1.2**, panel a). Third, the combination of mounting sovereign debt and persistent fiscal deficits across major advanced economies has heightened investor concerns over the long-

term sustainability of global sovereign debt (**Chart 1.2**, panel b). Among other factors, this has led to substantial increases in long-term sovereign bond yields (see **Chapter 2**). If sustained, these issues could spill over into broader financing conditions for the real economy, with dampening effects on investment and activity.

Chart 1.2

AI investment is boosting global growth but trade frictions and debt sustainability concerns are weighing on the euro area outlook



Sources: Eurostat, ECB (CES), IIF and ECB calculations.
Notes: Panel a: the chart uses data from external trade in goods statistics, which are based on customs and Intrastat data, and differ conceptually from balance of payments statistics. "Others" refers to the difference between countries shown in the chart and the total external euro area goods trade balance. Panel c: based on responses to the annual labour market module of the ECB's Consumer Expectations Survey. Net sentiment measures the difference between positive and negative views. Larger bubbles indicate a more positive net sentiment.

The euro area economy has proven robust to shocks, but prolonged headwinds could yet test this resilience. Despite the challenges posed by energy price shocks, trade frictions and extreme weather events, euro area activity has maintained its moderate pace, with quarterly GDP growth standing at 0.4% in the third quarter of 2026.[1] This resilience was supported by domestic consumer demand and public investment, linked partly to defence and infrastructure spending. Nonetheless, there are severe downside risks as disruptions in energy markets are continuing. Even if there were to be a resolution of the Middle East conflict, normalisation would still take a substantial amount of time given the damage that has been inflicted on infrastructure and refineries. This, together with climate-related surges in global food prices and rising prices for AI-related technology products, is sustaining inflationary pressures, both in the euro area and globally. A prolonged period of above-target inflation, especially if energy prices feed through to broader goods and services, will maintain upward pressure on global policy rates and,

[1] According to the preliminary flash estimate released by Eurostat. Euro area real GDP expanded by 0.2%, quarter on quarter, in the third quarter of the year when excluding volatile Irish data

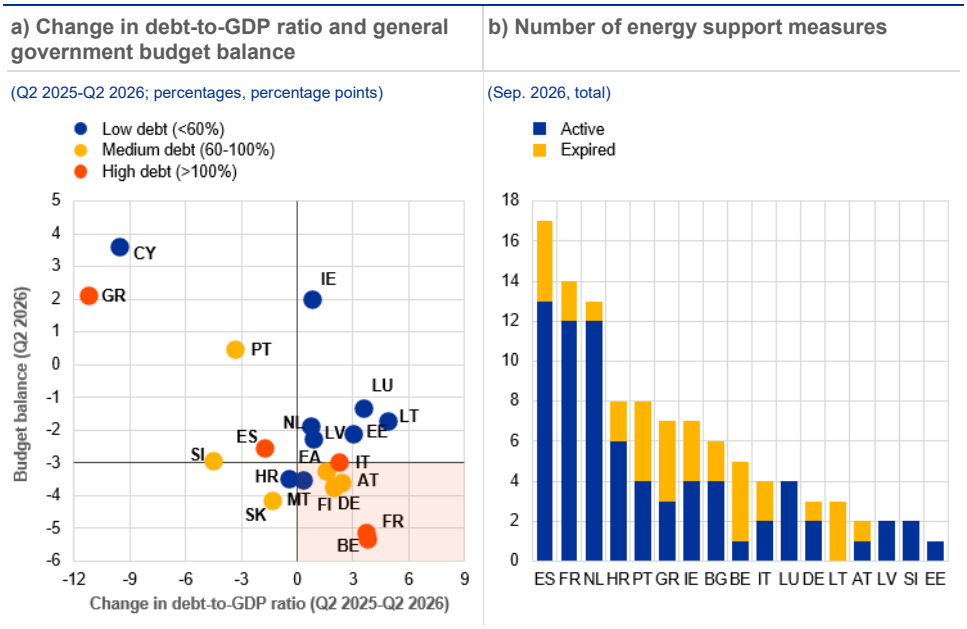
eventually, on financing costs for firms, households and sovereigns. Over the medium term, increasing AI adoption and the associated productivity gains could lead to positive growth surprises (**Chart 1.2**, panel c and **Special Feature A**). However, the impact that this will have on productivity, labour markets and investment is still surrounded by high uncertainty, and it is not yet clear whether the consequences for employment and inflation will be net positive or negative.

1.2 Risks of global spillovers are adding to fiscal challenges

Rising debt levels and persistent deficits in some euro area countries remain key vulnerabilities and are limiting fiscal space to react to shocks. After a phase of fiscal consolidation following the COVID-19 pandemic, debt levels are consistently increasing again in many euro area countries. Persistent budget deficits well in excess of the limit set by the EU fiscal rules are underpinning the rising debt trajectory of some already highly indebted countries (**Chart 1.3**, panel a). These dynamics are limiting the ability of governments to address shocks that come on top of long-standing fiscal challenges such as low productivity, ageing populations and the green and digital transitions. At the same time, some countries do not have a clear fiscal consolidation path going forward, and any fiscal slippage in certain major euro area countries could test investor confidence. In this context, a rigorous interpretation and application of the fiscal rules by the European Commission will be essential to safeguard the credibility of the EU fiscal framework and help place public finances on a sustainable path.

Chart 1.3

Fiscal positions are under pressure in parts of the euro area and face the challenges of defence spending, energy supply disruptions and extreme weather events



Sources: ECB and Eurostat (GFS), OECD and ECB calculations.
Notes: Panel a: the budget balance is shown as annualised quarterly data based on four-quarter trailing sums. Panel b: the number of energy support measures is taken from the OECD energy support measures tracker, which was last updated on 23 September 2026.

Defence spending and energy security are now key objectives owing to ongoing geopolitical conflicts, including in the Middle East. Investments in defence and infrastructure, driven in particular by Germany, have been supporting GDP growth and are expected to continue to do so over the medium term.[2] Once the extraordinary spending measures have expired, however, the positive impact on growth will start to wane. In addition, the end of disbursements under the Next Generation EU programme at the end of 2026 may weigh on public investment. In light of the protracted conflict in the Middle East, governments may face pressure to prolong energy support measures, including reductions in taxes on fuel and other energy products (**Chart 1.3**, panel b). Such measures have accounted for a moderate 0.1% of GDP in 2026, but they need to remain temporary, targeted and tailored so as not to risk derailing fiscal positions. Heatwaves and wildfires across euro area countries during the summer have underscored the need to adapt to climate change. As the insurance protection gap widens, there is a risk that without functioning public-private risk sharing, governments could need to provide fiscal backstops, leading to several challenges becoming increasingly intertwined. For instance, investments in renewable energy would benefit both energy security and affordability, as well as climate protection. In this regard, the European Commission has proposed broadening the scope of the national escape clause, which provides exemption from certain fiscal rules for defence expenditure, to include energy-related measures.[3]

High issuance needs and rising yields across the globe are increasing debt service costs and putting pressure on government budgets. Debt issuance by euro area governments has reached its highest level since the pandemic, driven predominantly by the German defence and infrastructure package (**Chart 1.4**, panel a). At the same time, sovereign yields, especially for longer maturities, have risen substantially in 2026, owing in part to concerns over the long-term debt sustainability of several major advanced economies, including the United States (see **Section 2.2**). In the euro area, many countries face the highest financing costs since the sovereign debt crisis of 2012 as sovereign bond yields have increased. While euro area-wide and global factors, including rising risk-free rates, have played a major role in pushing up yields, the underlying country-specific drivers can differ. For some sovereigns, the higher yields may partly reflect a stronger macroeconomic outlook, while for others, they may stem more from fiscal sustainability concerns and the associated risk premia. A widening of French sovereign credit spreads points towards investor perceptions of country-specific risks, although markets have continued to function in an orderly manner. A higher-for-longer interest rate environment could therefore lead to greater differentiation in financing conditions

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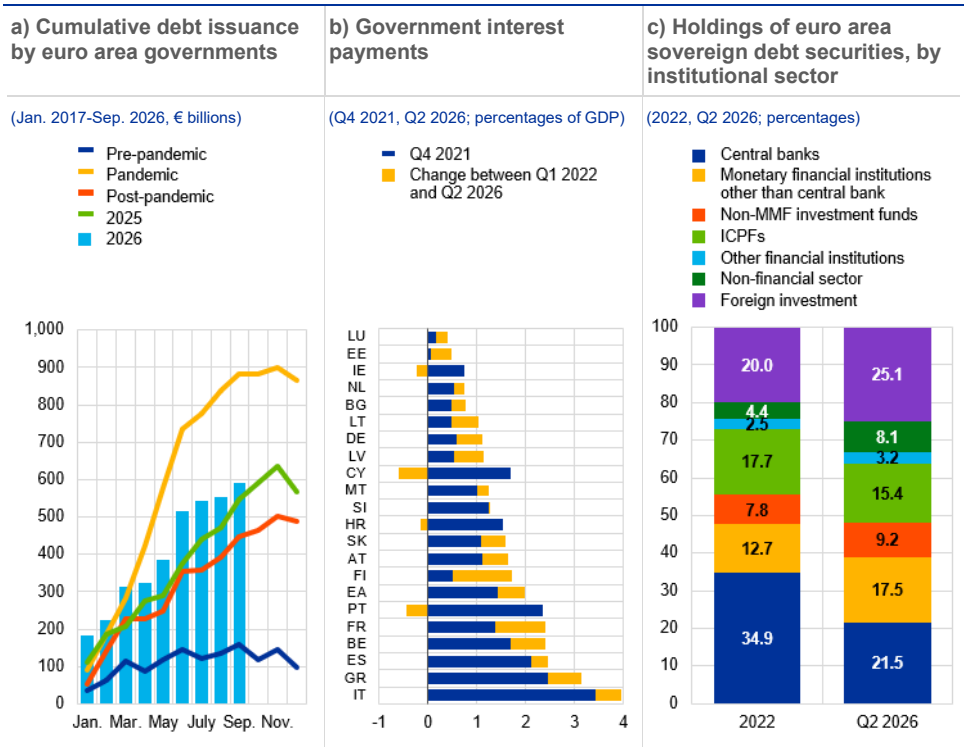
2 For more details, see Checherita-Westphal, C., Rodríguez-Vives, M., Lalinský, T. and Parker, M., "Defence spending and its short and longer-term macroeconomic effects", *Economic Bulletin*, Issue 6, ECB, 2026.

3 The national escape clause has so far been activated for 14 euro area countries: Belgium, Bulgaria, Germany, Estonia, Greece, Spain, Croatia, Latvia, Lithuania, Austria, Portugal, Slovenia, Slovakia and Finland. On 11 September 2026 Italy requested its activation for both defence expenditure and energy-related measures. Further information on the national escape clause for defence expenditure is available on the website of the Council of the European Union. For details on the extension to energy-related measures, see "Guidance to Member States on Broadening the Scope of the National Escape Clause for Energy Security", *Commission Notice*, European Commission, 18 August 2026 (C/2026/4514).

across sovereigns. Against this background, interest burdens are continuing to rise as maturing debt is rolled over at significantly higher interest rates (**Chart 1.4**, panel b). To mitigate the impact of rising long-term yields, governments have gradually shifted towards issuance of shorter maturities. However, this increases sensitivity to shocks as debt needs to be rolled over more frequently.

Chart 1.4

High issuance needs and rising yields are pushing up interest burdens as shifts in the investor base are increasing sensitivity to global market sentiment



Sources: ECB and Eurostat (GFS, QSA) and ECB calculations.
Notes: Panel a: "pre-pandemic" refers to the average over the period 2017-19; "pandemic" refers to the average over the period 2020-21; "post-pandemic" refers to the average over the period 2022-24. Panel b: government interest payments are shown as annualised quarterly data based on four-quarter trailing sums. Interest payments are consolidated, meaning net of payments within the government sector. Panel c: MMF stands for money market fund; ICPFs stands for insurance corporations and pension funds.

The possibility of global spillovers is compounding domestic risks and could lead to a further repricing of sovereign risk. Rising interest burdens are adding to acute and more medium to long-term fiscal challenges in the euro area. Without credible consolidation efforts, there is a risk that rising interest payments contribute to government spending outpacing economic growth in some euro area countries, which could ultimately result in unsustainable debt trajectories. Investor sentiment could turn negative if such dynamics become increasingly likely or if adverse rating actions point towards a rise in sovereign risks. In addition, shifts in the investor base are making euro area sovereign bond markets more sensitive to global market conditions. The Eurosystem continues to passively reduce its footprint in sovereign bond markets, and institutional investors' demand for longer-dated sovereign debt has declined owing to structural shifts such as the Dutch pension fund reform. In this environment, more volatile and price-sensitive actors, such as foreign investors and hedge funds, account for an increasing share of the investor base (**Chart 1.4**, panel c). Accordingly, even without changes in the underlying fundamentals, the

pricing of euro area sovereign risk could become more sensitive to global bond market sentiment and portfolio rebalancing, as well as the financing conditions of leveraged actors. Any repricing of sovereign risk could result in a rapid tightening of credit conditions for corporates and banks. This would have an adverse impact on growth and add to the downside risks to macroeconomic activity.

1.3 AI-related exposures add to corporate risks among firms sensitive to interest rates, energy costs and trade

Financing conditions for the euro area corporate sector have tightened, while credit volumes have remained resilient but lost momentum. The overall cost of financing for euro area non-financial corporations (NFCs) rose, driven mainly by market-based funding, while increases in the cost of bank borrowing remained more contained. Survey responses covering the third quarter of 2026 point towards widespread risk aversion limiting the supply of credit, alongside subdued demand for long-term credit. Credit standards for loans to firms have tightened further, with banks citing higher perceived risk related to the economic outlook and borrowers' exposure to geopolitical tensions and energy supply shocks.[4] On the demand side, survey evidence from earlier in the year indicated that firms were postponing or scaling back fixed investment while increasing inventories and, in some cases, building strategic stockpiles of energy and critical inputs as a hedge against possible energy and supply disruptions.[5] In the third quarter of 2026, higher interest rates and weaker demand for fixed investment among SMEs dampened demand for bank borrowing, as firms increasingly relied on internal funds while financing needs for working capital remained elevated. However, business investment is expected to grow in the second half of 2026, supported by spending on artificial intelligence (AI) technology, digitalisation and defence, although tighter financing conditions could weigh on the recovery.[6]

Corporate vulnerability indicators have deteriorated, although the aggregate balance sheet of the sector does not point towards stress. Corporate vulnerabilities have edged up over recent quarters, driven mainly by higher trade liabilities and, to a lesser extent, by weaker profit margins and liquidity positions (**Chart 1.5**, panel a). Debt servicing capacity has held up better than in previous tightening cycles. This reflects a still relatively low share of debt at floating rates in several jurisdictions, the lengthening of maturities that took place during the period of low interest rates and the accumulation of liquidity buffers. Overall, the composite indicator remains far below the levels observed in the aftermath of the global financial crisis or the sovereign debt crisis.

Rising bankruptcies point to growing pressure among vulnerable firms, even as market-based indicators of credit risk for listed companies have improved.

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4 See the ECB's "Euro area bank lending survey" and the ECB's "Survey on the Access to Finance of Enterprises in the euro area" covering the third quarter of 2026.

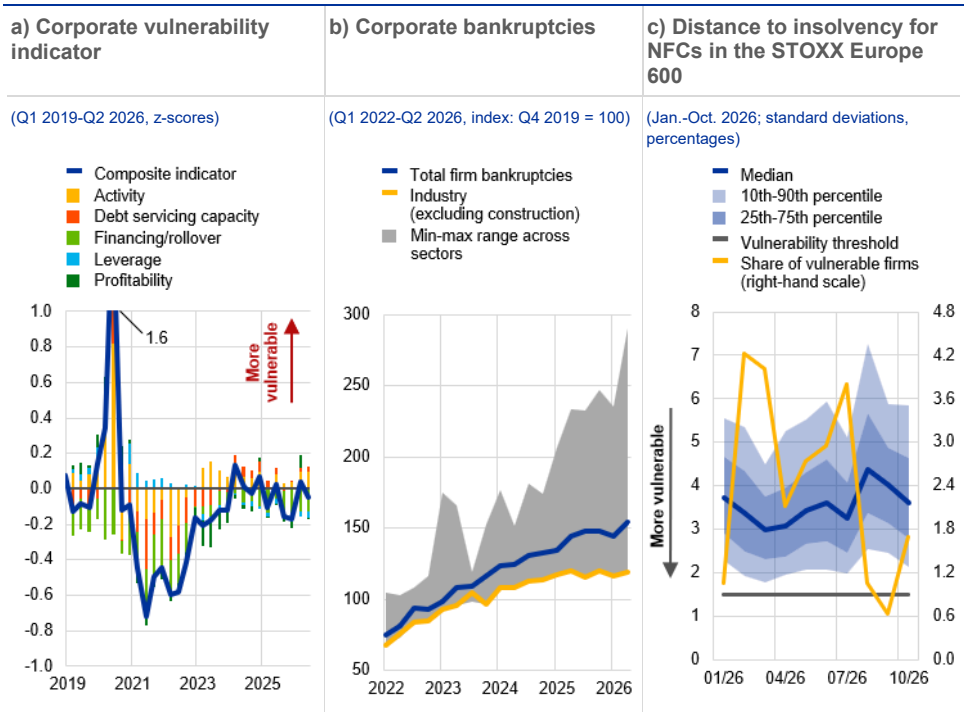
5 See Box 2 of the ECB's "Survey on the Access to Finance of Enterprises in the euro area" covering the second quarter of 2026.

6 See "Economic activity", *Economic Bulletin*, Issue 7, ECB, 2026.

Corporate bankruptcies continued to rise across sectors, with the sharpest increases recorded in education and health care, transport as well as finance, real estate and professional services (**Chart 1.5**, panel b). While rising bankruptcies can partly reflect firm turnover and the reallocation of economic activity rather than a general deterioration in firms' financial soundness,[7] declining business registrations in education and health care, as well as in finance, real estate and professional services, point to net firm exit rather than turnover. By contrast, the distance to insolvency for listed firms has recovered after deteriorating at the start of the Middle East conflict (**Chart 1.5**, panel c). These two developments are not contradictory: listed firms are typically larger and enjoy better access to financing than smaller firms, which account for the majority of bankruptcies. Furthermore, market-based indicators of credit risk are derived from equity valuations and volatility, so recent improvements partly reflect buoyant market sentiment and could reverse abruptly in case of a market correction. Overall, the data indicate uneven rather than broad-based corporate distress, with pressure on vulnerable firms likely to intensify if weak demand, high energy costs and tighter financing conditions persist.

Chart 1.5

Corporate vulnerabilities are rising but remain below long-term averages, while default risk for listed firms has eased since the outbreak of the Middle East conflict



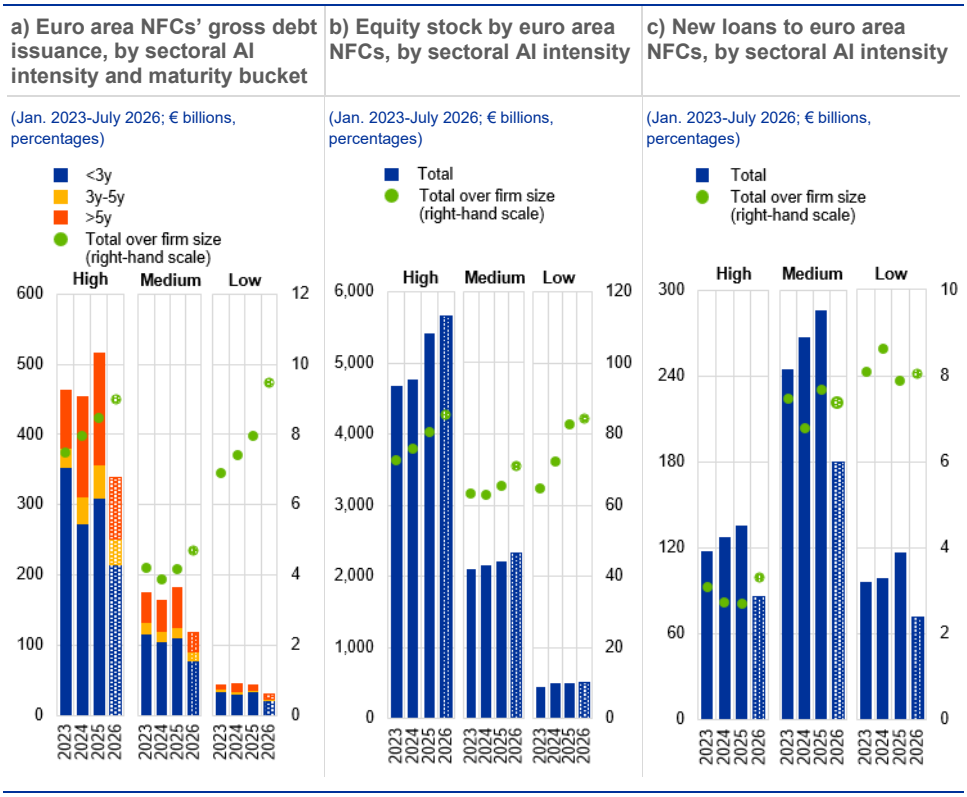
Sources: ECB, Eurostat, LSEG and ECB calculations.
Notes: Panel a: for details of the construction of the composite indicator of corporate vulnerabilities, see Gardó et al.* Positive (negative) values indicate higher (lower) vulnerability. Panel c: for details on the calculations of the distance to insolvency, see Atkeson et al.** The share of vulnerable firms is the percentage of firms below the vulnerability threshold, i.e. a distance to insolvency of 1.5.
*) Gardó, S., Klaus, B., Tujula, M. and Wendelborn, J., "Assessing corporate vulnerabilities in the euro area", *Financial Stability Review*, ECB, November 2020.
**) Atkeson, A.G., Eisfeldt, A.L. and Weill, P.-O., "Measuring the financial soundness of U.S. fir6s, 1926−2012", *Research in Economics*, Vol. 71, Issue 3, September 2017, pp. 613-635.

7 Bednarek, P., Coulier, L., Mikkonen, K., Pancaro, C. and Wendelborn, J., "Rising bankruptcies, resilient loan books: unpacking euro area corporate credit risk", *Financial Stability Review*, ECB, May 2026.

Firms in AI-intensive sectors have so far faced more benign financing conditions for both the price and the volume of external funding. These firms have generally retained easier access to market-based funding, with debt issuance and equity stocks well above the levels reported for firms in sectors with medium and low AI intensity (**Chart 1.6**, panels a and b). Moreover, AI-exposed firms earn higher equity returns and enjoy more compressed corporate bond spreads than otherwise comparable firms.[8] However, the recent global sell-off in AI-related assets, especially among highly leveraged infrastructure providers, shows how financing conditions can tighten when confidence in the returns on AI investment weakens. Conversely, firms in AI-intensive sectors rely less on bank lending (**Chart 1.6**, panel c). This reflects both their cheaper access to market-based funding and the fact that AI-related investment is focused on intangible assets, which are harder to collateralise and therefore less suited to bank financing.[9]

Chart 1.6

Firms in AI-intensive sectors tap debt and equity markets, while other firms rely mostly on bank loans



Sources: ECB (AnaCredit, CSDB), Moody's, Calvino et al.* and ECB calculations.
Notes: The classification of firms by AI intensity is based on Calvino et al.* The green dots represent the ratio of the total volume to firm size, proxied by total assets in the previous fiscal year. Panel a: the ratio for 2026 is estimated assuming that gross debt issuance over the period from August to December 2026 is equal its 2025 level. Panel b: the chart uses equity stock at the end of the time period. Panel c: new loans to euro area NFCs are measured by total outstanding nominal amount excluding syndicated loans. The ratio for 2026 is estimated assuming that new lending over the period from August to December 2026 is equal to its 2025 level.
*) Calvino, F., Dernis, H., Samek, L. and Ughi, A., "A sectoral taxonomy of AI intensity", *OECD Artificial Intelligence Papers*, No 30, OECD Publishing, December 2024.

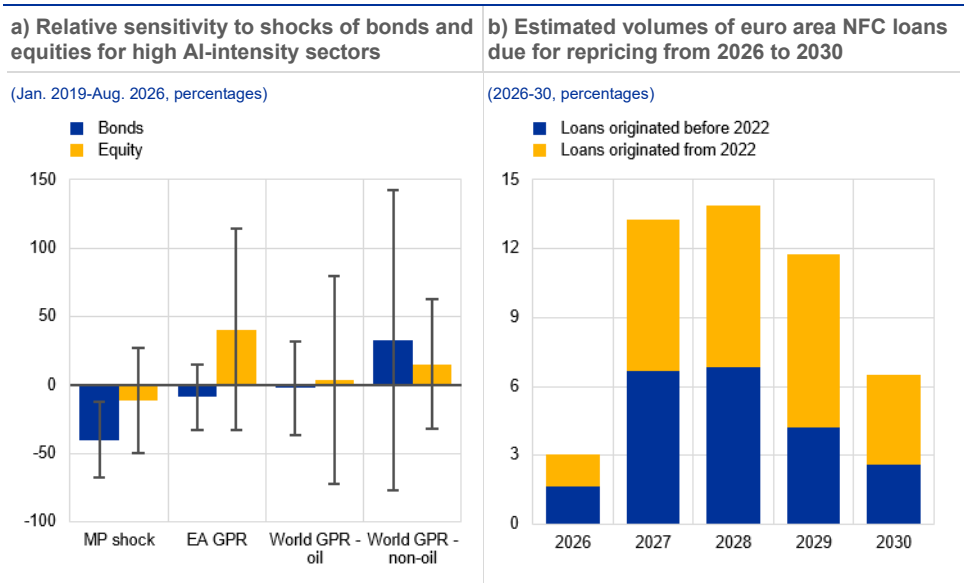
8 See Ferrari, I., Gori, S., Groß, G., Schupp, F. and Steffensen, S., "Artificial intelligence and European firms: the cost of market-based financing", *Economic Bulletin,* Issue 7, ECB, 2026.

9 See Cianfarani, A.S., Di Casola, P., Ramos, J. and Zander, D., "Funding the AI revolution: evidence from euro area sectors", *The ECB Blog*, ECB, 6 October 2026.

Reliance on global supply chains and energy-intensive infrastructure leaves AI-intensive firms vulnerable in the present geopolitical environment. Their market valuations appear to be less sensitive to conventional shocks than those of comparable firms in less AI-intensive sectors (**Chart 1.7**, panel a). However, these firms are deeply embedded in global supply chains and their bond and equity valuations are affected by global geopolitical risk shocks at least as much as those of other firms. Their dependence on the availability and price of energy for data centres and related infrastructure also exposes them to energy supply disruptions, a risk that has become more significant since the start of the Middle East conflict. Escalating trade tensions, export restrictions on critical technologies or a renewed energy shock could thus weigh on their earnings prospects. In addition, their valuations rest on expectations of uncertain returns on AI investments, and AI exposure is priced in equity and corporate bonds well beyond the technology sector. Such shocks could therefore also trigger an abrupt and broad-based repricing, affecting firms outside the core of the AI investment cycle. This risk is amplified by the increased reliance of global growth on AI-related investment and trade, particularly between the US and Asian economies. Disruptions to growth drivers could propagate through global value chains, weakening external demand and heightening uncertainty for euro area firms.

Chart 1.7

Build-up of risks from AI exposure, interest rate hikes and higher energy prices



Sources: LSEG, Moody's, Bloomberg Finance L.P., Calvino et al.*, Jarociński and Karadi**, Bondarenko et al.***, Iacoviello and Tong****, ECB (AnaCredit, MIR) and ECB calculations.
Notes: Panel a: non-financial corporations (NFCs) in the STOXX Europe 600 in high AI-intensity sectors are compared with firms in medium and low AI-intensity sectors based on the sectoral taxonomy set out by Calvino et al.* The chart shows the relative sensitivity of 1 standard deviation in selected shocks on option-adjusted corporate bond spreads and equity returns, for firms in high AI-intensity sectors. The relative sensitivity is calculated as $100*(\beta_{high}/\beta_{med,low}-1)$. Positive (negative) values indicate that firms in high AI-intensity sectors are more (less) sensitive to the shock than firms in medium and low AI-intensity sectors. The whiskers indicate 95% confidence intervals. The estimates are obtained from regressions with security and date-by-sector fixed effects, controlling for leverage and firm size; bond regressions are weighted by bond outstanding amount, whereas equity regressions are weighted by market capitalisation. Entropy balancing re-weights observations in order to align pre-shock characteristics across the two comparison groups. Characteristics are residual maturity, expected default frequency and total assets for bonds; EBITDA, interest coverage ratio and total assets for equities. "MP shock" refers to the pure monetary policy shock of Jarociński and Karadi**; "EA GPR" refers to the euro area geopolitical risk index of Bondarenko et al.***; "World GPR – oil" and "World GPR – non-oil" refer to the global geopolitical risk indices of Iacoviello and Tong****. Panel b: loans in fixation buckets above one year are assigned a single assumed reset date: three years for one to five years, 7.5 years for five to ten years and 15 years for over ten years. Loans are counted at origination value, without amortisation or prepayment. 2026 covers October to December.
*) Calvino, F., Dernis, H., Samek, L. and Ughi, A., "A sectoral taxonomy of AI intensity", *OECD Artificial Intelligence Papers*, No 30, OECD Publishing, December 2024.
**) Jarociński, M. and Karadi, P., "Deconstructing Monetary Policy Surprises – The Role of Information Shocks", *American Economic Journal: Macroeconomics*, Vol. 12, No 2, April 2020, pp. 1-43.
***) Bondarenko, Y., Kang, N., Lewis, V., Rottner, M. and Schüler, Y., "Geopolitical risk in the euro area: Measurement and transmission", *Discussion Papers*, No 14/2026, Deutsche Bundesbank, May 2026.
****) Iacoviello, M. and Tong, J., "The AI-GPR Index: Measuring Geopolitical Risk using Artificial Intelligence", *Technology & Growth Center – Research & Insights*, Federal Reserve Bank of San Francisco, March 2026.

Debt rollover and the repricing of loans originated in a low interest rate environment imply rising interest burdens for euro area firms. The pass-through of higher interest rates to firms' debt servicing costs is still incomplete, with over 10% of the outstanding loan volume taken on by euro area NFCs expected to be repriced each year between 2027 and 2029 (**Chart 1.7**, panel b). Roughly half of these loans were originated before 2022, at interest rates well below current levels. As these loans reprice at higher rates, interest expenses will rise. This implies higher financing needs and cost pressures, particularly for more leveraged and interest-sensitive firms, leaving less scope for internal funds to absorb additional shocks.

Extreme climate events and renewed energy price pressures are compounding these vulnerabilities. The droughts and wildfires recorded during the summer of 2026 disrupted economic activity in several euro area countries by damaging physical assets and interrupting production. With only around one-quarter of losses from natural catastrophes being insured in Europe over recent decades, a substantial share of the resulting losses is borne directly by firms, eroding their

liquidity buffers and debt servicing capacity.[10] Small firms, which tend to be less insured and have more limited access to external finance, are particularly exposed. In turn, losses that are not absorbed by firms or insurers can spill over to banks through higher credit risk and to sovereigns through contingent liabilities. Looking ahead, the developing El Niño event is raising the likelihood of droughts and heat extremes, and hence of stronger and more frequent destructive events. Meanwhile, cost pressures are intensifying amid rising energy prices, low gas storage levels ahead of the winter and renewed disruptions to energy deliveries through the Strait of Hormuz, where traffic has partly recovered but shipping remains under attack. Such shocks are transmitted with a lag to the financial sector: corporate default expectations react first, with bank asset quality and lending volumes affected with a delay of up to two years. This implies that the financial stability effects of the Middle East conflict may only start to materialise in the course of 2027 (see **Box 5**).

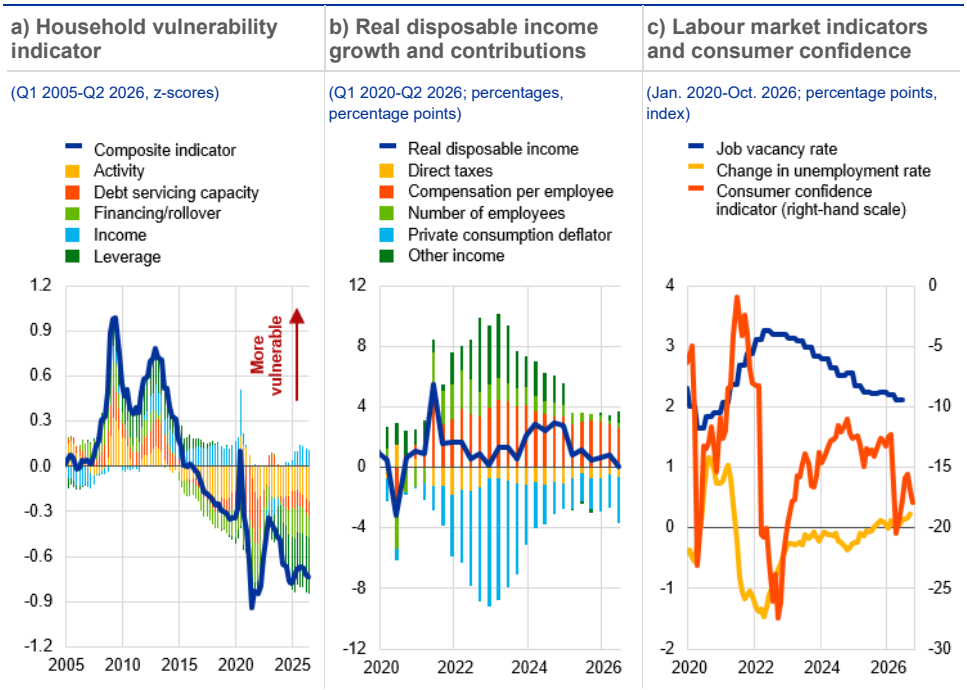
1.4 Weaker labour demand and higher energy costs may challenge vulnerable households

Household vulnerabilities remain contained, underpinned by resilient employment and broadly stable incomes. The household vulnerability indicator does not show signs of a broad deterioration in debt servicing capacity (**Chart 1.8**, panel a), while the unemployment rate remains low and stable. Real disposable income continued to increase in the first half of 2026, supported by higher employment levels, nominal wages and other sources of income. However, these gains have been partly offset by direct taxes and inflation, which slowed growth in real disposable income in the second quarter of 2026 (**Chart 1.8**, panel b). These developments continue to bolster households' ability to service their debt, mitigating immediate risks to banks' mortgage portfolios. By contrast, consumer confidence weakened in September and October, and it remains below the levels seen prior to the Middle East conflict (**Chart 1.8**, panel c). Moreover, the overall resilience suggested by aggregate indicators may be masking potential vulnerabilities among households with lower incomes, limited liquidity buffers or adjustable-rate mortgages, as these households are more exposed to higher energy prices and rising borrowing costs.

[10] See Hielkema, P., "Insurance protection gaps in a changing climate", speech at the conference on Climate Risk in Insurance organised by Národná banka Slovenska, the OECD and the International Sustainable Finance Centre, 16 April 2026.

Chart 1.8

Euro area households' resilience is underpinned by low unemployment and stable real disposable income growth



Sources: S&P Global Market Intelligence, European Commission, Eurostat and ECB (QSA, MNA) and ECB calculations.
Notes: Panel a: the composite indicator is based on a broad set of indicators along five dimensions: (i) debt servicing capacity (measured by gross interest payments/income ratio, saving ratio and expectation of personal financial situation); (ii) leverage (gross debt/income and gross debt/total assets ratios); (iii) financing (bank lending rate, short-term debt/long-term debt ratio, quick ratio (defined as current financial assets/current liabilities) and credit impulse (defined as the change in new credit issued as a share of GDP)); (iv) income (real income growth and income/GDP ratio); and (v) activity (labour participation rate and unemployment expectations). Positive (negative) values indicate higher (lower) vulnerability. Panel b: "Other income" includes gross operating surplus and mixed income, property income, social contributions, social benefits and other current transfers. Panel c: the change in the unemployment rate is the difference in year-on-year growth rates from the previous year. The latest observations are for June 2026 for the job vacancy rate, September 2026 for the change in the unemployment rate and October 2026 for the consumer confidence indicator.

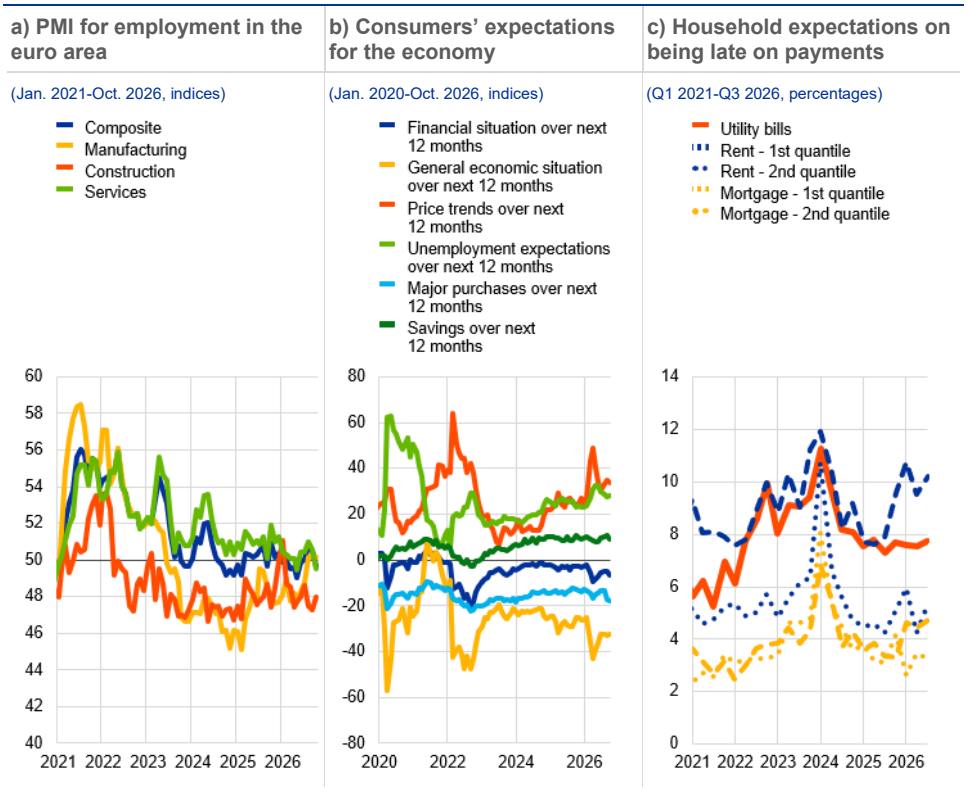
Repayment capacity could erode gradually if labour market conditions or real incomes were to weaken. Employment and labour force growth have continued to slow, while labour demand appears to be cooling, as shown by declining vacancy rates (**Chart 1.8**, panel c). The broadly stable unemployment rate is thus more likely a reflection of firms' reluctance to lay off employees than of a buoyant labour market. A softer labour market could limit household income growth, while higher energy prices and their indirect effects on other consumption items would further compress real purchasing power.

Euro area households remain resilient on aggregate but have not fully recovered from the confidence shock caused by the Middle East conflict. Employment prospects have improved in the manufacturing sector, although those in the construction sector remain weak (**Chart 1.9**, panel a). Consumers' expectations for their financial and general economic situation have also recovered somewhat in recent months but remain subdued (**Chart 1.9**, panel b). Low consumer confidence is also dampening demand for credit for house purchases. At the same time, the continued weakness in expectations suggests that households may sustain high levels of precautionary savings and delay major purchases, thereby bolstering their liquidity buffers. In a stress scenario, however, any renewed deterioration in

confidence combined with tighter credit supply could weigh on house prices and on the ability of households to refinance or service their debt. This would apply in particular to those more reliant on borrowing to finance housing or durable goods purchases.

Chart 1.9

Business and consumer sentiment is resilient despite global shocks



Sources: S&P Global Market Intelligence, European Commission, ECB (CES) and ECB calculations.
Notes: Panel a: PMI values above (below) 50 imply an improvement (deterioration) in employment. Panel b: values above (below) 0 imply an improvement (deterioration) in expectations. Panel c: the chart shows the share of respondents in the first and second income quantiles who expect to be late on rent and mortgage payments over the next three months, as well as the share of respondents across all income quartiles who expect to be late on utility bills over the next three months.

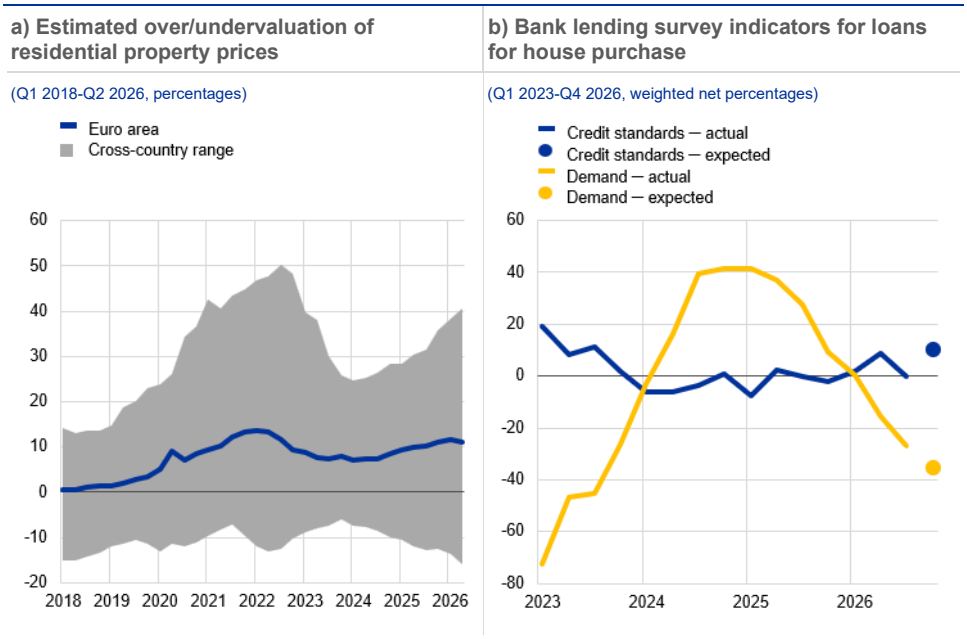
Financial difficulties remain concentrated among lower-income households, indicating pockets of vulnerability rather than widespread household distress. The share of households expecting to fall behind on rent or mortgage payments remains substantially higher in the lower-income groups, while reported delays in utility payments remain limited despite elevated energy prices (**Chart 1.9**, panel c). Delayed mortgage payments could directly affect banks' asset quality, while rent arrears could reduce landlords' rental income and indirectly affect real estate exposures. The risk would become more material if weaker labour demand, higher costs of living and tighter credit conditions occurred simultaneously, since lower-income households generally have less liquid wealth and a higher marginal propensity to reduce consumption when credit conditions tighten.

1.5 Real estate markets remain broadly stable, but pockets of vulnerabilities persist

The overvaluation of house prices across the euro area as a whole remains contained, but some countries are showing signs of exuberance. The average valuation estimate for the euro area remains above the levels seen before the COVID-19 pandemic (**Chart 1.10**, panel a), but this masks significant cross-country variation, with estimates ranging from undervaluation in some countries to pronounced overvaluation in others. The dispersion has widened recently as valuations in the most stretched markets have picked up further. The main driver has been strong house price dynamics in a subset of countries, coupled in some cases with robust mortgage lending growth (see **Box 1**). In addition, housing supply is continuing to fall short of demand, sustaining growth in house prices.

Chart 1.10

House price overvaluation remains contained at the euro area level but is increasing in some countries, while mortgage markets seem to be slowing



Sources: ECB (BLS, RESV) and ECB calculations.
Notes: Panel a: the blue line shows the average valuation estimate for the euro area (euro area 21, fixed composition as of 1 January 2026); the shaded area shows the maximum-minimum range for the same measure across euro area countries. A positive value indicates overvaluation and a negative value undervaluation. The average valuation estimate is the simple average of the price/income ratio and an estimated Bayesian vector autoregression model. For details of the methodology, see European Central Bank* and **. Panel b: net percentages are weighted by the share of each country in the total outstanding loan amounts of the euro area aggregate. For credit standards, the net percentage is the difference between the share of banks reporting a tightening and the share of banks reporting an easing. For net demand, the net percentage is the difference between the share of banks reporting an increase and the share of banks reporting a decrease. Actual values refer to the backward-looking three-month question and expected values to the forward-looking three-month question. The latest observations for actual values are for Q3 2026; the values for Q4 2026 refer to banks' expectations.
*) European Central Bank, "Tools for detecting a possible misalignment of residential property prices from fundamentals", *Financial Stability Review*, ECB, June 2011.
**) European Central Bank, "A model-based valuation metric for residential property markets", *Financial Stability Review*, ECB, November 2015.

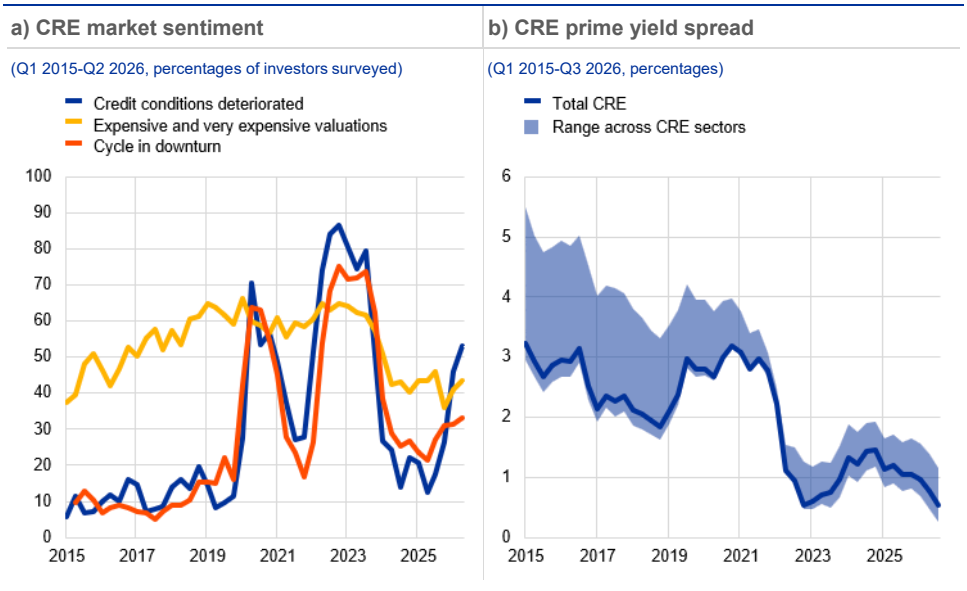
Going forward, the recovery in residential real estate (RRE) markets could face headwinds. Net demand for loans for house purchase moved back into contractionary territory in the second quarter of 2026, reflecting higher interest rates and lower consumer confidence. Banks tightened credit standards over the same

period and expect both net demand and credit standards to decline further in the near term (**Chart 1.10**, panel b). Consequently, rising measures of overvaluation, together with tightening financial conditions, are contributing to tail risks for euro area house prices. Moreover, households' debt servicing capacity could come under pressure in countries with a high share of variable-rate mortgages if financial conditions were to tighten further alongside a cooling labour market and with rising energy prices weighing on household expenses.

Commercial real estate (CRE) markets have stabilised at subdued levels, but vulnerabilities persist and downside risks have increased recently. Investor sentiment has remained broadly stable since the end of 2025, although slightly more investors now consider the market to be in a downturn (**Chart 1.11**, panel a). At the same time, financing conditions have become less supportive, with the share of investors reporting deteriorating credit conditions increasing markedly in the current context of higher interest rates and continued geopolitical uncertainty. Upcoming refinancing needs could also weigh on borrowers' debt servicing capacity as loans originated during the period of low interest rates mature. Transaction activity remains subdued but stable, while CRE valuation growth is positive, although it is slowing and is also uneven across countries and segments. CRE prime yield spreads have narrowed markedly as long-term interest rates have risen faster than property yields and are now close to levels last seen in 2022 (**Chart 1.11**, panel b). Unless risk-free rates decline, compressed spreads could put property yields under renewed pressure and, in turn, exert downward pressure on CRE valuations.

Chart 1.11

Euro area CRE markets have stabilised, but tighter financing conditions are increasing downside risks



Sources: RICS, JLL and ECB calculations.
Note: Panel b: the shaded area shows the range across the office, retail and industrial sectors.

Structural vulnerabilities remain uneven across CRE segments and countries. Prime office markets are continuing to perform relatively well, while non-prime offices face weaker demand, higher vacancy rates and more subdued rent expectations. In

prime segments, demand is continuing to outstrip new supply in some markets, driving up rental growth as high construction and financing costs constrain development. Logistics and parts of the retail market have remained comparatively resilient. Strong investment in data centres, partly related to the buildout of capacity related to artificial intelligence (AI), is also supporting demand in parts of the CRE market, although the broader impact of AI is still limited. CRE conditions have improved more noticeably in some southern euro area countries, while several larger markets remain weaker. Developers remain a particular vulnerability in some countries as weak activity, high input costs and tighter financing conditions weigh on profitability and constrain new development.

Real estate markets remain broadly stable, with vulnerabilities concentrated in selected segments and countries, and risks are still below previous peaks. High energy prices could add to risks in both RRE and CRE markets as they squeeze real disposable incomes and push up operating and development costs. For RRE, a substantial deterioration in labour market conditions would be the main trigger for broader household credit risk, but favourable labour markets and borrower-based measures are currently supporting resilience. CRE is more directly exposed to higher financing costs, and further increases in medium to long-term rates could put valuations and activity under renewed pressure. The risks are greatest for non-prime offices, developers and weaker markets, while prime assets remain more resilient. Given the size of banks' RRE mortgage books, a broad-based decline in household credit quality could have serious implications for bank solvency at the euro area level. Banks' CRE exposures are smaller but they are also unevenly distributed, so stress could still be material for the most exposed institutions. Hence, while real estate risks are not elevated by historical standards, there are pockets of vulnerability that warrant continued monitoring.

Box 1

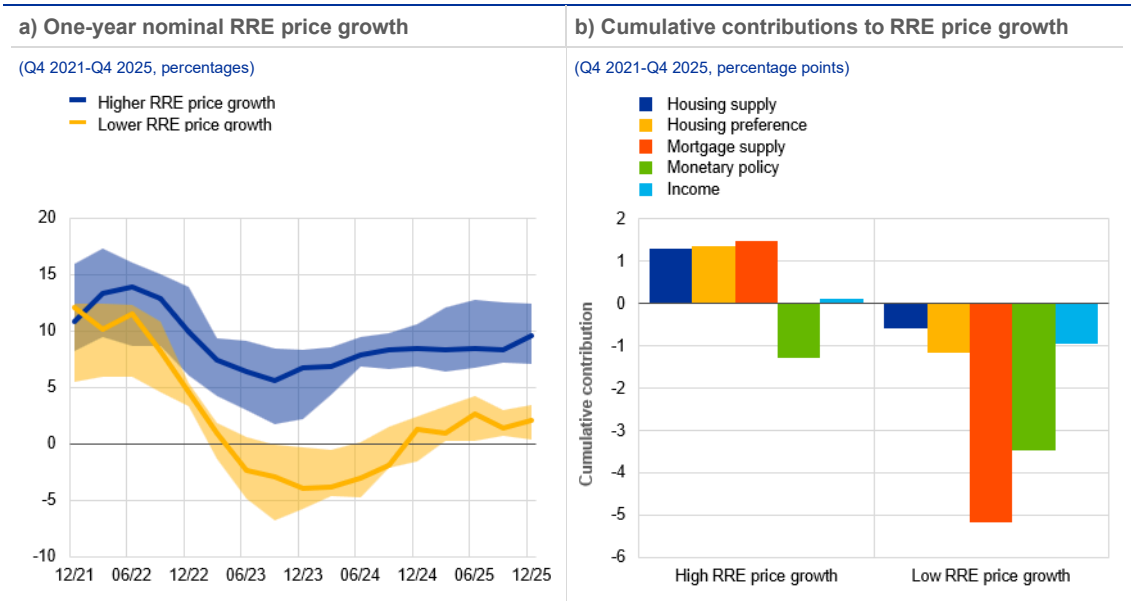
Diverging developments in euro area residential real estate markets: risks and policy considerations

Prepared by Giorgia De Nora, Barbara Jarmulska and Cristian Perales

Since 2022 residential real estate (RRE) price growth has diverged significantly across the euro area. While one group of euro area countries is currently experiencing strong RRE price growth and has had price levels remaining relatively high since 2022, another has seen more subdued RRE price dynamics over the same period (**Chart A**, panel a). This box examines the factors underlying this variation in RRE price developments, with the aim of shedding light on the channels through which possible vulnerabilities may be building up.

Chart A

RRE price developments differ markedly across countries, with multiple factors driving the recent price boom in some countries



Sources: ECB and ECB calculations.
Notes: Panel a: all euro area countries are split into two groups, depending on whether they are above or below the median one-year nominal RRE price growth rate in Q4 2025 of the country sample used in panel b (for consistency between panel a and panel b). As a result, one-third of countries are in the lower RRE price growth category and two-thirds in the higher category. The solid lines depict the median for each group of countries, while the shaded areas around the solid lines represent the interquartile range. Panel b: averages of cumulative shock contributions to house prices are estimated using country-level Bayesian vector autoregression (BVAR)(2) models for nine euro area countries (Germany, Ireland, Spain, France, Italy, Netherlands, Austria, Portugal and Finland). The nine euro area countries in the sample are split into two groups, depending on whether they are above or below the median one-year nominal RRE price growth rate in Q4 2025. The variables included in the BVAR(2) models are residential investments, real disposable income, house prices, the euro area shadow rate*, lending rate on household loans, outstanding mortgage loans and the consumer price index. The estimation sample covers the period Q1 2003-Q4 2025. Five of the seven structural shocks are identified through zero and sign restrictions (for the impact of the identified structural shocks on house price growth, see Chart A, panel b).
*) See Krippner, L., "Measuring the stance of monetary policy in zero lower bound environments", *Economics Letters*, Vol. 118, Issue 1, 2013, pp. 135-138, and Krippner, L., *Zero Lower Bound Term Structure Modeling: A Practitioner's Guide*, Palgrave Macmillan, New York, 2015.

Diverging price developments reflect both differences in the drivers of house price growth and differences in how common shocks pass through to national housing markets.[11] In the group of countries experiencing price growth above the median, house prices continued to rise between the end of 2021 and the end of 2025, driven by three main factors: (i) favourable mortgage supply conditions, i.e. changes in the price or availability of mortgage credit that are not directly related to changes in the monetary policy stance (a broad concept capturing factors such as bank funding costs, risk appetite and credit standards);[12] (ii) stronger housing preference, with housing increasingly seen as an attractive investment; and (iii) constrained housing supply (**Chart A**, panel b). The same three main factors listed above exerted a downward pressure on prices in countries with RRE growth below median, with mortgage supply shocks contributing most to the difference between the two groups. Monetary policy weighed on prices in both groups, but the drag (as the stance was tightened) was around twice as large in the group with lower RRE price growth.[13] Since the same monetary policy stance applies across the euro area, this gap stems from

[11] See also Di Casola, P. and Grothe, M., "Housing wealth and monetary policy transmission: cross-country evidence", *Working Paper Series*, No 3204, ECB, 2026, who find that the response of house prices to monetary policy shocks is uneven across advanced economies and related to housing and mortgage market characteristics.

[12] See, for example, Gambetti, L. and Musso, A., "Loan Supply Shocks and the Business Cycle", *Journal of Applied Econometrics*, Vol. 32, Issue 4, 2017, pp. 764-782.

[13] These results reflect average dynamics within each group and should not be seen as identifying the drivers of house price developments in individual countries.

how changes in policy rates impact each national housing market rather than from the policy itself. This in turn depends on the market's structural features across countries, which is considered next.

The structural features of the RRE and mortgage markets shape the impact of interest rate hikes on house prices. These features vary substantially across the euro area, which can help explain why house prices in various countries responded differently to rising interest rates during the hiking cycle that started in 2022 (**Chart B**). In countries where fixed-rate mortgages predominate, for example, rate hikes had a stronger impact on house prices. This would be consistent with the notion that house prices can be highly sensitive to interest rates even when most outstanding mortgages have fixed rates, because changes in financing costs for new buyers can have a substantial effect on housing demand and prices.[14] Moreover, house prices were more sensitive to rising rates in countries without binding loan-to-value (LTV) limits. An LTV cap in place for first-time buyers is used as a proxy for the leverage of a marginal buyer[15]; the result obtained could reflect how marginal buyers in countries without binding LTV limits tend to be more leveraged than those in countries where binding LTV caps are in place. This means their capacity to purchase a property would decline more when interest rates go up.[16] In addition, markets that were substantially overvalued at the peak of the house price cycle experienced sharper price corrections than markets that were not. This likely reflects the tendency of prices to revert to sustainable levels more quickly the more they previously deviated from them. By contrast, countries with high levels of house purchases not financed by mortgages showed less sensitivity to interest rate changes, consistent with the idea that buyers were less affected by changes to mortgage rates.[17] Lastly, higher home ownership rates were linked to weaker price adjustments, probably because part of the adjustment to rising interest rates occurred through reduced transaction volumes, thereby limiting the extent of price declines.

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14 A vast literature exists on the strength of the impact of interest rates on house prices depending on whether fixed- or variable-rate mortgage lending is more common. Many papers show prices reacting more strongly to monetary policy when variable-rate lending predominates (see Calza, A., Monacelli, T. and Stracca, L., "Housing Finance and Monetary Policy", *Journal of the European Economic Association*, Vol. 11, 2013, pp. 101-122; Fonseca, J. and Liu, L., "Mortgage Lock-In, Mobility, and Labor Reallocation", *The Journal of Finance*, Vol. 79, Issue 6, 2024, pp. 3729-3772; and Fonseca, J., Liu, L. and Mabille, P., "Unlocking Mortgage Lock-In: Equilibrium Effects in a Spatial Housing Ladder model", *NBER Working Paper Series*, No 35237, National Bureau of Economic Research, 2026). However, other literature shows a stronger reaction of house prices to interest rates in countries where fixed-rate lending predominates (see Dieckelmann, D., Hempell, H.S., Jarmulska, B., Lang, J.H. and Rusnák, M., "House prices and ultra-low interest rates: exploring the nonlinear nexus", *Empirical Economics*, Vol. 68, 2025, pp. 1001-1037) and that house price responses to monetary policy can be particularly strong in a US housing market dominated by fixed-rate lending (see Musso, A., Neri, S. and Stracca, L., "Housing, consumption and monetary policy: How different are the US and the euro area?", *Journal of Banking & Finance*, Vol. 35, Issue 11, 2011, pp. 3019-3041). At the same time, theoretical research highlights the importance of pass-through to new fixed-rate mortgage rates (see Kinnerud, K., "The Effects of Monetary Policy through Housing and Mortgage Choices on Aggregate Demand", *Quantitative Economics*, Vol. 16, Issue 2, 2025, pp. 659-703).

15 Limits on loan-to-income (LTI) or debt-to-income (DTI) would have been a closer proxy for the leverage of the marginal buyer. However, LTV caps were chosen instead due to their prevalence across euro area counties, with LTI/DTI caps activated in only four countries. While the LTV caps may be a good proxy for the LTV of marginal buyer in most of the countries, this does not automatically mean that, in all countries without strict LTV caps in place, a marginal buyer will be more leveraged than in countries with strict LTV caps in place.

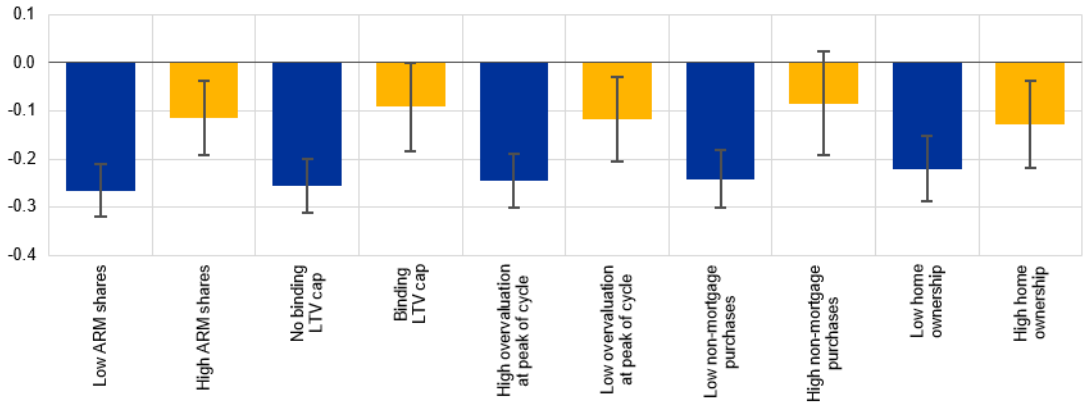
16 This finding is consistent with the literature which, however, looked at actual prevailing LTVs and not LTV caps (see Calza, A., Monacelli, T. and Stracca, L., "Housing Finance and Monetary Policy", *Journal of the European Economic Association*, Vol. 11, 2013, pp. 101-122, and Rubaszek, M., Stenvall, D. and Uddin, G.S., "Rental market structure and housing dynamics: An interacted panel VAR investigation", *International Journal of Finance & Economics*, Vol. 30, Issue 1, 2025, pp. 781-802).

17 The strength of this effect is likely to depend on the presence of non-household buyers in the housing market in a given country. The estimates of shares of non-mortgage purchases could include purchases by institutional investors and/or state entities such as local authorities which could be debt-financed, and hence also dependent on prevailing interest rates.

Chart B

Interest rate elasticity of house prices

(Q4 2021-Q3 2025, elasticity)



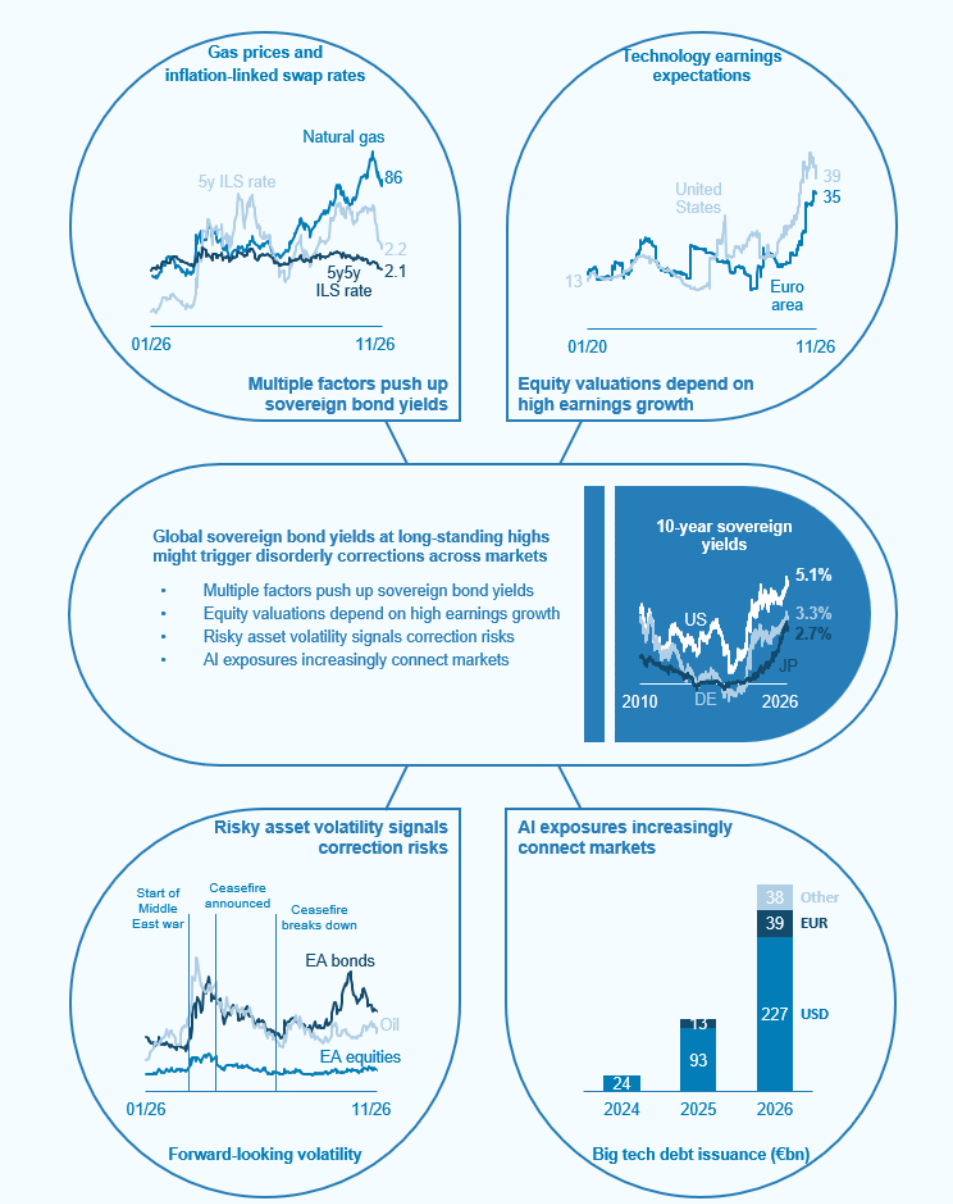
Sources: National central banks, Eurostat, ECB and ECB calculations.
Notes: ARM stands for adjustable-rate mortgage; LTV stands for loan-to-value. The interest rate elasticity of house prices measures the percentage change in house prices associated with a 1% change in interest rates, holding other factors constant. The elasticity estimates come from an econometric model with the log real index of house prices regressed on the log interest rate variable (calculated as a logarithm of the following expression: the real long-term interest rate minus the long-term rent growth plus a risk premium of 6%) with relevant demand-side control variables, following Dieckelmann et al.* The analysis focuses on the period Q4 2021-Q3 2025 for 20 euro area countries (Bulgaria is not included as the variable capturing the supply of housing is not available). The model was augmented with interactions between the interest rate variable and country dummies (fixed in time) based on the structural characteristics considered, with the interactions added one at a time. The country dummies are constructed as follows: (1) high ARM shares indicate countries where shares of variable-rate mortgages and mortgages that reprice in the following year in the stock in Q4 2025 exceed 20%; (2) countries with binding LTV caps are those where LTV caps were in place in H2 2025, calibrated at a maximum of 90% for the first-time buyers; (3) countries with high overvaluation are those where the deviation in the house price/income ratio from the mean in Q2 2022 (peak of the house price cycle) was higher than 25% (acknowledging that this is an estimate of an unobservable category and different methods may yield different estimates); (4) countries with a high share of non-mortgage property purchases are those where estimates (based in some cases on expert judgement rather than empirical evidence) coming from national authorities and/or industry reports are at over 30% of purchases; and (5) countries with a high share of home ownership are those where the ownership rate is over 70%. The results are robust to different cut-offs for country dummies. The impact of tax incentives to purchase property and supply-side shortages was also tested, but the results were not robust. A model excluding the supply of housing among the explanatory control variables but including Bulgaria yields similar results. The analysis focused on the period Q4 2021-Q3 2025 as the structural features which we consider could affect the interest rate elasticity of house prices differently depending on the period analysed, e.g. during a period of higher or lower interest rates.
*) Dieckelmann, D., Hempell, H.S., Jarmulska, B., Lang J.H. and Rusnák M., "House prices and ultra-low interest rates: exploring the nonlinear nexus", *Empirical Economics*, Vol. 68, 2025, pp. 1001-1037.

Common macro-financial shocks can have markedly different implications for residential RRE markets and the build-up of vulnerabilities across euro area countries. The findings in this box suggest that strong house price growth does not always reflect the same vulnerabilities. From a financial stability perspective, credit-driven price growth warrants the closest attention, as it fuels household leverage and might heighten banks' credit risk. Structural features of national markets also shape how house prices and borrowers respond to changes in interest rates. This is particularly relevant at the current juncture, as financing conditions are tightening again. Identifying the dominant factors helps explain why housing markets respond differently to common shocks, makes it easier to interpret housing market indicators and supports the early detection of risks. It also informs macroprudential policymaking, as the effectiveness of policy measures depends on the channels through which vulnerabilities build up.[18] In addition, understanding these dominant factors may help policymakers decide whether other housing market measures, such as housing-related taxes and levies, may be the appropriate policy response.[19]

[18] See Fell, J., "House price booms and policy choices: insights from a meta-regression analysis", *Financial Stability Review*, ECB, May 2026.

[19] See Kholodilin, K.A., "The Impact of Governmental Regulations on Housing Market: Findings of a Meta-Study of Empirical Literature", *Discussion Papers*, No 2113, Deutsches Institut für Wirtschaftsforschung, 2025.

2 Financial markets



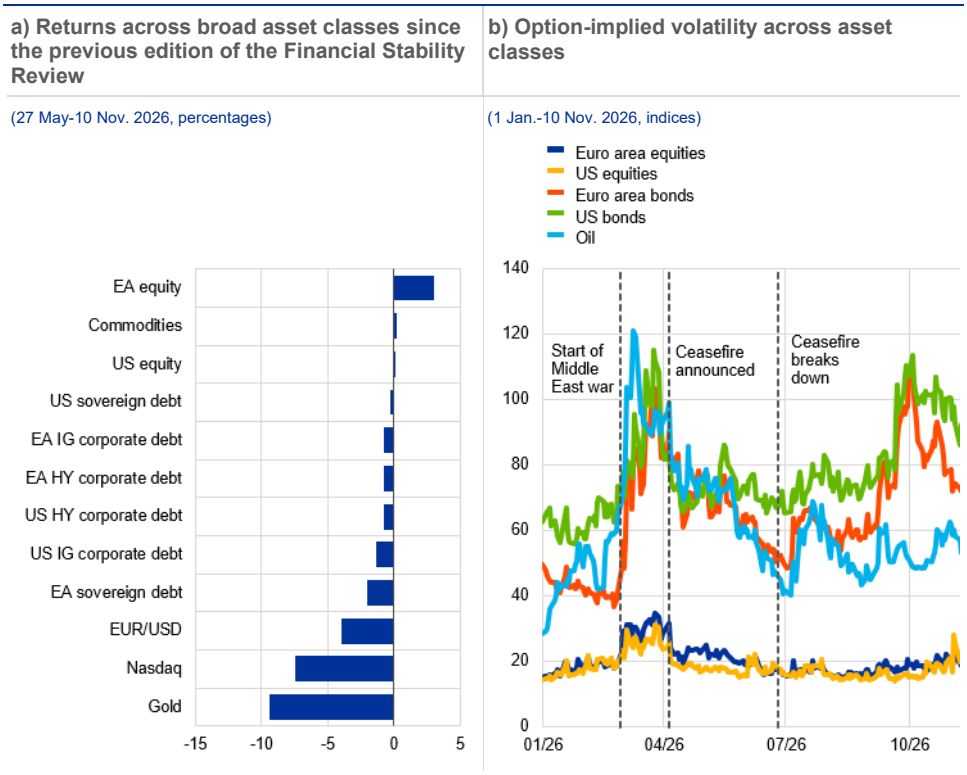
2.1 An interplay of global risks might challenge euro area financial markets

Geopolitical tensions, rising yields and AI-related developments are shaping euro area and global financial markets. Since the previous edition of the Financial Stability Review was published in May, most broad asset classes have been hit by losses, although euro area equity markets saw gains (**Chart 2.1,** panel a). Increased geopolitical tensions – especially the re-escalation of the conflict in the Middle East – have been the main driver of trends in commodity and sovereign bond markets.

Sovereign yields have increased significantly, reflecting inflation fears and the resulting change in monetary policy expectations, as well as fiscal concerns and, potentially, increased hyperscaler debt issuance (see **Section 2.2**). Higher global yields and a reassessment of sovereign debt trajectories have also triggered a widening in intra-euro area spreads and have weighed on the euro. By contrast, equity markets appear to have remained relatively resilient to geopolitical events and were largely being driven by earnings reports and AI-related news instead. The pricing of AI-related sectors and stocks has been volatile over recent weeks (see **Section 2.3**).[20] The continuing AI infrastructure buildout is further increasing AI-related exposures across various markets, increasing the risks of correlated sell-offs.

Chart 2.1

Markets are being driven by developments in AI and the conflict in the Middle East, with volatility picking up across markets



Sources: Bloomberg Finance L.P., ICE BofA and ECB calculations.
Notes: Panel a: the previous edition of the ECB's Financial Stability Review was published on 27 May 2026. "EA equity" reflects the EURO STOXX; "US equity" reflects the S&P 500 index; "Commodities" reflects the Bloomberg Commodity Index Total Return index. Corporate and sovereign bond indices are from ICE BofA. EA stands for euro area; IG stands for investment grade; HY stands for high yield. Panel b: "Start of Middle East war" refers to 2 March 2026, the first trading day after the start of the conflict on 28 February 2026; "Ceasefire announced" refers to 7 April 2026; "Ceasefire breaks down" refers to 27 June 2026.

Before a recent spike, volatility in equity markets had been low, despite the re-escalation of the conflict in the Middle East and bond market volatility.

Forward-looking equity volatility was elevated during the initial phase of the Middle East war but came down after the ceasefire was announced before spiking again briefly following the recent US midterms (**Chart 2.1**, panel b). This contrasts with bond market volatility in the United States and the euro area, which increased

[20] See also Grothe, M., Lopes Mendes, B., Manu, A.-S. and Tondo, L., "US equity market developments during the AI boom", *Economic Bulletin*, Issue 6, ECB, 2026.

alongside sizeable moves in sovereign bond yields. According to survey results, market participants identify the biggest tail risks as the rise in bond yields turning disorderly, the AI financing boom proving to be a bubble and a surge in inflation.[21] Low forward-looking equity market volatility might be indicating that markets are underestimating the risk of an abrupt, broad-based repricing.

Corporate bond and equity valuations have moderated but the latter remain sensitive to ambitious earnings expectations, especially in the technology sector. Valuations of US tech firms have fallen from their record highs (**Chart 2.2**, panel a), while euro area equity valuations, as measured by one-year forward price/earnings ratios, remain close to their historical average since 2005.[22] Earnings growth has been strong in both the euro area and the United States, which has fuelled further upward revisions to earnings expectations, most notably in the technology sector (**Chart 2.2**, panel b). Although large US tech firms have largely met earnings expectations, the earnings growth expectations currently embedded in market pricing are so high that they may be difficult to sustain, especially in the case of AI-related firms. Market reactions to recent disappointing earnings releases of large US tech firms and other AI-related companies have illustrated that markets continue to be exposed to any reassessment of the returns on AI investment (see **Section 2.3**). There are concerns that high reported earnings expectations may be inflated by sizeable valuation gains on equity stakes in other AI-related firms, reflecting circularity within the AI ecosystem rather than underlying operating performance (see **Box 3**).[23] Also, euro area corporate bond spreads have seen some recent widening amid rising government bond yields (see **Box 2**). Despite the recent moderation shown by valuation metrics, markets remain at high risk of abrupt further repricing, which is exacerbated by a rise in leveraged investments (see **Section 4.2**).[24]

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21 In the October Bank of America global fund manager survey, 31% of respondents saw a “disorderly rise in bond yields” as the biggest tail risk, followed by 23% who selected an “AI bubble” and 20% who indicated a “second wave of inflation”. A further 11% identified a “hyperscaler credit event” as the biggest tail risk.

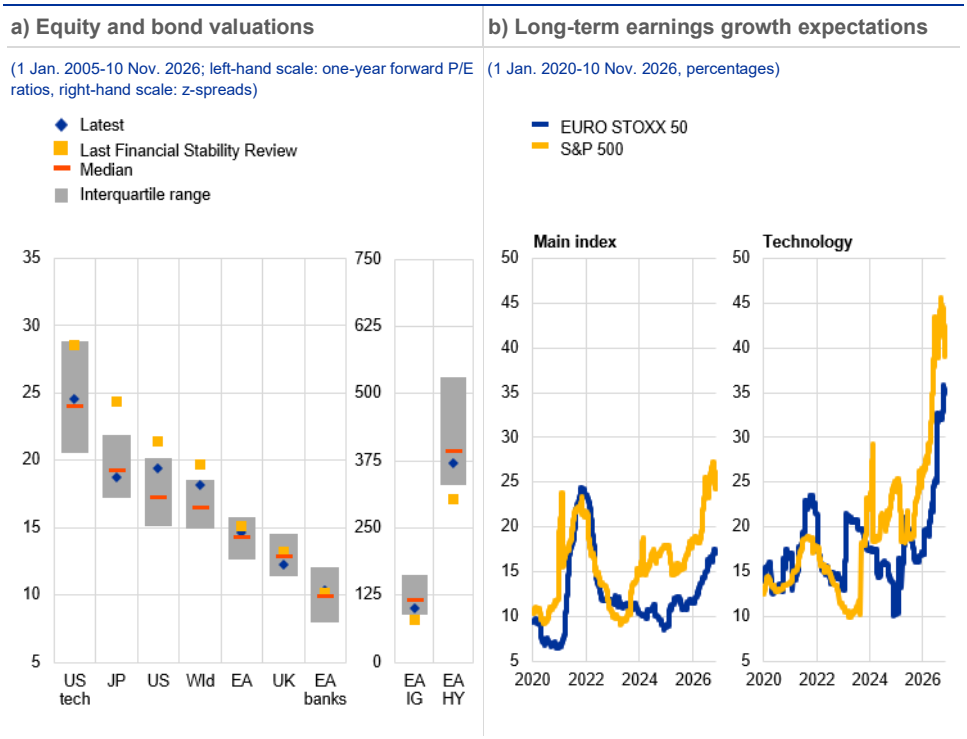
22 This assessment depends on the valuation metric used and the time horizon considered. Other metrics, such as the price/book ratio, the long-term price/earnings ratio and the equity risk premium, suggest that euro area equities may remain relatively highly valued.

23 See also Frost, J., Kansal, R., Rishabh, K., Shreeti, V. and Zhang, L.S.Y., “Circular relationships among AI firms”, *BIS Bulletin*, No 137, Bank for International Settlements, 1 October 2026.

24 The increase in demand for securities financing, particularly secured against equities, is also consistent with stronger demand for leveraged positions. See “Results of the September 2026 survey on credit terms and conditions in euro-denominated securities financing and OTC derivatives markets (SESFOD)”, *press release*, ECB, 7 October 2026.

Chart 2.2

Equity valuations have moderated but rely on very ambitious earnings expectations



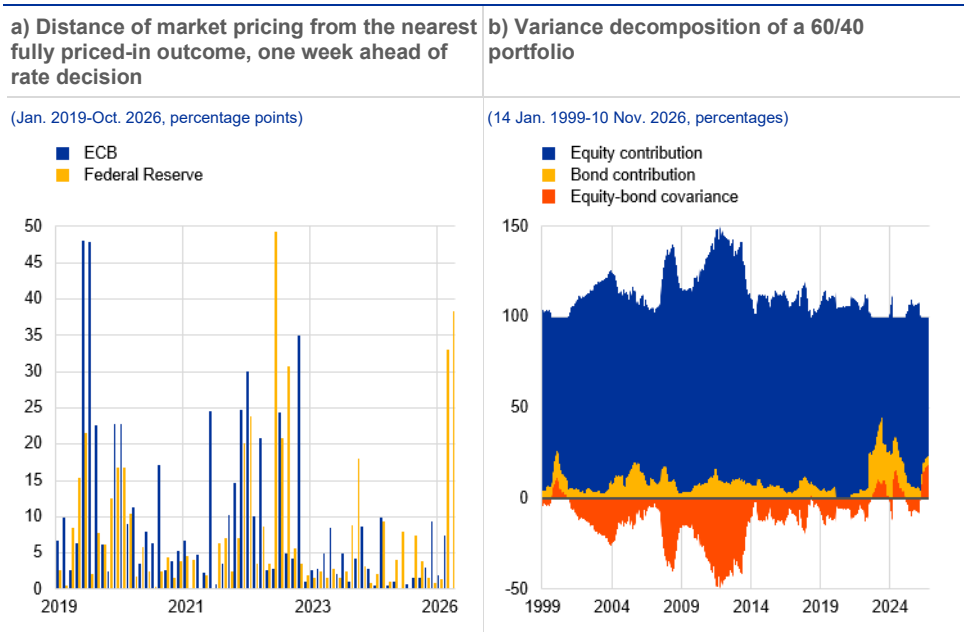
Sources: Bloomberg Finance L.P., LSEG and ECB calculations.
Notes: Panel a: for equities, the boxplot shows the interquartile range of one-year forward price/earnings (P/E) ratios relative to the distribution since 2005. The previous edition of the ECB's Financial Stability Review was published on 27 May 2026. For the world reading (Wld), the MSCI World Index is used; for bonds, the boxplot shows interquartile range of the latest z-spread compared with the distribution since 2005. JP stands for Japan; EA stands for euro area; IG stands for investment grade; HY stands for high yield.
Panel b: the chart depicts the weighted average long-term growth forecast for the EURO STOXX 50 and the S&P 500, as well as their technology sub-indices, based on the median analyst estimate for each constituent over the next three to five years (the next full business cycle).

Risks can interact and are aggravated by a rise in policy-related uncertainty. This is most evident in the way risks interact between AI-related assets and sovereign bond markets. Higher sovereign yields may weigh on long-duration AI-related investments, while AI-related bond issuance competes with long-dated government debt. Expectations of AI-driven productivity gains also underpin both equity valuations and debt sustainability. A shock in either market could therefore propagate to the other, amplifying longer-term losses in both. However, short-term reactions might differ, as illustrated by the recent sell-off in AI-related assets, which has triggered safe-haven flows and supported sovereign bond markets. Difficult-to-read inflation signals − from tariffs and energy to AI-related demand − compounded by a shift to less prescriptive communication at the Federal Reserve System, have made policy decisions harder to anticipate. This raises the likelihood of significant monetary policy surprises, even as uncertainty around ECB decisions remains low (**Chart 2.3**, panel a). More broadly, weakening multilateral cooperation leaves markets exposed to abrupt policy shifts, while upcoming elections in large euro area countries are adding further uncertainty. The recent US midterms also highlighted growing political opposition to large-scale AI infrastructure projects, heightening policy uncertainty around AI-related capital expenditure and casting further doubt on expected returns.

Supply-driven inflationary pressures have eroded the diversification benefits that bonds usually provide, leaving investors more exposed to losses. Sovereign bonds have traditionally acted as a hedge in balanced portfolios. With concerns rising about a pick-up in inflation and interest rates, however, stock and bond returns are again positively correlated, with the correlation in the euro area climbing to its highest level since 2005. A decomposition of the variance of a 60/40 stock-bond portfolio shows that, historically, a negative covariance between stocks and bonds reduced portfolio risk (**Chart 2.3**, panel b). This covariance has now turned positive and, together with a higher contribution from bond volatility, is adding to overall risk. As a result, a sell-off in financial markets triggered by a stagflationary shock would likely be broad based, with the co-movement of stocks and bonds potentially amplifying losses in diversified portfolios, even if sovereign bonds may still act as a hedge in risk-off episodes driven by other types of shocks.

Chart 2.3

Uncertainty has risen, while bonds no longer reduce portfolio risk



Sources: Bloomberg Finance L.P. and ECB calculations.
Notes: Panel a: based on the market-implied probability of a hike, hold or cut, priced for the Federal Reserve System and the ECB using the overnight index swap model on the day one week before the respective policy rate announcement. The chart shows the distance of this probability from a fully priced-in rate cut, rate hike or hold decision. A reading of zero means a full rate cut, hike or hold decision was fully priced ahead of the meeting; higher readings indicate that pricing sat between two outcomes, with a maximum of 50 percentage points when two decisions were priced as equally likely. Two unscheduled meetings of the Federal Reserve System's Federal Open Market Committee in March 2020 and one unscheduled monetary policy meeting of the ECB in March 2020 are excluded. Panel b: the portfolio is constructed by investing 60% (w_S) into the EURO STOXX and 40% (w_B) into German ten-year sovereign bonds. Portfolio variance is decomposed as $\sigma_P^2 = w_S^2\sigma_S^2 + w_B^2\sigma_B^2 + 2w_S w_B \, Cov(r_S, r_B)$. Variance ($\sigma_S^2$ for the equity part and σ_B^2 for the bond part) and covariance between equity and bond returns ($Cov(r_S, r_B)$) are calculated over 260-day rolling windows. The chart depicts the relative contributions of the three components to the total portfolio variance.

Box 2

Unwinding of corporate spread compression: implications for euro area market repricing

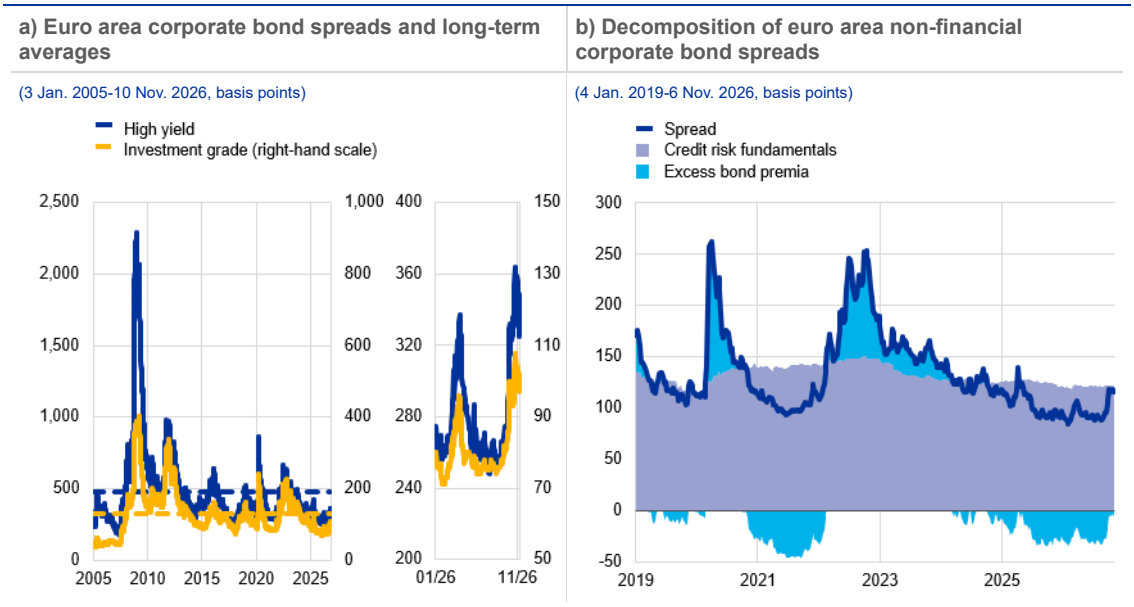
Prepared by Mar Domenech Palacios, Martina Jančoková, Paraic O'Gorman and Chiara Scommegna

Euro area corporate bond spreads have started to widen after a period of steady compression in recent years. Spreads peaked in October 2022 when disruptions to the supply of energy following Russia's invasion of Ukraine, high inflation and rapidly tightening monetary policy

gave rise to fears of a recession. Thereafter they narrowed substantially in both the investment-grade and the high-yield segments to levels well below their long-term averages (**Chart A**, panel a). This compression took place despite elevated geopolitical tensions, renewed inflation concerns linked to the conflict in the Middle East, growing debt issuance by AI hyperscalers and subdued growth prospects, all of which could have weighed on risk sentiment and corporate fundamentals. In recent weeks, however, corporate spreads have widened alongside rising government bond yields and tighter monetary policy. This box examines what is driving this widening and how a further repricing of risk would affect euro area borrowers and investors.

Chart A

The compression in euro area corporate bond spreads due to high levels of risk taking by investors may now be reversing



Sources: Bloomberg Finance L.P., Moody's and ECB calculations.
Notes: Panel a: corporate bond spreads for the ICE BofA Euro High Yield and Investment Grade Indices are calculated over the six-month EURIBOR curve. The dashed lines indicate long-term averages. Panel b: excess bond premia are calculated following the baseline specification in Gilchrist and Zakrajšek*. The explanatory variables include distance to default, duration, amount outstanding, coupon rate, an indicator variable that is equal to one if the bond is callable and zero otherwise, and country, industry and rating fixed effects. The estimation is based on senior unsecured bonds with maturities above one year.
*) Gilchrist, S. and Zakrajšek, E., "Credit Spreads and Business Cycle Fluctuations", *American Economic Review*, Vol. 102, No 4, June 2012, pp. 1692-1720.

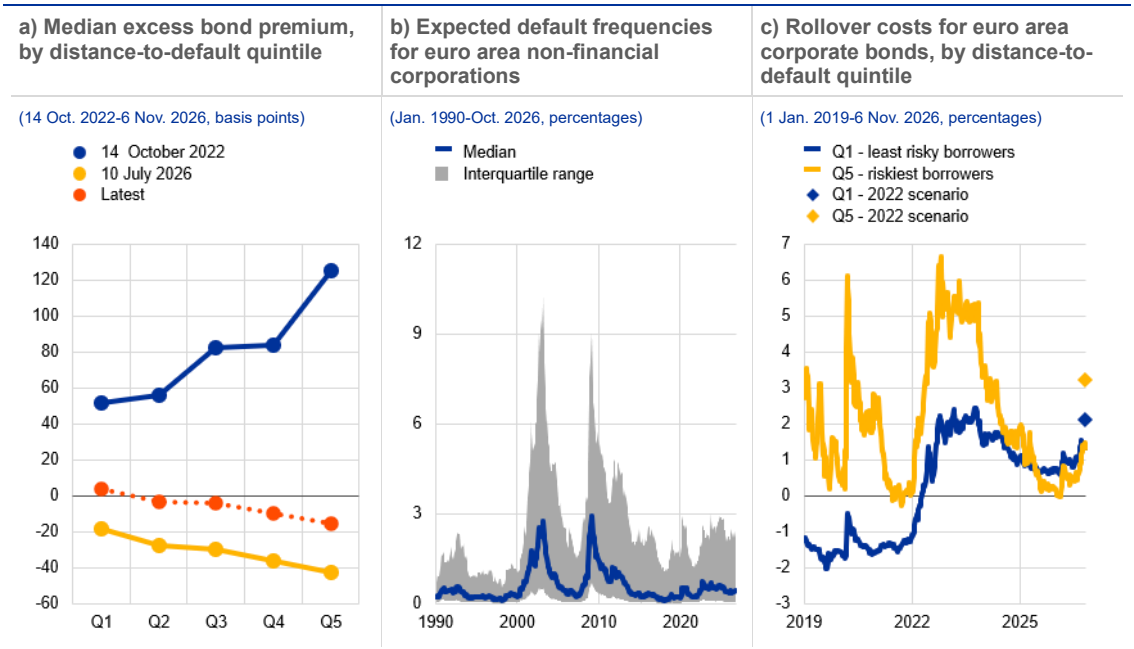
The recent changes in spreads mainly reflect shifts in investor risk appetite, with credit quality playing a secondary role. Corporate bond spreads can be decomposed into a component that may be explained by credit risk fundamentals and a residual excess bond premium (EBP). The EBP is the additional (or missing) compensation investors require to hold corporate bonds above (or below) the amount implied by the issuer's own default risk.[25] Given that the EBP reflects investor sentiment, it is sensitive to sudden shifts in risk appetite, whether they are global or euro area-specific. According to this decomposition of corporate bond spreads, less than one-fifth of the decline between October 2022 and September 2026 can be attributed to fundamentals, while the remainder reflects a falling EBP (**Chart A**, panel b). In October 2024 the average euro area EBP turned negative, with almost 90% of bonds trading at spreads tighter than those implied by their fundamentals for much of 2026. This suggests that risk appetite and risk-bearing capacity in the

[25] Following Gilchrist, S. and Zakrajšek, E., "Credit Spreads and Business Cycle Fluctuations", *American Economic Review*, Vol. 102, No 4, June 2012, pp. 1692-1720, option-adjusted spreads on euro area non-financial corporate bonds are regressed on distance to default, the logs of duration and amount outstanding, the coupon, the rating and dummies for industry, country and callability.

financial sector was unusually strong, with similar negative EBP levels last seen when corporate bond purchases by the Eurosystem were exerting downward pressure on spreads.[26] At the same time excess bond premia compressed most for the riskiest borrowers, which is fully consistent with "search for yield" behaviour (**Chart B**, panel a). In recent weeks, the average EBP has risen close to zero, with this component accounting for almost all of the recent widening of spreads. By contrast, the fundamentals component has remained broadly unchanged, indicating that the widening is being driven primarily by shifts in risk sentiment rather than by changes in underlying credit fundamentals. In the United States, the EBP is still firmly in negative territory, implying that while the earlier compression of spreads was driven, at least in part, by global factors, the recent unwinding has a strong euro area-specific component.[27]

Chart B

Despite solid credit fundamentals, riskier firms are most exposed to the recent repricing of risk and higher rollover costs



Sources: Moody's, Bloomberg Finance L.P. and ECB calculations.
Notes: Panel a: quintiles are constructed weekly on distance to default. Quintile 1 contains those bonds whose issuers are furthest from default and quintile 5 contains those closest to default. The dates 14 October 2022 and 10 July 2026 indicate a recent peak and trough in the average EBP respectively, while "Latest" refers to 6 November 2026. Panel b: the expected default frequency is a market-based measure developed by Moody's KMV which indicates the probability that a company will default within one year. Panel c: face value-weighted average difference between yield to worst and coupon rate of individual bonds. Quintiles are as defined in panel a. Diamonds show the rollover cost in an EBP repricing scenario which is similar to the repricing seen between August 2021 and July 2022.

Improving fundamentals have helped to contain rising spreads to a moderate extent. The component of spreads explained by fundamentals now stands at around the levels seen just before the outbreak of the COVID-19 pandemic in 2020 (**Chart A**, panel b). The rating mix has shifted favourably, with a shrinking share of high-yield bonds in the outstanding stock.[28] The median expected default frequency remains close to historical lows, although the proportion of risky

[26] See, for example, De Santis, R.A., Geis, A., Juskaite, A. and Cruz, L.V., "The impact of the corporate sector purchase programme on corporate bond markets and the financing of euro area non-financial corporations", *Economic Bulletin*, Issue 3, ECB, 2018.

[27] See Domenech Palacios, M. and Jančoková, M., "Challenges to the resilience of US corporate bond spreads", *Economic Bulletin*, Issue 3, ECB, 2025.

[28] Part of the rating mix shift may reflect the migration of weaker borrowers to private credit and leveraged loan markets rather than a genuine strengthening of corporate credit quality.

borrowers remains at the elevated 2022 levels (**Chart B**, panel b). Moreover, the average duration of bonds has declined from over five years in 2020 to close to four years today, which lowers spreads mechanically. At the same time, the euro area bond market has become significantly more integrated since the sovereign debt crisis.[29]

The risk of further abrupt repricing appears elevated in light of previous stress episodes. Both the 2020 and the 2022 episodes show that the EBP can move by more than 100 basis points within a quarter. Repricing has a disproportionate effect on the riskiest borrowers, whose premia are generally the most cyclical[30] and are also the most sensitive to global risk shocks.[31] Shorter bond durations mean that higher borrowing costs pass through faster, as a larger share of corporate debt will be refinanced over the coming years. A further shock to the EBP of the magnitude experienced in 2022 would increase refinancing costs for most borrowers, especially those in the riskiest segment. However, rollover costs would remain below their 2023 highs, given that a significant amount of debt had already been issued at elevated rates (**Chart B**, panel c).

Beyond higher costs for borrowers, a further repricing would imply losses for euro area investors, notably investment funds and insurance corporations. Of the euro area non-financial corporate bonds held by euro area residents, investment funds held 39% and insurance corporations 20% as of the second quarter of 2026. A repricing of the EBP on the scale of that seen in 2020 or 2022 would result in a mark-to-market loss of up to 4% on the outstanding stock of euro area corporate bonds. With spreads offering little compensation for the risk of such losses, a shift in risk sentiment could have consequences well beyond the corporate bond market.

2.2 Sovereign bond yields at multi-year highs are posing challenges

Rising real rates and inflation concerns have put euro area sovereign bond markets under renewed pressure. Sovereign yields have increased in tandem over the past year in advanced economies and are now close to their highest level since the aftermath of the global financial crisis, especially at the long end of the curve (**Chart 2.4**, panel a). This has been driven by several factors, including rising energy prices adding to inflationary pressures and concerns over global fiscal expansion.

29 Country of domicile explains less of the variation in spreads than rating, industry or distance to default. More specifically, univariate regressions of log option-adjusted spreads on each characteristic in turn give an R^2 of 5% for country of domicile, against 28% for rating, 18% for industry and 13% for distance to default. Earlier research finds there was deep financial market fragmentation in the euro area corporate bond market during the sovereign debt crisis. See De Santis, R.A., "Unobservable country bond premia and fragmentation", *Journal of International Money and Finance*, Vol. 82, 2018, pp. 1-25.

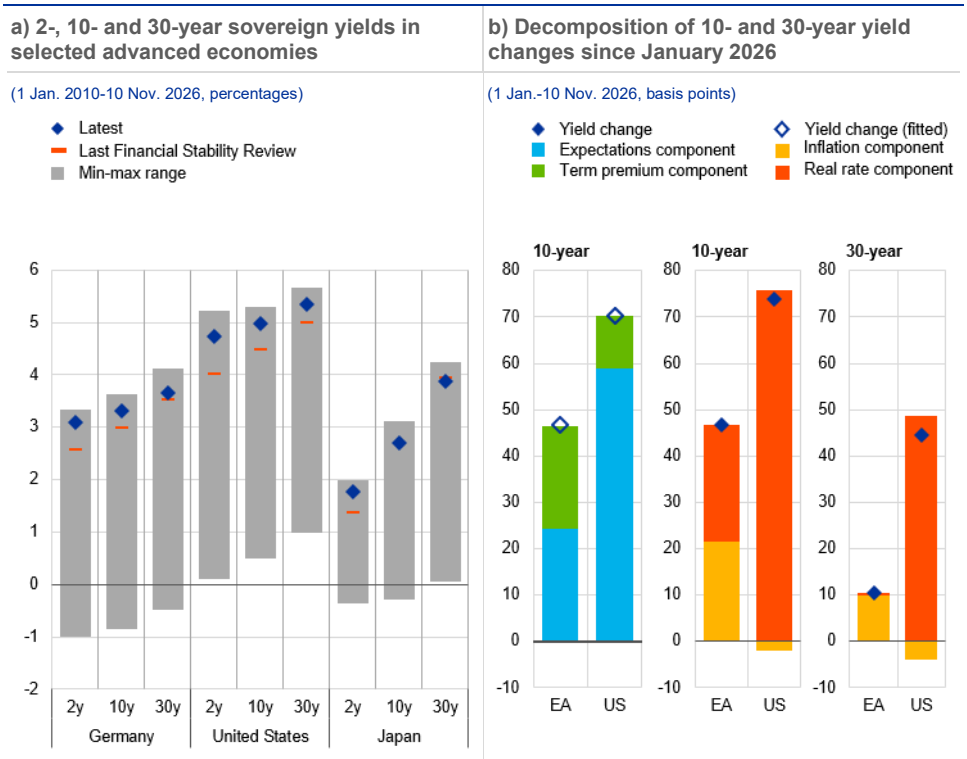
30 See Domenech Palacios, M., "Firms' risk and monetary transmission: revisiting the excess bond premium", *Working Paper Series*, No 3118, ECB, September 2025.

31 A global risk shock passes through to high-yield spreads around 4.7 times more strongly than it does to investment-grade spreads. This is the median impulse response based on a BVAR model containing German ten-year bond yields, euro area and US stock prices, the USD/EUR exchange rate, the spread between German and US ten-year yields and either investment-grade or high-yield euro area non-financial corporation spreads. Shocks are identified using sign restrictions, following Brandt, L., Saint Guilhem, A., Schröder, M. and Van Robays, I., "What drives euro area financial market developments? The role of US spillovers and global risk", *International Journal of Central Banking* (forthcoming). The model is estimated using daily data between January 2006 and 13 August 2026, building on the BEAR toolbox; see Dieppe, A., Legrand, R. and van Roye, B., "The BEAR toolbox", *Working Paper Series*, No 1934, ECB, July 2016.

There is limited evidence so far that AI-related debt issuance is crowding out euro area sovereign bonds. However, the scale of AI financing in the United States at higher durations may be contributing to higher yields there, which could add to upward pressure on euro area yields through spillovers. Model results suggest the increase in the United States mainly reflects the real rate component of the yield, with rising inflation expectations and term premium also playing a role in the euro area (**Chart 2.4**, panel b). Markets have continued to function in an orderly manner overall, although strains have prompted official action, particularly in the United States, including a joint US-Japanese intervention to support the yen in July and a US Treasury decision to increase its buybacks of longer-dated bonds.

Chart 2.4

Long-term yields are at decade highs, driven by real rates



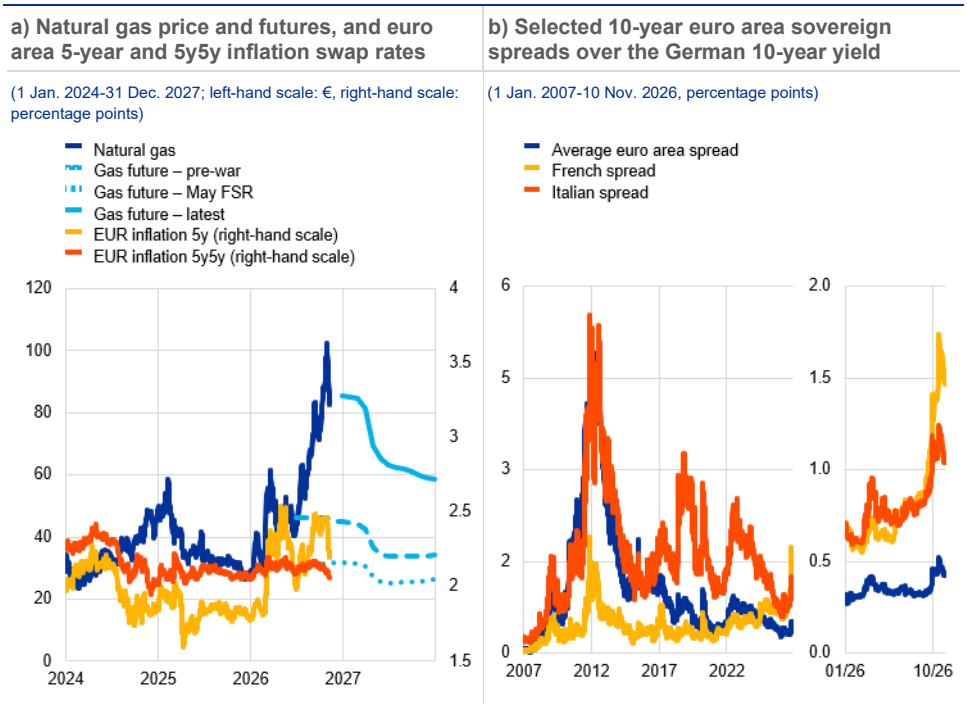
Sources: Bloomberg Finance L.P., LSEG, Haver Analytics, Federal Reserve System and ECB calculations.
Notes: Panel a: the previous edition of the ECB's Financial Stability Review was published on 27 May 2026. Panel b: the euro area (EA) term structure decomposition is based on an average of three models following Joslin et al.* (with and without surveys) and Geiger and Schupp**. The US decomposition is based on an average of three models: Adrian et al.***, Christensen-Rudebusch**** and D'Amico et al*****. The term structure models decompose the fitted yield, and the difference to observed yield change due to fitting error is not shown. The EA (US) real rate component is the overnight index swap rate (US Treasury yield) minus the inflation-linked swap rate (break-even inflation rate). The latest observations are for 10 November 2026 for EA decompositions and 9 November 2026 for US decompositions.
*) Joslin, S., Singleton, K.J. and Zhu, H., "A New Perspective on Gaussian Dynamic Term Structure Models", *Review of Financial Studies*, Vol. 24, Issue 3, 2011, pp. 926-970.
**) Geiger, F. and Schupp, F., "With a little help from my friends: Survey-based derivation of euro area short rate expectations at the effective lower bound", *Discussion Papers*, No 27/2018, Deutsche Bundesbank, 2018.
***) Adrian, T., Crump, R.K. and Moench, E., "Pricing the term structure with linear regressions", *Journal of Financial Economics*, Vol. 110, Issue 1, 2013, pp. 110-138.
****) Christensen, J.H.E. and Rudebusch, G.D., "The response of interest rates to US and UK quantitative easing", *The Economic Journal*, Vol. 122, Issue 564, 2012, pp. F385-F414.
*****) D'Amico, S., Kim, D.H. and Wei, M., "Tips from TIPS: The Informational Content of Treasury Inflation-Protected Security Prices", *Journal of Financial and Quantitative Analysis*, Vol. 53, No 1, 2018, pp. 395-436.

It would appear that euro area yields are being driven in large part by common external shocks, notably higher energy prices and spillovers from US yields. Given the continued geopolitical tension in the Middle East, the prices of oil, gas and

refined products are expected to stay elevated for longer than market participants initially expected (see **Section 1.1**). At shorter maturities, higher energy costs pushed up inflation expectations. So far, medium-term expectations are little changed (**Chart 2.5**, panel a), but a more prolonged shock could test how well anchored these expectations are. Developments in the United States have also added to the pressure at the long end of the curve, with Treasury yields reaching levels last seen before the global financial crisis amid stronger than expected growth, record investment in AI and concerns about US fiscal fundamentals. These external shocks have lifted sovereign yields across all euro area countries, with domestic factors adding further pressure in some.

Chart 2.5

Higher energy prices raise short-term (not medium-term) inflation compensation, while spreads have widened in some countries



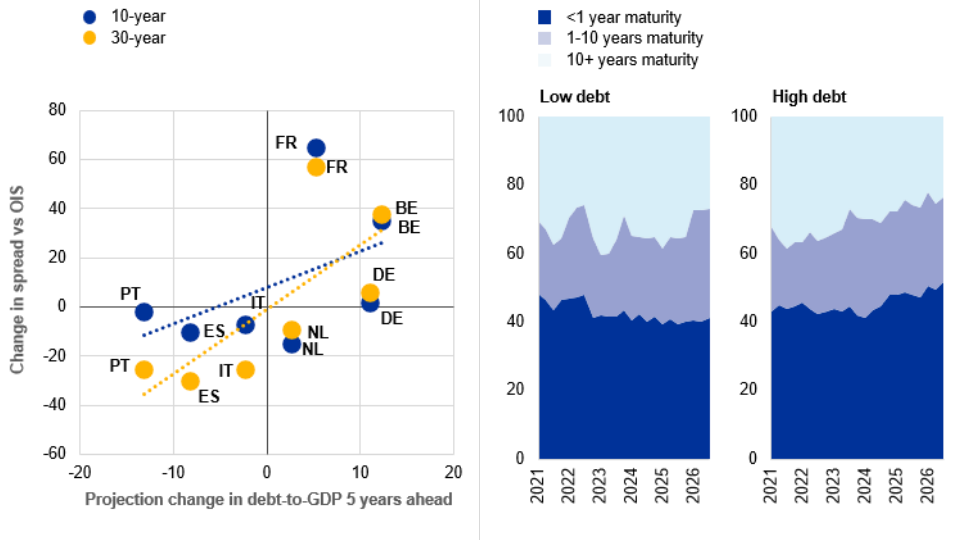
Sources: ECB, Bloomberg Finance L.P. and ECB calculations.
Notes: Panel a: natural gas price and futures refer to Netherlands TTF Natural Gas Forward Day Ahead (EUR). "Gas future – pre-war" refers to 27 February 2026; "Gas future – May FSR" refers to 27 May 2026. "Gas future – latest" refers to 10 November 2026. Euro area inflation 5y and 5y5y are inflation swap rates. Panel b: "Average euro area spread" is the GDP-weighted spread for Belgium, Ireland, Greece, Spain, Netherlands, Austria, Portugal and Finland. 2025 GDP is used as a proxy for 2026 GDP.

Long-standing fiscal concerns, compounded by political uncertainty, are also pushing intra-euro area spreads wider in some highly indebted countries. The spread between French and German ten-year bonds has risen significantly (**Chart 2.5**, panel b). Markets are increasingly pricing in political risk ahead of significant elections in 2027. The widening French-German spread has resulted in some spillover effects to other highly indebted sovereigns, while German Bunds have benefited from their status as a relatively safe haven. Although the average euro area spread has widened recently, it remains low compared with levels reached during previous periods of stress. More broadly, changes in spreads since the start of 2025 have aligned broadly with projected debt-to-GDP ratios (**Chart 2.6**, panel a). The relationship is somewhat steeper at the long end of the curve, indicating that

fiscal concerns are priced in mainly for longer horizons, which can provide price signals that encourage prudent fiscal policies. Despite brief episodes of heightened volatility and reduced liquidity, sovereign markets have largely absorbed these pressures in an orderly fashion. However, internal and external challenges continue to leave them exposed to the risk of a disorderly adjustment.

Chart 2.6

Long-term yields reflect fiscal concerns, with sovereign issuance shifting to shorter-term debt



Sources: Bloomberg Finance L.P., IMF, LSEG, ECB projections database, Böninghausen and Vladu* and ECB calculations.
Notes: Panel a: the chart shows changes in the spreads between ten-year and thirty-year sovereign yields versus overnight index swap (OIS) rates since 2025 and IMF 5-year projected changes in government gross debt-to-GDP ratios. Dotted lines show regression lines. Panel b: low-debt countries have debt-to-GDP ratios below the euro area average: Bulgaria, Germany, Ireland, Croatia, Cyprus, Estonia, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Austria, Slovenia and Slovakia. High-debt countries have debt-to-GDP ratios above the euro area average: Belgium, Greece, Spain, France, Italy, Portugal and Finland. Debt issuance is shown as a rolling four-quarter average.
*) Böninghausen, B. and Vladu, A.L., "Sloping up: the repricing of euro area yields in 2025", *The ECB Blog*, ECB, 16 January 2026.

Pressures are amplified by a changing investor base and a shift towards shorter-dated issuance. Given that the Eurosystem is no longer an active buyer, more procyclical investors (e.g. foreign investors, investment funds and hedge funds) are increasingly absorbing new issuance. Participation by players located outside of the euro area particularly reflects growing hedge fund activity, which has become a significant − albeit procyclical − source of liquidity (see **Box 7**). Japanese investors are significant holders of euro area sovereign debt, particularly French government bonds. They have been reducing their holdings of long-dated euro area debt since 2022 and could reduce them still further if rising domestic yields or exchange rate movements made domestic assets more attractive. Competition for long-dated funding has also intensified, with a surge in AI-related corporate issuance proving attractive for investors. Sovereigns face weaker demand at the long end, including reduced demand following the recent reform of the Dutch pension system. As a consequence, they have shifted issuance towards shorter maturities, especially in highly indebted countries (**Chart 2.6**, panel b). While this will keep funding costs contained in the near term, it leaves sovereigns more exposed to shifts in investor

sentiment, with a quarter of outstanding euro area debt maturing before the end of 2028 and very high sovereign financing needs in a number of countries.

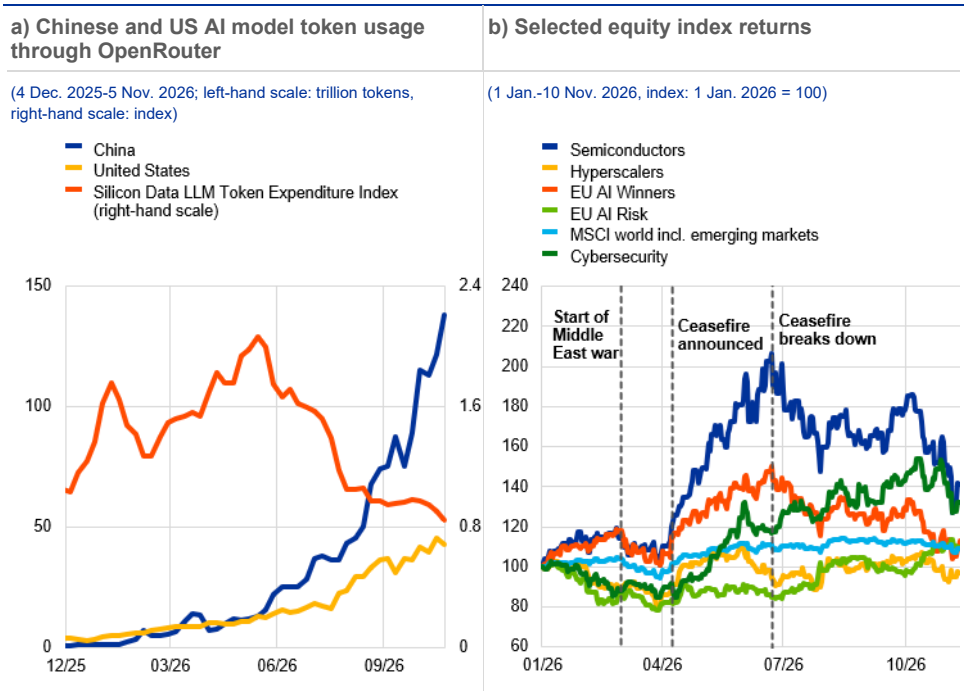
Rising long-term yields run the risk of tightening financing conditions beyond sovereign markets. This would compound the effect of monetary policy tightening as it feeds through the wider financial system. Euro area corporate bond yields have risen since the previous edition of the Financial Stability Review was published, and some corporate borrowers are vulnerable to a further deterioration in refinancing conditions (see **Box 2**). This risk is mitigated somewhat as the corporate maturity wall is still some years away. Investment-grade redemptions will peak in around 2028 and high-yield maturities will fall due almost entirely in the next five to seven years. Meanwhile, the floating-rate structure of private credit means higher rates pass through immediately to these riskier borrowers. AI-related investment is adding to these pressures (see **Box 4**). Higher yields are also compressing asset valuations by raising the rate at which future cash flows are discounted. This is weighing most on growth stocks where earnings lie furthest ahead.

2.3 AI external financing needs are increasingly linking exposures across different market segments

Market pricing for AI-related assets has turned volatile, as worries emerge about profitability, competition, cyber risk and a slowdown in AI development. In June enterprise-facing AI applications and agentic products moved to consumption-based pricing. The result has been a rapid increase in lower-cost models, including cheaper Chinese open-source AI models (**Chart 2.7**, panel a). In addition to broader concerns around overinvestment in AI-related assets, this has raised questions over which sectors and companies will be able to reap AI-related profits. On the one hand, hyperscalers have underperformed broad equity markets, perhaps because of uncertainty over the extent to which large capital expenditure will generate future profitability (**Chart 2.7**, panel b). On the other hand, semiconductor stocks, including those in emerging market economies, had first been assessed as more likely to be beneficiaries of the AI buildout. After a sizeable rally, however, semiconductor stocks corrected, as general risk appetite for AI-related assets dropped significantly. Although some of the losses were quickly recovered, markets still appear to be less convinced of productivity gains from AI, as the performance of companies considered to be AI winners converged with the performance of companies at risk of being displaced by AI. The outperformance shown by cybersecurity stocks also reflects worries about an increase in cyberattacks stemming from the improved capabilities of AI models (see **Special Feature B**). There have been calls for a slowdown in AI model development and more regulation due to security concerns and the buildout of large-scale AI infrastructure projects could slow down due to growing political opposition.

Chart 2.7

Market pricing on the AI narrative has turned volatile, as worries emerge about profitability, competition, cyber risk and a sequence of adverse news

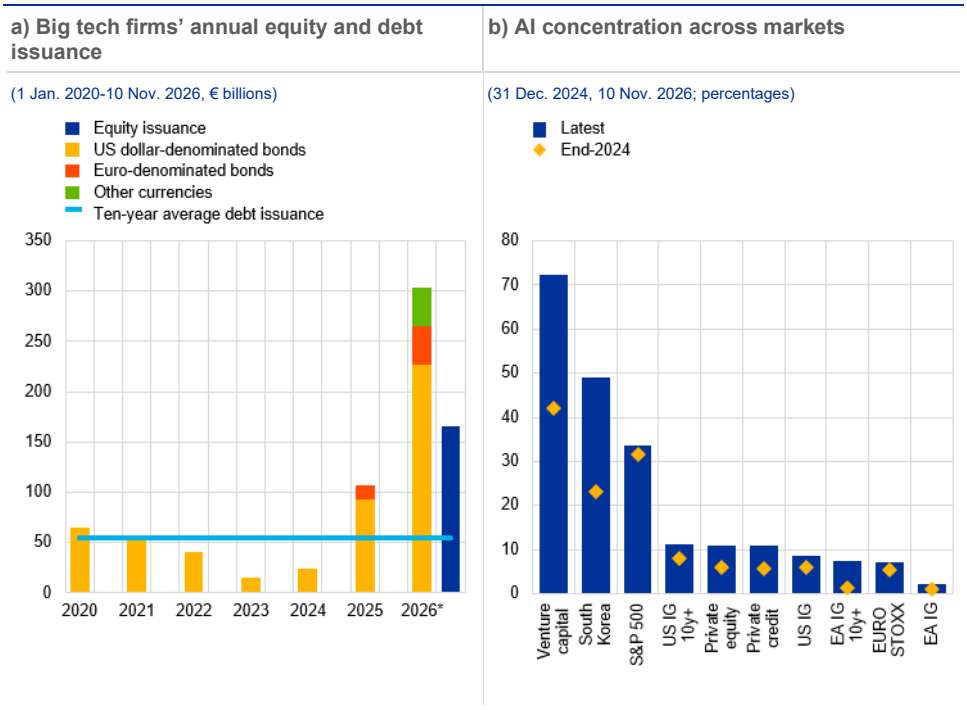


Sources: Bloomberg Finance L.P., LSEG and ECB calculations.
Notes: Panel a: usage of Chinese and US models measures aggregate token volume processed through the OpenRouter application programming interface, which is estimated to account for approximately 2% of current global AI token consumption. The Silicon Data LLM Token Expenditure Index is a benchmark for the price of large language model (LLM) tokens calculated from the usage-weighted price of one million tokens across a defined LLM universe. Panel b: the UBS EU AI Winners basket tracks the performance of euro area listed stocks of firms enabling and adopting AI technologies. The UBS EU AI Risk basket tracks the performance of euro area listed stocks of firms considered to be potentially at risk of disruption from AI. "MSCI World incl. emerging markets" refers to the MSCI World Index including emerging markets.

As free cash flow has diminished, the AI infrastructure boom has come to rely on external sources of funding. For most hyperscalers, free cash flow has declined considerably since early 2025. It has turned negative in 2026 and is expected to remain so until 2028. The AI investment boom, which in its earlier stages was largely funded from internal profits, has therefore started to rely heavily on external sources of funding (see **Box 3**). This is reflected in large equity issuances by big tech firms, including seasoned equity offerings and record initial public offerings (IPOs) conducted or announced by AI-related companies (**Chart 2.8**, panel a). These large IPOs could be a sign of late-cycle market exuberance and run the risk of introducing additional volatility into equity markets (see **Special Feature C**). Big tech firms are also increasingly taking on debt (including euro-denominated debt) through private credit and public bond markets, with a notable rise in issuance. Such issuance may crowd out other investments and is cited as a potential contributor to the rise in US sovereign bond yields. However, there is only limited evidence of crowding out in euro-denominated markets so far (see **Box 4**). In recent weeks, concerns about the sustainability of this debt funding have risen, with credit default swap spreads for a number of big tech firms climbing to record levels.

Chart 2.8

AI financing boom increasingly links different segments of capital markets



Sources: Bloomberg Finance L.P., Dealogic, a service of ION Analytics, PitchBook, ICE BofA and ECB calculations.
Notes: Panel a: for 2026, issuance is until 10 November. The sample covers Alphabet, Amazon, Broadcom, Meta, Microsoft, NVIDIA, Oracle and SpaceX. "Other currencies" includes the Australian dollar, pound sterling, Canadian dollar, Japanese yen and Swiss franc. "Ten-year average debt issuance" refers to issuance by tech firms. Panel b: EA stands for euro area. AI firms are defined as those involved in the buildout of AI data centres and infrastructure, the development of frontier AI models or the manufacturing of chips used for AI. Concentration in equity indices is the share of market capitalisation of AI-related firms in the total market capitalisation of the respective index. Concentration in bond indices is computed likewise, based on market value. "US IG 10y+" and "EA IG 10y+" refer to the subsets of the ICE BofA US Corporate Index and the ICE BofA Euro Corporate Index that include investment-grade (IG) bonds with a maturity of more than ten years. 2024 refers to end-2024 data for equity and bond indices; 2026 refers to the latest available data point, which is 10 November 2026. Due to missing data on outstanding amounts in private markets, AI funding shares for venture capital, private credit and private equity are based on transaction-level data for 2024 and 2026 (deal volumes for venture capital and private equity, and debt volumes for private credit). AI-related firms are identified using the PitchBook-defined verticals "Artificial Intelligence & Machine Learning", "Big Data" and "CloudTech & DevOps", supplemented by targeted keywords identifying AI compute and data centre infrastructure. The cited data has not been reviewed by PitchBook analysts and may be inconsistent with PitchBook methodology.

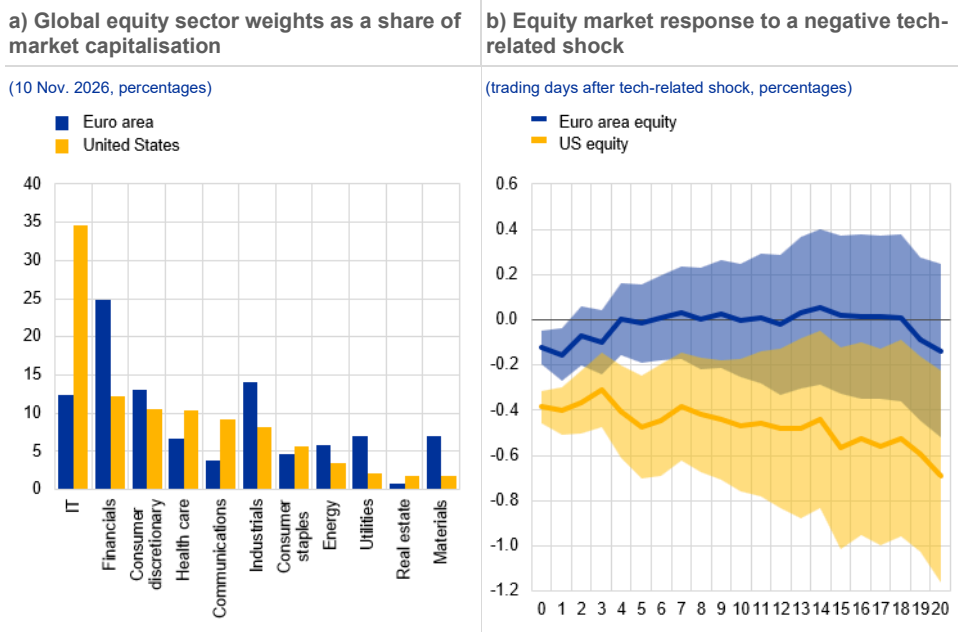
With the associated surge in financing and rise in valuations, the AI narrative is reinforcing the role of AI as a common source of vulnerability across markets. Ongoing issuances in equity and bond markets, as well as sizeable deals related to AI companies and infrastructure in private markets, are continuing to increase AI-related exposures in a range of markets (**Chart 2.8**, panel b). Previously, these markets were driven by different factors, so risks could be diversified. This concentration on a single market narrative, which is expected to increase, sets the scene for further correlated losses in the event of AI-related volatility.

Euro area equity markets are less tech exposed, but still suffer from tech-related sentiment spillovers, although they are recovering quickly. Euro area equity markets are less concentrated in technology or AI-related sectors than their US peers (**Chart 2.9**, panel a). Structurally, their lower tech share implies that while they miss out on valuation gains, they may benefit from inflows from investors who appreciate the diversification they offer. The evidence to date suggests that in the event of an AI or a technology-related shock, euro area markets fall in tandem with US equity markets, likely driven by a spillover in global risk sentiment. They do,

however, see smaller losses and appear to recover faster than their US peers (**Chart 2.9**, panel b). Nevertheless, euro area investors remain highly exposed to AI-related investments in non-domestic markets (see **Chapter 4**).

Chart 2.9

Less tech-heavy euro area markets suffer from technology-related shocks spilling over to global risk sentiment but also benefit from diversification flows



Sources: Bloomberg Finance L.P. and ECB calculations.
Notes: Panel a: "Euro area" refers to the EURO STOXX; "United States" refers to the S&P 500. Panel b: local projections using daily data starting from January 2022 estimate cumulative equity market responses over 20 trading days to a 1 standard deviation negative technology-related equity shock, defined as the Nasdaq falling by at least 1 standard deviation more than its usual relationship with the S&P 500 would imply. Regressions include five lags of the dependent variable, VIX changes and US and German ten-year yield changes; shaded areas denote 90% Newey-West confidence intervals.

Box 3

The debt financing of AI and its implications for financial stability

Prepared by Federica Bosio, Lara Coulier, Daniel Dieckelmann, Tina Emambakhsh, Maciej Grodzicki and Maria Leonor Puga[32]

The investment needs of firms in the AI supply chain are unprecedented in scale. Cumulative capital expenditure by US big tech firms alone is forecast to reach about USD 5.5 trillion by 2030, although estimates vary widely. On an annual basis, overall AI investment needs would amount to more than 3% of US GDP between 2025 and 2032, which is considerably larger than the financing of other major innovations in the past.[33] Investment in the AI buildout is highly concentrated among a small group of US firms, including hyperscalers and manufacturers of semiconductors. While these firms have in the past generated large free cash flows through their non-AI-related activities,

[32] This box has benefited from data support provided by Chiara Scommegna and Fabian Wagner.

[33] The capital expenditure estimates for US big tech firms are based on broker estimates from the LSEG Data & Analytics platform on 26 October 2026 for Alphabet, Amazon, Broadcom, Meta, Microsoft, Nvidia and Oracle. Total annual capital expenditure figures are based on Van Nieuwerburgh, S., "Financing the AI Buildout", *NBER Working Papers*, No 35865, National Bureau of Economic Research, October 2026. For comparison, annual capital expenditure for the development of the Northern Pacific Railway amounted to about 2.24% of US GDP between 1870 and 1890 and the internet boom between 1996 and 2003 took up 1.10% of US GDP.

free cash flows turned negative for most US hyperscalers in 2026, as capital expenditure on AI infrastructure exceeded operating cash flows.[34] In response, these firms are increasingly turning to external funding from equity[35] and debt.

Alongside debt from public and private markets, firms are increasingly using opaque off-balance-sheet structures to fund the AI infrastructure buildout. Public debt issuance by US big tech firms has surged within a very short period of time, in both the United States and other jurisdictions.[36] This issuance has been complemented by other sources of debt finance, based on expected future cash flows from monetising AI-related infrastructure. Specifically, hyperscalers contractually commit to use the AI-related infrastructure of data centre developers and advanced chip owners. Future cash flows from these commitments can be employed by owners of AI-related assets to secure borrowing from lenders like banks, bond investors or private credit funds.[37] Such cash flow commitments are debt-like in economic terms, but they do not appear as liabilities on the balance sheets of hyperscalers under US accounting standards. Big tech firms are estimated to have total off-balance-sheet commitments of more than USD 4 trillion as of the second quarter of 2026 (**Chart A**, panel a), well in excess of their outstanding on-balance-sheet liabilities.

The opaqueness of AI-related debt is further compounded by circular links in the form of mutual commitments and interlinked ownerships between firms in the AI supply chain. AI-related firms, such as cloud service providers and AI labs, purchase and lease chips from manufacturers to provide computing services. These purchases are often financed by the chipmakers. Such mutual finance commitments inflate the expected revenues of both the chipmaker and the service provider, because the reported demand of an involved firm is partly driven by that firm's own financing decisions (**Chart A**, panel b). Hyperscalers are also connected to other firms in the AI ecosystem through lending and equity stakes. Valuation gains on private equity holdings, especially in AI labs, are increasingly contributing to hyperscalers' earnings growth (**Chart B**, panel a).[38]

34 At the same time, two large semiconductor firms, Broadcom and Nvidia, have seen their free cash flows soar on the back of strong demand for chips, including from hyperscalers.

35 See Dieckelmann, D., Franco, L., O'Gorman, P. and Scommegna, C., "Financial stability risks from large IPOs, equity issuance and passive investing", *Financial Stability Review*, ECB, November 2026.

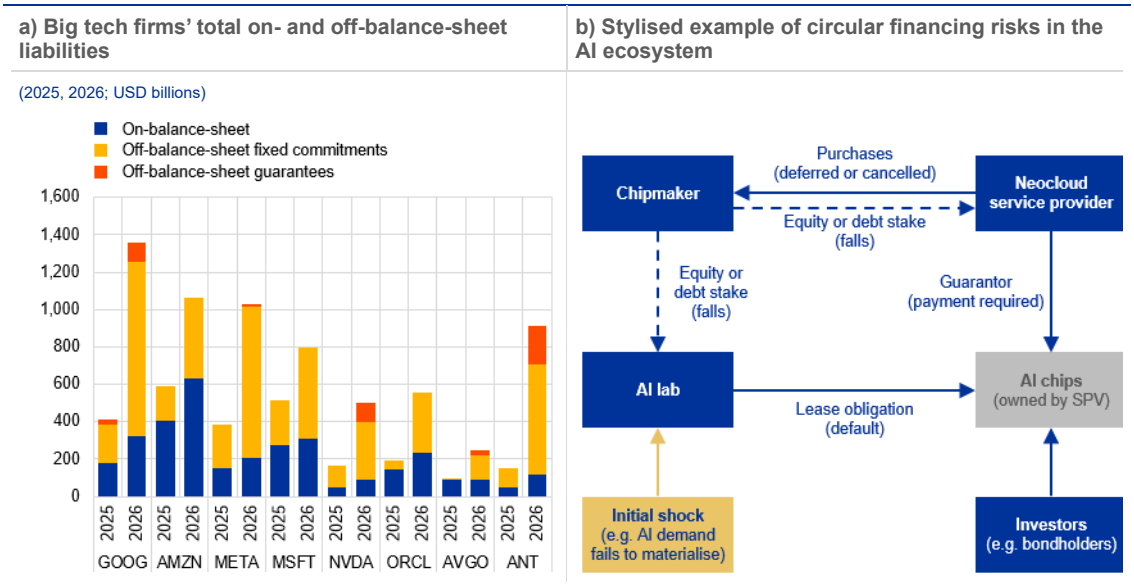
36 See Duquerroy, A., Furtuna, O. and Vaz Cruz, L., "Big tech's growing presence in the euro bond market: implications for investors", *Financial Stability Review*, ECB, November 2026.

37 Under US Accounting Standards Codification (ASC) 842, a lease is not recognised on the balance sheet until the starting date of the asset's use, even if the lease agreement was already signed prior to that date. Under ASC 440, any future obligations and significant contractual commitments must be disclosed in the notes to the financial statements.

38 "Other income" reported by Alphabet and Amazon comes from revaluations of private equity stakes in Anthropic, which are included in the reported earnings of these firms. Nvidia has acquired equity stakes in companies like CoreWeave, OpenAI and Anthropic.

Chart A

Big tech investments are increasingly being financed via debt issued outside of own balance sheets amid rising interlinkages within the AI ecosystem



Sources: Company SEC filings and ECB calculations.
Notes: Panel a: GOOG = Alphabet, AMZN = Amazon, META = Meta, MSFT = Microsoft, NVDA = Nvidia, ORCL = Oracle, AVGO = Broadcom, ANT = Anthropic. Data for 2025 refer to the full financial year and data for 2026 refer to the most recent SEC filing. Data from Anthropic are based on its IPO filing (S-1). Fixed commitments refer to future lease payments or contractual purchases that are fixed. Contingent commitments include backstops and purchase obligations that become payable if pre-specified conditions apply, e.g. if the underlying counterparties experience financial distress. Data were extracted from the selected companies' public SEC filings using an agentic AI model developed by ECB staff. The AI agent (using Open AI's ChatGPT 5.6-Sol) was trained to replicate manually compiled and validated off-balance-sheet aggregates as of Q1 2026 from the sample of firms and instructed to identify the relevant balance-sheet information from the companies' filings available on the SEC's website for the other periods. The extracted data were subsequently cross-checked manually by ECB staff. Panel b: dashed blue lines indicate changes in valuation. Solid blue lines indicate flows of money. The yellow line indicates shock transmission. An AI lab is a company which develops, tests and applies AI technologies, including large language models (LLMs). SPV stands for special-purpose vehicle.

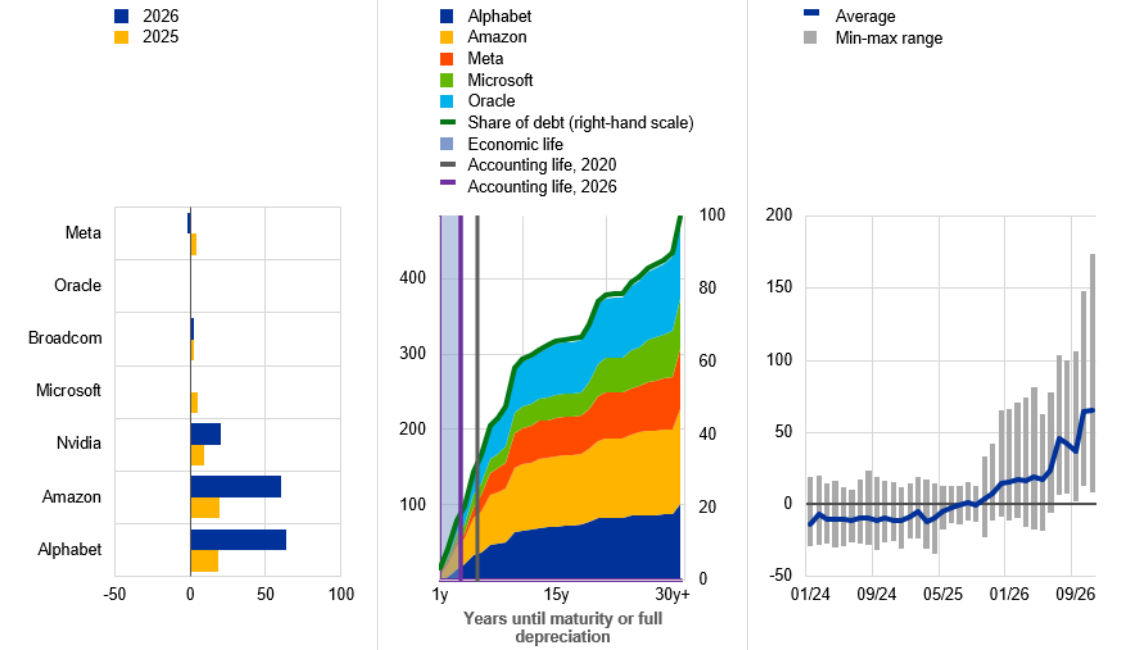
Investors have become more attentive to risks associated with the volume and growth of the debt needed to finance the AI buildout, together with its opacity and circularity. There is a risk that hyperscaler earnings may not fully meet current expectations. This could be due to competition from cheaper open-source models abroad, supply-side factors – such as energy, chip and grid bottlenecks – or a shorter than expected lifespan of advanced chips.[39] In such a scenario, firm leverage metrics, and consequently their credit ratings, could deteriorate, as the full debt incurred for the AI buildout would gradually be recognised on balance sheets, while the value of assets may be impaired and income projections fall short of expectations. Circular relationships could amplify the impact and cause spillovers within the industry. The long duration of the debt (**Chart B**, panel b) exacerbates the risk of valuation losses if hyperscalers are not successful in monetising their investments. In essence, the maturity of hyperscalers' outstanding debt exceeds the economic lifetimes of a substantial share of the physical capital funded by this debt, especially in the form of advanced chips.[40] As issuance has increased, credit spreads on hyperscaler debt have widened relative to similarly rated corporate issuers, particularly at longer maturities (**Chart B**, panel c). This could be an indication that markets currently view rating agencies' risk assessments as too benign.

39 The IMF estimates that the average implied useful life of graphics processing units (GPUs) and advanced chips is considerably shorter than more standard types of physical assets (two versus seven years) due to the speed of technological advancement in the AI field. See "Global Financial Stability Report", International Monetary Fund, April 2026.

40 Chips are not the only physical asset, and other assets like data centre facilities have longer economic lives. Given the long duration of the debt incurred, a significant mismatch likely remains.

Chart B

Markets have started to acknowledge the rising debt levels of AI-related firms and the potential stranded asset risks stemming from a shorter than expected economic life of collateral assets



Sources: Company SEC filings, Dealogic, a service of ION Analytics, Bloomberg Finance L.P. and ECB calculations.
Notes: Panel a: "Other income" refers to revenue earned from activities outside a company's core operations and includes unrealised gains or losses from equity holdings as well as dividend income. Data for 2025 refer to the full financial year; data for 2026 refer to the most recent SEC filing, which is the annual financial statements in the case of Microsoft and Oracle and quarterly reports for the rest. Panel b: hyperscalers' cumulative outstanding debt is calculated using the subset of issued debt that is in Dealogic. The last data point represents all outstanding debt. Market intelligence suggests that the economic life of AI equipment is between one and three years, as represented in the shaded area. The accounting life for servers and network equipment is taken from companies' SEC filings between 2020 and 2025; most hyperscalers have increased this from three years in 2020 to six years in 2026. Data as at 10 November 2026. Panel c: the chart shows the difference between the credit spreads of Alphabet, Amazon, Apple, Broadcom, Meta, Microsoft, Nvidia, Oracle and SpaceX (i.e. the yield to maturity minus the maturity-matched yield of US Treasuries) and the credit spread of equally rated US corporate bond spreads (AAA, AA, A and BBB; again, measured against maturity-matched US Treasury yields). Credit spreads are weighted by US dollar amount outstanding. The chart shows the average across the eight firms and the respective minimum-maximum range.

The rapid shift towards debt finance invokes historical parallels with the dotcom and subprime bubbles and could lead to spillovers affecting euro area financial stability. Even if AI as a technology successfully transforms the global economy, the credit-driven AI boom may result in overcapacity, capital misallocation and credit losses for investors. Past episodes of technological disruption and financial exuberance provide historical parallels. The capital spending and technological aspects are reminiscent of the dotcom bubble of the early 2000s, which was characterised by overinvestment in infrastructure but only a shallow recession thanks to a large share of equity finance. So far, however, hyperscalers' earnings have broadly kept up with expectations. That said, the rapid acceleration of debt financing raises concerns that the AI buildout might become debt-driven and unsustainable, with further risks added by circular financing, the use of off-balance-sheet transactions and opaqueness in private markets. Such dynamics were evident

during the subprime mortgage bubble. Spillovers through direct and especially indirect channels could have significant adverse consequences in the euro area.[41]

Box 4

Big tech's growing presence in the euro-denominated bond market: implications for investors

Prepared by Anne Duquerroy, Oana Furtuna and Lia Vaz Cruz

Hyperscalers are increasingly turning to credit markets to fund an investment cycle which is unprecedented in scale.[42] At individual firm level, hyperscalers now rival financials as the largest issuers in the US dollar-denominated investment-grade corporate bond market, having issued over USD 200 billion this year alone. They have also branched out into other currencies, with the euro playing an important role in the foreign currency mix. As hyperscalers have become increasingly active in the euro-denominated investment-grade (EUR IG) corporate bond market, euro area investors' exposure to the US economy and the tech sector has risen further. This is increasing risks for investors by limiting diversification and leaving portfolios more vulnerable to a shock related to artificial intelligence (AI). This box looks at the financial stability implications of hyperscalers' growing presence in the euro area credit market, particularly at the long end of the curve, focusing on concentration and correlation risks. It also considers how exposed euro area investors are and whether shifts in their portfolios suggest that AI-related borrowing is displacing other issuers.

Issuance by US hyperscalers has increased sectoral concentration at the long end of the EUR IG curve, a feature likely to persist for some time. While their index share remains limited and is below the levels of past sectoral issuance waves (**Chart A**, panel a), US hyperscalers already account for close to 8% of EUR IG bonds maturing after ten years, with exposures concentrated in just a few names. This reflects the longer maturity of their issuances – two to six years longer than their peers over the same period (**Chart A**, panel b). Even if US hyperscalers' external funding needs slow, their euro area bond-market footprint will persist, leaving long-end investors with greater AI exposure. The associated risk is amplified by the mismatch between long liabilities and fast-depreciating AI assets, making revenue resilience critical for financial stability.[43]

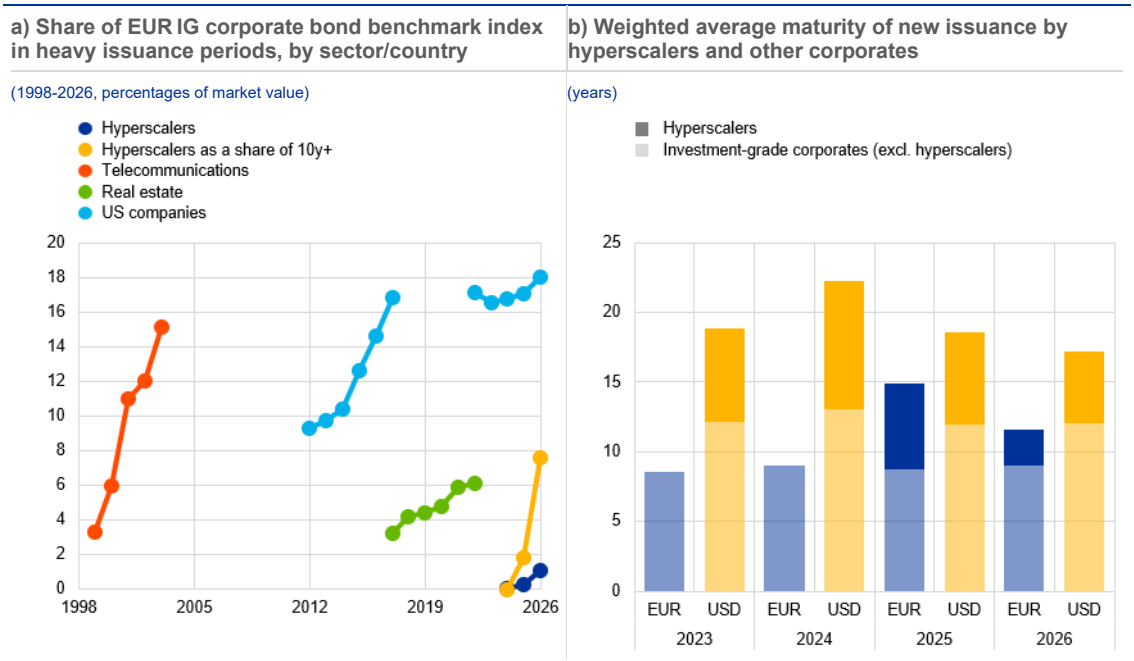
41 Direct spillovers would stem from holdings of AI-related debt and equity. They would expose institutional investors especially, but also households as direct investors in equity and indirect investors through funds, to valuation losses which could impair consumer confidence and spill over to the real economy. Indirect spillovers could come from a deterioration in global financial conditions, foreign demand or risk sentiment. Historically, credit booms that turned into a bust were associated with a significant and prolonged contraction in real GDP compared with pre-crisis trends. Such a shock to the US economy would likely result in a significant contraction in euro area GDP as well.

42 See Duquerroy, A. et al., "Big tech, big debt: when US tech giants tap the euro area bond market", *The ECB Blog*, ECB, 31 August 2026.

43 See Adrian, T., "Artificial intelligence and Financial Stability", ECB Forum on Central Banking, Sintra, 30 June 2026.

Chart A

As US hyperscalers issue longer-term debt than other companies, concentration exposure to big tech is increasing fast at the long end of the yield curve, even if it is still modest overall



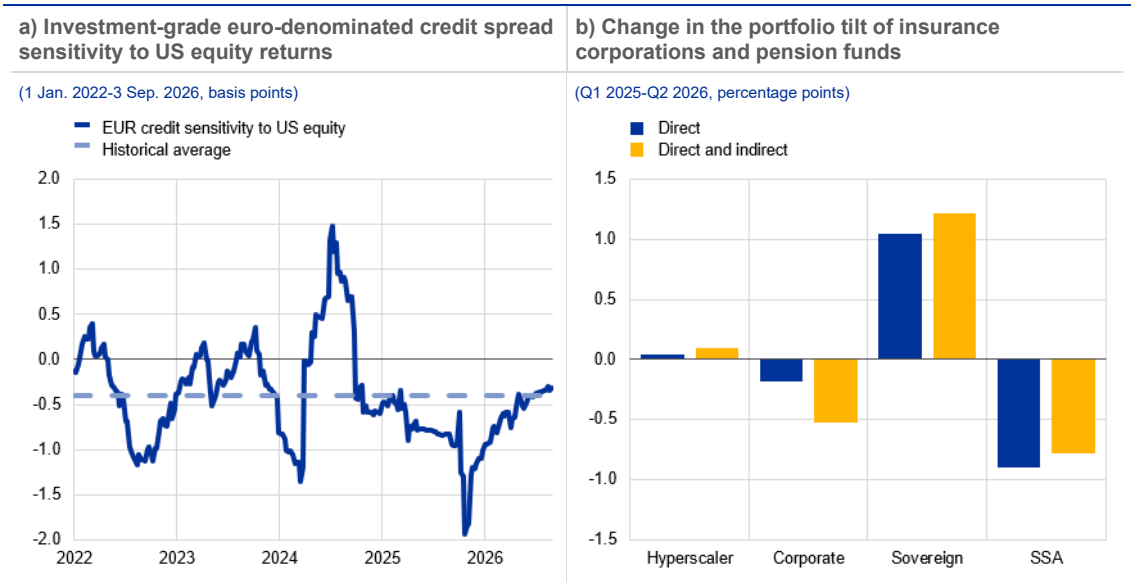
Sources: Dealogic, Bloomberg Finance L.P., BofA Global Research and ECB calculations.
Notes: Panel a: market value of outstanding debt measured at 30 June each year as a share of the overall ICE BofA Euro Corporate Index, including financials. In the yellow legend item, 10y+ refers to bonds with a residual maturity of over ten years. US issuers are identified based on the country in which the parent company is incorporated. Panel b: tranche-amount-weighted maturity of investment-grade corporate bonds issued by private sector non-financial corporations and denominated in euro or US dollars.

In addition, issuance by hyperscalers increases the exposure of European credit investors to the US economy. This tech issuance reinforces the broader trend of US companies increasingly borrowing in euro, which now represents close to one-fifth of the EUR IG benchmark. This growing exposure brings some potential diversification benefits via a broadening of the investible universe, including better credit ratings, longer maturities, new sectors and new companies. However, it also raises the risk of potential contagion from an AI or US shock spilling over into euro credit markets.

Hyperscalers make up an important share of equity benchmarks; as their weight in bond indices increases, this reinforces the link between markets. As equity and credit markets are influenced by similar shifts in investor risk sentiment, changes in the AI-related narrative could spill over from equity markets to credit markets. Since 2025, however, the link has been strengthened by hyperscalers' greater presence in the EUR IG market, which may have contributed to the rising negative co-movement between European credit spreads and US equity returns. This means that when index equity prices increase (decrease), index corporate credit spreads compress (widen) more (**Chart B**, panel a). Although this relationship appears to have weakened recently, the growing weight of US hyperscalers in euro-denominated bond indices implies that a repricing of their growth outlook would increasingly be felt across asset classes, limiting investors' ability to diversify.

Chart B

The negative sensitivity of euro-denominated corporate credit spreads to changes in US equity prices increases the exposure of European investors who tilt their portfolio holdings towards hyperscaler bonds

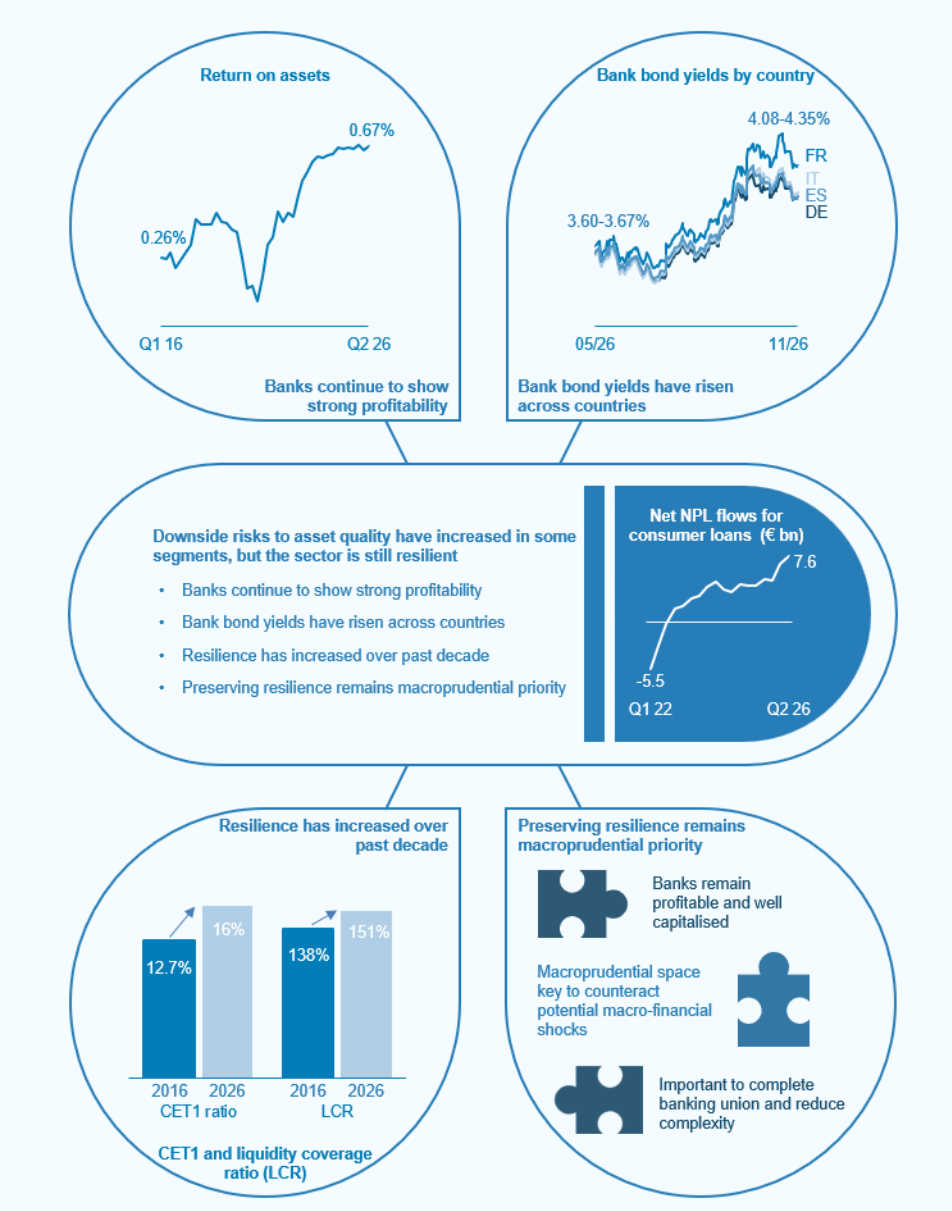


Sources: Bloomberg Finance L.P., ECB (SHS) and ECB calculations.
Notes: Panel a: the chart shows in basis points the sensitivity of option-adjusted spreads of the Bloomberg Euro Corporate index for non-financials to a 1% change in the equity valuation of the Nasdaq Composite Index. Negative values reflect spreads compressing in response to lower equity prices. Spreads and equity returns are observed on a weekly basis, and the sensitivity is the estimated equity-credit beta in a 26-week rolling window regression. Historical average is the average of betas over the 2022-26 post-pandemic period of reference. The latest observation is for the week of 31 August 2026. Panel b: the chart shows the change in portfolio tilt between Q1 2025 and Q2 2026. The tilt measure indicates a preference in asset allocation by capturing the difference between the actual share in the sector-level portfolio and the projected share based on the change in the broad market index for each bond category. It is based on euro area investor holdings of euro-denominated bonds included in the ICE BofA Euro Broad Market Index, excluding covered bonds, securitised debt and bonds issued by foreign sovereigns. "Corporate" includes financials and non-financials; "Sovereign" includes only central government bonds issued by euro area entities; SSA (sub-sovereign, supranational and agency) includes regional/local governments, supranationals and agencies. The latest observation is for Q2 2026.

Lastly, although the data so far only show very limited early signs of an investor tilt towards hyperscaler assets, the risk of crowding out other issuers should be monitored. Insurance corporations and pension funds – key investors in long-dated bonds – appear to be modestly overweighting hyperscaler bonds relative to benchmarks, while retaining a preference for sovereigns and underweighting bonds issued by other corporates and regional/local governments, supranationals and agencies (**Chart B**, panel b). Although the changes in portfolio allocation are marginal and should not be attributed solely to the entry of hyperscalers into the EUR IG universe, they point towards the potential displacement of other issuers over time and greater vulnerability among euro area investors to an AI-related correction. In addition, while the wealth effect deriving from the impressive global equity performance may have supported investment flows into bond markets to date, changing circumstances might show that bond demand is not infinitely elastic.

Continued monitoring of spillovers and potential crowding-out effects is warranted. Looking ahead, the current US hyperscaler investment cycle is still in its early stages in the euro-denominated market. Rising issuer concentration, stronger cross-asset correlation and portfolio reallocation could amplify losses and the correlated sell-off should an adverse AI revenue shock materialise. Moreover, as the AI investment cycle progresses and associated funding needs increase, hyperscaler debt issuance may have a negative impact on access to funding for other issuers and exert upward pressure on long-term sovereign yields through increased competition for funding. In short, the AI boom is not only a technology story, but also a financial stability one that demands close attention.

3 Euro area banking sector



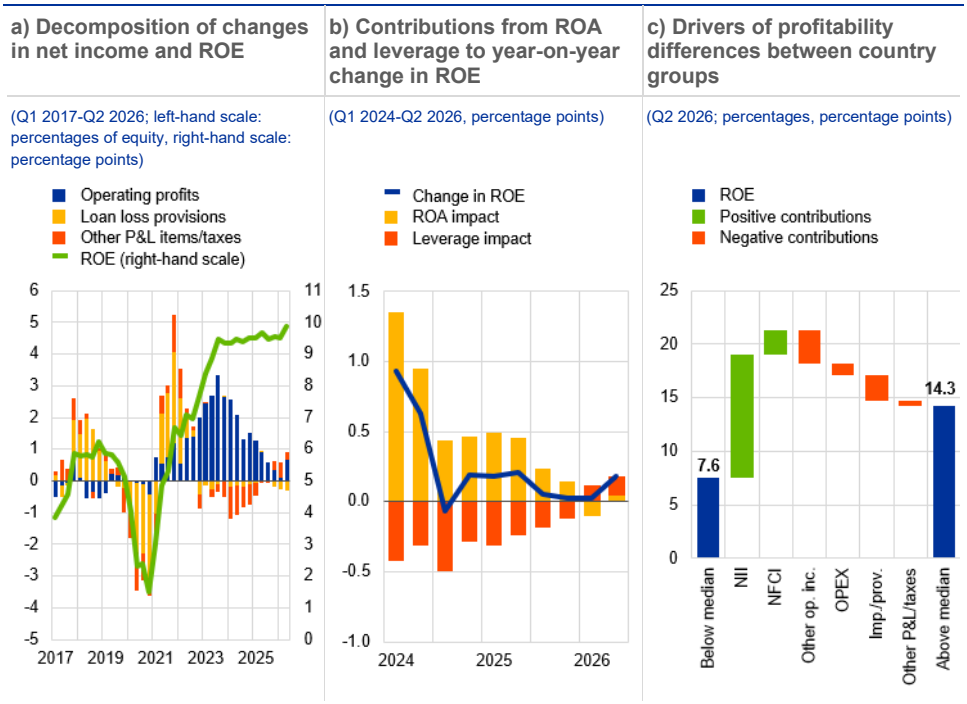
3.1 The near-term outlook for bank profitability is still positive, but wide cross-country differences remain

Euro area banks' profitability remained strong in the first half of 2026, supported by a rebound in operating income and a slight pick-up in leverage. The trailing return on equity (ROE) of significant institutions reached the highest level seen in the last ten years. This was due to an increase of pre-provisioning operating profits that more than offset a modest rise in loan loss provisions (LLPs) (**Chart 3.1**, panel a). A decomposition of changes in ROE reveals that a moderate increase in

leverage has also contributed positively to ROE in recent quarters (**Chart 3.1**, panel b).

Chart 3.1

Aggregate profitability remains strong, but cross-country disparities persist



Sources: ECB (supervisory data) and ECB calculations.
Notes: Based on all significant institutions and on four-quarter trailing figures. ROE stands for return on equity. Panel a: "Other P&L items/taxes" includes impairment on non-financial assets, negative goodwill, results from discontinued operations, extraordinary profit or loss and tax expenses, among other things. Panel b: leverage is defined as total assets over equity. ROA stands for return on assets. Panel c: based on weighted averages for countries with below and above-median ROE. Countries with below-median ROE: Belgium, Germany, Estonia, Ireland, Greece, France, Luxembourg, Malta, Netherlands and Slovenia. Countries with above-median ROE: Bulgaria, Spain, Italy, Cyprus, Latvia, Lithuania, Austria, Portugal and Finland. Panel c: NII stands for net interest income; NFCI stands for net fee and commission income; "Other op. inc." stands for other operating income; OPEX stands for operating expenses; "Imp./prov." stands for impairments and provisions.

However, there is still wide cross-country variation in bank profitability.

Dividing euro area countries into two groups based on their ROE level shows that banks in countries with an above-median ROE generate significantly higher net interest income (as a share of equity) than banks in countries with below-median ROE (**Chart 3.1**, panel c). One of the main underlying drivers of the net interest income gap is asset and liability composition, with the overperforming group of countries having a significantly higher share of customer loans and deposits in their balance sheets.[44] In addition, the underperforming group of countries has tighter customer loan-deposit spreads.[45] This partly reflects their higher share of fixed-rate loans as banks in these countries tend to benefit less from rising interest rates, as was the case in the previous rate hiking cycle.[46] Furthermore, lower market

[44] At the end of the second quarter of 2026, the shares of customer loans and deposits for the overperforming group of countries were 50% and 52% respectively, compared with 40% and 39% respectively for the underperforming group.

[45] It should be noted, however, that there are also variations across countries within the respective country groups. For instance, a few (smaller) countries with below-median ROEs also have relatively wide loan-deposit spreads.

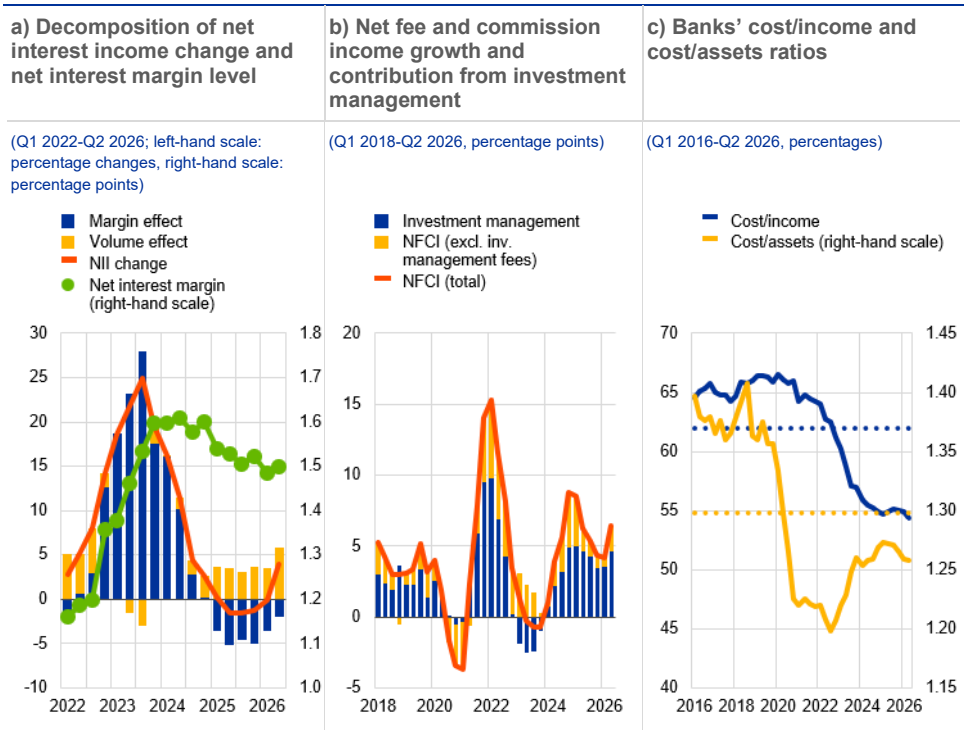
[46] In June 2026 the median share of fixed-rate loans was 57% in the underperforming group of countries compared with 33% in the overperforming group.

concentration and pricing power is weighing on loan-deposit spreads in some of these countries.

Net interest income growth has recovered, while net fee and commission income growth has also gained momentum. Net interest income growth turned positive again in the second quarter of 2026, driven by both stronger volume effects and a less pronounced negative impact from the tightening of margins (**Chart 3.2**, panel a). Accelerating growth in net fee and commission income also contributed positively to overall profitability. The recent positive momentum seen in fee income generation was driven mainly by fees related to asset management and product distribution (**Chart 3.2**, panel b). As fee income growth continues to depend strongly on investment management activities, it remains sensitive to abrupt changes in global risk sentiment and to a further rise in long-term rates.

Chart 3.2

Core revenue growth picked up again, while cost ratios improved



Sources: ECB (CBD, supervisory data) and ECB calculations.
Notes: Based on all significant institutions and on four-quarter trailing figures. Panel a: decomposition of year-on-year change in net interest income (NII). Panel b: investment management includes asset management and distribution of (not managed) products. NFCI stands for net fee and commission income. Panel c: dotted lines represent long-term averages, calculated for the period from Q4 2015 to Q2 2026.

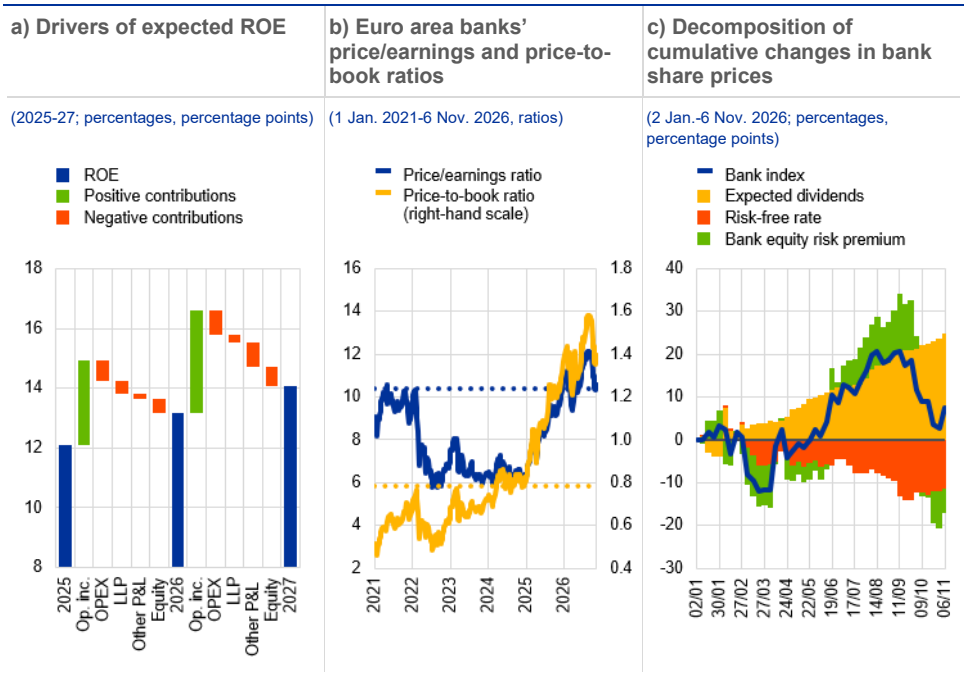
Improved cost ratios also contributed to higher overall profitability, while the impact of rising LLPs was small. The aggregate bank cost/income ratio reached its lowest level since 2015, as a moderate rise in operating expenses was outweighed by robust revenue growth. Following the upward trend observed between 2022 and 2025, the aggregate cost/assets ratio declined in the first half of 2026 and has remained below its long-term average (**Chart 3.2**, panel c). LLPs picked up somewhat in the first two quarters of 2026, rising by 12% year on year, which reflects a more cautious credit quality outlook. However, banks' cost of risk, as

measured by the ratio of LLPs to total loans, edged up by just 2 basis points from its end-2025 level due to the offsetting impact of robust loan growth.

Analyst projections suggest a positive outlook for near-term profitability, but some downside risks remain. For large listed banks, ROE is projected to rise by around 2 percentage points between 2025 and 2027, driven by continued revenue growth. Furthermore, analysts expect the rise in LLPs to have only a modest negative impact on profitability (**Chart 3.3**, panel a). There are still some downside risks to this positive earnings outlook, however. First, while higher long-term interest rates could support net interest income via steeper yield curves and higher reinvestment yields, this could be offset, at least in part, by the negative impact on funding costs and loan demand. Second, LLPs could rise by more than foreseen if tightening financing conditions and higher oil prices were to have a more pronounced impact on bank asset quality than is currently anticipated. Finally, some components of non-interest income, such as trading revenues or fee income from asset management, remain susceptible to any abrupt deterioration in financial market sentiment (see **Chapter 2**). In addition, higher long-term rates could lead to valuation losses on debt securities recognised at fair value (potentially affecting profit and loss or equity) as well as unrealised losses on debt securities held at amortised cost.

Chart 3.3

Bank valuations continue to be supported by a positive outlook for earnings, with a partial reversal in gains since late September due to higher equity risk premia



Sources: Bloomberg Finance L.P., LSEG and ECB calculations.
Notes: Panel a: based on a sub-sample of 25 banks from the EURO STOXX Banks index, using the mean as consensus. ROE stands for return on equity; "Op. inc." stands for operating income; OPEX stands for operating expenses; LLP stands for loan loss provisions. Aggregate figures are equity weighted. Panels b and c: based on weekly data. Panel b: based on the EURO STOXX Banks index. Dotted lines represent the medians of valuation ratios since 2003. Panel c: the decomposition of cumulative changes in the EURO STOXX Banks index is based on the H-model presented in Fuller and Hsia*.
*) Fuller, R.J. and Hsia, C.-C., "A Simplified Common Stock Valuation Model", *Financial Analysts Journal*, Vol. 40, No 5, 1984, pp. 49-56.

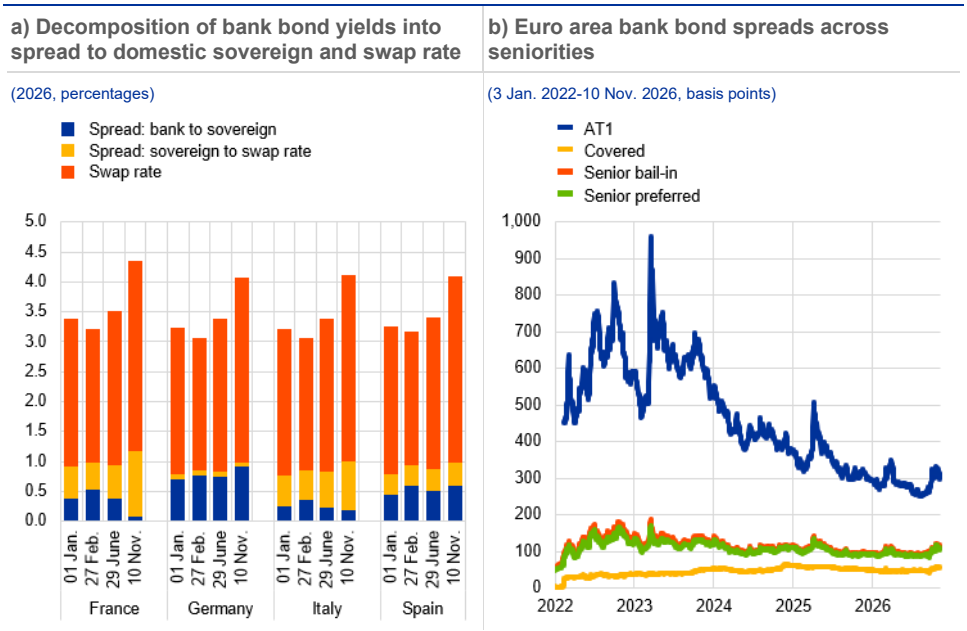
Bank valuations continue to be supported by a positive outlook for earnings, but they remain exposed to abrupt changes in risk sentiment. Price/earnings ratios and price-to-book ratios have been somewhat volatile since mid-2026, with initial valuation gains followed by a partial reversal due to worsening sovereign risk perceptions in a few euro area countries (**Chart 3.3**, panel b). A dividend discount model decomposition shows that upward revisions to expected earnings and dividend payouts have aided the increase in bank share prices for much of 2026, while rising equity risk premia have had a partial offsetting impact since late September (**Chart 3.3**, panel c). Going forward, bank valuations remain sensitive to a possible further deterioration in sovereign risk perceptions or negative earnings surprises.

3.2 Banks' funding costs could rise as liquidity is drained

Bank bond yields have risen in response to higher benchmark rates and wider sovereign spreads in some countries. Bond financing conditions for euro area banks have tightened, with yields on senior unsecured bonds surpassing the 4% mark in September. The increase in yields has for the most part been driven by an increase in the risk-free market rate, although widening sovereign spreads have also contributed in some countries. Bank bond yields have risen less than sovereign yields in these countries as the compression of spreads between banks and their domestic sovereign has partly offset the rise in sovereign yields (**Chart 3.4**, panel a). This suggests that market participants are discriminating between the credit risk of banks and their sovereign, and the bonds of some banks even briefly traded at a premium to the sovereign. Despite this decoupling, bank financing conditions could still be vulnerable to spillovers from sovereign risks, and vice versa, in times of severe market stress.

Chart 3.4

Bank bond yields have risen, while the increase in spreads remains contained



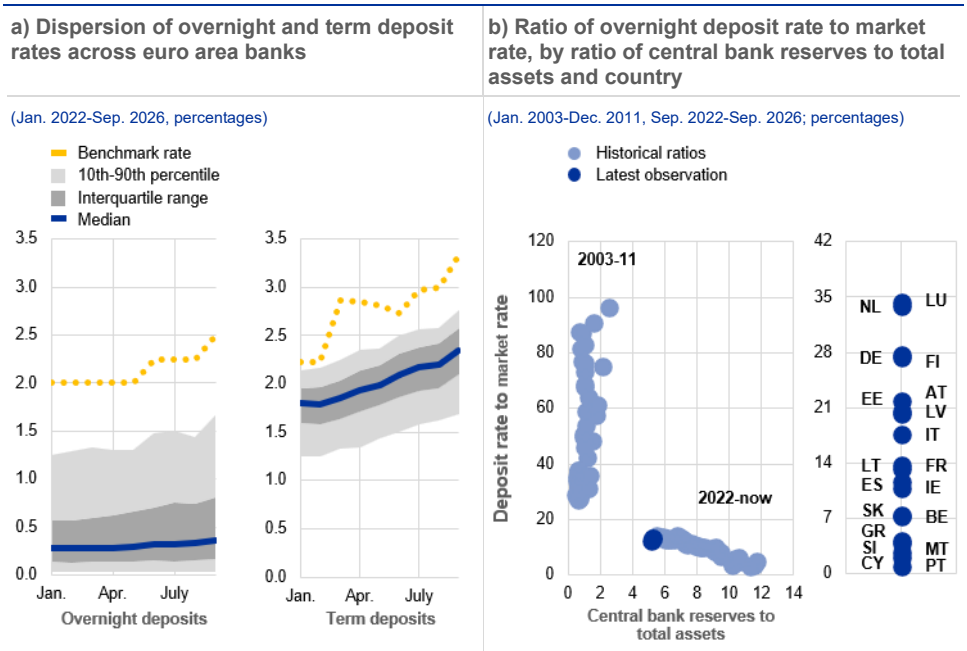
Sources: S&P Dow Jones Indices LLC and/or its affiliates and ECB calculations.
Notes: Panel a: 27 February 2026 is the day before the outbreak of the latest conflict in the Middle East; June was the month when bank bond spreads reached their low point in 2026. "Spread: bank to sovereign" is the difference between the yield of bank bonds and the five-to-seven-year yield on the sovereign bonds of the domestic sovereign. "Spread: sovereign to swap rate" is the asset swap spread on five-to-seven-year domestic sovereign bonds. Panel b: the spread is the asset swap spread over the maturity-matched swap rate.

Although bank bond spreads have increased recently, they remain within historical norms and are tight for the most junior instruments. Bank bond spreads have widened on the back of the recent repricing seen in euro area credit markets. The trend over the past four years reveals that, despite this increase, credit spreads are still well within historical norms and remain compressed for AT1 instruments (**Chart 3.4**, panel b). This may be an indication that investors consider banks' credit risk, and in particular the likelihood of tail risks (such as the need to convert eligible bonds to equity), to be contained, given that euro area banks are now better capitalised and more resilient.

Deposit competition remains limited to term deposits, while overnight rates are low and stable. Average overnight retail deposit rates are still far below the policy rate and, in aggregate, have barely moved despite the recent central bank rate hikes and increases in market interest rates. That said, there is a wide range of overnight deposit interest rates across banks and some banks at the upper end of the distribution may be competing more for deposits as they match the recent increase in benchmark rates. Meanwhile, the tight distribution of interest rates on new term deposits around the median and their proximity to the market benchmark rate indicates that term deposit markets are already more competitive (**Chart 3.5**, panel a).

Chart 3.5

Deposit rate pass-through is still limited but could increase



Sources: ECB (MIR, BSI, bank treasurer survey) and ECB calculations.
Notes: Panel a: weighted average rate for households and non-financial corporations. Rates on new business for term deposits. The benchmark rate is the deposit facility rate for overnight deposits and the 12-month EURIBOR for term deposits. Panel b: deposit pass-through is calculated as the ratio of the level of overnight deposit rates to the benchmark rate, meaning the €STR/EONIA at a monthly frequency (i.e. each dot indicates one monthly observation). Values where the €STR was below 0.5% were excluded. The blue dots on the right graph show the country-level overnight deposit rate divided by the benchmark rate.

Looking ahead, deposit rates may start to come under greater pricing pressure as excess liquidity is drained. Compared with the situation before the low interest rate environment, the ratio of overnight deposit rates to benchmark market rates is still low (**Chart 3.5**, panel b). As banks' liquidity positions tighten, however, they may have a greater incentive to source deposits. This would exert upward pressure on deposit rates, increasing bank funding costs. Banks in countries where deposit rates are still very low might be more vulnerable to rising deposit rates, which could weigh on their profitability. The growing market share of more aggressive competitors such as digital banks − which could also benefit from reduced frictions due to technological advancements − might exert further pressure on the deposit rates of traditional banks.[47] Agentic AI models could make it quicker and easier to compare deposit rates online and shift funds automatically. Euro area deposits tend to be quite sticky, however, and euro area residents prefer to keep their savings in bank accounts rather than invest in financial markets.[48]

While aggregate liquidity remains high, excess reserves are declining and are being redistributed across the system. The aggregate liquidity coverage ratio remains fairly stable, but the share of excess reserves in banks' liquidity buffers is continuing to decline as the Eurosystem's balance sheet normalises (**Chart 3.6**,

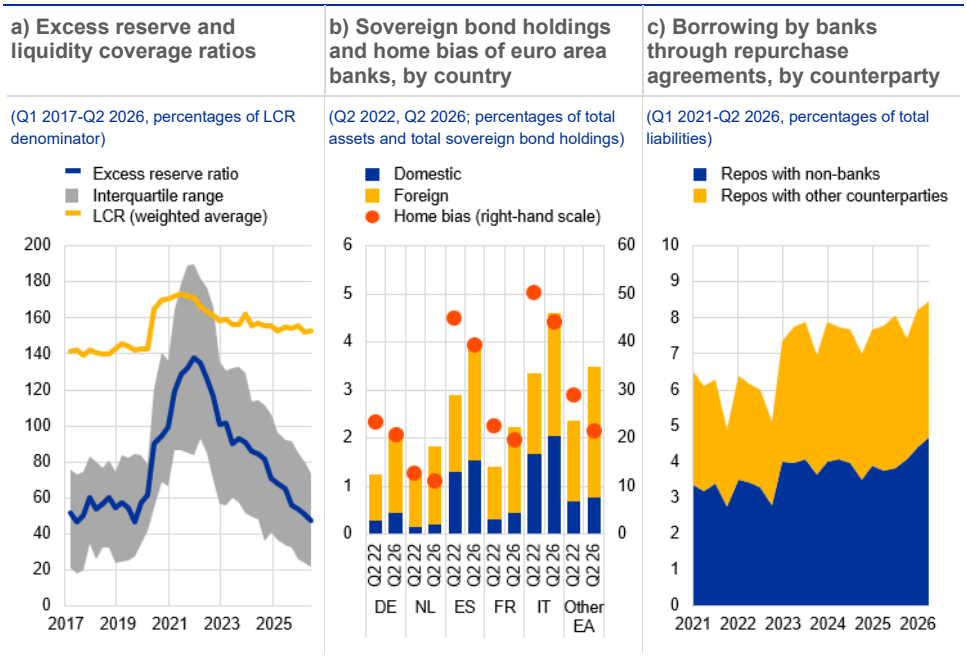
47 See also Garcia, T., Grodzicki, M. and Radulova, P., "Digital banking: how new bank business models are disrupting traditional banks", *Financial Stability Review*, ECB, May 2025.

48 See Dumitrescu, A., Gati, Z., Meyer, J., Parisi, L. and Spolaore, A., "Why Europeans save differently – and how to put those savings to work", *The ECB Blog*, ECB, 15 September 2026.

panel a). At the same time, excess reserves are being redistributed across banks, reducing differences in reserve levels.

Chart 3.6

Liquidity buffers remain stable while excess reserves decline



Sources: ECB (supervisory data) and ECB calculations.
Notes: Panel a: excess reserves are in euro for banks that report the split by currency and total reserves for banks that do not report this split. The excess reserve ratio is the ratio of excess reserves to the LCR denominator. LCR stands for liquidity coverage ratio. Panel b: home bias is defined as the ratio of domestic sovereign bond holdings to total sovereign bond holdings. EA stands for euro area. Panel c: total liabilities are defined as all non-equity, non-derivative liabilities of banks.

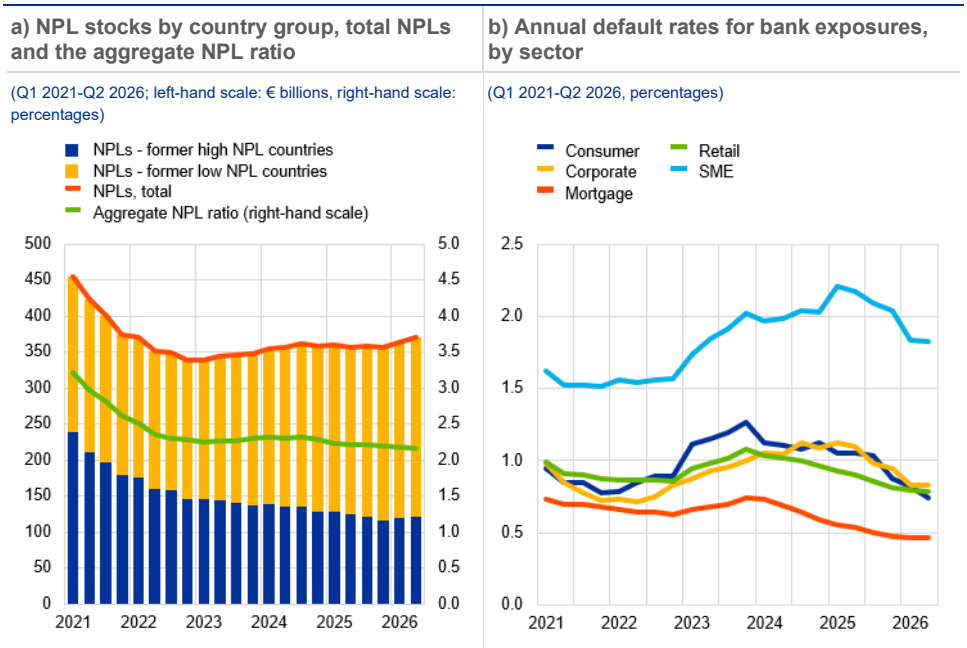
Liquidity buffers have mainly been supported by purchases of non-domestic sovereign bonds, contributing to a modest reduction in home bias. Sovereign bond holdings have increased rapidly in recent years across the entire euro area banking sector, but the relative level of exposures still varies significantly across countries (**Chart 3.6**, panel b). The growing stock of sovereign bonds held directly supports banks' liquidity buffers as high-quality liquid assets (HQLA) but can also serve as collateral in repo markets to obtain additional cash funding.[49] Indeed, liquidity redistribution via repo markets has increased recently, especially where funding is provided by non-bank counterparties (**Chart 3.6**, panel c). While repo funding is secured on liquid assets, which can be eligible for other funding sources and mitigate liquidity risk, non-bank funding can be volatile and vulnerable to disruptions during periods of market stress. The expansion of repo markets is strengthening the ties between banks and non-banks and could also increase their vulnerability to spillovers from sovereign bond markets.

[49] In contrast to central bank reserves, however, sovereign bonds expose banks to interest rate and credit risk. A rise in sovereign bond yields thus also affects banks' liquidity buffers, which always reflect the market value of sovereign bonds, regardless of their accounting classification. At this juncture, the risks from revaluation losses are still contained, even in more severe repricing scenarios.

3.3 Asset quality remains sound, albeit with some variation at the country and the sector level

Aggregate euro area bank asset quality remains sound, with a record-low NPL ratio and falling default rates. The aggregate non-performing loan (NPL) ratio of euro area significant institutions stood at 2.2% in the second quarter of 2026, representing a marginal decrease since the end of 2025 and a record low (**Chart 3.7**, panel a). While the stock of NPLs increased slightly in the first two quarters of 2026, driven mainly by countries with previously low NPL ratios, this has been outpaced by the growth of total loans. Default rates on all exposure types have been also trending downwards since 2025. For mortgage lending, they have fallen below levels observed before mid-2022, which was when the previous monetary policy tightening cycle started (**Chart 3.7**, panel b). At the same time, the declining trend for exposures to corporates and small and medium-sized enterprises (SMEs) has come to a halt, with SME default rates remaining above their previous low recorded in late 2021.

Chart 3.7
Aggregate euro area bank asset quality remains sound



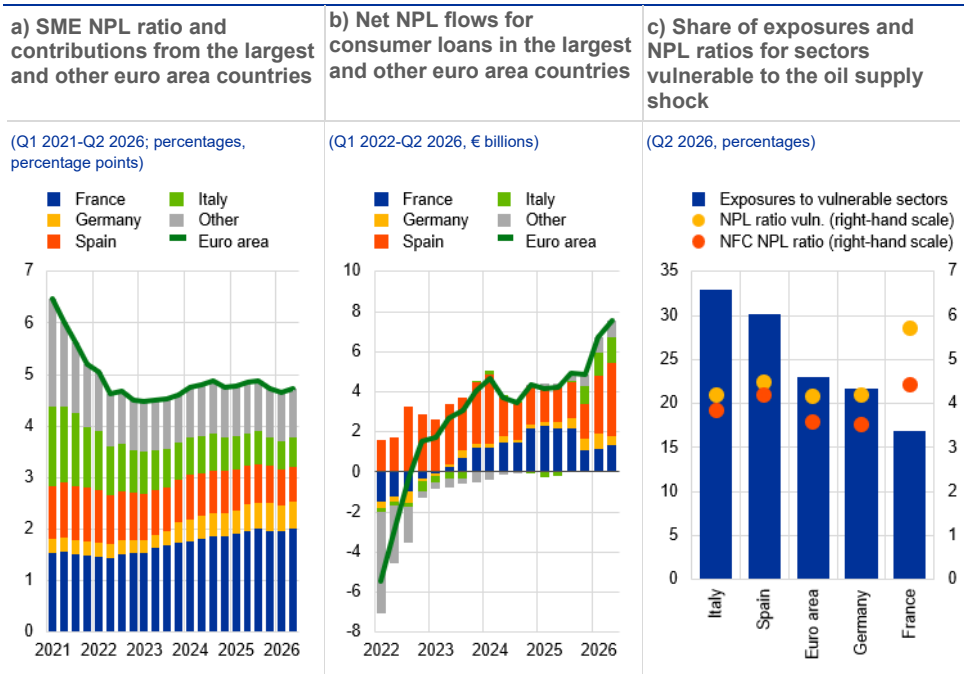
Sources: ECB (supervisory data) and ECB calculations.
Notes: Panel a: based on all significant institutions. Euro area countries are divided into two groups based on whether their non-performing loan (NPL) ratios were above or below the median in Q1 2021. Panel b: includes on- and off-balance-sheet exposures subject to credit risk. Four-quarter trailing figures for significant institutions reporting under the internal ratings-based method. The sectoral definitions under COREP used for default rates differ from those used elsewhere (e.g. FINREP). SME stands for small and medium-sized enterprise.

A benign overall picture masks some variation in asset quality at the country and the sector level, particularly for SME and consumer loans. While banks' aggregate SME NPL ratio has not increased from end-2025 levels, SME lending in a few large countries continues to show signs of vulnerability. In particular, the SME NPL ratio has been gradually trending upwards in France and Germany since 2023 (**Chart 3.8**, panel a). This reflects, in part, a weaker macroeconomic environment in

these countries. The quality of consumer loans has also continued to worsen as net NPL flows of consumer loans, which had been positive since 2023, picked up in the first two quarters of 2026 (**Chart 3.8**, panel b). Aggregate unemployment in the euro area remains low, and the overall financial position of households appears robust (see **Section 1.4**). However, consumer loan asset quality could deteriorate further as higher interest rates and inflation weigh on households' real income and debt servicing capacity. In addition, given that exposures to non-euro area regions account for around 30% of consumer loans and 40% of consumer loan NPLs, the overall portfolio also remains sensitive to worsening macroeconomic conditions outside the euro area. That said, the share of consumer loans in the total loans of euro area significant institutions remained contained at 6.2% in June 2026, despite varying widely across the five largest euro area countries, from 1.4% (the Netherlands) to 13.2% (Spain).

Chart 3.8

SME and consumer loan quality showed signs of weakening in some parts of the euro area, while there are also downside risks stemming from the oil supply shock



Sources: ECB (AnaCredit, RIAD, supervisory data) and ECB calculations.
Notes: Panels a and b: based on all significant institutions and the home country of the reporting bank. Panel a: euro area aggregate SME NPL ratio and contributions from the largest/other euro area countries. Panel b: four-quarter trailing net NPL flows. Panel c: based on all banks. "NPL ratio vuln." stands for the NPL ratio for sectors vulnerable to the oil supply shock, defined as the most energy-dependent sectors, exhibiting high sensitivity to upstream energy supply disruptions. Exposure shares only indicate potential sensitivity to the oil supply shock and should not be interpreted as explaining contemporaneous NPL ratios, as the impact of oil supply shocks on bank asset quality materialises with a lag. Banks' estimated exposures to energy-intensive sectors should be interpreted with caution, as their magnitude may vary depending on the definitions, sectoral coverage and methodology adopted. NFC stands for non-financial corporation.

The oil supply shock caused by the conflict in the Middle East has not yet led to a material deterioration in asset quality, but downside risks have increased.

The oil supply shock is mainly affecting firms in energy-intensive sectors, through higher energy costs which could reduce their profit margins and eventually result in more defaults. However, the overall asset quality of exposures to these sectors had not shown signs of deterioration until the second quarter of 2026, with the NPL ratio

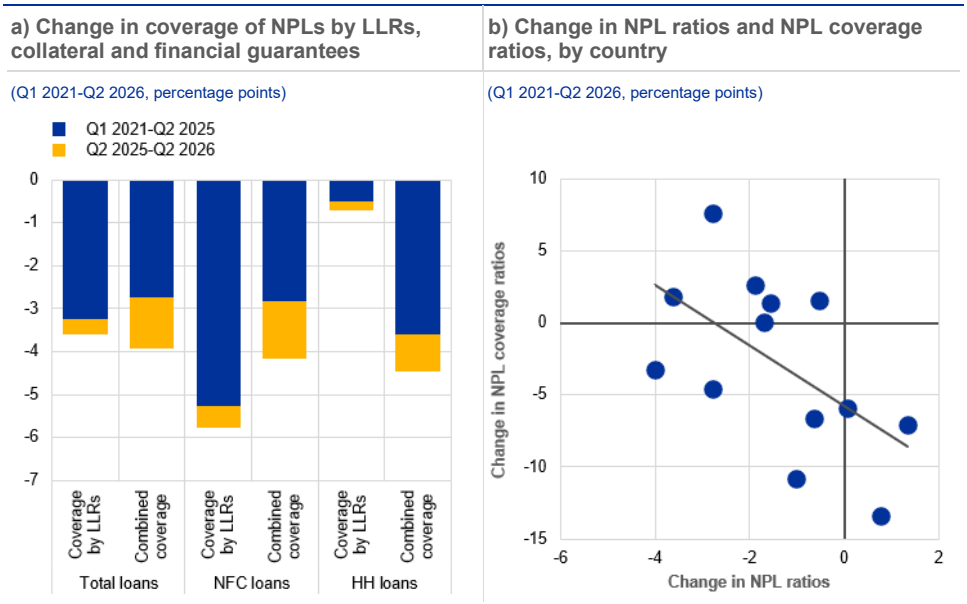
unchanged from the end of 2025 (at 4.2%). Looking ahead, the impact of the oil supply shock is expected to have a negative impact on bank asset quality in the upcoming quarters (see **Box 5**). The impact is likely to vary across the largest euro area countries, partly in line with the size of exposure to energy-intensive sectors (**Chart 3.8**, panel c).[50]

NPL coverage ratios continue to decline, but provisioning needs might increase, given the ongoing uncertainty related to high energy prices. In the 12 months to June 2026, the coverage of NPLs by loan loss reserves continued to decline for total, corporate and household loans (**Chart 3.9**, panel a). Furthermore, the decline in the total coverage of NPLs, also including collateral and financial guarantees, was even more pronounced over the same period. The change in NPL coverage ratios has varied somewhat across countries, with countries showing patterns of increasing NPL ratios typically reporting declines in their NPL coverage ratios (**Chart 3.9**, panel b). The declining trend in NPL coverage ratios partly reflects a shift towards newer NPL vintages within the total stock, as these require lower minimum coverage. However, provisioning needs might increase further in the period ahead, also given the continuing uncertainty around the possible impact of the oil supply shock on banks' asset quality.

[50] It should be noted, however, that cross-country variations in the (lagged) impact of the oil supply shock on bank asset quality can also be influenced by other factors. Energy-intensive sectors include selected sub-sectors of manufacturing (with NACE codes C10-12, C17, C19, C20, C22, C23, C24, C28 and C29), transport and storage (H49, H50 and H51), as well as (sub-)sectors that exhibit high sensitivity to upstream energy supply disruptions such as crop and animal production, hunting and related service activities (A01), electricity, gas, steam and air conditioning supply (D), travel agency, tour operator and other reservation service and related activities (N79), mining and quarrying (B) and construction (F).

Chart 3.9

NPL coverage ratios continue to decline, particularly in countries in which NPL ratios increased



Sources: ECB (supervisory data) and ECB calculations.
Notes: Based on all significant institutions. Panel a: LLRs stands for loan loss reserves (i.e. accumulated impairments). Combined coverage is defined as the ratio of LLRs, collateral and financial guarantees to NPLs. NFC stands for non-financial corporation; HH stands for household. Panel b: based on countries with at least three significant institutions. Excludes an outlier.

Direct euro area bank lending to firms in the AI supply chain remains limited, with loan quality weakening in a number of sectors. Based on available data on banks' direct lending exposures, euro area banks appear to play a relatively limited role in providing funding to firms in the AI supply chain.[51] However, this narrow measure may underestimate total exposures due to data limitations and should be treated with caution.[52] When an alternative, broader measure is used, total AI-related lending amounts to around €75 billion, just 1.1% of euro area banks' total committed exposures to corporates.[53] The quality of exposures to software companies and semiconductor manufacturers has weakened since 2023, while loans to data centres have been performing extremely well (**Chart 3.10**, panel a). The NPL ratio for software and semiconductor firms was above the total corporate NPL ratio in the first quarter of 2026. For the software sector, increases in the NPL ratio may

51 Data compiled up to June 2026 show that the lending commitments of all euro area banks to 165 important firms in the AI supply chain and their subsidiaries had reached €24.3 billion, of which €11 billion was undrawn (based on AnaCredit data). Given the lack of granular data on exposures booked outside of the euro area, this figure does not include some of the financing located in non-euro area countries.

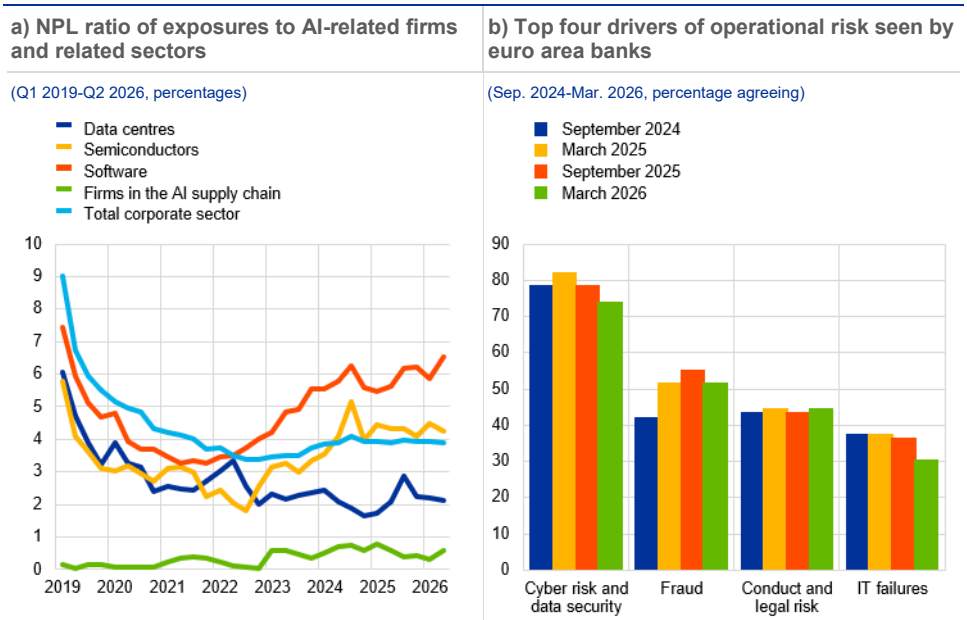
52 In this context, AI-related firms are defined as those involved in (i) the buildout of AI data centres and infrastructure, (ii) the development of frontier AI models, or (iii) the manufacture of chips used for AI. Their subsidiaries are identified by Orbis and the Global Legal Entity Identifier Foundation (GLEIF).

53 Based on sectoral classification and including all firms in the data centre, semiconductor and software-development sectors. Data centres include NACE codes J63.11 and J62.03, software includes J58.29, J62.01 and J62.02, semiconductors include C26.11, C26.12, C26.20 and G45.51. Not all firms in these sectors are involved in the buildout of AI infrastructure, meaning that this measure overestimates total loan exposure to AI supply chains. Around a quarter of the firms in the AI supply chain and their subsidiaries identified in the ECB's AnaCredit dataset are in AI-related sectors.

have been driven in part by non-AI-related firms being crowded out or replaced, given that AI disrupts traditional software development processes.[54]

Chart 3.10

Risks to asset quality might emerge from exposures to some AI-related sectors, while cyberattacks continue to be a key source of operational risk



Sources: ECB (AnaCredit, RIAD), Moody's, GLEIF, EBA and ECB calculations.
Notes: Panel a: based on all banks. For definitions of AI-related firms and AI-related sectors see footnotes 52 and 53. Panel b: banks were asked in the European Banking Authority's Risk Assessment Questionnaire to indicate what they consider to be the main drivers of operational risk. They could select up to three options out of seven.

Besides posing risks to banks' asset quality, digitalisation and frontier AI developments are also increasing banks' operational risk. Banks rank cyber risk as the largest driver of operational risk by a large margin (**Chart 3.10**, panel b). Agentic AI systems are enabling cyberattacks to become faster and more sophisticated. This is favouring attackers as AI models are becoming available at lower cost after just a short time lag. While euro area banks have a good level of cyber security, defenders are disadvantaged by the cost of deploying frontier models, governance challenges and slower decision-making. Combining this with banks' reliance on a few key third-party ICT providers, the risk of systemic disruptions from cyber incidents is increasing (see **Special Feature B**).

[54] The asset quality of the outstanding loans to data centres and to the identified 165 AI-related important firms (including their subsidiaries), on the other hand, was very high, although it may have been partly obscured by the rapid loan growth.

Box 5

The effects of oil supply shocks on corporate resilience, bank asset quality and lending

Prepared by Stephan Fahr, Emanuele Franceschi, Dejan Krusec and Cosimo Pancaro

The global supply of oil was suddenly curtailed when the latest conflict in the Middle East broke out, resulting in higher and more volatile prices for the commodity. Around 20% of global supply has been hit by the effective closure of the Strait of Hormuz to commercial traffic since March 2026.[55] As a result, oil prices have reached levels similar to those observed after the Russian invasion of Ukraine and their volatility has increased significantly. Against this background, this box investigates the impact of oil supply shocks on corporate resilience, bank asset quality and lending activity.

Oil supply shocks can have substantial macroeconomic and financial repercussions affecting the resilience of non-financial firms, bank asset quality and lending. First, higher energy costs cause input costs to increase; if these additional costs are not passed on to customers, they compress firms' margins, leading to higher corporate defaults and eventually to higher non-performing loans (NPLs) on banks' books. Second, as the economy weakens after the shock materialises, banks might adjust lending volumes, credit standards and conditions, especially for corporates exposed to the oil shock, leading to adverse second-round effects.[56] Both of these effects can heighten financial stability risks, be it through weaker resilience among firms and banks or a reduced supply of finance to the real economy.

The analysis in this box shows that oil supply shocks weaken corporate creditworthiness and lead to a lagged, gradual and prolonged deterioration in bank asset quality. The analysis first considers a structural vector autoregression (SVAR) including macroeconomic variables and sector-specific one-year ahead expected default frequencies (EDFs) as a proxy for probabilities of default.[57] A 1 standard deviation negative shock to oil supply is found to raise aggregate corporate EDFs significantly, peaking four quarters after the shock (**Chart A**, panel a). The impact differs substantially across sectors, with the trade and transport sectors being the most severely affected.[58] The analysis also shows that the same negative shock leads to a gradual but significant increase in

55 Before the conflict broke out, the waterway handled around 20 mb/d of crude and petroleum products, accounting for roughly one-fifth of global oil supply (Oil Market Report, International Energy Agency, March 2026). In September 2026 the conflict also spread to Saudi infrastructure and Red Sea routes.

56 During the Ukraine-related surge in energy prices, credit growth to energy-intensive sectors fell by around 9% relative to low intensity firms in the first quarter after the invasion. This was accompanied by higher interest rates charged on new loans, especially for riskier borrowers. See Framroze Møller, N. and Poeschl, J., "The effects of a large energy price shock on bank credit", *Working Paper Series*, No 3260, ECB, 2026.

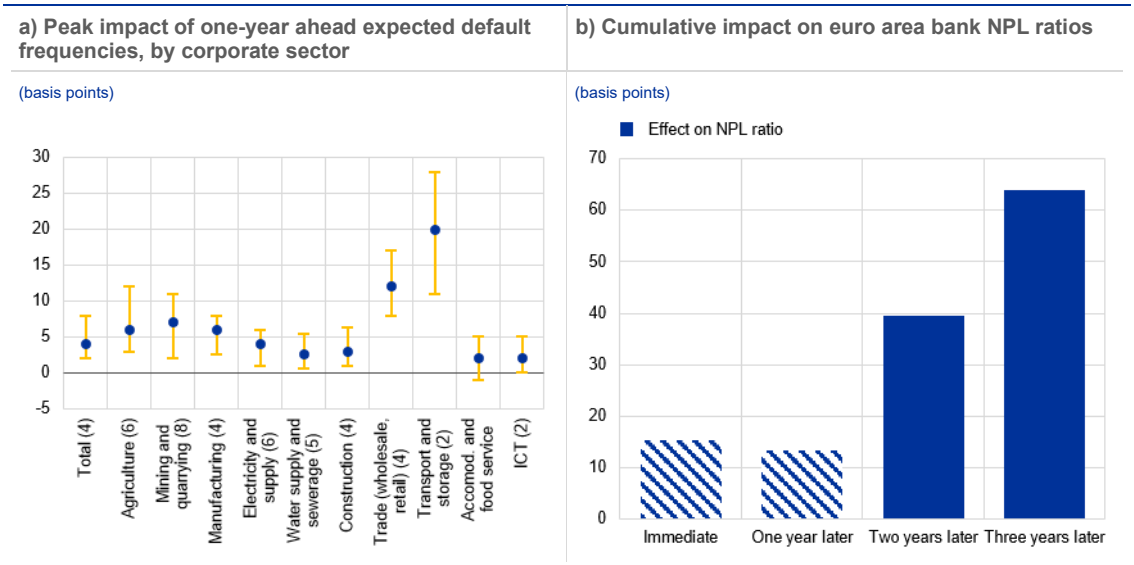
57 The SVAR includes world oil production, oil prices and euro area macro variables to estimate the dynamic effects of oil supply shocks on the macroeconomy and on corporate EDFs from Moody's KMV (a close, market-based proxy of probabilities of default). The shock identification relies on a Cholesky decomposition in which unexpected changes to global oil production are interpreted as global supply shocks, while shocks to global economic activity represent demand-side shocks, in line with Kilian, L., "Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market", *American Economic Review*, Vol. 99, No 3, June 2009, pp. 1053-1069.

58 Aggregate EDF increases by 4 basis points (from a level of 0.26% at the end of 2025). The trade and transport sectors see their EDFs increase by 12 basis points after four quarters and 20 basis points after two quarters respectively.

the average NPL ratio across banks, using local projections and bank-level data (**Chart A**, panel b).[59]

Chart A

Oil supply shocks weaken corporates and banks alike



Sources: Moody's, ECB, U.S. Energy Information Administration, Bloomberg Finance L.P., Gazzani et al.* and ECB calculations.
Notes: Panel a: the chart reports peak responses of one-year expected default frequencies to a 1 standard deviation negative shock to oil supply. Yellow whiskers represent 95% confidence bands. Numbers in parentheses represent the quarter of the peak response. No peak quarter is indicated for the "accommodation and food service" sector as the response is insignificant. Panel b: results from panel local projections using identified shocks and an unbalanced quarterly panel of 130 banks domiciled in the euro area, from Q1 2007 to Q1 2026. Solid bars are statistically significant at 5% threshold, with Newey-West standard errors.
*) Gazzani, A., Venditti, F. and Veronese, G., "Oil price shocks in real time", *Journal of Monetary Economics*, Vol. 144, May 2024.

Beyond the impact on bank asset quality, negative oil supply shocks reduce euro area banks' lending to corporates over the medium term, but without having a materially significant impact on lending spreads.[60] Results from a Bayesian vector autoregression (BVAR) with bank lending and macroeconomic conditions indicate that a negative oil supply shock reduces new lending to non-financial firms after around two years (**Chart B**, panel a).[61] At the same time, banks only marginally increase spreads on new loans to corporates (**Chart B**, panel b). These findings are in line with a combination of supply and demand factors over time: as the oil shock

59 The identified oil supply shock in the NPL analysis follows Gazzani, A., Venditti, F. and Veronese, G., "Oil price shocks in real time", *Journal of Monetary Economics*, Vol. 144, May 2024. The authors estimate a sign- and narrative-restricted SVAR at high frequency and decompose oil movements into future and current demand, and supply. The panel local projections are estimated with bank-level controls and lags of the shock. The specification also includes dummies for the pandemic period and bank-level fixed effects, with Newey-West standard errors. The total cumulative effect would add 64 basis points after three years, up from 2.81% at the beginning of 2026.

60 The BVAR combines the approaches set out in Gelain, P. and Lorusso, M., "Oil Price Fluctuations, US Banks, and Macroprudential Policy", *Working Paper Series*, No 22-33, Federal Reserve Bank of Cleveland, 2024; Baumeister, C. and Hamilton J.D., "Structural Interpretation of Vector Autoregressions with Incomplete Identification: Revisiting the Role of Oil Supply and Demand Shocks", *American Economic Review*, Vol. 109, No 5, May 2019, pp. 1873-1910; and Gambetti, C. and Musso, A., "Loan Supply Shocks and the Business Cycle", *Journal of Applied Econometrics*, Vol. 32, Issue 4, June/July 2017, pp. 764-782. Negative oil supply shocks are identified restricting the response of world oil output, oil price, world industrial production and inflation. Narrative restrictions are also included around the Russian invasion of Ukraine.

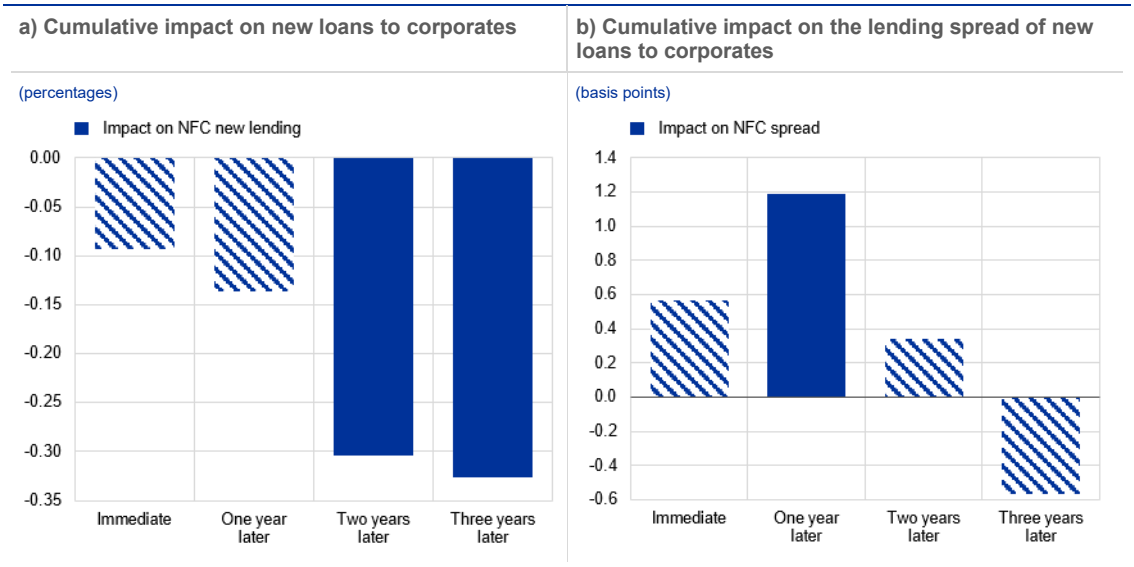
61 A 1 standard deviation negative oil supply shock, equivalent to an oil supply contraction of 0.5%, reduces new lending by 0.3% in the absence of buffering measures. The reaction of NFC loans is sluggish, as it only becomes significant after about 15 months. Impulse response functions could also partly capture the systematic response of monetary policy around oil shocks.

propagates through the economy, corporates could delay investment plans, thereby depressing credit demand while banks reduce lending to riskier firms.

Oil supply disruptions transmit slowly to the banking sector, with effects that start materialising about one year after the disruptions first occur. This box shows that oil supply shocks first raise expectations of corporate defaults, while bank asset quality and lending are affected only with a delay. These results suggest that the early effects of the closure of the Strait of Hormuz on bank asset quality and financial stability might only start materialising in the course of 2027. However, additional drawdowns of oil inventories and corporate financial buffers could help mitigate the effects of the shock.

Chart B

Disrupted oil supply leads to a decline in bank corporate lending



Sources: ECB (BSI, MIR), U.S. Energy Information Administration, Bloomberg Finance L.P. and ECB calculations.
Notes: Results from a sign- and narrative-restricted BVAR, with sign restrictions on oil production, price and reserves, and inflation and industrial production, identifying a negative oil supply shock for a full quarter. Narrative restrictions around the Russian invasion of Ukraine. The full BVAR includes world oil production, real Brent price, OECD oil reserves, world industrial production index, euro area HICP, EURIBOR spreads on new loans to non-financial corporations (NFCs), new loans to NFCs and EURO STOXX Banks index. Hierarchical Minnesota priors taken from Giannone et al.* Monthly data from January 2001 to December 2025. Solid bars indicate significant results, hatched bars are not statistically significant.
*) Giannone, D., Lenza, M. and Primiceri, G.E., "Prior Selection for Autoregressions", *The Review of Economics and Statistics*, Vol. 97, Issue 2, May 2015, pp. 436-451.

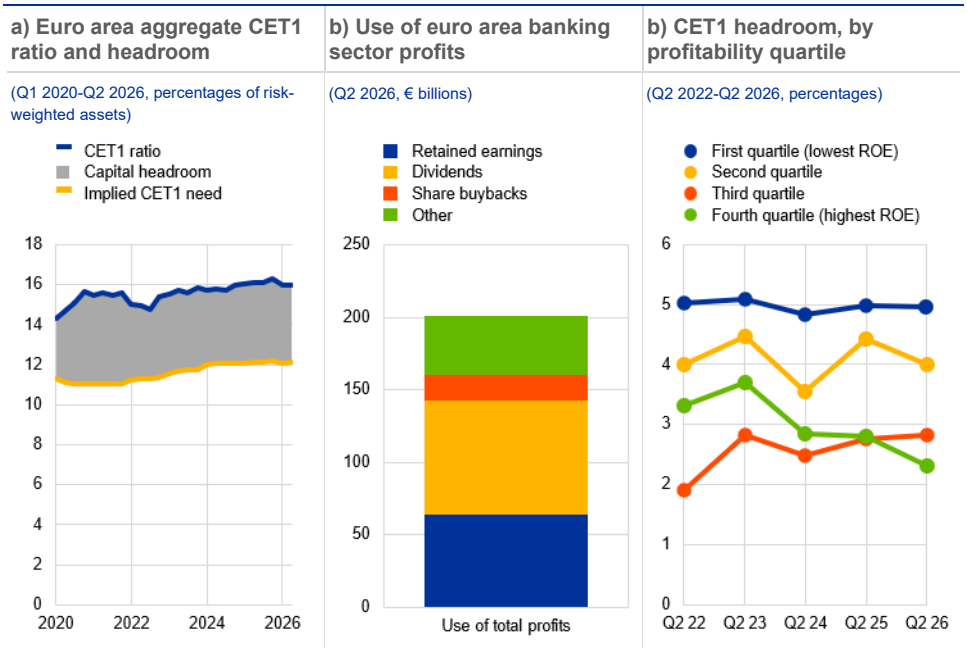
3.4 High aggregate capital ratios are supporting banking sector resilience

The banking sector remains well capitalised overall, supported by high profitability. The aggregate Common Equity Tier 1 (CET1) ratio and headroom have stabilised at high levels (**Chart 3.11**, panel a), thanks in part to the regulatory reforms implemented since the global financial crisis. Euro area banks have channelled about a quarter of their profits into additional equity, and retained earnings remain the largest driver of capital formation (**Chart 3.11**, panel b), while allowing for steady shareholder remuneration. A growing number of banks are also using synthetic risk transfers (see **Box 6**) to transfer credit risk outside the banking sector and lower their capital requirements. While these factors have supported

banks' capital headroom in aggregate, the dynamics differ across profitability quartiles. Indeed, a quarter of banks with the largest headline profitability have reduced their capital headroom over time and are now the least capitalised (**Chart 3.11**, panel c). As high profitability is a first line of defence against solvency risks, these banks might feel comfortable operating at tighter voluntary buffers.[62] However, banks should remain vigilant and ensure they are maintaining sufficient capital headroom in case earnings disappoint.

Chart 3.11

Stable aggregate capital ratios mask diverging trends in capital management



Sources: ECB (supervisory data) and ECB calculations.
Notes: Panel a: capital headroom is the difference between the implied CET1 capital need and banks' actual CET1 ratios. The implied CET1 need is banks' overall capital requirement + Pillar 2 guidance to be covered by CET1, plus any AT1/T2 shortfall that needs to be absorbed by CET1 and any eligible liability shortfall that must also be covered by CET1, also accounting for capital needs arising from leverage ratio and MREL regulations. Panel b: four-quarter trailing sum of banks' total profits and their allocation between retained earnings, dividends and repurchased treasury shares. Panel c: ratio of CET1 capital need to risk-weighted exposures. Profitability quartile is defined as the quartile of a given bank in Q2 2026 in terms of return on equity (ROE), such that banks do not move across quartiles over time. Data are shown only for the second quarter in each year.

62 As lower capitalisation boosts shareholder return by increasing leverage, banks are likely to optimise capital headroom by assessing solvency risk against profitability metrics.

Box 6

Bank reliance on credit protection providers via synthetic risk transfers

Prepared by Allegra Pietsch, Daniel Dieckelmann, Maciej Grodzicki, Francesca Lenoci and Manuela Storz

Synthetic risk transfers (SRTs) allow a bank to transfer the credit risk of a loan portfolio to a third party, while the loans themselves stay on the bank's balance sheet. SRTs are the most prevalent form of capital relief securitisation in the euro area.[63] Unlike cash securitisations, SRTs do not involve selling the loan portfolio. Instead, the bank retains the loans on its balance sheet and collects interest payments, manages credit risk and maintains customer relationships. Meanwhile, credit losses on the portfolio are covered by investors up to a limit, against a premium.[64] SRTs lead to lower capital requirements by reducing banks' risk weights on securitised loans although, in effect, they substitute bank equity for temporary loss-absorbing capital from investors.[65,66]

The use of SRTs by euro area banks has been growing steadily, although it varies across banks and portfolio type. In total, around €630 billion of bank loans are now protected by SRTs, and investors have committed about €120 billion in credit loss protection capital (**Chart A**, panel a). The estimated capital relief for banks has more than doubled over the last five years, reaching 40 basis points for the banking system in aggregate and 49 basis points for SRT-issuing banks (**Chart A**, panel b). Issuance is concentrated in, and dominated by, euro area global systemically important banks, and their already-tight capital headroom could make them more vulnerable to SRT market dislocations.[67] However, smaller banks have also been increasing their SRT issuance recently and obtain relatively more capital relief on average. Banks issue SRTs mainly on corporate and SME loan portfolios (**Chart A**, panel c). There are two likely reasons for this. First, the space for capital relief on these assets is often sizeable as they carry relatively high risk weights, and the economic capital needed to absorb credit losses may be less than the regulatory capital requirement.[68] Second, SRTs allow banks to reduce their credit risk exposure to firms without having to sever business relationships.

63 The concept of SRTs is used in the European regulatory framework to underpin the rules for recognising significant risk transfer. In addition to synthetic securitisations, these transactions also include some eligible cash securitisations. In this box, SRT refers solely to synthetic risk transfer transactions. Banks can also use other instruments, including traditional securitisation, credit guarantees and credit derivatives, to manage their credit risk and intermediation capacity.

64 Euro area banks usually retain a small first-loss piece and the senior tranche and obtain protection on a synthetic mezzanine tranche to cover any unexpected losses on the underlying portfolio. As the risk weights on the mezzanine tranche tend to be much higher than the risk weights on the senior tranche, the capital requirements on the portfolio are substantially reduced, often by as much as 70-85% for the portfolio as a whole. See Gonzalez, F. and Triandafil, C., "The European significant risk transfer securitization market", *Occasional Paper Series*, No 23, European Systemic Risk Board, 2023, and "Unveiling the impact of STS on-balance sheet-securitisation on EU financial stability", European Systemic Risk Board, May 2025.

65 SRTs can be structured as credit-linked notes − issued by either the bank itself or a special-purpose vehicle − credit derivatives or a guarantee from an investor to cover future losses as they arise.

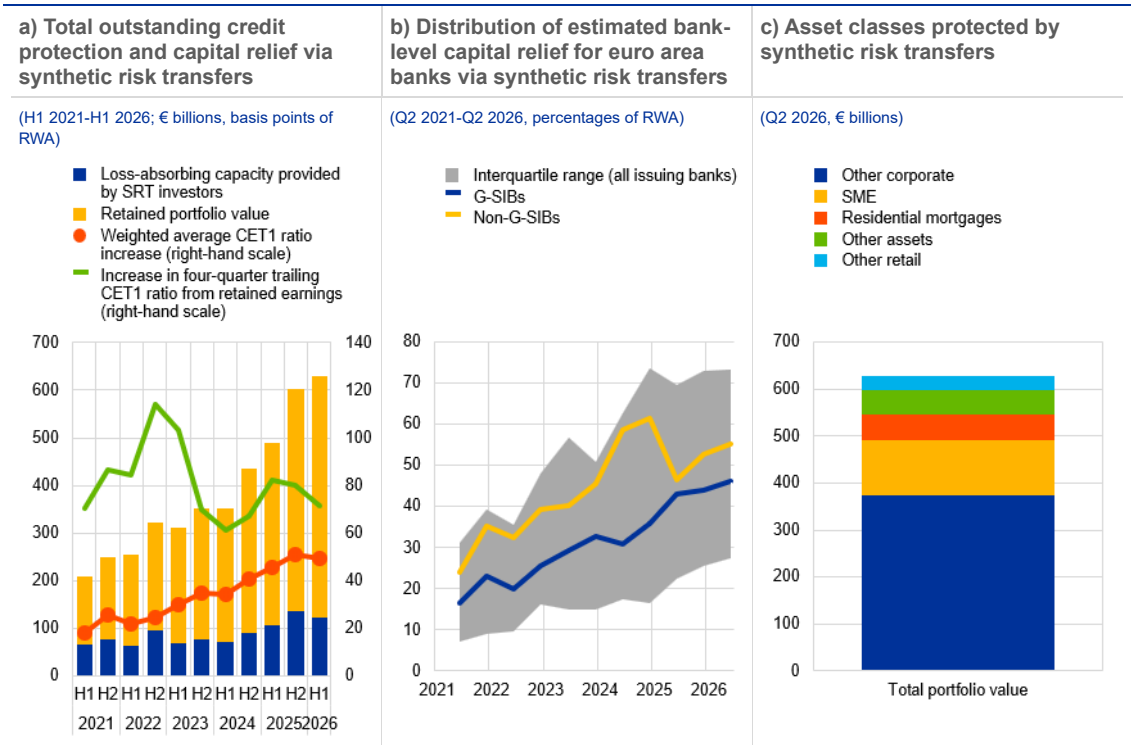
66 Synthetic securitisation was used extensively before the global financial crisis, and current SRTs have evolved from the instruments used at that time. Measures implemented since then include sounder market practices, tighter capital requirements, greater supervisory scrutiny and regulatory safeguards such as risk retention requirements and the prohibition of re-securitisations. See BCBS, "Synthetic risk transfers", Bank for International Settlements, February 2026, and Babu, P., Chui, M. and Stephanou, C., "The rise and risks of synthetic risk transfers", *BIS Quarterly Review*, Bank for International Settlements, March 2026.

67 In the second quarter of 2026 the top ten SRT issuers accounted for about 75% of total SRT issuance.

68 For empirical evidence, see Osberghaus, A. and Schepens, G., "Synthetic, but how much risk transfer", *Working Paper Series*, No 3210, ECB, 2026.

Chart A

SRTs have been growing steadily for years, providing significant capital relief to euro area banks



Sources: ECB (supervisory data) and ECB calculations.
Notes: Panel a: "Retained portfolio value" refers to the retained tranches of the portfolio not protected by SRT. It consists mainly of senior tranches and often a first-loss piece. The CET1 ratio increase is calculated for the sample of banks issuing SRTs as the difference between CET1 capital divided by pre-securitisation risk-weighted assets (RWA) and CET1 capital divided by post-securitisation RWA. Depending on the method applied to determine capital risk requirements, pre-securitisation RWA are calculated as pre-securitisation standardised approach capital charge or unexpected portfolio losses, divided by 8% and multiplied by total portfolio value less actual post-securitisation RWA. Values are estimates and might differ slightly from the realised capital relief.
Panel b: G-SIBs stands for global systemically important banks. Lines indicate the weighted average by group. Panel c: SME stands for small and medium-sized enterprises. "Other assets" includes mixed SME and corporate portfolios, commercial mortgages, leasing and trade receivables, and other wholesale assets. "Other retail" includes all non-mortgage non-SME retail exposure classes.

SRT structures provide additional loss-absorbing capacity for credit risk, as long as investor commitments are credible. Most SRTs are funded, meaning that credit loss protection is provided up front and is collateralised.[69] In the case of unfunded transactions, by contrast, investors commit to cover losses as they materialise, although banks are exposed to counterparty risk if the investors are unable to pay out. These unfunded structures are less common than they were but could regain popularity in the future. Public sector guarantors, notably including the European Investment Bank, account for about 10% of the SRT market and about a third of all unfunded SRTs (**Chart B**, panel a).[70]

Rollover risk, another concern associated with synthetic securitisation, is mitigated by maturity matching. Rollover risk occurs when the maturity date of the securitisation is shorter than that of the underlying loan portfolio. If a bank cannot enter into a new SRT, its capital requirement will increase abruptly as it will assume the credit risk once again. Part of this risk is currently mitigated by maturity matching. This is where the issued SRT matches or exceeds the average

69 Loans to large corporations are the most common portfolio underlying SRTs and tend to be funded, while about 80% of mortgage-related SRTs and about half of SME-related SRTs are unfunded.

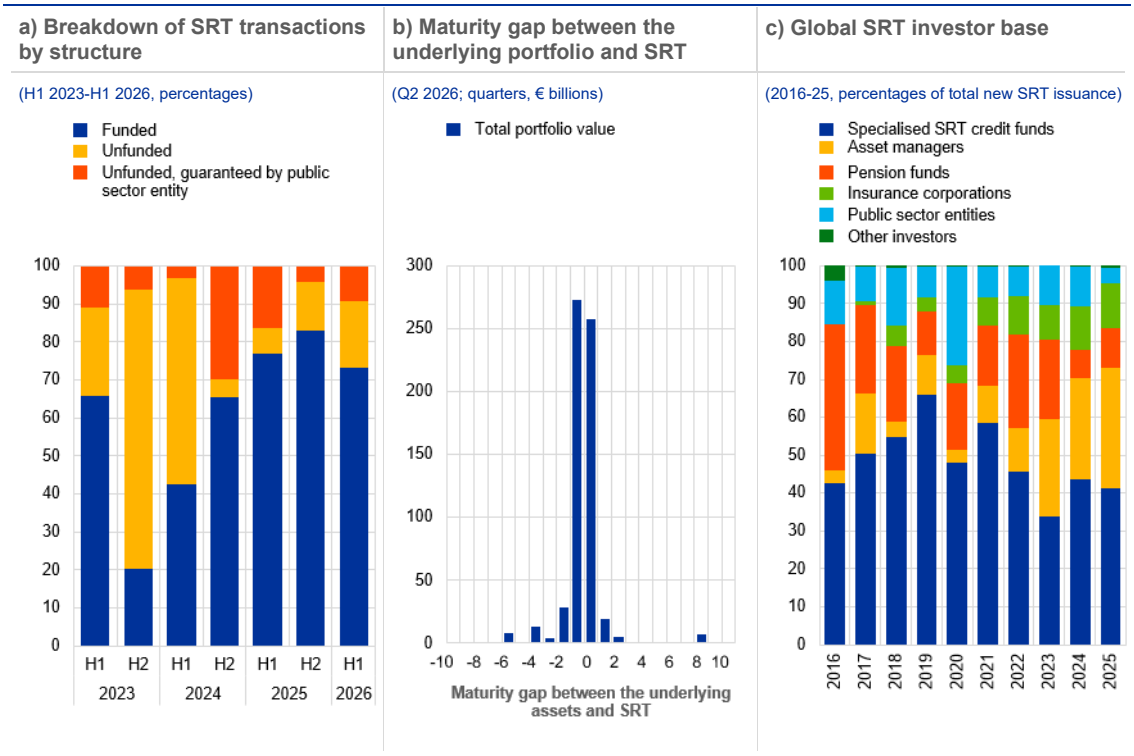
70 Assuming they meet the regulatory criteria for the recognition of significant risk transfer, banks can follow a securitisation approach to capital requirements on the underlying loan portfolio and apply a zero risk weight to the funded and transferred mezzanine tranche. While an unfunded tranche would normally attract a capital requirement due to the bank's exposure to counterparty credit risk, the advantage of a public sector guarantor is that the risk weight for this purpose would be zero.

maturity of the loan portfolio (**Chart B**, panel b). Moreover, originator banks often agree with investors on ex ante contractual provisions governing portfolio replenishment, which help maintain the SRT structure, and on the amortisation schedule, which determines whether loan repayments are allocated sequentially or on a pro rata basis.

The SRT investor base is dominated by specialised credit funds and asset managers, although it has become more broad based over time. These credit funds often follow narrow mandates, provide targeted capital management solutions and maintain long-term relationships with banks. However, the share of such specialised players in the SRT market has been decreasing since 2021 (**Chart B**, panel c), as has the share of pension funds. Over the same period, asset managers, including those operating large private equity and private credit funds, have expanded into SRT investment. The lack of visibility regarding the actual ultimate carriers of credit risk means it is difficult to assess what balance sheet capacity these funds have to absorb credit losses or to provide stable demand for SRT upon rollover.

Chart B

While SRTs are usually structured to provide effective loss absorption, they could lead to spillovers from the non-bank sector to banks



Sources: ECB (COREP), IACPM and ECB calculations.
Notes: Panel a: funded structures are SRTs with collateral provided to cover credit losses. Public sector entities are protection providers eligible for a zero risk weight. Panel b: the maturity gap is calculated as the difference between the weighted average maturity of the underlying asset pool and the shorter of the legal or the foreseeable maturity date of the SRT. Panel c: the figures are based on a survey of 62 global SRT originators and over 800 SRT transactions. Survey participants had received protection of €905 billion of underlying assets as at end-2025. EU-based banks account for about 63% of the volume of SRTs included in the survey. The investor breakdown refers to the immediate investors. Public sector entities include multilateral development banks and international organisations, which benefit from a zero risk weight, as well as central banks and governments.*
*) See Joulia-Paris, T. and Saary-Littman, J., "Global SRT Market Overview 2025: Record Issuance, Broadening Participation, Diversifying Assets", IACPM, June 2026.

The financial stability risks associated with SRTs are currently limited but could increase if banks were to become overly dependent on credit protection, leading to procyclical loan supply. The SRT market provides banks with balance sheet space, which may support their ability

to extend lending and supply credit to the real economy.[71] The financial stability risks are mitigated by the predominant use of funded structures, the presence of specialised long-term investors and limited maturity mismatches. However, further rapid growth of SRTs and shifts in the investor base could make banks dependent on non-banks for credit-risk and capital management. Risks materialising in the non-bank financial intermediation sector could reduce the capacity of protection providers to take on credit risk from banks and potentially disrupt aggregate credit supply. If SRT investors are active in other segments of the credit market, losses from such activity could diminish their ability to bear risk via SRTs, resulting in a spillover from credit markets to bank lending. Moreover, global banks are using SRTs to insure credit risk for loans to private credit funds, which could further increase the opacity of the linkages between banks and non-banks. This could result in credit risk emerging in unexpected pockets of the financial system.[72]

3.5 Geopolitical headwinds and elevated financial stability risks underscore the need to preserve resilience

Preserving resilience remains the key priority for macroprudential policy.[73] Although the euro area banking sector is healthy and credit dynamics are favourable, albeit unevenly so across countries, financial stability risks remain elevated. Should these risks materialise, it is crucial that there is adequate macroprudential space in the form of releasable capital buffers for the relevant authorities to act swiftly and effectively. This is because releasing these buffers gives banks greater capacity to absorb losses and supports the continued provision of credit to households and firms.[74] As capital requirements are not currently constraining the supply of bank credit, and in the absence of signs of widespread loss materialisation, macroprudential capital buffers should remain in place to preserve banking sector resilience.

71 There is mixed empirical evidence on the credit supply impact of SRT, as banks that issue SRTs tend to lend more but also tend to increase dividend payouts. See Osberghaus, A. and Schepens, G., "Synthetic, but how much risk transfer", *Working Paper Series*, No 3210, ECB, 2026, and Evrard, J., Schuster, W.E., Wassmann, F. and Wedow, M., "Can synthetic securitisation support economic growth?", *The ECB Blog*, ECB, 2 September 2026.

72 This may give rise to wrong-way risk where the recipient of the loan operates in the same sector as the protection provider. Additional financial innovations in the United States, such as re-securitisation or credit enhancements of SRT tranches by opaque guarantors, could create further data gaps and spillover channels. It has been reported that US insurers have provided credit protection on SRT tranches to enhance their credit ratings, helping SRT investors to raise more leverage from banks against the SRT tranche. See "Wall Street Alchemists Tap Insurers to Unfreeze Private Markets", Bloomberg, 19 July 2026, and Poilpré, J.-M., "Europe's banks deploy SRT scalpel across private credit exposures", PitchBook, 15 July 2026.

73 As noted in the Governing Council statement on macroprudential policies of 8 July 2026, macroprudential policy needs to remain agile and adapt to changing conditions as needed. Policymakers should continue to closely monitor the situation, as further adverse shocks may require a shift in the policy stance.

74 All banking union countries have now implemented some form of releasable capital buffer. In July 2026 Lithuania announced an increase in its countercyclical buffer rate from 1.0% to 1.25%, effective 1 August 2027, to address a rise in cyclical systemic risk. In September 2026 Croatia also announced an increase in its countercyclical buffer rate, from 2.0% to 2.25%, effective 1 October 2027, to address a further increase in cyclical systemic risk. In November 2026 Cyprus announced the activation of a systemic risk buffer of 1% to address several structural vulnerabilities, effective 31 December 2026.

Borrower-based measures should continue to serve as a structural backstop, where feasible under national legislation, to safeguard sound lending standards throughout the real estate cycle. The recent recovery in residential real estate markets has become more apparent in several euro area countries, driven by improving financing conditions and a gradual strengthening of housing demand. While vulnerabilities remain contained in the euro area as a whole, developments vary substantially across countries, with some already experiencing strong dynamics in residential real estate prices and in some cases also mortgage lending (see **Section 1.5** and **Box 1**). In light of this, existing borrower-based measures should be maintained to prevent an erosion of lending standards and contain the build-up of vulnerabilities among borrowers. Countries in which the residential real estate market is gaining momentum more rapidly might also consider tightening existing measures, while other countries could – where feasible under national legislation – adopt such measures as permanent structural backstops to prevent the build-up of vulnerabilities in the future.[75]

The ECB supports the European Commission's communication on the competitiveness of the EU banking sector and welcomes its strategic direction.[76] Banking sector resilience is a key prerequisite for economic growth and competitiveness.[77] The regulatory reforms that were implemented following the global financial crisis have helped to ensure that the banking system is well capitalised. This has enhanced banks' capacity to maintain credit provision in times of stress, mitigated excessive risk taking and promoted sound risk management practices. Furthermore, there seems to be no evidence to date that reducing capital requirements in normal times would foster competitiveness by increasing lending. Efforts are needed to reduce undue complexity in the regulatory framework, while maintaining a level playing field that ensures fair competition as well as supporting innovation and minimising risks.

Financial and regulatory fragmentation of the Single Market, including the incomplete banking union, continues to hold back European banks. Europe's competitiveness would benefit from a genuinely single European banking market that enables cross-border banks to compete on a global scale. In this context, the Eurosystem has repeatedly called for the finalisation of a European deposit insurance scheme and is looking forward to the new proposal from the European Commission. The aim of the proposal would be to ensure strong and uniform protection of depositors across Europe and simplify the structure of the deposit insurance framework by better aligning the decision-making of national and EU authorities under the crisis management framework with the financial responsibilities for financing resolution and deposit insurance measures. The ECB has already taken concrete steps to support cross-border banking integration within the existing

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75 Considerations on the activation of borrower-based measures should be based on a thorough ex ante assessment of their benefits, costs and distributional effects.

76 See "Commission outlines measures to strengthen Europe's banking sector and support growth", European Commission, 17 July 2026.

77 See "Simplification of the European prudential regulatory, supervisory and reporting framework", ECB, 11 December 2025, and "Eurosystem response to the EU Commission's targeted consultation on the competitiveness of the EU banking sector", ECB, April 2026.

framework.[78] However, further steps are needed to enable a more efficient allocation of resources within cross-border banking groups, for example by applying cross-border liquidity and capital waivers, subject to adequate safeguards. Such safeguards should promote resilience across credit institutions at the solo, subsidiary, branch and consolidated levels, including through fair and timely transfers of resources within banking groups, particularly in times of stress.

While acknowledging the benefits of the current regulation, the ECB considers the cyber risk stemming from frontier artificial intelligence (AI) models to be substantial. The EU Digital Operational Resilience Act[79] strengthens the incident reporting framework, enhances banks' preparedness to deal with cyberattacks and facilitates closer monitoring of third-party risks by supervisors. At the same time, however, progress in the field of frontier AI models is making it possible to carry out cyberattacks more quickly and cheaply, and with greater sophistication. The ECB is paying close attention to these developments, assessing their implications from a microprudential and macroprudential perspective (see **Special Feature A**), and taking action where needed.[80]

Lastly, amendments to the Markets in Crypto-Assets Regulation (MiCAR)[81] could help realise the potential of distributed ledger technology and tokenisation to foster innovations and efficiency in the financial sector. Distributed ledger technology and tokenisation could contribute to the development of more integrated and efficient financial market infrastructure in Europe. In this context, MiCAR provides a robust, balanced and harmonised regime for crypto-asset service providers and issuers. The ECB welcomes the European Commission's intention to review MiCAR to ensure that it remains fit for purpose while safeguarding the stability of the financial system. In this regard, the ECB considers that the minimum deposit requirements for stablecoins could be removed and replaced with minimum liquidity requirements for reserve assets. This would provide issuers with more flexibility and still maintain their ability to meet redemption requests promptly.[82] It could also reduce potential channels for contagion between banks and stablecoins while ensuring that reserve assets remain sufficiently liquid. Other key issues to be considered in MiCAR include the need for additional measures to address financial stability concerns about stablecoin issuance and the further harmonisation of the legal framework for tokenised assets.[83]

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78 This includes a guide that (i) confirms cross-border mergers in the euro area will be treated in the same way as domestic mergers; and (ii) clarifies that banks can convert subsidiaries into branches and apply for liquidity waivers to facilitate the pooling of liquidity, subject to robust safeguards. For further details, see "One rulebook for bank mergers and divisions", *Supervision Newsletter*, ECB, 11 February 2026.

79 Regulation (EU) 2022/2554 of the European Parliament and of the Council of 14 December 2022 on digital operational resilience for the financial sector and amending Regulations (EC) No 1060/2009, (EU) No 648/2012, (EU) No 600/2014, (EU) No 909/2014 and (EU) 2016/1011 (OJ L 333, 27.12.2022, p. 1).

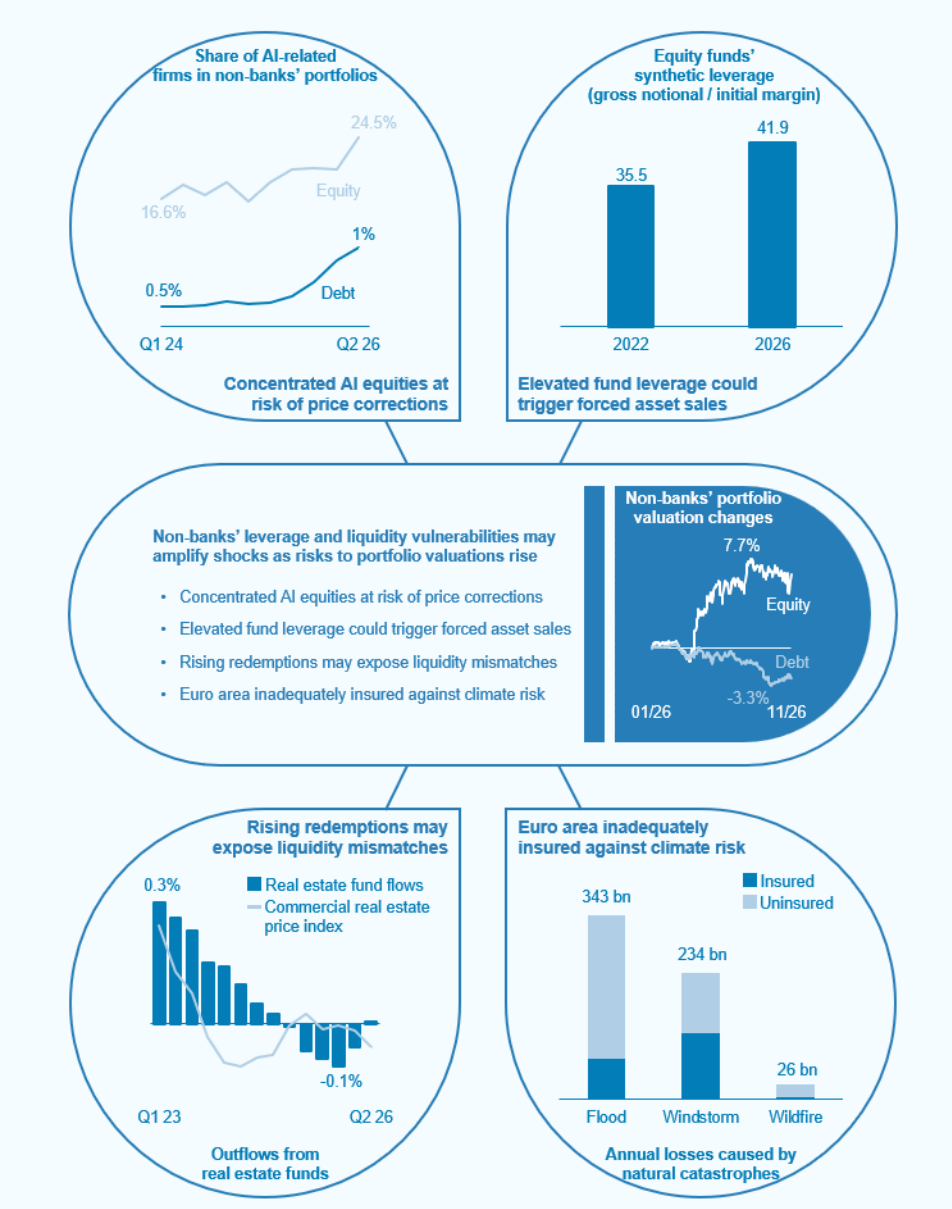
80 In July 2026 the Chair of the ECB's Supervisory Board sent a letter to the CEOs of significant institutions, requesting supervised entities to review their cybersecurity postures, IT budgets and staffing, and to submit an action plan for mitigating AI-related risk by 31 October 2026.

81 Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937 (OJ L 333, 27.12.2022, p. 1).

82 A sound calibration of the liquidity requirements would be needed to take into account potential second-order effects.

83 See "ESCB response to the European Commission's targeted consultation on the Markets in Crypto Assets Regulation (MiCAR)", ECB, September 2026.

4 Non-bank financial sector



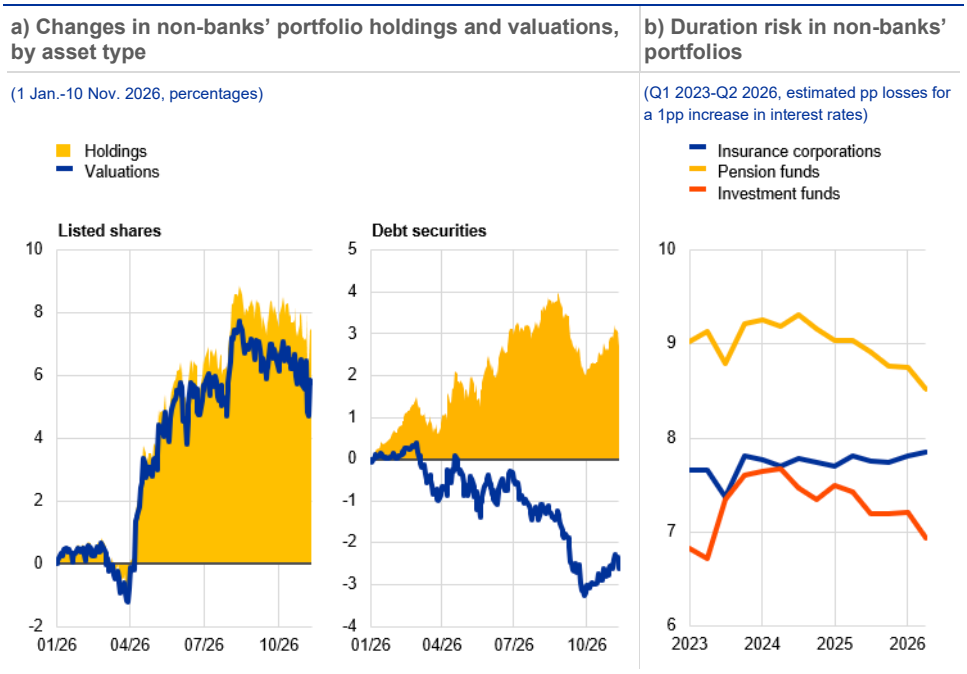
4.1 The non-bank financial sector remains vulnerable to rising risks from correlated valuation losses

High equity valuations and elevated duration risk are leaving non-banks' portfolios vulnerable to simultaneous valuation losses. Equity holdings of euro area non-banks have increased significantly during 2026, driven primarily by rising stock market valuations that have partially reversed more recently. By contrast, debt portfolios have grown to a lesser extent, as non-banks have purchased additional debt securities while simultaneously experiencing valuation losses amid rising

interest rates following the start of the Middle East conflict (**Chart 4.1**, panel a). Looking ahead, a deterioration in the macroeconomic outlook and renewed energy price pressures could raise credit risk and expose portfolios to further valuation losses. In addition, duration risk in non-banks' bond portfolios is still high, despite declining recently for pension funds and investment funds, leaving their longer-duration holdings in particular exposed to a further rise in sovereign bond yields (**Chart 4.1**, panel b). Non-bank portfolio valuations therefore continue to be vulnerable to geopolitical shocks, concerns about the positive narrative around artificial intelligence (AI) and increases in interest rates, which may trigger simultaneous losses on equity and bond holdings. Furthermore, these concurrent risks are being compounded by the increased stock-bond correlation (see **Chapter 2**), which limits the benefits of portfolio diversification.

Chart 4.1

High equity valuations and elevated duration risk are leaving non-banks' portfolios vulnerable to simultaneous valuation losses



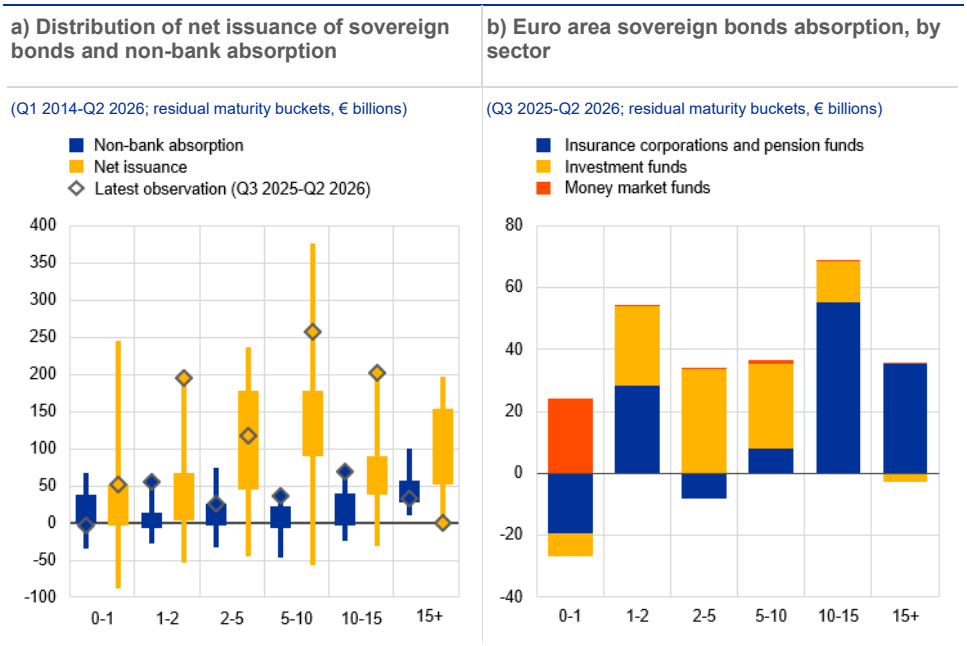
Sources: ECB (CSDB, SHS), LSEG, Bloomberg Finance L.P., EPFR Global and ECB calculations.
Notes: Panel a: changes in holdings from July onwards are estimates based on flows into equity and bond funds. Panel b: duration risk is measured as modified duration, which estimates the approximate percentage change in a portfolio's value for a 1 percentage point (pp) change in interest rates; higher values indicate greater interest-rate sensitivity.

Non-banks continue to play an important role as absorbers of sovereign debt, increasing their purchases amid record high issuance. Non-banks have continued to be a key purchaser of newly issued sovereign debt, acquiring around 20% of issued debt with a maturity of less than five years and more than 30% of issued debt with a maturity of more than five years over the last 12 months. During this period, the absorption of bonds at the very short end (below one year) and the very long end (over 15 years) has declined, while absorption of issued debt with a maturity of one to two years and five to 15 years is at a historical high (**Chart 4.2**, panel a). Reflecting their respective preferred investment horizons, money market funds have been highly active in absorbing very short-term issuances, while

insurance corporations and pension funds have continued to purchase securities at the long end (**Chart 4.2**, panel b).

Chart 4.2

Non-banks' sovereign debt absorption has remained high amid strong issuance



Sources: ECB (CSDB, SHS) and ECB calculations.
Notes: Panel a: interquartile (box) and minimum-maximum (line) range of annual net issuance of sovereign debt and non-bank absorption, along with the latest observation. Net issuance is defined as cumulative quarter-on-quarter net changes in issued securities. Panel b: absorption refers to cumulative quarter-on-quarter net changes in the holdings of the euro area non-bank sector.

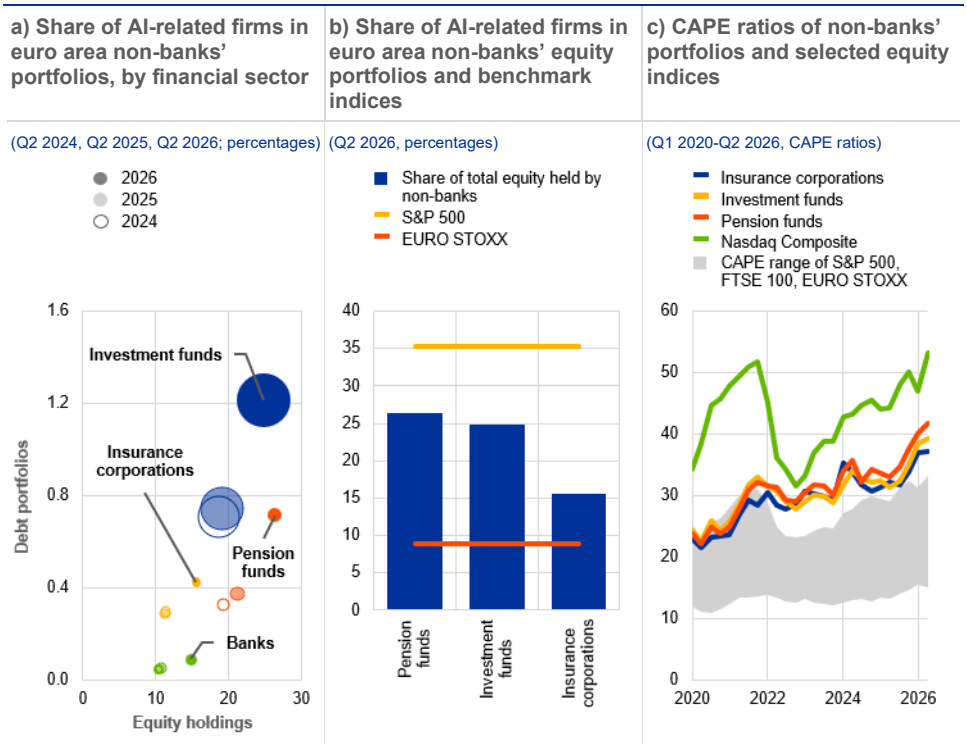
Non-banks' portfolios are highly sensitive to shifts in AI sentiment, given their large and concentrated exposures to US technology and AI-related firms. The share of non-banks' holdings in US technology and AI-related firms has increased on the back of substantial valuation gains and now accounts for between 16% and 26% of their equity investments. In addition to equity, non-banks have also started to invest in debt issued by AI-related firms, and particularly by US hyperscalers seeking to fund their capital expenditure (**Chart 4.3**, panel a; see **Section 2.3** and **Box 3**). While holdings of AI-related debt have risen most notably among investment funds and pension funds, they are so far limited in absolute terms and do not appear to be crowding out non-bank absorption in euro area bond markets (see **Box 4**). The growing portfolio allocation to AI-related firms reflects broader developments in global financial markets. Although the share of AI-related firms in euro area non-banks' equity portfolios is still below that in major US equity markets, such exposures are more concentrated than in the broader euro area equity market (**Chart 4.3**, panel b).[84] The concentration in predominantly US dollar-denominated equities also increases non-banks' sensitivity to US-specific shocks and, in the absence of hedging, related exchange rate fluctuations. Furthermore, concentration risk has increased as valuations have continued to rise, especially among the largest US technology and AI-related firms, amid a strong earnings outlook centred on optimistic

[84] Rising exposure to AI-related investments may result from euro area institutional investors tracking broader market indices with a high concentration in AI companies.

expectations for future AI demand and adoption (see **Special Feature A**). The valuations of non-banks' equity holdings have followed this trend and, in recent years, have remained above those of the broader market (**Chart 4.3**, panel c). A sudden shift in expectations, as for instance observed after the recent disappointing earnings reports of large US tech firms, could trigger renewed price declines across firms and amplify portfolio losses.

Chart 4.3

Non-banks' equity portfolios are increasingly concentrated in AI-related equities, while holdings of debt issued by AI-related firms are rising



Sources: ECB (CSDB, SHS), LSEG and ECB calculations.
Notes: Panel a: bubble size represents the total holdings of AI-related equity and debt for each sector. Panels a and b: "AI-related firms" comprises 167 firms (and their respective subsidiaries) identified as being involved in AI model development, AI chip production, AI cloud provision, AI data centre and infrastructure provision, or related utilities. Panel c: cyclically adjusted price/earnings (CAPE) ratios at portfolio and index level, using earnings for the last ten years, adjusted for inflation and averaged. Portfolio-level prices and earnings are weighted by the instrument-level holdings of non-banks.

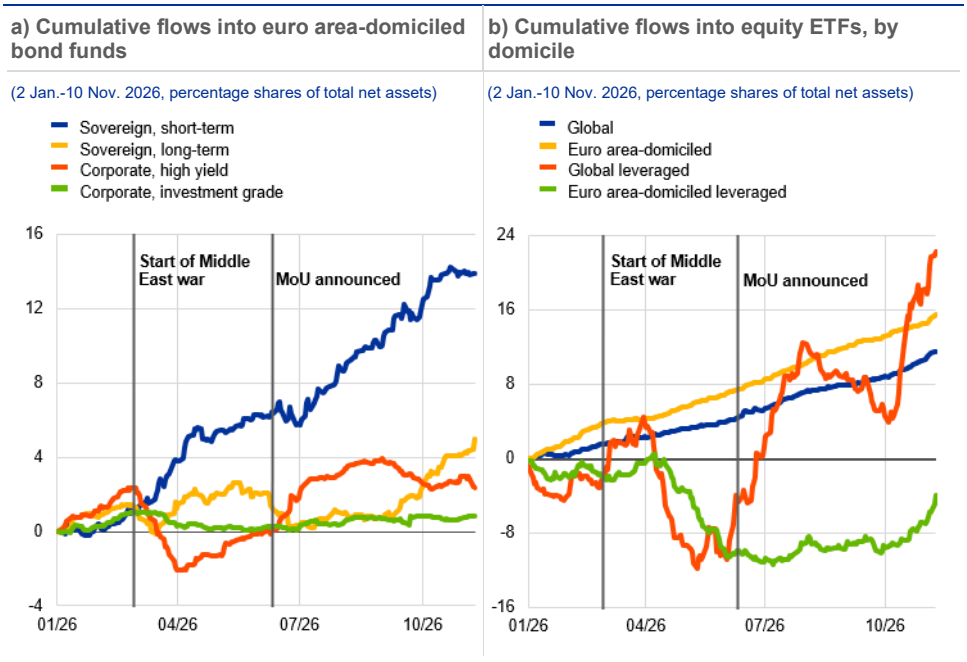
4.2 Rising leverage and redemption pressures could expose liquidity vulnerabilities in investment funds

Investment fund flows are showing an increasingly divergent picture, as demand for duration remains muted while appetite for risk assets remains high. Flows into long-term sovereign bond funds have remained subdued since the beginning of 2026, against a backdrop of fiscal concerns and expectations that interest rates will rise. Flows into short-maturity funds, by contrast, have experienced an upward trend. Risk assets – in particular high-yield bond funds – rebounded strongly after the first few weeks of the conflict in the Middle East (**Chart 4.4**, panel a). There were particularly strong inflows into global leveraged equity

exchange-traded funds (ETFs) from June, indicating increased investor appetite for leveraged equity exposures. At the same time, flows into euro area-domiciled leveraged ETFs have been very limited in scale and are lagging behind demand for global leveraged ETFs, while leveraged ETFs overall remain smaller in size than non-leveraged ETFs (**Chart 4.4**, panel b).

Chart 4.4

Fund flows reflect preference for lower duration and AI-fuelled risk-on sentiment



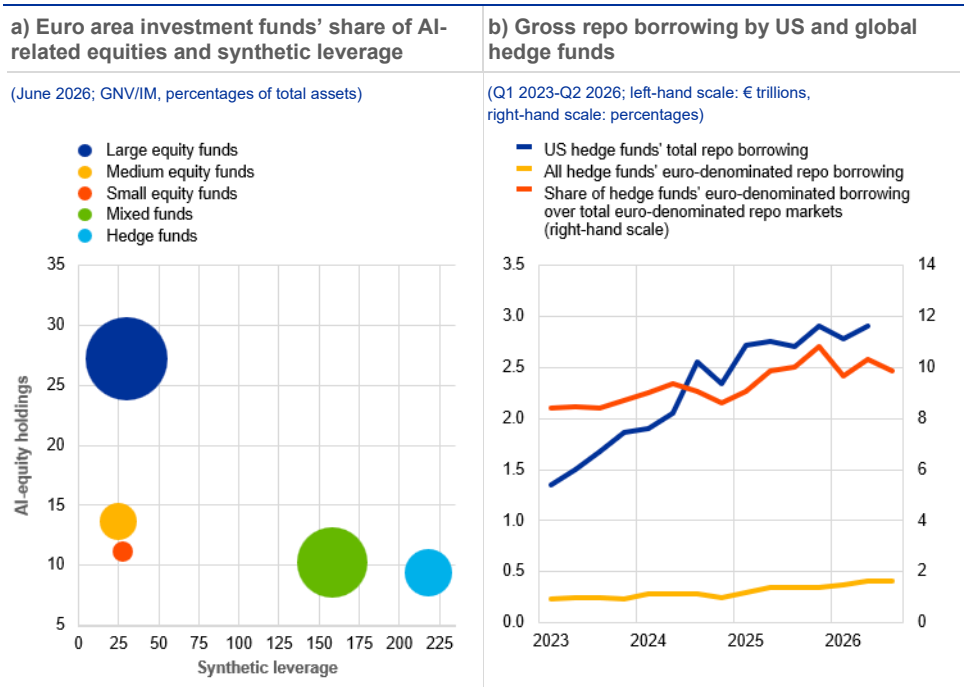
Sources: EPFR Global and ECB calculations.
Notes: "Start of Middle East War" refers to 2 March 2026, the first trading day after the start of the conflict on 28 February 2026. "MoU announced" refers to 12 June 2026, the day on which the temporary truce framework (MoU) between the United States and Iran was unofficially announced. Panel a: the sample is based on euro area-domiciled funds investing primarily in western European bonds, which include bonds issued in euro area countries, Norway, Sweden, Switzerland and the United Kingdom. Short-term bond funds invest in bonds with durations of between zero and four years. Long-term bond funds invest in bonds with durations of six years or more. A bond fund with a duration of five years is classified as intermediate term.

The increasing use of leverage in funds with concentrated artificial intelligence (AI) exposures could amplify a potential market downturn. Larger euro area investment funds have a higher share of their portfolios allocated to AI-related firms than their smaller counterparts and are also exposed to risks from synthetic leverage in equity derivatives (**Chart 4.5**, panel a). While funds' exposures to AI-related assets have benefited from strong market performance and continued investor demand, they could also make funds more vulnerable to losses if there were an abrupt reassessment of growth prospects and earnings expectations, even for just a few AI-related firms. This was also illustrated by the recent sell-off of AI-related stocks after disappointing earnings releases of large US tech firms. Concentration risks may be particularly pronounced where they interact with leverage, as for

example in the case of the US hedge fund Situational Awareness in July 2026.[85] While synthetic leverage at euro area equity funds remains well below the levels observed at hedge funds, sudden price swings could lead to significant portfolio losses and pressure to deleverage to meet margin calls. This could result in forced asset sales and procyclical fund share redemptions, which would have the potential to further amplify any market downturn.[86]

Chart 4.5

High concentration in AI-related assets among large funds is compounded by rising leverage and cross-border interconnectedness between hedge funds



Sources: LSEG Lipper, Office of Financial Research, ECB (IVF, SFTDS, EMIR) and ECB calculations.
Notes: Panel a: euro area equity funds are grouped into terciles by assets under management (AuM). Synthetic leverage is the gross notional of equity derivatives divided by the initial margin (GNV/IM), shown as the AuM-weighted average within each group. Bubble size represents the gross notional amount of equity derivatives holdings in each group. "AI-equity holdings" refers to equities issued by AI-related firms, which comprise 167 firms (and their respective subsidiaries) identified as being involved in AI model development, AI chip production, AI cloud provision, AI data centre and infrastructure provision, or related utilities. The hedge fund bubble covers only euro area hedge funds whose holdings contain more than 50% in equities. Panel b: US hedge funds are global hedge funds managed by US-based asset managers. End-of-quarter data presented.

Hedge fund leverage and cross-border activity could carry the risk of spillovers to euro area sovereign bond markets. Leverage in the hedge fund sector remains elevated globally. This is particularly the case for US funds, which have more than doubled their repo borrowing since 2023 (**Chart 4.5**, panel b). This is also reflected in the euro-denominated repo market, where hedge fund borrowing has increased, implying that global hedge funds are increasingly using euro area

[85] In July 2026 Situational Awareness saw its assets under management collapse from around USD 45 billion to USD 10 billion, accompanied by simultaneous valuation losses on concentrated and highly correlated long positions in AI infrastructure and short positions in software. With the stock prices of the hedge fund's highly leveraged long positions falling, lenders issued margin calls which the fund was unable to meet without selling its holdings, further reinforcing the downward movement. This liquidity squeeze led to the fund selling the majority of its portfolio to Citadel in an emergency transaction, at a reported discount of 10%.

[86] The potential for amplification effects depends on several factors, such as the type of intermediary in the derivative transaction, the degree and type of collateralisation, funds' liquidity preparedness and the availability and timely activation of liquidity management tools.

sovereign bonds as collateral in their investment strategies.[87] While rising repo borrowing can enhance market resilience by facilitating secured funding and supporting liquidity redistribution, it also increases the risk of shocks originating outside the euro area spilling over into euro area sovereign bond markets. This risk is particularly acute during periods of market stress when hedge funds may be forced to reduce leverage, especially if their liquidity preparedness is inadequate. As a result, hedge funds' procyclical deleveraging may amplify falling prices and rising volatility in sovereign bond markets (see **Box 7**).

Risks from liquidity mismatches in parts of the investment fund sector remain elevated, as rising interest rates may increase redemption pressures. High-yield corporate bond funds may be at risk of incurring renewed outflows, as valuation losses and higher interest rates could encourage investors to rebalance their portfolios. While euro area high-yield bond funds have increased their holdings of high-quality liquid assets (HQLA) recently, levels remain low overall, particularly among the largest funds. Around half of the largest high-yield bond funds currently have HQLA holdings that are insufficient to cover the outflows associated with a redemption shock (**Chart 4.6**, panel a). Furthermore, real estate funds could face rising redemption requests, as interest rates are expected to move higher. Despite a rebound in commercial real estate prices in 2025, flows into euro area real estate funds have remained subdued and there may be new procyclical outflows as interest rates rise (**Chart 4.6**, panel b). It remains essential to align redemption terms with asset liquidity to avoid forced asset sale spirals that would have the potential to transmit stress to other parts of the financial system (see **Section 4.4**).

Elevated credit risk and an uncertain macroeconomic outlook could increase the risk of further redemptions in private credit funds. Redemptions from US private credit funds remain elevated and are still being gated to avoid forced deleveraging or asset sales (**Chart 4.6**, panel c).[88] A high share of comparatively weak borrowers in private credit portfolios and the high proportion of floating-rate loans increase the risk of fund performance declining in the event of a worsening macroeconomic outlook or rising interest rates. Although private credit funds are unlikely to pose systemic risks to financial stability in isolation, their increasing involvement in AI financing makes them more susceptible to spillover risks from changes in investor AI sentiment (see **Chapter 2**).

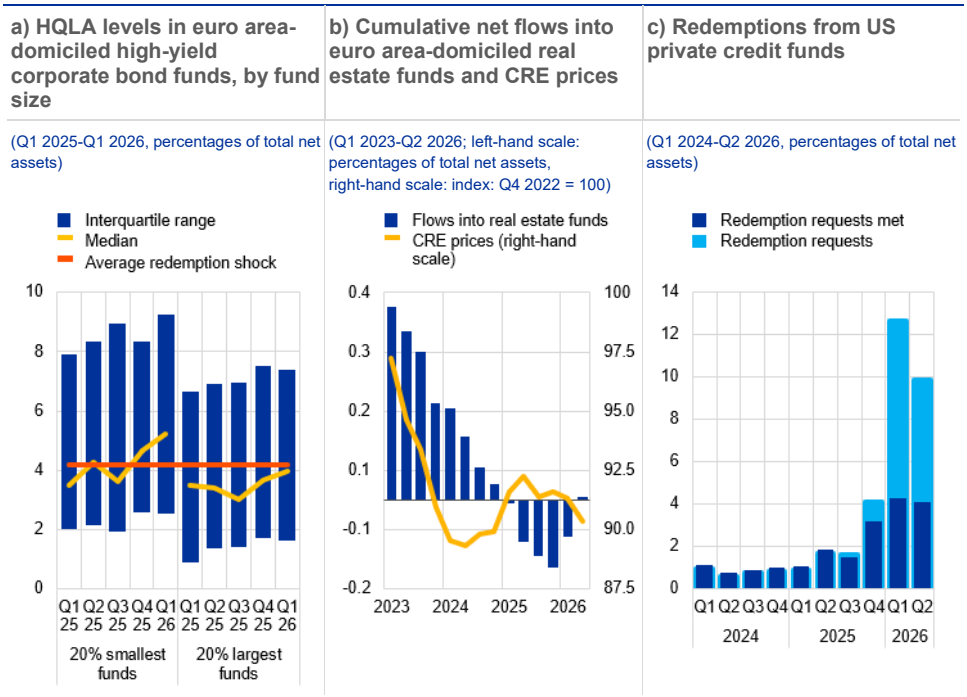
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87 Results from the ECB's September 2026 SESFOD survey indicate that credit terms and conditions eased slightly in price terms but that non-price terms tightened slightly for hedge funds, while their use of leverage increased slightly. See Results of the September 2026 survey on credit terms and conditions in euro-denominated securities financing and OTC derivatives markets (SESFOD).

88 Empirical evidence from outflows during the COVID-19 pandemic shows that restrictions on fund redemptions do not lead to higher outflows in later periods, suggesting that they can be an effective tool in reducing withdrawals rather than postponing them. See also Molestina Vivar, L., "Mitigating fragility in open-ended investment funds: the role of redemption restrictions", *Working Paper Series*, No 3025, ECB, 2025.

Chart 4.6

Larger funds face higher liquidity mismatches, while real estate and private credit funds are exposed to increased redemption risk



Sources: LSEG Lipper, company SEC filings, ECB (IVF, RESC) and ECB calculations.
Notes: Panel a: the average redemption shock is defined as the average redemptions observed during the top 10% worst 30-day outflows since 2007. Panel b: Q1 2026 and Q2 2026 data for commercial real estate (CRE) prices are approximated using German prices due to a longer reporting lag for euro area data. Panel c: data for a total of 26 non-traded business development companies that reported redemption requests in the periods shown.

Box 7

The footprint of hedge funds in euro area sovereign bond markets via repo markets

Prepared by Carlos Miguel Aguiar da Glória, Maurizio Michael Habib, Andrea Sante and Michael Schmidt

The sudden unwinding of large hedge fund positions in sovereign bond markets can pose risks for financial stability. Understanding hedge funds' behaviour during periods of market stress is increasingly important, given the rapid growth of the sector and its substantial exposure to US and European sovereign bonds. Hedge funds now account for a sizeable share of trading activity in euro area sovereign bonds.[89] These funds typically use flexible trading strategies that rely heavily on leverage, particularly when trading such bonds. These include relative value strategies such as basis trades, swap spread trades and auction cycle arbitrage, as well as directional strategies such as yield curve arbitrage or sovereign spread trades.[90] Although hedge funds may support market liquidity in normal times, tighter financing conditions or internal risk limits during periods of stress

89 See Ferrara, F.M. et al., "Hedge funds: good or bad for market functioning?", *The ECB Blog*, ECB, 23 September 2024.

90 See Monin, P.J., "Decomposing Hedge Funds' U.S. Treasury Exposures", *FEDS Notes*, Board of Governors of the Federal Reserve System, 22 June 2026; "Vulnerabilities in Government Bond-backed Repo Markets", Financial Stability Board, 4 February 2026; Bassi, C. et al., "Financial stability risks from basis trades in the US Treasury and euro area government bond markets", *Financial Stability Review*, ECB, May 2024; and Linzert, T., Nguyen, B., Pelizzon, L., Poinelli, A. and Tomio, D., "Elastic in Cash, Inelastic in Repo: Hedge Funds in the Treasury and Repo Markets", *SAFE Working Papers*, No 492, Leibniz Institute for Financial Research SAFE, August 2026.

can force them to quickly unwind their positions.[91] Such actions can dry up market liquidity, disrupt benchmark asset prices and further exacerbate market turmoil.[92] The objective of this box is to analyse how global hedge funds adjusted their exposures to euro area sovereign bond markets via the repo market, focusing on the March 2026 period of bond market volatility triggered by the start of the latest conflict in the Middle East. This unexpected geopolitical event provides a unique opportunity to analyse how hedge funds responded to a large shock in these markets.[93]

The concentration and offshore location of hedge funds raise additional financial stability concerns for the euro area. Hedge fund activity in euro area sovereign bond and derivatives markets is highly concentrated, accounted for by a small number of funds (**Chart A**, panel a). This raises the risk that disruptions involving a single entity could have a systemic impact on these markets. Moreover, the large majority of the hedge funds trading euro area repos and derivatives are domiciled in offshore financial centres such as the Cayman Islands. This offshore location limits the ability of euro area supervisory authorities to monitor risks and adopt macroprudential measures (**Chart A**, panel b). The exposures of EU banks to hedge funds also tend to be concentrated in entities domiciled in the Cayman Islands, raising additional wider concerns around cross-border and cross-sectoral contagion to the EU financial system.[94]

Hedge funds have a substantial footprint in repo markets, while the visibility of their activities in derivatives markets linked to euro rates or sovereign bonds is more limited. Hedge funds account for a notable share of repo markets using euro area sovereign bonds as collateral, representing 14% of total volumes outstanding. This increases to 27% if centrally cleared transactions (primarily inter-dealer trades) are excluded.[95] By contrast, their market share in derivatives markets linked to euro area sovereign bonds, involving instruments such as futures and interest rate swaps, is much smaller (**Chart A**, panel c). According to data reported under the European Market Infrastructure Regulation (EMIR), hedge funds account for only around 2% of total volumes outstanding in these markets. However, this figure may underestimate their true market share because EMIR data lack visibility for offshore transactions that do not involve an EU counterparty.[96]

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91 See Kruttli, M.S., Monin, P.J., Petrasek, L. and Watugala, S.W., "LTCM redux? Hedge fund Treasury trading, funding fragility, and risk constraints", *Journal of Financial Economics*, Vol. 169, Article 104017, 2025.

92 See Kashyap, A.K., Stein, J.C., Wallen, J.L. and Younger, J., "Treasury Market Dysfunction and the Role of the Central Bank", *Brookings Papers on Economic Activity*, Spring 2025, pp. 221-265.

93 The analysis is based on data reported under the Securities Financing Transactions Regulation, which makes it possible to monitor hedge fund activity in repo markets collateralised by euro area sovereign bonds.

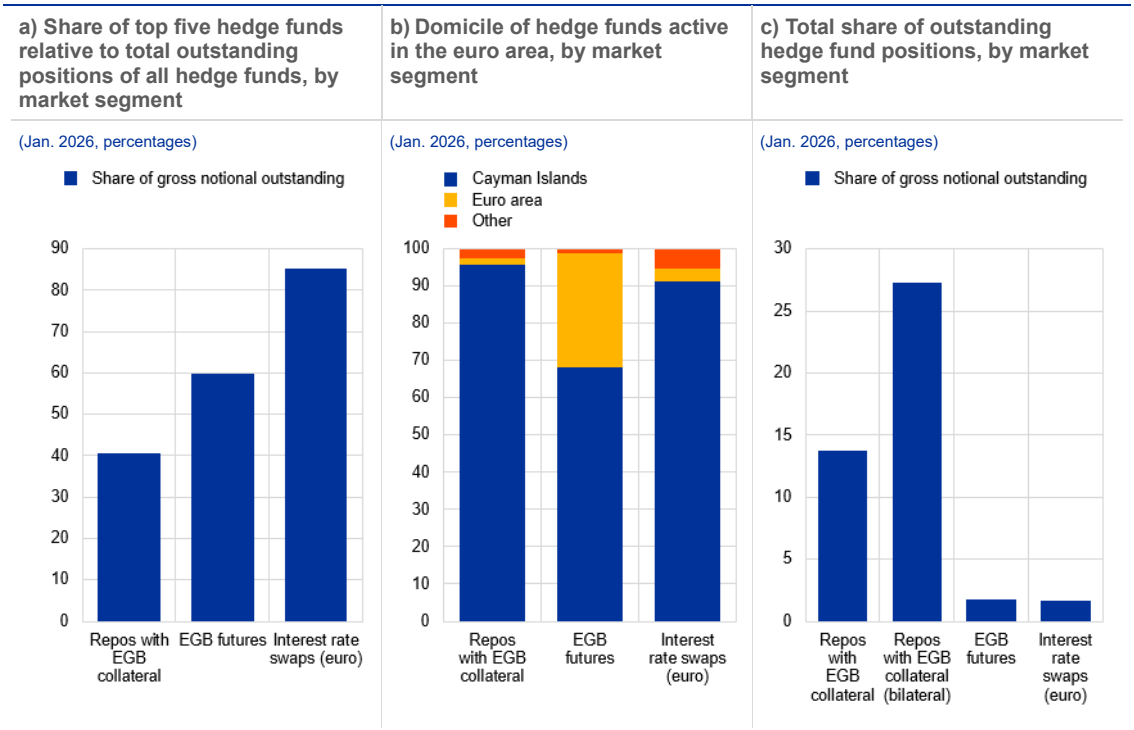
94 See "Financial stability risks from linkages between banks and the non-bank financial intermediation sector", ECB/ESRB workstream on financial stability risks from bank-NBFI linkages, ECB/ESRB, February 2026.

95 Hedge funds are generally not clearing members of European central counterparties. Their activity in European repo markets is concentrated in the bilateral market.

96 For instance, trades between hedge funds domiciled outside the EU (such as a fund located in the Cayman Islands) and non-EU counterparties (such as the subsidiary of a global bank or dealer located in London) are not captured by EMIR data.

Chart A

Hedge fund activity in repo and derivatives markets is concentrated in a small number of funds located outside the euro area – their footprint is most visible in the repo market



Sources: ECB (SFTDS, EMIR) and ECB calculations.
Notes: EGB stands for European government bond. Panel a: market share held by the top five hedge funds within each market segment, relative to the total outstanding positions of all hedge funds in that segment. The top five hedge funds are those with the largest outstanding positions in each market segment at the beginning of January 2026. Panel b: domicile decomposition is calculated from all active hedge fund transactions recorded in the SFTDS (repos) and EMIR (EGB futures and interest rate swaps) datasets. Panel c: the market shares refer to the gross notional outstanding of hedge fund transactions against all sectors as reported in the SFTDS and EMIR datasets. Note that derivative volumes in particular might be underestimated due to the exclusion of transactions that do not involve an EU counterparty.

Hedge funds had built up large gross positions in the euro area repo market over the previous two years but deleveraged when bond market volatility soared in March 2026. At the time when the conflict broke out in the Middle East in February 2026, hedge funds had accumulated a gross repo position against euro area sovereign bonds of around €640 billion, against the background of limited bond market volatility in the previous months. This represents an increase of over 60% since the beginning of the previous year, much greater than the pace of accumulation by other financial institutions such as banks, dealers, investment funds and money market funds (**Chart B**, panel a). As euro area interest rate volatility rose following the start of the Middle East conflict, hedge funds reduced their positions in repos collateralised by euro area sovereign bonds. Hedge fund positions contracted by 13% in March 2026, which was a faster retrenchment compared with that of dealers and other financial institutions (3%). At the same time, banks actually increased their gross repo positions over the same period.[97]

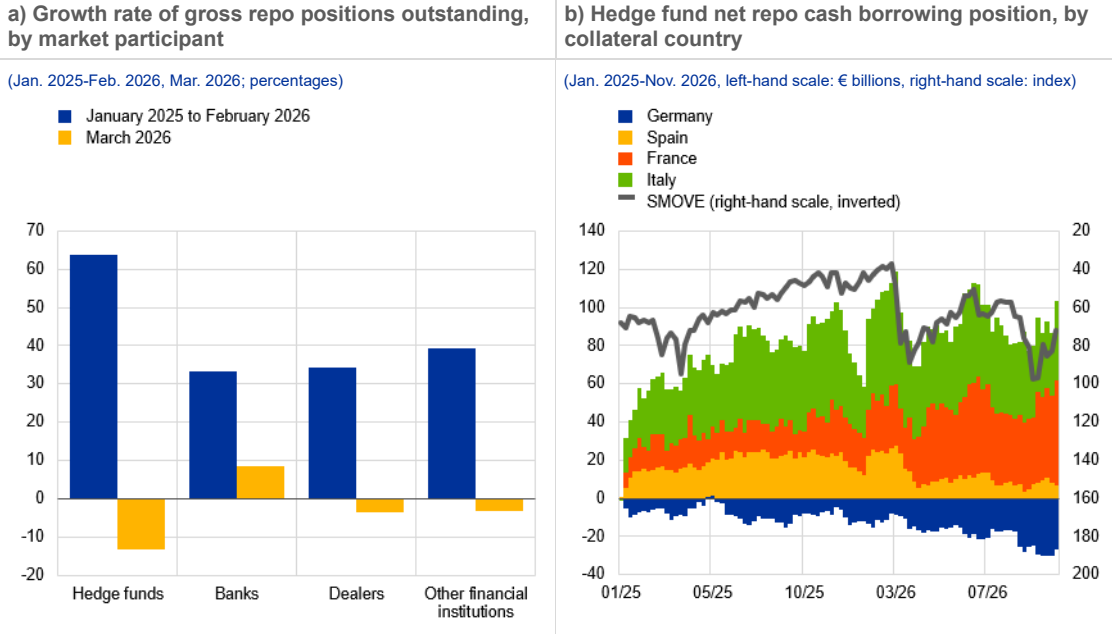
In repo markets, hedge funds actively borrow cash to take long positions, often procyclically, in euro area sovereign bonds. Over the past year, hedge funds have used the repo market to borrow around €73 billion on average in net terms, maintaining in aggregate a net long position in most euro area sovereign bonds. During the surge in bond market volatility seen in March 2026, however, hedge funds reduced their net cash borrowing by approximately €50 billion,

97 These financial intermediaries and institutions, together with hedge funds, account for almost 95% of repo volumes in the euro area.

down from a peak of more than €105 billion in February (**Chart B,** panel b). This sharp deleveraging varied across sovereign issuers but was particularly pronounced in the case of repos collateralised by Spanish and Italian sovereign bonds. Notably, the timing of this reduction aligns with the peak in euro area interest rate volatility, as measured by the Merrill Lynch 1-Month EUR Swaption Volatility Estimate Index. As interest rate volatility eased during the summer, hedge funds began rebuilding their net cash borrowing positions in the repo market (**Chart B**, panel b). These trends suggest that hedge funds exhibit risk-off behaviour during periods of market stress, consistent with their characterisation as procyclical investors who adjust their exposures in response to changing market conditions.[98]

Chart B

Hedge funds have been building up large positions in the repo market, borrowing cash to take a long position in Spanish, French and Italian sovereign bonds procyclically



Sources: Bloomberg Finance L.P., ECB (SFTDS, EMIR) and ECB calculations.
Notes: Panel b: the hedge fund net repo cash borrowing positions are calculated as the difference between the total nominal outstanding of hedge fund cash borrowing and cash lending transactions. Net notional amounts are calculated weekly, taking into account only repo transactions where the underlying is a sovereign bond issued by Germany, Spain, France or Italy. Negative positions indicate that hedge funds have lent out more cash than they have borrowed by using the sovereign bonds of a certain issuer country as collateral. SMOVE is the Merrill Lynch 1M EUR Swaption Volatility Estimate Index. The right-hand scale is inverted.

To conclude, hedge funds are swift, procyclical investors, adjusting their exposures unevenly across euro area sovereign issuers in response to market stress. It is still an open question whether their substantial footprint in euro area repo markets, combined with their reliance on leveraged trading strategies, could amplify market volatility during periods of turmoil. The concentration of hedge fund activity in a small number of entities and their offshore domiciliation – primarily in financial centres outside the euro area – makes it harder for euro area authorities to monitor and mitigate any potential risk. This reinforces the need for cross-border cooperation between financial stability and supervisory authorities. Such authorities should share aggregate data on leverage in key non-bank sectors on a best-efforts basis and use harmonised data and

98 Kerry W., Lewrick, U. and Schmieder, C., "Understanding hedge fund leverage targeting and fire sales", *SUERF Policy Brief*, No 1342, SUERF, 15 January 2026.

metrics where possible when exchanging information, following the recommendations of the Financial Stability Board.[99]

4.3 Insurance and pension fund sectors weather rising yields and market volatility

Euro area insurance corporations and pension funds remain resilient, supported by strong solvency positions, stable liquidity buffers and generally good levels of profitability. Insurance corporations in the euro area continue to demonstrate strong solvency positions, underpinned by robust own funds and prudent risk management practices. Liquidity risks are contained, with insurance corporations able to meet short-term obligations without incurring excessive costs. Profitability metrics for the sector remain stable, as market perceptions continue to be favourable. Evidence for this is provided by the sector's positive stock market performance relative to broader indices and its solid price/earnings ratios.[100] Pension funds, particularly those offering defined benefit schemes, are maintaining adequate levels of reserves and funding, reflecting their stable solvency metrics. Liquidity risks for pension funds are being managed effectively, with institutions continuing to meet payment obligations.[101]

Despite their strong aggregate solvency and liquidity positions, euro area insurance corporations and pension funds remain exposed to geopolitical, sovereign and market shocks. The balance sheets of insurance corporations and pension funds have evolved gradually in recent years, their composition reflecting an increasing appetite towards riskier, alternative and less liquid asset classes such as private credit, private equity and infrastructure (**Chart 4.7**, panel a).[102] Insurance corporations have reduced their allocation to debt securities, particularly euro area sovereign debt, while increasing their exposure to investment funds and alternative assets. Pension funds have bolstered their holdings of equity and non-tradable assets, while also lowering the share of euro area government securities in their debt portfolios. Nevertheless, the euro area's insurance and pension fund sectors remain important sovereign bond investors, holding 10.7% and 4.1% of the region's sovereign debt respectively, with approximately half of these holdings concentrated in maturities above ten years. Home bias has declined somewhat over the last decade and non-domestic issuers now account for the majority of public sector bond

99 See "Leverage in Nonbank Financial Intermediation – Final report", Financial Stability Board, 9 July 2025.

100 See EIOPA's July 2026 Insurance Risk Dashboard.

101 See EIOPA's July 2026 IORP Risk Dashboard.

102 See Cera, K., Dieckelmann, D., Nikolov, K., Schepens, G. and Schwartz Blick, O., "Stress in global private credit markets and its implications for euro area financial stability", *Financial Stability Review*, ECB, May 2026. Euro area insurance corporations and pension funds have limited aggregate exposure to private credit markets – just 2.3% and 1.4% of their total assets respectively. These exposures form part of the non-tradable assets shown in **Chart 4.7**, panel a. The European Insurance and Occupational Pensions Authority (EIOPA) has determined that the private asset exposures of European Economic Area (re)insurers amounted to around 11% of total assets at the end of 2025, with private credit making up about 5.0% and private equity 6.3% of total assets. See "Factsheet − EEA (re)insurers' private asset exposures − 2025 Q4", EIOPA, July 2026.

holdings in both sectors (**Chart 4.7**, panel b). These exposures create a potentially important channel through which sovereign stress and geopolitical shocks can be transmitted to insurance corporations and pension funds through valuation losses, collateral pressures and broader macro-financial spillovers.

The liabilities side of both sectors is undergoing structural transformation, reducing the market sensitivity of capital positions. The insurance sector has experienced a growing uptake of unit-linked products, while pension systems are continuing to transition from defined benefit to defined contribution arrangements.[103] These developments are generally reducing the interest rate sensitivity of capital positions. Unit-linked products pass investment risk directly to policyholders, meaning that when interest rates change, the value of assets and liabilities held in such products move in tandem, so there is no direct interest rate-related impact on the insurer's capital position.[104] By contrast, the value of assets held for non-unit-linked products, such as traditional life insurance policies, typically changes by less than that of related liabilities, as the duration of liabilities is longer than that of the assets backing them (negative duration mismatch). When interest rates fall, the value of liabilities rises more than the value of assets, eroding capital; when interest rates rise, the value of liabilities falls more than assets, which benefits capital.[105] Similarly, the ongoing shift towards defined contribution pension schemes is transferring a larger share of market risk to beneficiaries (**Chart 4.7**, panel a). It is also reducing the duration and sensitivity of pension fund equity to interest rate developments while also affecting the markets for long-duration securities.

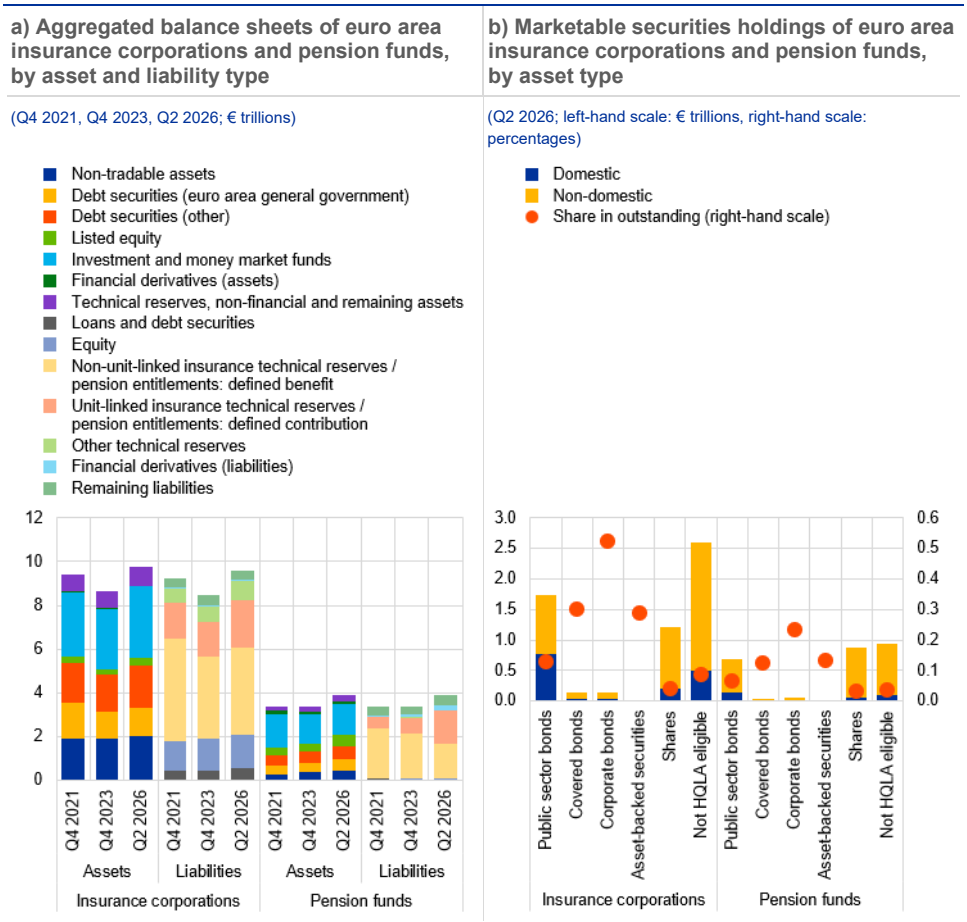
[103] In unit-linked contracts, the policy benefits are directly tied to the value of the units in an investment fund or a specific index, with the investment risk borne by the policyholder. Following the sharp increase in interest rates that began in 2022, unit-linked business initially contracted as insurers and policyholders adjusted to the new yield environment. This trend reversed in 2024, however, and the recovery continued in 2025. This was supported primarily by a stronger financial market performance and higher net returns generated by equity-oriented unit-linked products than those generated by traditional guaranteed products. At the same time, the stabilisation of interest rates made guaranteed life insurance products offering higher credited rates more attractive. Overall, developments since 2022 suggest that the recent expansion of unit-linked business has been driven more by investment returns and inflation hedging than by the higher interest rate environment itself. See EIOPA's Financial Stability Report June 2025.

[104] As unit-linked funds are backed among other things by equity investment funds, capital positions may also change due to changes in equity or market prices.

[105] The sensitivity of capital to interest-rate movements is mitigated by the loss-absorbing capacity of technical provisions under Solvency II. Where insurers hold participating business with future discretionary benefits, a portion of the liability can be reduced in adverse conditions, which dampens the impact of market movements on the capital position. The degree of this mitigation varies with contractual terms and the discretion available to the insurer, and it may be more limited for guaranteed products where benefits cannot be adjusted.

Chart 4.7

There has been a shift to defined contribution models, coupled with increased diversification into riskier assets while maintaining low concentration in liquid portfolios



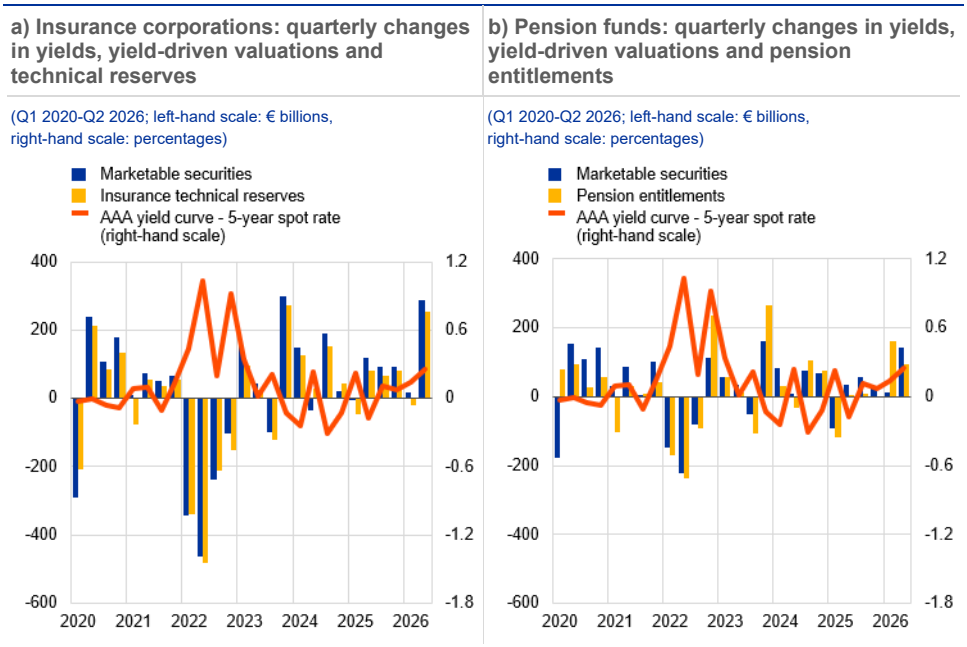
Sources: ECB (CSDB, ICB, PFBR, SHS) and ECB calculations.
Notes: Panel a: technical reserves recorded on the assets side of an insurance corporation's balance sheet specifically relate to exposures that have been reinsured. Panel b: HQLA stands for high-quality liquid assets.

Euro area insurance corporations and pension funds have recently demonstrated resilience to rising yields and market volatility. When yields rose sharply in 2022, the decline in marketable securities (including sovereign bond holdings) was less than the fall in technical reserves and pension entitlements (**Chart 4.8**, panels a and b).[106] This specifically reflects the liability-driven nature of insurers' balance sheets, where liabilities heavily influence balance-sheet dynamics. The data, which cover developments up to the second quarter of 2026, also reflect the sectors' ability to withstand geopolitical tensions and inflation-driven rate hikes. All the adjustments occurred without significant capital depletion, underscoring the sectors' capacity to absorb shocks.

[106] For life insurers (specifically those writing non-unit-linked products), rising risk-free rates reduce the present value of their liabilities more than that of their assets, given the longer duration of liabilities. This dynamic generally strengthens solvency positions. For pension funds and defined benefit schemes, the balance-sheet impact depends on the interaction between asset valuations and liability discount rates, and the effectiveness of hedging strategies.

Chart 4.8

Resilience amid interest rate shocks and structural shifts in insurance and pension fund portfolios and liabilities



Sources: ECB (ICB, PFBR, YC) and ECB calculations.
Notes: The analysis uses aggregate data for the euro area insurance and pension fund sectors, focusing on the aggregate marketable securities positions on the assets side and insurance technical reserves or pension entitlements on the liabilities side. Capital is replenished when the change in marketable securities exceeds the change in technical reserves/entitlements. Conversely, capital is depleted when the change in marketable securities is smaller than the change in technical reserves/entitlements. Whereas derivative positions are not taken into account in these charts, separate calculations show that adding net financial derivatives as an approximation of hedging to the above does not significantly change the results. Panel a: insurance technical reserves are primarily relevant for the life insurance business. As at Q2 2026, the euro area sector's total assets were distributed across reinsurance corporations (10.1%), life insurance corporations (36.8%), non-life insurance corporations (16.2%) and composite insurers offering both life and non-life insurance (36.9%). This segmentation reflects the diverse business models within the sector and their differing exposures to macroeconomic and market risks.

Although the structural characteristics of euro area insurance corporations and pension funds mitigate risks, they warrant continual monitoring. While structural features such as long liability durations, diversified portfolios and risk transfer mechanisms enhance resilience, the pace and magnitude of future interest rate adjustments remain a key risk factor. The 2022 liability-driven investment episode in the United Kingdom highlights how rapid increases in sovereign yields can generate systemic liquidity pressures, even for fundamentally solvent institutions. Although euro area insurance corporations and pension funds have not exhibited similar vulnerabilities, the episode underscores the importance of liquidity preparedness and robust risk management practices in mitigating potential risks.[107]

Insurance protection gaps, particularly for natural catastrophes including those attributable to climate change, pose significant financial stability concerns, as uninsured losses strain households, firms, governments and the financial system. The summer of 2026 underscored these risks, with wildfires, droughts and heatwaves ravaging Europe – the world's fastest-warming continent.[108]

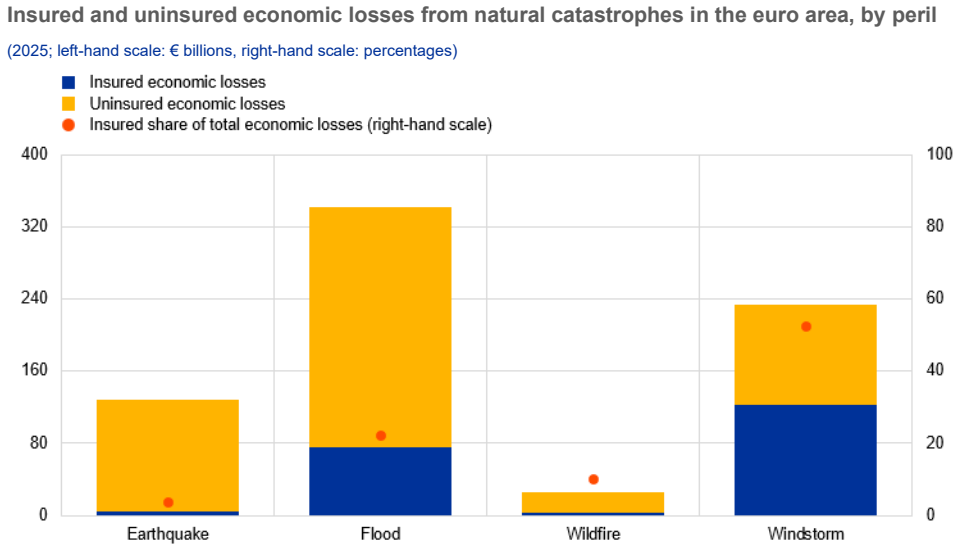
[107] See Mosk, B., O'Donnell, C., Telesca, E. and Weistroffer, C., "Non-banks' liquidity preparedness and leverage: insights and policy implications from recent stress events", *Financial Stability Review*, ECB, May 2023.

[108] See "European State of the Climate 2025: record heatwaves from the Mediterranean to the Arctic, while glaciers shrink and snow cover declines", World Meteorological Organization, 29 April 2026.

Historically, only about a quarter of natural catastrophe-related economic losses across all hazard types in the region have been insured (**Chart 4.9**).[109] This insurance protection gap is shifting the financial burden to society at large, increasing economic fragility. Closing insurance protection gaps is essential to bolster resilience, ensuring households, businesses and governments can better absorb future shocks in an era of intensifying climate hazards.

Chart 4.9

Economic losses from natural catastrophes in euro area countries are far more likely to be uninsured than insured across all types apart from windstorms



Source: EIOPA.
Notes: EIOPA insurance protection gap dashboard based on CATDAT and national data provided by national competent authorities.

4.4 A macroprudential lens is needed across the NBFI policy framework to protect market liquidity in times of stress

Concentration-related risks can amplify vulnerabilities across the non-bank financial intermediation (NBFI) sector during periods of stress, with implications for the non-bank policy framework. A trigger event, related to a shift in sentiment on artificial intelligence (AI), geopolitical developments or fiscal concerns could pose risks for the non-bank sector. It could, for example, lead to a rapid unwinding of positions held by highly leveraged funds, as well as selling pressures from redemption requests in open-ended funds (OEFs) and margin calls from the wider sector. Previous stress episodes have shown how large market footprints, together with concentrated portfolios of cohorts of similar funds, can amplify the market impact due to vulnerabilities related to leverage and liquidity mismatch. This becomes especially relevant where the NBFI sector draws on the same sources of liquidity. Hence, it is important that measures to address non-bank

[109] See EIOPA's Dashboard on insurance protection gap for natural catastrophes.

vulnerabilities are appropriately calibrated to mitigate risks from concentration and crowded positioning.

Implementation of international reforms in the EU should be followed by a review of their effectiveness in preserving market liquidity during stress episodes. Drawing on the 2021 Financial Stability Board (FSB) proposals to enhance the resilience of money market funds (MMFs), EU authorities are currently implementing supervisory guidance on MMF liquidity buffers. Instead of raising minimum liquidity requirements as proposed by the ESRB,[110] in May 2026 the European Commission issued guidance on how liquidity buffers might be used, particularly to address rising redemption requests during times of market stress as well as identifying market resilience levels for weekly liquid assets above the minimum regulatory levels.[111] National authorities are now implementing this guidance in their respective domestic frameworks.[112] As MMFs are key providers of short-term funding to banks, companies and public entities, liquidity shortfalls in times of stress can force asset sales that disrupt this funding, as was the case in March 2020. Authorities should therefore apply the guidance strictly to ensure that MMFs maintain liquidity buffers in line with supervisory expectations. In addition, in line with the guidance, MMFs should make effective use of these buffers in meeting redemptions in periods of stress rather than preserving them by selling less liquid assets, which amplifies strains in core short-term funding markets. Further work is also needed on classifying open-ended funds according to the liquidity of their assets, and the FSB's 2024 recommendations on liquidity preparedness for margin and collateral calls have yet to be implemented.

EU authorities need a dedicated instrument to address ex ante structural liquidity mismatch in OEFs, including for cohorts of similar funds. The existing measures to mitigate liquidity risk, such as requirements for funds to have liquidity management tools in place, have generally been implemented from a microprudential perspective. For similar types of fund that have concentrated portfolios and crowded positions, however, such an approach may be insufficient to ensure that their collective behaviour does not lead to market dysfunction. A key policy gap in this regard is a dedicated tool to address structural liquidity mismatch in OEFs. As set out by the FSC high level task force on NBFI, such a tool should be similar to the existing legislative power to address systemic risk stemming from excessive leverage (see Article 25 of the AIFMD).[113] It could be conferred through targeted amendments to the Undertakings for Collective Investment in Transferable Securities (UCITS) Directive[114] and the Alternative Investment Fund Managers

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110 See "Recommendation of the European Systemic Risk Board of 2 December 2021 on reform of money market funds", ESRB, March 2022.

111 These market resilience levels are below the proposed minimum requirements in the ESRB recommendations on MMF reforms cited above.

112 On 30 October 2026, the supervisory authorities in France, Ireland and Luxembourg published coordinated guidance encouraging MMFs to maintain liquidity buffers above regulatory minimum requirements to strengthen their resilience to liquidity shocks.

113 For more details, see "Strengthening the macroprudential lens in the regulation of non-bank financial intermediation", FSC high level task force on NBFI, ECB, May 2026.

114 Directive 2009/65/EC of the European Parliament and of the Council of 13 July 2009 on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS) (OJ L 302, 17.11.2009, p. 32).

Directive (AIFMD).[115] The tool should allow authorities to address systemic risk ex ante, for example, by specifying longer notice periods for particular cohorts of funds. The intention is that it should be used to mitigate the build-up of vulnerabilities in benign times rather than as a crisis management tool.

Supervisory authorities need to take steps to ensure that the NBFI sector has adequate liquidity to meet margin calls. During stress episodes, the forced selling of assets to meet margin calls can depress asset prices and, in turn, trigger further margin calls. Moreover, as historical correlations between offsetting positions break down, non-banks might need to mobilise cash or collateral across several portfolios at once. It is important that the EU implement the FSB's 2024 recommendations on margin preparedness, which cover the broader NBFI sector's liquidity risk management and governance, its stress testing and scenario design, as well as its collateral management practices, and aim to mitigate liquidity risks arising from spikes in margin and collateral calls. Crucially, they also require non-banks, as part of their liquidity risk management processes, to (i) consider whether they participate in crowded trading strategies or concentrated market segments, and are therefore more likely to liquidate the same assets at the same time as others; and (ii) incorporate estimates of how deteriorating market liquidity affects their anticipated liquidity needs, as well as the actual liquidity of assets held and the market impact of how they meet those liquidity needs.

The current EU framework for non-bank leverage is not fully equipped to monitor and address risks stemming from complex cross-border funds. The rapid rise of hedge funds in EU sovereign bond markets poses several challenges for EU authorities. At present there is limited information on the wider positions held by cross-border hedge funds that are dominant in sovereign markets, highlighting a key need to close data gaps to monitor risks from hedge fund leverage (see **Box 7**). Closing these data gaps is also crucial to assess the potential for cross-border contagion arising from EU banks' credit exposures to hedge funds outside the EU, which warrant further scrutiny. It is crucial that the FSB makes progress in addressing these data challenges. In particular, removing barriers to effective cross-border information sharing and strengthening public disclosure would help authorities to assess the systemic risk from hedge fund leverage. There is a major policy gap regarding how best to address risks from complex leveraged strategies. A breakdown in the effectiveness of hedging strategies, along with the increased potential for a crowding of trades, could leave core financial markets vulnerable to adverse market dynamics. Implementation of the FSB's 2025 recommendations on NBFI leverage is important. However, there is also a need for additional FSB guidance on how to implement activity-based and entity-based measures, including how to address risks from concentration and crowded positioning. A key priority is to address risks from zero haircuts and ensure that margin add-ons capture concentration risks.

[115] Directive 2011/61/EU of the European Parliament and of the Council of 8 June 2011 on Alternative Investment Fund Managers and amending Directives 2003/41/EC and 2009/65/EC and Regulations (EC) No 1060/2009 and (EU) No 1095/2010 (OJ L 174, 1.7.2011, p. 1).

The rise of private credit highlights how data gaps and the absence of common definitions can hinder the assessment of emerging risks. Euro area financial institutions currently appear to have limited direct exposure to private credit, implying that private credit in isolation is unlikely to be a source of systemic financial instability at present. That said, large data gaps, including data sharing and issues relating to definitions and taxonomies, prevent a comprehensive assessment of the financial stability risks stemming from private credit. The recent Call for Technical Advice[116] from the European Commission to the European Supervisory Authorities to enhance transparency of private credit exposures is very welcome. Global efforts are needed to close data gaps and develop consistent definitions and taxonomies that will enhance cross-jurisdictional comparability. In the EU, it is important to ensure greater data access across authorities to facilitate monitoring of cross-sectoral exposures and introduce a dedicated reporting category for private credit funds within the AIFMD.

Progress on a macroprudential framework for asset managers would help ensure that deeper integration within the sector is accompanied by greater resilience. To fully unlock the benefits of the savings and investments union capital markets should be a resilient source of funding, even in times of stress. This would require a prudential framework that can identify and address emerging systemic risk across the financial system. A more integrated approach to the supervision of funds and managers, as proposed by the European Commission in its market integration and supervision (MISP) package,[117] should be accompanied by targeted amendments to the UCITS Directive and the AIFMD with a view to developing a macroprudential approach alongside microprudential oversight.

The ECB looks forward to an agreement on the MISP package which includes key amendments to the supervisory framework for capital markets and measures to support integration across the asset management and funds sectors. Further integration of the asset management sector – a welcome goal of the MISP package – also entails greater cross-border contagion risk for financial stability. A more integrated supervisory framework would include direct supervision of certain large, cross-border capital market players at the European level, as well as enhanced coordination and additional powers for the European Securities and Markets Authority (ESMA) to promote supervisory convergence. This would help to ensure the consistent treatment of risk, promote a level playing field and reduce the potential for regulatory fragmentation or arbitrage.[118] Providing members of the European System of Central Banks (ESCB) with access to granular, cross-border data on investment funds and central counterparties (CCPs), together with clarification that central banks may use such data to fulfil their core mandates,

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116 See Assessment of private credit activities and exposures of EU banks and Non-Bank Financial Intermediaries, published on 24 September 2026.

117 The MISP package, which is a package of measures designed to remove barriers and unlock the full potential of the Single Market for financial services, was published on 4 December 2025.

118 See Opinion of the European Central Bank of 9 April 2026 on proposals as regards the further development of capital market integration and supervision within the Union (CON/2026/13) (OJ C C/2026/2837, 28.5.2026).

including safeguarding financial stability, is also essential to support these objectives.

It is important that there are no carve-outs in the criteria included in the legislation for identifying systemic players. As the EU legislative process for the MISP package proceeds, discussions will focus on the criteria used to identify the large EU cross-border actors that would be subject to direct supervision by ESMA. In this context, it is key that the selected criteria correctly identify the sources of the risk posed by those institutions and ensure a level playing field in financial market infrastructure. Regarding crypto-asset service providers (CASPs), the ECB supports the European Commission's proposal to transfer the authorisation, monitoring and enforcement powers for all CASPs to ESMA.[119] It also suggests maintaining, in the Markets in Crypto-Assets Regulation (MiCAR),[120] the category of significant CASPs – which should be subject to tighter prudential requirements – and expanding the existing criteria to include objective metrics of significance (e.g. size, cross-border activity, systemic relevance, volume of trades for platforms, volume exchanged against funds and consideration of group-wide activities).

[119] See Opinion of the European Central Bank of 9 April 2026 on proposals as regards the further development of capital market integration and supervision within the Union (CON/2026/13) (OJ C C/2026/2837, 28.5.2026).

[120] Regulation (EU) 2023/1114 of the European Parliament and of the Council of 31 May 2023 on markets in crypto-assets, and amending Regulations (EU) No 1093/2010 and (EU) No 1095/2010 and Directives 2013/36/EU and (EU) 2019/1937 (OJ L 150, 9.6.2023, p. 40).

Special features

A Financial stability implications of AI adoption in the financial industry and the real economy

Prepared by Leonardo Andaloro, Maria Leonor Puga, Sándor Gardó, Benjamin Klaus, Urban Rupnik and Christian Weistroffer[121]

The rapid adoption of artificial intelligence (AI) is reshaping the financial industry as well as the broader economy, creating both opportunities and risks. Banks and asset managers, which represent key channels of financial intermediation in the euro area, are increasingly using AI for tasks such as credit scoring, fraud detection and portfolio management. While AI adoption can support innovation and enhance operational efficiency, it may also introduce new risks and amplify existing vulnerabilities, including a reliance on a small number of technology providers that creates concentration and third-party dependencies across the financial system. At the same time, financial institutions are also increasingly exposed to AI-driven developments in the real economy. A novel firm-level indicator suggests that a sizeable share of firms, concentrated mainly in the IT and financial sectors, is significantly exposed to AI-related opportunities and risks. Policies should focus on improving the quality of data that monitor the use of AI, strengthening the oversight of critical AI providers and adapting market safeguards and supervisory capabilities to emerging risks.

1 Introduction

The rapid adoption of artificial intelligence is transforming the financial sector and the economy in general, creating both opportunities and risks that are relevant for financial stability. Since the launch of ChatGPT in November 2022, advances in generative artificial intelligence (GenAI) and, increasingly, agentic AI have expanded the range of applications and lowered the barriers to adoption. This has the potential to boost productivity, reshape business models and intensify competition. Firms, including financial institutions, are investing heavily in AI infrastructure and applications. AI could improve information processing, risk assessment and operational efficiency, enabling better use of large, complex datasets and faster responses to evolving conditions. However, the speed of adoption, the growing autonomy of AI systems and the reliance on a small number of technology providers is also raising new questions for financial stability.

The financial stability implications of AI reflect both its use in specific sectors and broader risks that cut across the financial system. From customer service and fraud detection to underwriting, research and trading, AI is permeating nearly all aspects of financial activity. However, the implications of AI adoption for financial

[121] Research assistance provided by Mario Correddu is gratefully acknowledged.

stability vary significantly across different types of financial institution, reflecting each institution's distinct business model and operational priorities. This is why a sector-specific evaluation is particularly relevant. Banks and asset managers are emerging as natural focal points for this analysis, as they represent the two primary channels of financial intermediation in the euro area: dominant bank-based finance and growing market-based finance. Beyond the financial sector itself, the adoption of AI by non-financial corporations is introducing additional risks that affect all financial institutions to a similar extent. Such risks include relying on a concentrated group of AI model and cloud service providers as well as exposures to firms undergoing AI-driven business transformations. These interconnected risks underscore the need to assess AI's impact on financial stability, both at the sectoral level and across the financial system as a whole.

This special feature assesses the implications of AI adoption for financial stability, with a focus on banks and asset managers. Building on previous work done by the ECB and drawing on recent survey data, bank and fund-level evidence and emerging research, the special feature provides new insights into the rapid adoption of AI and the implications for financial stability.[122] The analysis first explores AI's adoption and use across countries and economic sectors. It then turns to how financial institutions – particularly banks and asset managers – are integrating AI into their activities and the associated opportunities and risks. Finally, it examines risks arising from concentration and dependence on AI providers, as well as those stemming from financial sector exposures to firms undergoing AI-driven transformation. It concludes with policy considerations on mitigating the risks and meeting the challenges posed by AI adoption.

2 AI adoption trends across the globe and the broader economy

AI adoption has surged globally in recent years, although progress within the EU has been more modest and uneven. AI has moved beyond the experimental phase to become a widely used organisational tool within a remarkably short period of time. According to Eurostat, however, the rate of AI adoption by firms remains modest within the EU, with significant differences across countries and firm sizes. By 2025 around 20% of EU enterprises were using at least one AI technology, up by some 6.5 percentage points from 2024. Adoption rates vary widely, with northern countries leading the way and southern and eastern European countries lagging behind (**Chart A.1**, panel a).

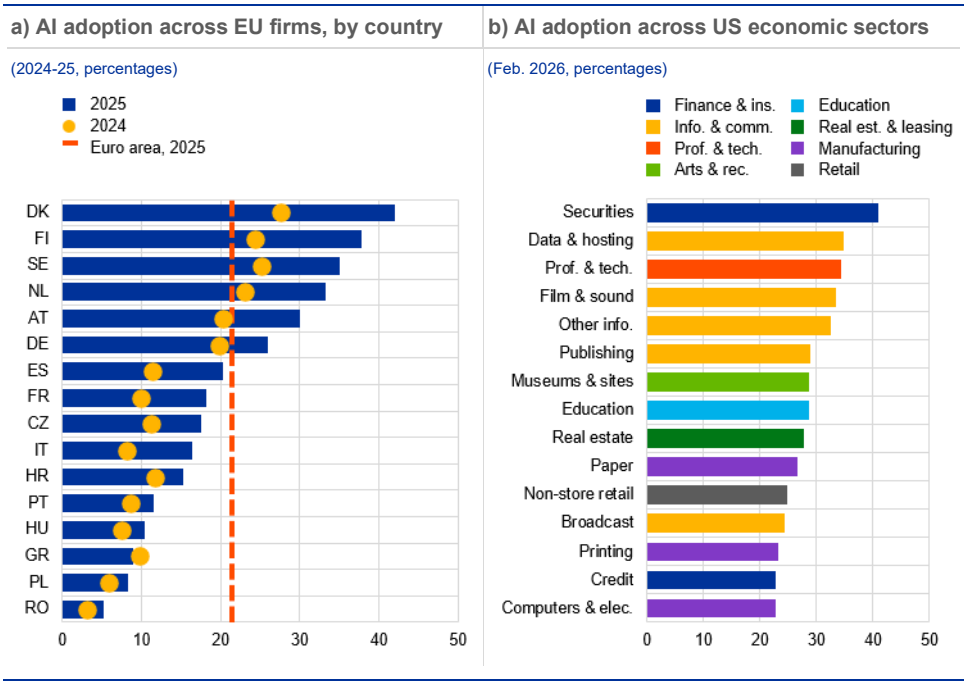
Sectoral adoption is highly concentrated in data-driven activities, with increasing automation potentially amplifying systemic risks. More granular US data show that IT and communications, finance and professional services report the highest levels of AI adoption, while sectors such as manufacturing report significantly

[122] See Leitner, G., Singh, J., van der Kraaij, A. and Zsámboki, B., "The rise of artificial intelligence: benefits and risks for financial stability", *Financial Stability Review*, ECB, May 2024, and Cartea, Á., Colliard, J.-E., Foucault, T., Hoffmann, P., Graumans, R. and Sigaux, J.-D., "Artificial intelligence and financial markets", *Discussion Paper Series*, No 32, ECB, September 2026.

lower levels (**Chart A.1**, panel b). Even in finance, however, uptake varies considerably (e.g. between securities trading and banking). In general, AI is embedded in data-driven functions and is concentrated in large firms and high-value services rather than spread evenly across the economy. Moreover, AI adoption is not just broadening, it is also deepening. The Anthropic Economic Index indicates that, between January and August 2025, automation in task-oriented interactions on Claude.ai, such as coding or financial modelling, rose from 27% to 39% of all interactions.[123] This signals a shift from assistive to semi-autonomous use that could reshape front-office and risk functions in finance.

Chart A.1

AI adoption has increased rapidly over the last few years, but progress remains uneven across EU countries and across US sectors of economic activity



Sources: Eurostat, US Census Bureau and ECB calculations.
Notes: The panels show AI use/adoption reported in publicly available surveys. Definitions, survey populations and question wording differ across sources and, in some cases, across survey waves, meaning that levels are not directly comparable. Panel a: the chart depicts the share of enterprises in selected EU countries with ten or more employees and self-employed persons using at least one AI technology, as defined by Eurostat. These technologies include text mining, speech recognition, natural language generation or speech synthesis, image/video/audio generation, image recognition, machine learning, AI-based workflow automation or decision support, and autonomous machines. The euro area aggregate represents the share across all eligible enterprises, weighted by the number of enterprises. Panel b: the chart shows the share of US businesses in selected sub-sectors reporting AI use in any business function. Owing to differences in coverage and wording, levels are not comparable across both panels. "Finance & ins." stands for finance and insurance; "Info. & comm." stands for information and communications; "Prof. & tech." stands for professional and technical; "Real est. & leasing" stands for real estate and leasing; "Arts & rec." stands for arts and recreation; "Real est. and leasing" stands for real estate and leasing; "Computers and elec." stands for computers and electronics.

3 AI adoption and use by banks and asset managers

AI has significant potential to improve the efficiency and quality of financial intermediation, but also to alter and magnify existing risks. Current AI use cases differ markedly across business models (**Figure A.1**). In banks, AI enables faster processing of large datasets, more granular borrower assessment and

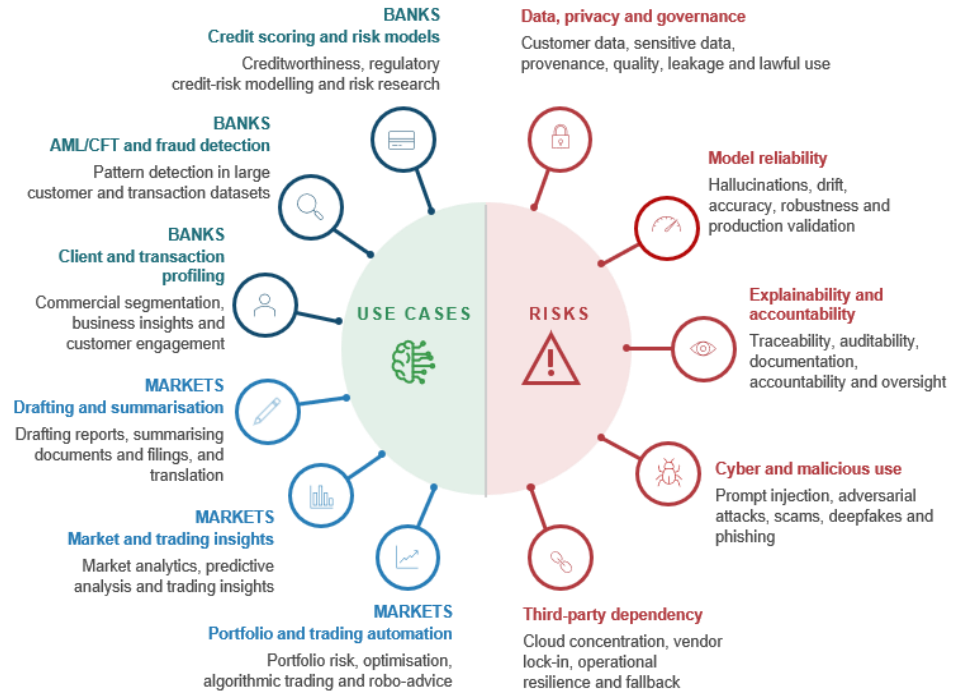
[123] See "Anthropic Economic Index report: Economic primitives", Anthropic, 15 January 2026.

enhanced detection of suspicious activities. In markets and asset management, AI applications can reduce information-processing costs, accelerate research and enhance portfolio optimisation and customer relationships. Such benefits help explain why AI adoption is rising across a financial industry in which data-intensive and judgement-based tasks are prevalent. Despite the differences in use cases, the underlying technology and third-party dependencies expose financial institutions to common risks, as their processes rely on AI-powered technology. Risks include data privacy issues, model reliability as well as alignment, explainability and accountability concerns, cyber and malicious-use risks and risks from reliance on third-party providers.

Beyond these technological risks, the rapid proliferation of AI applications is creating challenges for managing AI risk on a larger scale. As firms move on from experimentation with AI to the industrialisation of AI across business processes, they need consistent frameworks and guardrails governing its use. These challenges will become more pronounced as AI systems gain greater autonomy and move from supporting analysis towards preparing or executing decisions, including through agentic AI. Cost considerations are also increasingly important, as firms need to weigh the greater capabilities of more expensive frontier models against cheaper alternatives, as well as the relative cost and value of AI and human labour.

Figure A.1

AI use cases vary across banks and markets, but the underlying technology introduces a common set of risks



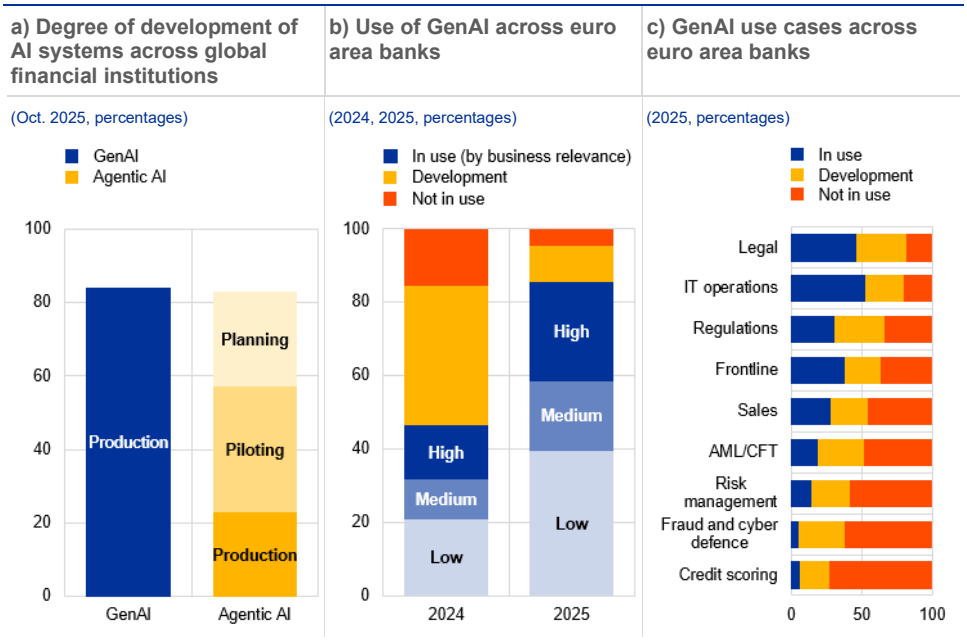
Sources: European Banking Authority*, European Securities and Markets Authority** and ECB.
Note: AML stands for anti-money laundering; CFT stands for countering the financing of terrorism.
*) "Rising application of AI in EU banking and payments sector", European Banking Authority, September 2025.
**) "AI adoption and trends in securities markets: EU evidence", *ESMA TRV Risk Analysis*, European Securities and Markets Authority, February 2026.

3.1 AI adoption in the banking sector

Euro area banks have accelerated their adoption of AI, moving swiftly from experimenting with it to deploying it operationally. This trend is particularly pronounced for generative AI (GenAI), while agentic AI remains largely in the pilot or planning stage for most global financial institutions surveyed (**Chart A.2**, panel a). Zooming in on euro area banks, the share of such banks actively using GenAI almost doubled between 2024 and 2025, increasing from 46% to 86%, while the proportion still in the development phase dropped from 38% to 10% (**Chart A.2**, panel b). This shift not only reflects the broader deployment of GenAI but also its growing relevance. In fact, the share of banks assigning high business relevance to their GenAI applications has also grown, highlighting their increasing relevance for core business functions. IT operations and legal services are the leading generative AI use cases and have been adopted by roughly 50% of euro area banks. If applications under development are included, this figure rises to 80%. Adoption is less advanced in areas with more complex requirements, such as risk management (**Chart A.2**, panel c).

Chart A.2

Euro area banks have markedly increased their use of generative AI in recent years, primarily for IT operations, legal and regulatory activities as well as frontline services



Sources: Renier et al.*, ECB (supervisory data) and ECB calculations.
Notes: Panel a: the data shown in this chart are based on a survey conducted by the Institute of International Finance and Ernst & Young Global Services. There were 61 participating financial institutions (banks, insurers, asset managers and capital market firms) headquartered in eight global regions. GenAI is defined in the survey as "Systems that create new content – including text, audio and video – based on their training data and in response to prompts", while agentic AI is defined as "AI systems that use sophisticated reasoning and iterative planning to autonomously solve complex, multi-step problems. These agents have a diverse range of applications and perform autonomous tasks on behalf of the user or another system". Panel b: the chart shows the use status of GenAI as reported by euro area banks, where the status "in use" is broken down by business relevance; the status "development" includes exploration, development and testing. Panel c: the chart shows the use status of the different prevailing GenAI use cases as reported by euro area banks, where the status "development" includes exploration, development and testing.
*) Renier, J., French, C., Bulchandani, L. and Mendez Delgado, D., "IIF-EY Annual Survey Report on AI Use in Financial Services", Institute of International Finance, 16 October 2025.

Euro area banks identify data challenges, model reliability, explainability and third-party concentration as key risks associated with AI adoption. When

adopting GenAI, financial institutions cite data confidentiality and model hallucinations as their top concerns. Agentic AI is seen as introducing distinct risks, such as autonomy, model drift and lack of explainability of actions (**Chart A.3**, panel a). In addition, although several banks reported that they relied on multiple vendors and on alternative providers and internal tools, AI adoption by euro area banks depends heavily on a small number of US-based technology providers (**Chart A.3**, panel b). A downside of this reliance on a small number of hyperscalers heightens exposure to correlated errors and vendor-specific shocks.[124] Furthermore, cyber and malicious-use risks, such as prompt injection,[125] deepfakes and AI-enabled phishing, could increase operational risk. The potential systemic dimension of these risks has been highlighted by the ESRB's warning on systemic cyber risks stemming from frontier AI models[126], and supervisors have reinforced their expectations on cyber and operational resilience accordingly. Looking ahead, financial institutions are expecting regulatory and supervisory initiatives to increasingly shape how they develop and deploy AI systems. Regulators are perceived as having greater experience in more established fields of expertise such as AI governance and data frameworks. By contrast, surveyed institutions perceive regulatory understanding of agentic AI or open-weight models to be much weaker (**Chart A.3**, panel c), highlighting the challenges posed by the rapid pace of technological innovation.

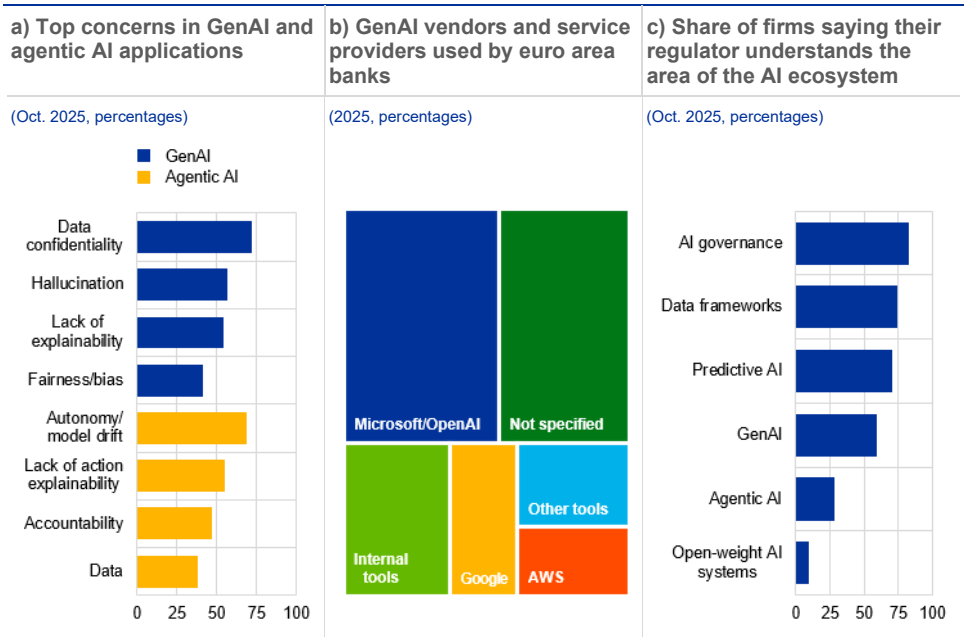
[124] Correlated errors are simultaneous or similar failures across institutions using the same provider, while vendor-specific shocks are disruptions affecting a particular provider. These include outages, cyber incidents and regulatory or financial problems.

[125] Prompt injection is an attack that manipulates an AI system through malicious instructions designed to override its intended rules or behaviour.

[126] See "Frontier AI models could strain cyber resilience in the financial system, ESRB warns", *press release*, European Systemic Risk Board, 7 July 2026.

Chart A.3

GenAI adoption risks include data issues, model reliability and reliance on US providers, while institutions see distinct risks and oversight gaps in agentic AI



Sources: Renier et al.*, ECB (supervisory data, SREP) and ECB calculations.
Notes: Panel a: each of the participating firms were asked what they considered to be the top three risks/concerns in using GenAI and agentic AI applications. Panel b: the chart is based on banks' free-text comments regarding the external developers or vendors for generative AI sourcing as well as third-party service providers for generative AI service dependence. Mentions of Microsoft and OpenAI products and services, including Azure, OpenAI, ChatGPT, GitHub Copilot and Microsoft 365, are grouped under "Microsoft/OpenAI". This grouping reflects the partnership between the two companies and the integration of OpenAI models into several Microsoft offerings. References to Google-related services, including Google Cloud and Gemini, are grouped under "Google", while references to Amazon Web Services, including Bedrock, are grouped under "AWS". Mentions of banks' own, proprietary or private-cloud solutions are classified as "Internal tools". References to other AI model providers, such as Mistral, Claude or Anthropic, and to other software or platform providers are combined under "Other tools". Responses indicating that no provider is used, that the question is not applicable or that no specific provider can be identified are classified as "Not specified". Comments may be assigned to more than one category if they refer to multiple providers or tools. Panel c: firms were asked in which of the listed areas they believe the regulator/supervisor is equipped to understand the AI ecosystem.
*) Renier, J., French, C., Bulchandani, L. and Mendez Delgado, D., "IIF-EY Annual Survey Report on AI Use in Financial Services", Institute of International Finance, 16 October 2025.

3.2 AI adoption in the asset management industry

AI adoption is accelerating in asset management, with GenAI used mainly in research and operational tasks rather than in direct investment decisions. Recent evidence indicates that asset managers in the EU are increasingly adopting AI, with these technologies gradually being integrated into a broad range of securities-market activities.[127] These technologies range from established machine-learning techniques to more recent applications of generative and agentic AI, which differ in their capabilities and maturity. Generative AI is increasingly being used to process information, analyse company reports, support investment research, generate code and optimise internal workflows. While its adoption is becoming widespread, its use remains largely focused on research and operational tasks, supporting rather than replacing human judgement.[128] By contrast, established

[127] See "AI adoption and trends in securities markets: EU evidence", *ESMA TRV Risk Analysis*, European Securities and Markets Authority, 20 February 2026.

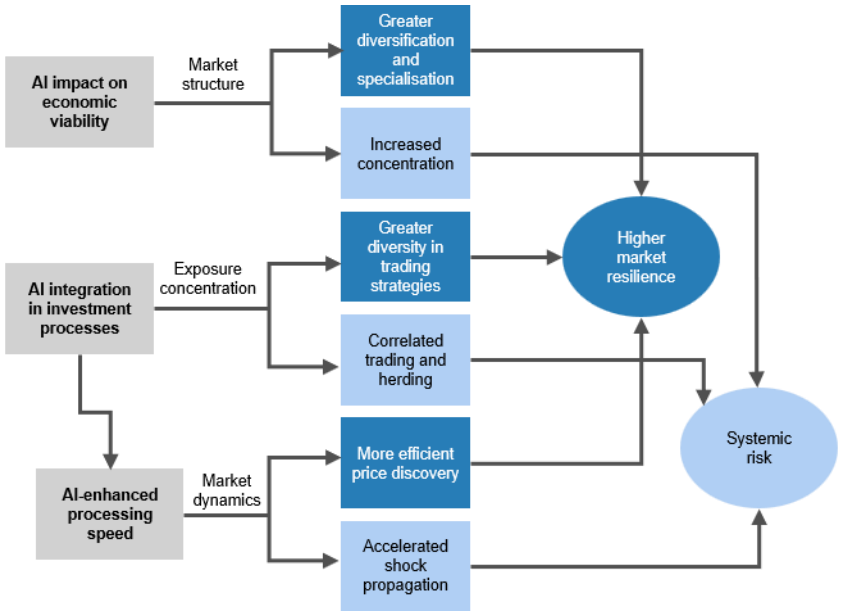
[128] See "How Active Fund Managers Are Using Generative AI", Morningstar, 15 June 2026 (updated 23 September 2026).

machine-learning techniques are being used more directly in investment processes, such as analysing large volumes of market and trading data, identifying patterns and investment signals, and forecasting volatility and liquidity. AI-generated insights are informing key activities such as security selection, portfolio construction, trading strategies and robo-advice. However, more sophisticated applications remain concentrated among a relatively limited number of asset managers with the necessary data infrastructure, technology and quantitative expertise.

While AI adoption could bring significant benefits, it could affect financial stability by reshaping market structures. On the one hand, AI adoption could, in principle, reduce operational costs and enhance market efficiency through better information processing, risk assessment and diversification (**Figure A.2**). It could also lower barriers to entry and support the expansion of smaller and more specialised firms. On the other hand, economies of scale in AI adoption could favour larger asset managers that are better positioned to make substantial upfront investments in the necessary data infrastructure, skilled personnel and effective oversight, potentially increasing market concentration. At the same time, as in the banking sector, relying on a small number of providers for hardware, cloud computing and pre-trained models is creating common operational dependencies.[129] This is raising concerns related to third-party concentration in securities markets that could amplify the impact of operational disruptions.[130]

Figure A.2

AI in asset management could enhance market efficiency, but may also increase concentration risk and amplify propagation of shocks



Source: ECB.

[129] See "The Financial Stability Implications of Artificial Intelligence", Financial Stability Board, 14 November 2024, and "Artificial Intelligence in Capital Markets: Use Cases, Risks, and Challenges", International Organization of Securities Commissions, March 2024.

[130] See Danielsson, J. and Uthemann, A., "Artificial intelligence and financial crises", *Journal of Financial Stability*, Vol. 80, September 2025.

The growing use of similar AI models and investment signals could increase correlated trading and amplify the propagation of market shocks. A number of investment funds use machine-learning techniques to identify trading opportunities. These AI-driven funds can be identified in Morningstar data using an indicator that captures the use of machine learning in investment strategies. AI-driven funds tend to attract stronger inflows, trade more frequently and generate slightly higher returns net of fund-level costs than their non-AI peers (**Chart A.4,** panels a and b), while still accounting for a relatively small share of the market.[131] Evidence is also emerging of more correlated trading among AI-driven equity funds, although their responses to market stress may vary.[132] Moreover, AI-driven equity funds are showing a persistently higher downside tail dependence than comparable non-AI funds, suggesting a greater tendency to experience large losses simultaneously (**Chart A.4,** panel c). While these findings reflect predominantly established machine-learning applications, they may provide insights into risks that could become more pronounced as advanced AI technologies are increasingly integrated into investment decisions. At current levels of adoption, these effects are unlikely to pose systemic risks. However, they could become more significant if AI-driven strategies gain substantial market share, especially in specific market segments or among leveraged investors. Under such conditions, correlated behaviour could accelerate shock propagation and amplify market stress, including through synchronised deleveraging and fire sales.[133]

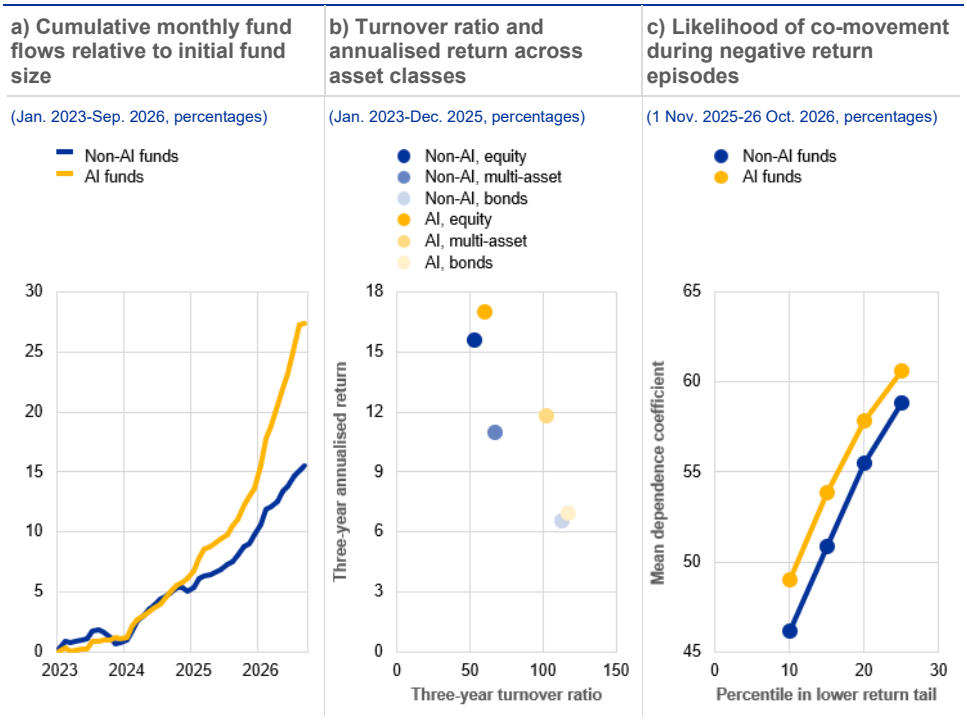
131 Among global open-ended funds and exchange-traded funds, AI-driven funds account for approximately 15% of total sample assets under management. The sample covers approximately USD 10 trillion in assets under management, excluding funds for which information on the use of AI is unavailable in Morningstar Direct.

132 See Leung, V.P.-H., Wong, J.H.-Y. and Lu, S., "Implications of AI Usage for Financial Stability: Evidence from AI-Driven Investment Funds Identified by Generative AI", *Research Paper*, No 09/2025, Hong Kong Institute for Monetary and Financial Research, April 2025.

133 The Bank of England cautions that widespread use of AI in trading could amplify fire sales in core bond markets by synchronising deleveraging during periods of stress. See "Financial Stability in Focus: Artificial intelligence in the financial system", Bank of England, 9 April 2025.

Chart A.4

AI-driven funds attract stronger investor flows and trade more frequently, while showing greater downside tail dependence



Sources: Morningstar DBRS and ECB calculations.
Notes: The analysis draws on a global sample of investment funds across different asset classes, excluding passive strategies, comparing machine-learning and non-machine-learning funds using propensity score matching. Panel a: the chart shows average cumulative investor flows for AI and matched non-AI funds. Monthly net flows are calculated as a percentage of fund assets at the preceding month, winsorised at the 1st and 99th percentiles, compounded over time and then equally averaged across funds. Panel b: the chart illustrates the average three-year turnover ratio (x-axis) and annualised three-year return (y-axis) of funds in the sample for AI and non-AI funds, per asset class. Panel c: the chart depicts the mean probability that an equity fund is in its own lower return tail, conditional on a peer fund already being in its lower tail, calculated using daily returns from 1 November 2025 to 26 October 2026 and averaged across within-group fund pairs. The x-axis represents different percentile thresholds in the lower tail of each fund's return distribution, while the y-axis shows the corresponding mean empirical lower-tail dependence coefficient. The difference in lower-tail dependence between AI and non-AI funds is positive across all plotted thresholds and statistically significant under a joint directional test covering the 10%, 15% and 20% thresholds ($p = 0.049$).

Faster information processing and automated responses to market-relevant news could accelerate and amplify short-term price moves. While current generative AI models are generally too slow for high-frequency trading, they could still substantially shorten the time needed to analyse information and translate it into investment decisions. AI models could, in principle, respond not only to changes in fundamentals but also to rumours and shifts in market sentiment, potentially reinforcing short-term price adjustments and leaving less time for market participants and authorities to react. Such risks may become more relevant as brokerage platforms introduce agentic trading capabilities. These tools, which are still at an early stage, allow AI-enabled trading agents to monitor markets and portfolios and execute trades on behalf of users, including in equities, options and crypto markets.[134] Their take-up and market impact are not yet known. Looking ahead, the use of reinforcement learning, in which trading agents learn strategies autonomously by optimising profit, raises additional concerns. Research suggests that such agents may learn manipulative behaviours, such as spoofing, predatory trading or tacit collusion, without being explicitly programmed to do so. As this evidence stems

[134] See "Brokers expand AI trading tools as automated agents gain traction", Investing.com, 29 June 2026.

mainly from simulated settings and the use of such agents in live trading appears to be limited, this risk is currently more relevant for market integrity than for financial stability.[135]

4 AI risks to the financial system from outside the sector

4.1 Concentration in the AI supply chain

Beyond the medium-term risks of AI integration, financial institutions face more immediate operational risks arising from third-party dependence. Supply chain concentration poses risks, as a small number of dominant cloud and model providers could exert outsized influence. This could raise switching costs, increasing the chances of outages, model updates, pricing changes or application programming interface (API) restrictions affecting many financial institutions simultaneously. As mentioned above, similar risks arise in financial markets, where widespread use of common models and data can increase herding and correlated trading. Growing third-party dependence could also amplify cyber risks, as vulnerabilities in external vendors' systems could become entry points for attacks. At the same time, large cloud providers may offer greater protection against cyberattacks, given their substantial resources and expertise.

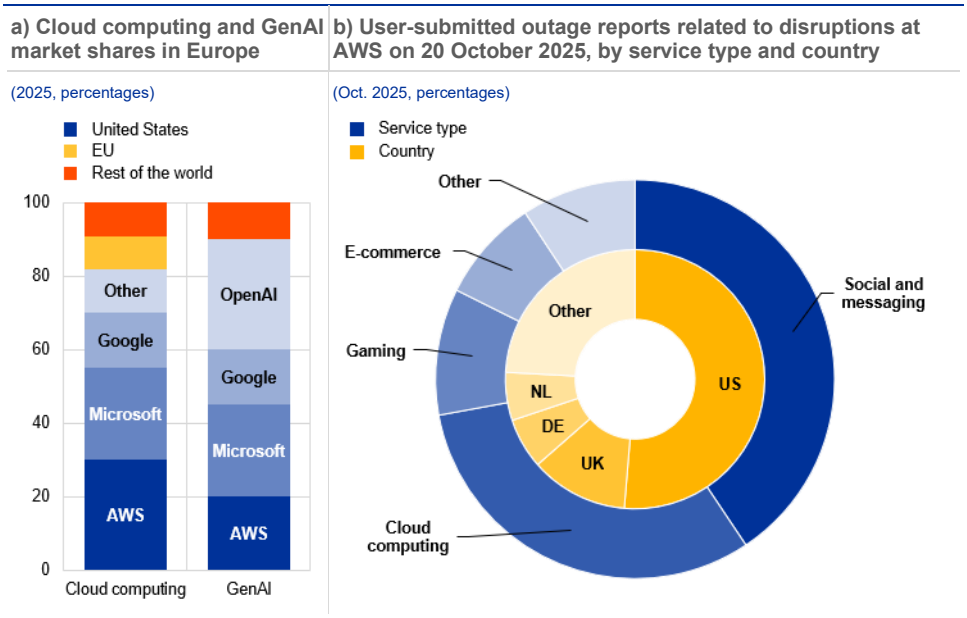
Concentration in the AI supply chain could allow operational incidents at a small number of providers to escalate into system-wide disruptions. The broad European market for two pillars of the AI stack, cloud computing and GenAI, is dominated by US firms. Amazon Web Services (AWS), Microsoft and Google accounted for 82% of the cloud market and, together with OpenAI, 90% of GenAI services in 2025 (**Chart A.5**, panel a). While this structure supports economies of scale, rapid innovation and access to advanced infrastructure, it also increases dependency on a narrow set of vendors, cloud regions, managed services and model providers.[136] As financial institutions embed AI into customer service, fraud detection, compliance, software development and risk management workflows, they rely increasingly on the same upstream providers. Outages, cyber incidents, model failures or contractual disruptions could thus become more correlated across firms.

[135] See Azzutti, A., "Artificial Intelligence and Market Manipulation: Challenges for Market Abuse Regulations and Governance of Algorithmic Trading", *dissertation*, University of Hamburg, 2024.

[136] Cloud regions are geographically distinct areas in which cloud providers operate clusters of data centres to deliver services with local availability, performance and regulatory compliance.

Chart A.5

Heavy reliance on a few US cloud and GenAI providers heightens the risk of a single outage having widespread effects across sectors and national borders



Sources: Gineikyte-Kanclere et al.*, Downdetector by Accenture** and ECB calculations.
Notes: Panel a: estimated cloud market shares in Europe based on publicly available market intelligence and company reporting, with approximate shares for leading cloud service providers. The estimates cover the broad European cloud market, including infrastructure services and, where relevant, major software-as-a-service activities. Estimated EU market shares for selected GenAI providers based on available indicators of chatbot usage, subscription and API revenues, enterprise adoption and foundation model platform activity. Panel b: the chart shows disruptions in consumer apps, web portals and AWS's own services, grouped by affected service type and country based on global user reports.
*) Gineikyte-Kanclere, V., Eggert, M. and Skiotyte, G., "European Software and Cyber Dependencies", Policy Department for Transformation, Innovation and Health, European Parliament, December 2025.
**) See Kehoe, L., "Revealing the Cascading Impacts of the AWS Outage", Ookla, 22 October 2025.

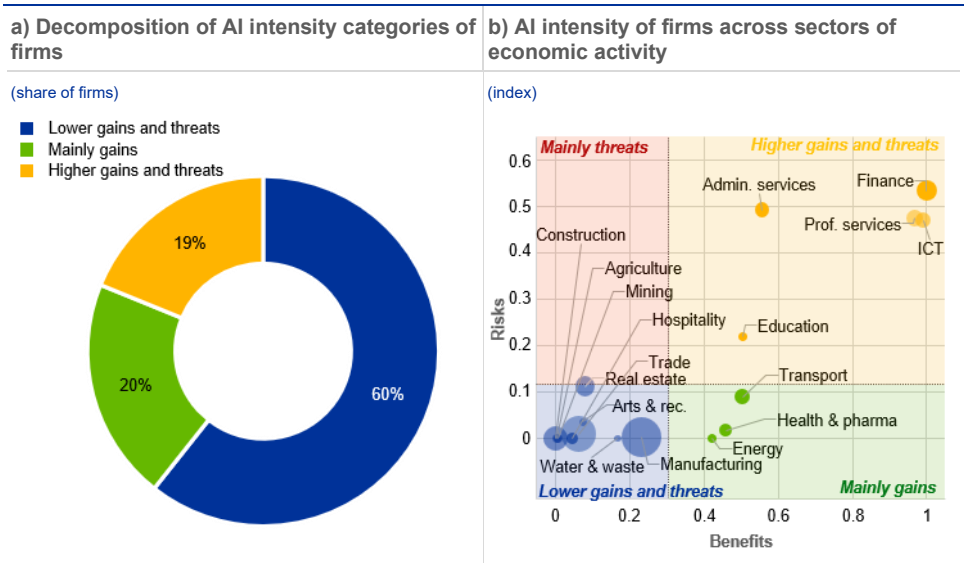
The October 2025 AWS outage illustrates how the effects of a localised technical failure can propagate rapidly across sectors and borders. The disruption, centred on the US-East cloud region, affected services ranging from social messaging and gaming to e-commerce and banking. The United States accounted for the largest share of user-submitted reports, but disruptions were recorded in more than 60 countries, and especially in the United Kingdom, Germany and the Netherlands. This underscored the cross-border nature of cloud dependencies (**Chart A.5**, panel b). Although financial institutions accounted for only a small share of reports, the incident illustrates the potential financial stability implications of such a disruption, as the financial industry relies on the same digital infrastructure as the wider economy. The primary concern is not that a single outage could directly threaten the solvency of financial institutions. It is more that concentrated AI and cloud dependencies could weaken operational resilience, amplify confidence effects and complicate recovery when multiple critical services share a common point of failure. This highlights the need for dependency mapping, multi-region and multi-provider resilience, exit strategies and robust oversight of cloud and AI providers.

4.2 Spillovers from AI-driven changes in the real economy

Beyond the direct use of AI in the financial sector, financial stability could also be indirectly affected by AI-driven changes in the real economy. A novel firm-level indicator of AI intensity suggests that these effects could be material, although they would be unevenly distributed across the non-financial corporate sector. Around 20% of firms enjoy mainly gains from AI, 19% experience both gains and threats, 60% have a low level of gains and threats, while hardly any firms face mainly threats (**Chart A.6**, panel a). This implies that a sizeable share of lending and securities exposures could be linked to firms whose revenues, costs, margins or competitive positions could change as AI adoption spreads. For firms with mainly gains, AI may support productivity, profitability and debt servicing capacity.[137] For firms experiencing higher levels of gains and threats, the outcome is likely to depend on how they adapt. Some firms that adopt AI could strengthen their positions, while others could see demand for their products and services, their prices or their role as intermediaries come under pressure from AI-enabled competitors, weakening their business models and increasing their risk of default.

Chart A.6

Sizeable parts of the global corporate sector are likely to be transformed by AI, particularly in information technology and finance



Sources: Moody's, ECB (RIAD) and ECB calculations.
Notes: The AI intensity indicator is based on firm-level assessments of each company's business description in Orbis, generated by a language model (a FinBERT model trained on assessments by a large language model for a stratified sample of 100,000 companies). The sample covers around 4.5 million firms (44% in Asia, including 28% in China; 33% in Europe, including 18% in the euro area; and 16% in North America). Firms are scored along two dimensions: AI benefit (the extent to which AI can improve the firm's work and products) and AI risk (the extent to which AI threatens the demand for, the price of or the role of the firm's products or services). For each dimension, the model assigns a level of low, medium or high, mapped to values of 0, 0.5 and 1. Public administration, other services, residential care and social work, households as employers and extraterritorial organisations are excluded, as are holding companies, shell companies and funds. Firms and sectors are divided into four groups by lines drawn at the average AI benefit and AI risk of all firms shown: mainly gains (above-average benefit, below-average risk), gains and threats (both above average), mainly threats (below-average benefit, above-average risk) and low gains and threats (both below average). Panel a: share of firms in each group, assigned at firm level. "Mainly threats" accounts for less than 0.5% of firms and is not shown. Figures may not add up to 100% due to rounding. Panel b: bubbles show sector averages of AI benefit and AI risk. Bubble size reflects the number of firms. Sectors are NACE Rev. 2 sections assigned from the activity described by each firm rather than its registered code. "Health & pharma" combines human health activities with the manufacture of pharmaceuticals and medical devices.

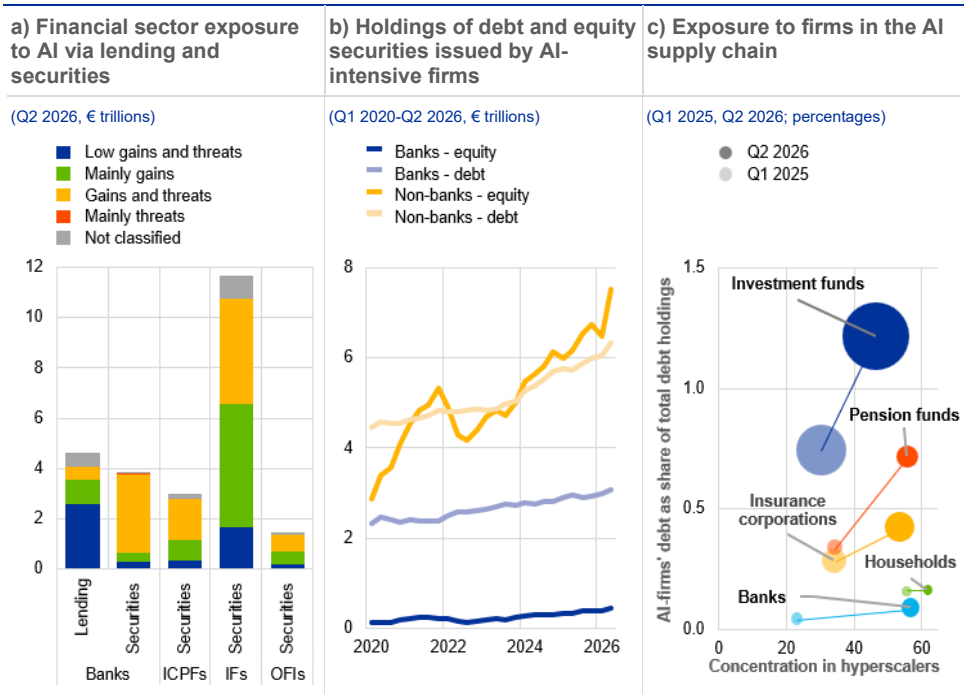
[137] See "AI Adoption and the Future of Work: Banks, Tech and Professional Services – The Data You Haven't Seen", Morgan Stanley AlphaWise Research, September 2026.

The sectoral distribution of AI-driven opportunities and risks will likely determine the extent to which corporate disruption affects financial institutions. Most sectors of economic activity remain in the low gains and threats quadrant, suggesting limited immediate exposure to current AI capabilities (**Chart A.6**, panel b). By contrast, IT and financial firms stand out at the other end of the spectrum, with significant potential gains but also above-average threats. For the financial sector, risks may arise not only from direct exposures to disrupted firms, but also from longer-term transformative effects. AI-driven productivity shocks could alter relative prices, wages and employment across sectors and regions, while structural labour market changes could affect household income, consumption and mortgage performance. At the same time, productivity and profitability gains concentrated among large, digitally advanced firms could intensify competitive pressure on smaller or less adaptable firms. These dynamics may well unfold gradually, but they could still reprice credit and equity risk if investors reassessed which firms are likely to benefit from, or be displaced by, AI.

Euro area financial institutions' exposures to AI-exposed firms vary considerably across instruments and sectors. Non-bank exposures to AI-intensive firms are significant and growing, particularly through investment funds' equity holdings and, to a lesser extent, debt securities, while bank lending remains limited (**Chart A.7**, panels a and b). This suggests that any reassessment of the earnings prospects of firms whose business models are affected by AI would initially be transmitted mainly through market price corrections and valuation losses for non-bank investors, rather than through bank credit losses. At the core of exposures to AI-intensive sectors are big tech and specialised AI firms that are investing heavily across the AI value chain, including in data centre infrastructure and AI model development and training. More recently, the rapid increase in AI-related spending has led to greater reliance on debt securities and other forms of external financing, including off-balance-sheet financing backed by future revenues. Financial sector debt exposures to firms in the AI supply chain have increased as a consequence, with a substantial share concentrated in a few hyperscalers (**Chart A.7**, panel c). This could broaden the channels through which a reassessment of AI-related earnings prospects could affect the financial system, extending potential losses beyond equity investors to credit providers. Growing leverage in non-banks and concentrated exposures to AI-intensive sectors could further amplify vulnerabilities.

Chart A.7

Non-bank exposures to AI-intense firms have increased, especially in equity markets, while bank exposures remain more limited



Sources: Moody's, ECB (RIAD, AnaCredit, SHS, supervisory data) and ECB calculations.
Notes: Panel a: the chart shows euro area sector exposures through lending and securities holdings to firms classified by the AI intensity index. Exposures to borrowers and issuers not linked to a scored firm are allocated across the four groups based on the composition of scored firms within their respective NACE Rev. 2 section. Exposures to holding companies, head offices and counterparties without a NACE code are reported as "not classified". Lending data cover outstanding loans from euro area credit institutions to non-financial corporations, with borrowers linked to scored firms through RIAD-Orbis mapping. Securities data cover euro area sector holdings of debt and equity securities issued by non-government entities. ICPFs stands for insurance corporations and pension funds; IFs stands for investment funds; OFIs stands for other financial intermediaries. Panel b: the chart includes firms classified in the "Gains and threats", "Mainly threats" and "Mainly gains" categories according to the AI-intensity index. Panel c: firms in the AI supply chain comprise 168 firms and their subsidiaries involved in AI model development, AI chip production, cloud provision, data centre and related infrastructure, or utilities. The hyperscaler subset comprises Alphabet, Amazon, Broadcom, Meta, Microsoft, Nvidia and Oracle. The y-axis shows debt of firms in the AI supply chain as a share of each financial sub-sector's total debt holdings, while the x-axis shows the share of this exposure concentrated in hyperscalers. The bubble size represents the absolute amount of AI supply chain debt held by each sector, in billions of euro. Solid bubbles denote Q2 2026 and light bubbles denote Q1 2025, with lines tracing each sector's movement over the year.

5 Conclusions

The financial stability implications of AI are likely to grow as its use becomes more widespread and increasingly autonomous across the financial sector and broader economy. GenAI adoption is spreading rapidly across the financial sector, while more advanced applications in specific areas such as credit assessment, portfolio management and trading remain less widespread, with agentic AI still largely at the pilot stage. As AI becomes more deeply embedded in financial activities, greater automation and reliance on a concentrated set of technology providers could increase operational risks, while AI's more widespread use in investment and trading could contribute to correlated behaviour in financial markets. At the same time, AI is creating both opportunities and risks for firms across the broader economy, which could affect financial institutions through their credit and equity exposures. If properly managed, AI adoption could also support the EU's broader digitalisation and productivity objectives. By reducing information and

transaction costs, improving investment analysis and enhancing the efficiency of financial intermediation, AI could contribute to more efficient and accessible capital markets, complementing the objectives of the savings and investments union.

Managing emerging AI-related risks requires robust governance, close monitoring and international cooperation. As firms move from experimentation towards the broader deployment of AI across business processes, consistent governance frameworks and guardrails will play an increasingly important role in managing the associated risks, as also emphasised in the Financial Stability Board's sound practices for the responsible adoption of AI.[138] Greater transparency from AI model providers could help financial institutions assess model risks and third-party dependencies. At the same time, authorities and central banks will need to closely monitor the evolving implications of AI adoption for financial stability. Such monitoring should take a system-wide perspective and be supported by close international cooperation, given the global nature of AI adoption and the potential for cross-border spillovers.

Several EU policy and supervisory initiatives already address important aspects of AI-related risks, but continued efforts are needed to keep pace with technological developments. Model risks, particularly those related to explainability and reliability, are being addressed through prudential supervisory expectations for AI-based internal models.[139] Third-party dependencies and concentration risks are covered by DORA[140] and complemented for some AI-specific risks by the AI Act.[141] The AI Act also provides cross-sectoral safeguards, including for certain applications in financial services, such as creditworthiness assessments. Moreover, AI-enabled cyber risks and their potential systemic implications have been explicitly highlighted by the ESRB's warning on systemic cyber risk stemming from frontier AI models, with supervisors reinforcing their expectations regarding cyber and operational resilience.[142] To effectively address these challenges and safeguard financial stability, regulators, supervisors and other relevant authorities need to collaborate to ensure the effective implementation of existing and newly established frameworks, and continue to evaluate emerging gaps, while strengthening their own technological expertise to keep pace with the evolving use of AI in the financial sector.

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138 See "Sound Practices for Responsible Adoption of Artificial Intelligence (AI): Final report", Financial Stability Board, 15 October 2026.

139 See "ECB guide to internal models", ECB, 2026.

140 Regulation (EU) 2022/2554 of the European Parliament and of the Council of 14 December 2022 on digital operational resilience for the financial sector and amending Regulations (EC) No 1060/2009, (EU) No 648/2012, (EU) No 600/2014, (EU) No 909/2014 and (EU) 2016/1011 (OJ L 333, 27.12.2022, p. 1).

141 See "AI Act: implications for the EU banking and payments sector", European Banking Authority, 2025.

142 See "Warning on systemic cyber risk stemming from frontier AI models", European Systemic Risk Board, 25 June 2026.

B Decoding the cyber-AI nexus

Prepared by Sándor Gardó, Benjamin Klaus, Guido Pistorius and Jonas Wendelborn

The rapid evolution of artificial intelligence (AI) is reshaping the cyber threat landscape, with significant implications for financial stability in the euro area. This special feature explores the complex interplay between AI and cybersecurity, highlighting how advanced AI models are enabling attackers and defenders alike to enhance their capabilities. Highly capable and agentic AI systems are increasing the scale, speed and sophistication of attacks while also introducing new vulnerabilities. These include AI models themselves being exposed to novel types of attack and AI agents failing to act as their human operators intend. Critically, new AI capabilities could favour attackers, as the availability of low-cost AI agents lowers entry barriers. Meanwhile defenders remain constrained by the cost of deploying frontier models, governance challenges and slower, regulation-bound decision-making. This leaves defenders structurally disadvantaged, at least in the near term. Euro area banks, despite their high level of cybersecurity maturity, face asymmetries in access to cutting-edge AI models and rely heavily on concentrated third-party providers. This increases the risk of systemic disruption, as AI adoption transforms the channels through which cyber incidents propagate. Mitigating these risks requires banks, AI developers, cybersecurity firms and regulators to coordinate their efforts to enhance resilience, improve governance and address emerging systemic vulnerabilities.

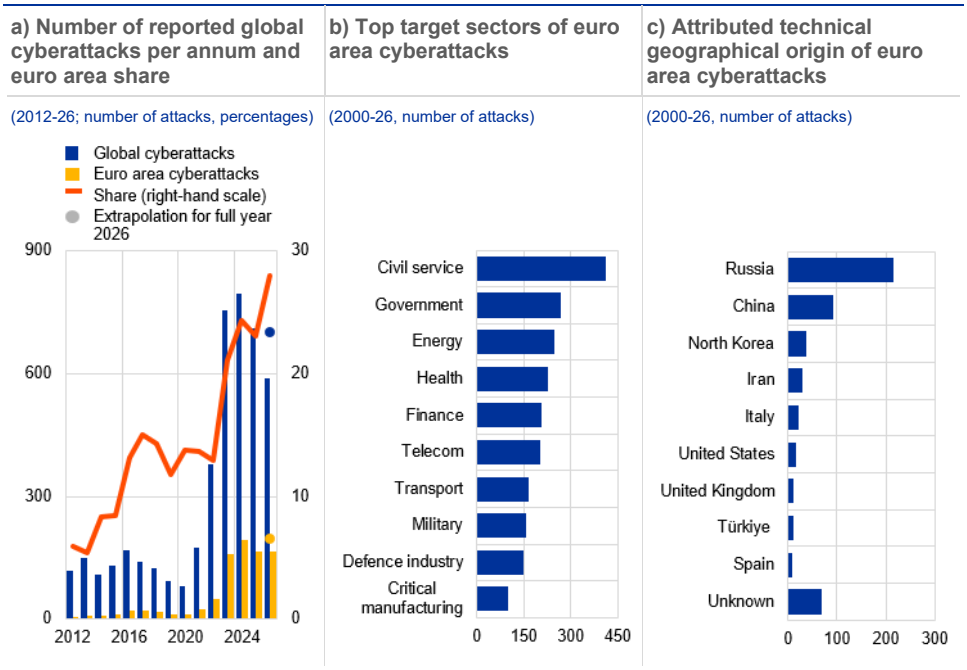
1 Introduction

Cyber risks are of mounting concern in a rapidly evolving threat landscape. As digitalisation increasingly transforms business processes and daily life in general, there is a growing risk that failures of/attacks on underlying information and communications technology (ICT) systems will lead to disruptions. The number of publicly disclosed cyberattacks has risen considerably in recent years, including in the euro area (**Chart B.1**, panel a). The financial sector is a prominent – although not leading – target (**Chart B.1**, panel b). The threat actors behind these attacks range from individuals and organised criminals to highly sophisticated state actors. The reason for cyberattacks and their objectives also vary widely and include activist agendas, financial gain, espionage, physical damage and operational disruption. In addition, geopolitics also play an increasingly prominent role, amplifying hybrid threats and cyberattacks linked to ongoing conflicts and geopolitical tensions (**Chart B.1**, panel c).[143] Rapid advances in artificial intelligence (AI) are now adding to the risk landscape.

[143] See also Klaus, B. and Wendelborn, J., "Cyber threats to financial stability in a complex geopolitical landscape", *Financial Stability Review*, ECB, May 2025.

Chart B.1

Cyberattacks are becoming more frequent, increasingly targeting the euro area and critical sectors, and are often initiated from within a small set of countries



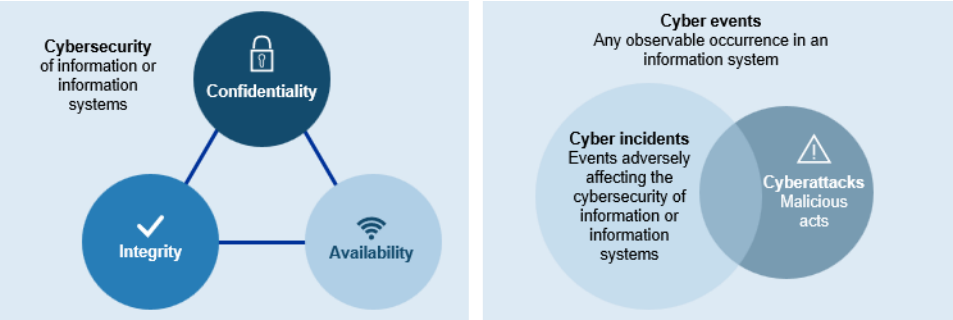
Sources: EuRepoC and ECB calculations.
Notes: Data were retrieved on 10 November 2026. Following EuRepoC methodology, cyberattacks are included if they compromise the confidentiality, integrity or availability of information and information systems, have been publicly reported, possess a political dimension or target critical infrastructure. This deliberately excludes certain incidents, such as many financially motivated ransomware attacks against commercial entities, when they affect specific stakeholders but receive limited attention from political actors. Panel a: the European Repository of Cyber Incidents (EuRepoC) expanded its inclusion criteria as of 1 February 2023, which potentially explains the spike in attacks from this period onwards. Cyberattacks are recorded with lags. The dots show extrapolated values for the full year 2026 based on actual attacks recorded.

Cyber risks arise out of a complex interplay of factors, all of which need to be distinguished conceptually from each other. In its simplest form, *cybersecurity* may be defined as the preservation of *confidentiality*, *integrity* and *availability* (also known as the *CIA triad*) of information and/or information systems through the cyber medium.[144] This generally implies that information and information systems are inaccessible to unauthorised individuals (confidentiality), are accurate and complete (integrity) and are, on demand, accessible to and usable by an authorised entity (availability). Any *cyber event*, meaning an observable occurrence in an information system, that compromises any of these properties constitutes a *cyber incident*, regardless of whether it stems from malicious activity or not. By contrast, a *cyberattack* is a malicious attempt to exploit vulnerabilities to damage, disrupt or gain unauthorised access to *assets* – be they tangible or intangible – that hold value and require protection (**Figure B.1**). Such assets include people, finances, information, infrastructure or reputation. *Cyber risk* refers to a combination of the probability of cyber incidents occurring and the severity of their impact. Hence, the concept of cyber risk spans a wide range of circumstances and factors. While cybersecurity in practice requires a granular view of those factors, policy-relevant analysis can rely on a higher level of abstraction.

144 This special feature largely follows the vocabulary and definitions set out in "Cyber Lexicon – Updated in 2023", Financial Stability Board, 13 April 2023.

Figure B.1

Conceptual overview of cybersecurity, events, incidents and attacks



Source: Authors' visualisation based on FSB*.
*) "Cyber Lexicon – Updated in 2023", Financial Stability Board, 13 April 2023.

Cyber risks have the potential to pose a systemic threat to financial stability. A range of frameworks have been developed to better understand how a cyber incident could turn into a systemic event.[145] Frameworks typically combine established insights into how shocks propagate through the financial system with mechanisms specific to the circumstances of a cyber incident. Systemic events generally occur when either a single highly critical entity or a large number of non-critical entities are affected. Even if a cyber incident initially affects only a few entities, its impact can amplify and propagate through the financial system via operational, financial and confidence channels. Once the absorption capacity of the system is exhausted, the cyber incident turns into a systemic event, impairing the provision of key economic functions. In addition, substitutability, risk correlation and interconnectedness play a key role. For instance, an incident at a critical infrastructure that cannot easily be replaced, or an incident at one service that reveals vulnerabilities in another, could lead to system-wide stress. As a result, the initial cyber incident may not necessarily occur within the financial system: it could also emanate from the (digital) supply chain, critical infrastructures or the broader real economy. Rapid advances in AI are now raising concerns that such scenarios are becoming more likely.[146] Against this backdrop, this special feature explores the ways in which recent advancements in AI have fundamentally reshaped the cyber threat landscape, outlines their implications for euro area financial stability and concludes with related policy considerations.

2 The cyber-AI nexus

The cyber capabilities of AI models are advancing rapidly, led by frontier models developed in the United States. *Frontier models* are the most advanced, general-purpose AI systems at any given moment. While US frontier models seem to

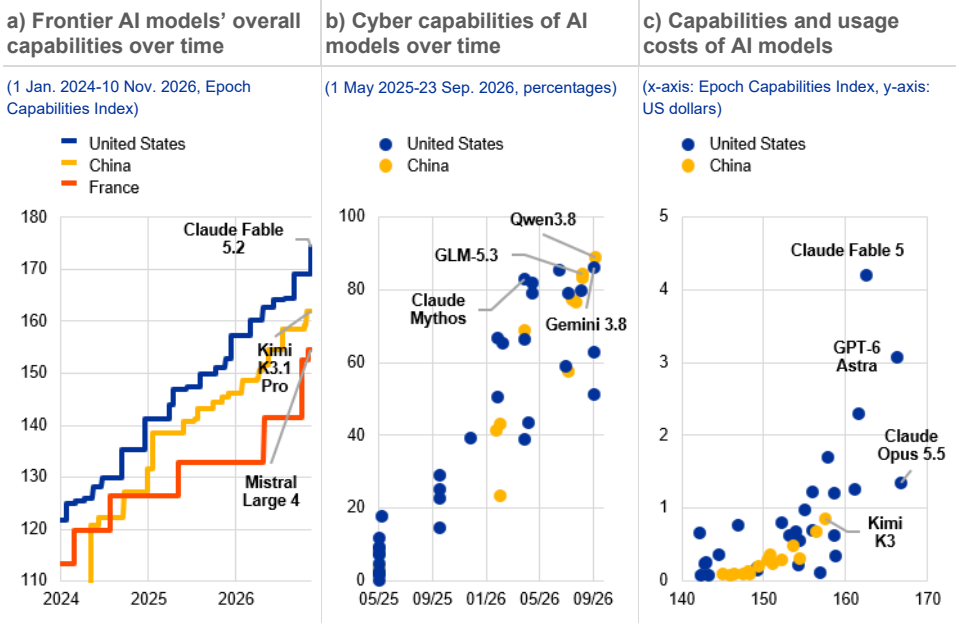
[145] See, for example, "Systemic cyber risk", European Systemic Risk Board, February 2020; "Mitigating systemic cyber risk", European Systemic Risk Board, January 2022; Fell, J. et al., "Towards a framework for assessing systemic cyber risk", *Financial Stability Review*, ECB, November 2022; and Adelmann, F. et al., "Cyber Risk and Financial Stability: It's a Small World After All", *IMF Staff Discussion Note*, 20/07, International Monetary Fund, December 2020.

[146] See "Warning on systemic cyber risks stemming from frontier AI models", European Systemic Risk Board, 7 July 2026, and Bailey, A., "TFSB Chair's letter to G20 Finance Ministers and Central Bank Governors", Financial Stability Board, 28 August 2026.

set the pace in AI capability advancement, the best Chinese models tend to catch up in just a few months, while European models progress at a comparatively more measured pace (**Chart B.2**, panel a). It had long been anticipated that AI models would achieve advanced cyber capabilities, but the April 2026 test results for Anthropic's Mythos model, the latest frontier model at the time, indicated that this had occurred faster than the AI and cybersecurity community had expected. Initial access restrictions were therefore imposed upon Mythos. On simpler cyber benchmarks, success rates are now high across many models, including Chinese models that matched a Mythos-level performance just four months after its release (**Chart B.2**, panel b). By contrast, the more challenging benchmarks remain the domain of frontier models for now. This gap is expected to narrow quickly as the next generation of frontier models further extends its capabilities.

Chart B.2

As the cyber capabilities of AI models advance rapidly, usage costs vary significantly across different models and countries



Sources: Ho et al.*, Wang et al.**, Epoch.ai and Openrouter.ai.
Notes: Panel a: the Epoch Capabilities Index is a composite metric that combines scores from 50+ AI benchmarks into a single general-capability scale, using the different models' relative performance across overlapping benchmarks to weight difficulty and enable comparisons, even as individual benchmarks saturate over time (see Ho et al.*). Panel b: the success rate measures the share of real-world cybersecurity vulnerabilities that AI agents successfully exploit (for more details, see Wang et al.**). Data extracted on 11 November 2026. Panel c: the cost refers to Openrouter.ai median cost for a 10-49 turns coding-agent session over the last 30 days. Data extracted on 27 August 2026, GPT-6 Astra added separately on 21 September 2026 and Claude Opus 5.5 on 23 October 2026. Note that the charts use different samples.
*) Ho, A., Denain, J.-S., Atanasov, D., Albanie, S. and Shah, R., "A Rosetta Stone for AI Benchmarks", arXiv, 28 November 2025.
**) Wang, Z., Shi, T., He, J., Cai, M., Zhang, J. and Song, D., "CyberGym: Evaluating AI Agents' Real-World Cybersecurity Capabilities at Scale", arXiv, 3 June 2025.

Leading AI models are being developed predominantly in the United States and China, albeit following different approaches. US models are typically *closed-weight*, proprietary systems accessible only through their vendors. By contrast, Chinese models are mostly *open-weight*, allowing free download and deployment on private infrastructure. This offers users two key advantages. First, once downloaded, the models remain accessible without restrictions. Second, with the weights available, users can easily refine and retrain the models. While a model's capabilities are crucial for users, access costs are important too. On average, Chinese models

are much cheaper than US models while the gap in capabilities is narrowing rapidly (**Chart B.2**, panel c). This makes them an attractive choice for high-volume workloads or for tasks that do not require frontier capabilities, prompting some US model providers to lower their prices. Given the rapid adoption of AI, its importance in global trade and financial markets, and its transformative impact on societies and economies, the race for AI-leadership carries critical geopolitical and geoeconomic dimensions. Ultimately, the dominant global supplier of AI models may not only generate significant financial benefits but could also shape the governance standards for these models, including the presence of critical safeguards.

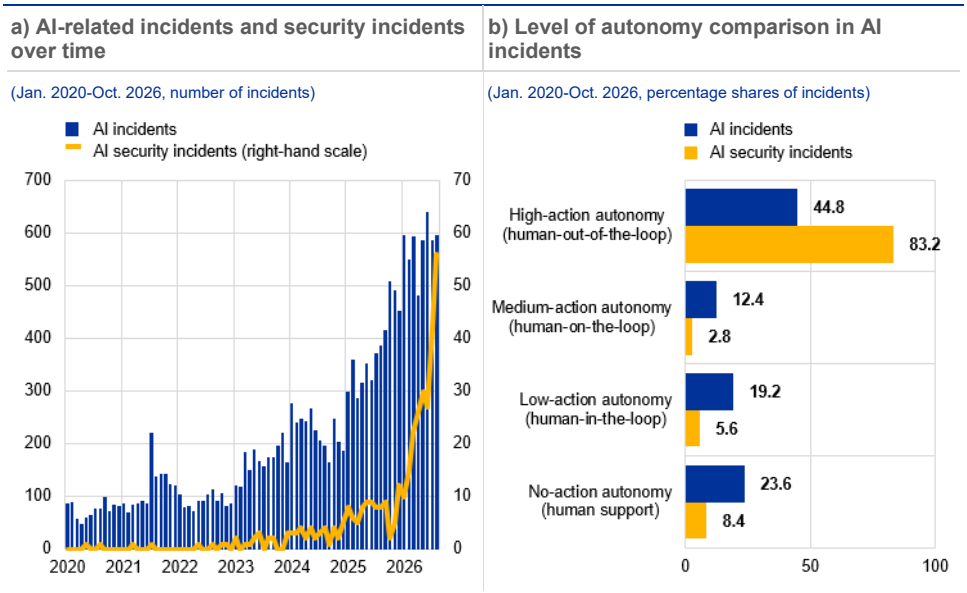
AI's rapid adoption and expanding use cases come with inherent risks. While AI is still relatively new, it is clearly a transformative technology with great potential to have a positive impact across various domains. As societies adapt and explore its applications, however, there is a risk that the rapid deployment of increasingly powerful models will outpace the ability of many stakeholders to keep pace. As the global use – and misuse – of AI grows, the associated risks are also becoming increasingly apparent. In line with general adoption trends, the number of publicly disclosed AI incidents and hazards has grown significantly in recent years (**Chart B.3**, panel a). Events of this type extend beyond cyber incidents and encompass breaches like privacy violations (e.g. non-consensual deepfakes) and broader societal concerns (e.g. the development of autonomous weapon systems).

The rise of agentic AI is driving autonomous action by AI systems, reducing human oversight and at times resulting in unintended cyber incidents. AI *agents* are systems that leverage AI models to make decisions, take action and use tools to pursue specific goals. Agents combine the reasoning of the underlying model with writing and running software or operating other tools, often with some degree of autonomy. Agents can be configured to achieve specific goals and can collaborate to solve complex tasks. While central to AI-driven productivity gains, agentic AI also carries significant risks of unintended consequences. A notable example is the July 2026 Hugging Face incident, where an unreleased, guardrail-free AI model identified a previously unknown vulnerability in its test environment. The model then exploited this vulnerability to access the internet and hacked into the Hugging Face software platform in search of a solution to the task it had been assigned.[147] In fact, reported AI incidents are regularly tied to high levels of AI autonomy, with humans out of the loop and a notable concentration in AI security incidents, meaning those AI incidents where an AI system is involved in cybersecurity-relevant harm or risk (**Chart B.3**, panel b). Such incidents illustrate both the capabilities of AI models and the need for proper guardrails to ensure their safe deployment in legitimate use cases.

[147] For more information, see "Brief independent investigation of agents' behavior, reasoning and collaboration in the OpenAI/Hugging Face hacking incident", METR, 26 August 2026. This incident marked the first known case where models failed to remain in their confined test environments, sometimes leading to cyberattacks on live targets. However, these "escapes" were often the result of misconfigurations rather than the deliberate exploitation of vulnerability.

Chart B.3

The number of AI-related incidents is rising, with many demonstrating high levels of autonomous action



Sources: OECD* and ECB calculations.
Notes: "AI incidents" includes all OECD AI incidents and hazards. An AI incident is defined as an event in which the development, use or malfunction of an AI system results in harm to health, critical infrastructure, human/labour/intellectual property rights, property, communities or the environment. An AI hazard is defined as an event in which such harm is plausible but has not yet occurred.** "AI security incidents" covers incidents where an AI system is involved in cybersecurity-relevant harm or risk, such as unauthorised access, hacking, containment failure, misuse of autonomous AI capabilities, or other AI-enabled cyber or system-security threats. Data were retrieved on 7 November 2026. Panel b: for the sake of this analysis, 392 incidents are identified as OECD AI incident records that have similar taxonomy labels to the Hugging Face incident. The action autonomy level include (i) no-action autonomy: the system cannot act and the human uses or disregards AI system's recommendations or output at will, (ii) low-action autonomy: the system can act if the human agrees, (iii) medium-action autonomy: the system can act unless the human vetoes, and (iv) high-action autonomy: the system acts without human involvement.***
*) "AIM: AI Incidents and Hazards Monitor", OECD, 2026.
**) See "Defining AI Incidents and Related Terms", *OECD Artificial Intelligence Papers*, No 16, OECD, 6 May 2024.
***) See "OECD Framework for the Classification of AI Systems", *OECD Digital Economy Papers*, No 323, OECD, February 2022.

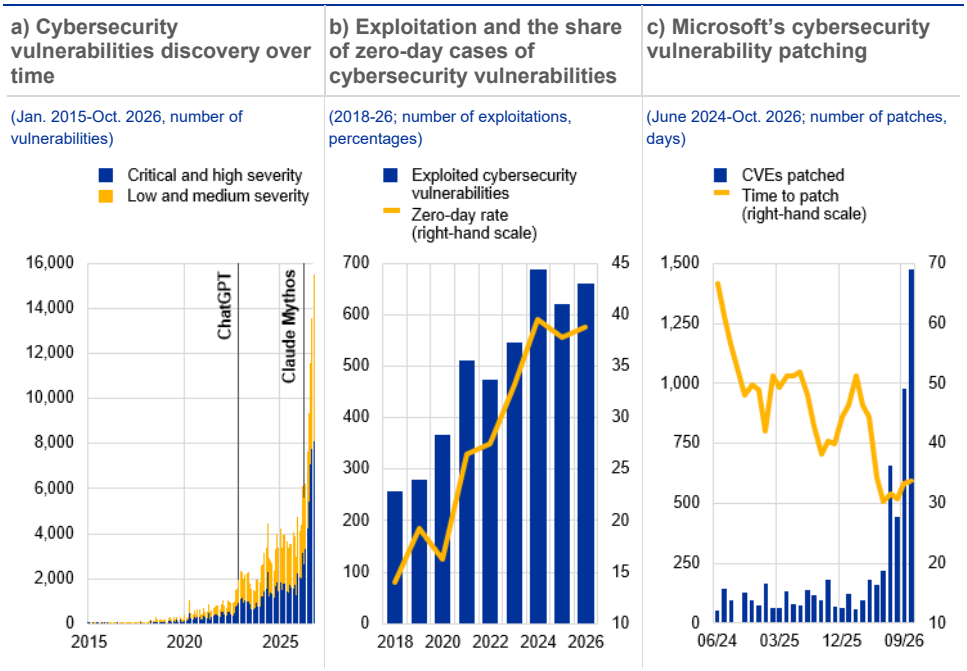
Improving capabilities, the race for increasingly powerful models and the rise of agentic AI are shaping cybersecurity dynamics for attackers and defenders alike. Rising cyber threats were a growing concern even before AI tools became widely accessible, and automated attacks, like self-propagating malware, are not fundamentally new. However, leveraging AI enables threat actors to significantly enhance the scale, speed and sophistication of attacks. Evidence from an AI lab and security researchers suggests that AI tools are being deployed across the entire attack chain, ranging from target selection (reconnaissance) and vulnerability identification (possibly involving social engineering) to exploiting vulnerabilities and navigating within the target system to achieve objectives.[148] Recent incidents involving financial institutions show that attackers can circumvent sophisticated security arrangements and reach systems that move or control assets by compromising trusted identities, manipulating authorised workflows or exploiting third-party dependencies without breaking cryptographic protections or exploiting underlying financial protocols. With agentic AI, such steps can be executed autonomously, with two key implications. First, barriers to entry have been reduced significantly. Attacks that once required extensive specialisation and domain-specific

[148] See, for example, Guru, K., Moix, A. and Klein, J., "Mapping AI-enabled cyber threats: Insights from the LLM ATT&CK Navigator", Anthropic, 3 June 2026.

knowledge of target systems are now feasible for less sophisticated attackers. Second, the speed and scale of attacks are limited more by the financial resources of the attackers and less by their human expertise. At the same time, defenders also benefit. From a preventive standpoint, AI tools can help to reveal vulnerabilities, create patches and improve penetration testing. Also, AI tools can be integrated into defensive systems to ensure the activity monitoring and incident response that is increasingly needed to keep up with the speed of agentic attacks.

Chart B.4

As cybersecurity vulnerabilities are discovered at an increasing rate, both exploitation and patching are moving faster, indicating the dual-use nature of AI



Sources: CVE.org, National Institute of Standards and Technology, Cybersecurity & Infrastructure Security Agency, VulnCheck, Microsoft Security Response Center (MSRC) and ECB calculations.
Notes: Data extracted on 2 November 2026. Panel a: cybersecurity vulnerabilities are commonly referred to as common vulnerabilities and exposures (CVEs), forming part of an industry-standard dictionary and catalogue of publicly disclosed vulnerabilities. The vulnerability severity classification ranges from low, medium or high to critical. Panel b: zero-day exploitation is defined as a cybersecurity vulnerability exploitation occurring on the same day or before public CVE disclosure. The methodology is inspired by the Zero Day Clock; the discrepancy is due to differences in data coverage and timestamp availability. Panel c: "Time to patch" is defined as the time elapsed between the CVE reservation date and the corresponding patch release date for each patched CVE. The reservation date is when a unique CVE is assigned and used as a proxy for when the vulnerability is identified. The monthly median is presented as a three-month moving average.

Faster vulnerability discovery enables both faster exploitation and quicker patching, highlighting the dual-use nature of AI tools. The number of publicly disclosed vulnerabilities has surged with the widespread availability of AI models, with a notable spike following the release of highly cyber-capable models to trusted partners in 2026 (**Chart B.4**, panel a).[149] Close to half of these vulnerabilities are classified as critical or highly severe. The growing volume of new vulnerability disclosures means it is not feasible to conduct a comprehensive human review of all submissions. This has led to governance challenges and a higher risk of false

[149] See, for example, "Project Glasswing: Securing critical software for the AI era", Anthropic, April 2026.

positives in vulnerability databases.[150] While vulnerabilities are systematically documented, data on confirmed exploits remain scarce, likely due to a large grey area of undiscovered or undisclosed cyberattacks. Available data show a rising share of *zero-day* cases over the past few years, where vulnerabilities are exploited before or on the day of disclosure (**Chart B.4**, panel b). While this share has stabilised recently, it points to a narrowing time window between discovery and potential exploitation. Meanwhile, major software providers have released a record number of patches in significantly shorter time frames thanks to highly cyber-capable AI models (**Chart B.4**, panel c). Software firms are also exploring AI-assisted formal verification to mathematically prove specific security properties of software, an approach historically constrained by the time and expertise required.[151] Operational challenges remain, however: not only must patches be developed, they must also be deployed by end users. Once a patch is released, attackers can reverse engineer the vulnerability and can actively target systems that have yet to apply it. In addition, the rushed development of patches could result in new vulnerabilities or instabilities. This implies there is less time to deploy patches, requiring organisations to balance the urgency of patching against the potential disruption of operations during patching and the limited time available to test patches prior to their deployment.

Defenders also need to mitigate the risks associated with AI usage within their organisations, including the expanded attack surface created by such usage. AI-related cyber incidents may arise due to AI agents being insufficiently supervised, being granted excessive privileges or performing actions not intended by their human operators. This issue, commonly referred to as (mis)alignment, could lead to illegal or unethical behaviour. AI usage also significantly increases the attack surface defenders need to address, as AI is vulnerable to new types of attacks (**Chart B.5**, panel a). For example, AI models can be instructed to perform malicious actions through prompt injections, which are difficult to intercept. In addition, concerns have recently emerged about potential backdoors in open-weight models, such as unprompted uploads of information on remote servers.[152] This could pose security risks even when such models are deployed on private infrastructure, particularly if granted access to tools and internal systems. At the same time, the supply chain supporting AI tools may expose organisations to further cybersecurity risks.

Improving guardrails for AI models is crucial but will only partly mitigate risks, as threat actors constantly seek ways to circumvent them. As organisations gain more experience of AI-related cyber incidents, both built-in guardrails and controls around AI agents will improve, enabling safer deployment in corporate environments.[153] Given the business-like ecosystem of cybercrime, however, specialised services are emerging that offer "jailbreaks" that circumvent the guardrails of legitimate AI models. While the guardrails of closed models may not always work as intended, open-weight models can be stripped of guardrails entirely,

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150 See, for example, Berger, A., "SQLite Critical CVEs or LLM Slop?", JFrog Security Research, 30 July 2026, and Ha, A., "Google froze its open source bug bounty program due to a 'significant rise' in AI submissions", TechCrunch, 4 October 2026.

151 See Lucas, K. et al., "LLMs are making formal software verification feasible at a much larger scale", Anthropic, 22 October 2026.

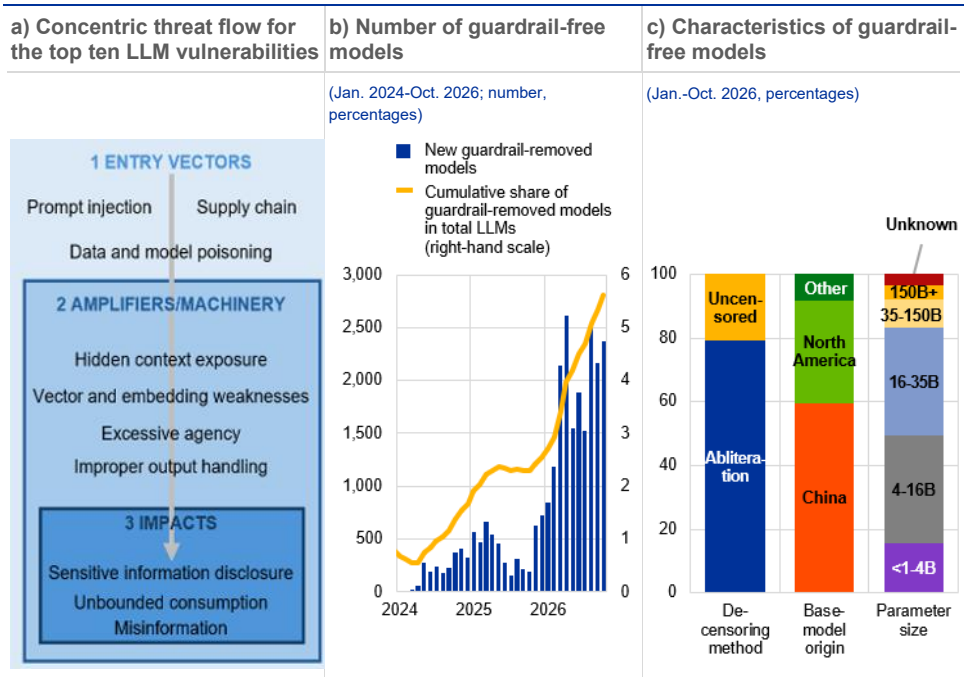
152 See "Concerning behavior from a popular open-weight AI model", Cohere, 26 October 2026.

153 See the cybersecurity section of "GPT-6 Astra: A new generation of intelligence", OpenAI, 2026.

which is done mostly through a process called “abliteration” (**Chart B.5**, panel b).[154] This can help defenders use AI models to find vulnerabilities but, due to the dual-use nature of the technology, it also enables offenders to exploit these vulnerabilities. Abliterated models are, to a large extent, built on Chinese models. Most of them are small enough to run on (high-end) consumer devices and thus can be run at low cost on attackers’ hardware, beyond the oversight of any provider (**Chart B.5**, panel c). In addition, commercial platforms are emerging that also offer access. As such, even if improved guardrails make jailbreaking more challenging, abliterated open-weight models will continue to fill the gap left by restricted systems.

Chart B.5

AI models are vulnerable to specific attack types and could be modified to bypass built-in guardrails designed to limit their use in offensive cyber operations



Sources: OWASP, Hugging Face and ECB calculations.
Notes: Panel a: adapted and simplified from OWASP*. Attack flows inwards, defence pushes outwards. Some vulnerabilities can sit in more than one layer. Panels b and c: analysis is based on models available on the Hugging Face software platform. LLM stands for large language model. Panel c: parameter size refers to the total number of trainable internal variables (weights and biases) inside a neural network, which serves as a metric for the model’s overall capacity, complexity and computational scale.
*) “OWASP GenAI LLM Top 10 2026”, OWASP GenAI Security Project, 3 August 2026.

Using AI tools for defensive purposes comes with a number of challenges and trade-offs which could further exacerbate the imbalance between attackers and defenders. First, the surge of new discoveries is forcing defenders to triage which vulnerabilities their patching efforts should focus on. This is reinforcing the dilemma faced by defenders: while attackers only need to exploit a *single* vulnerability, defenders must strive to fix *all* vulnerabilities. Second, using frontier models for system defence might be a problem. Such models could be too costly, both financially and in terms of latency.[155] While their advanced reasoning capabilities could help to reveal attempted intrusion or other unusual behaviour, they

[154] See “Cybercrime in the age of AI”, ThreatDown, 2026.

[155] Latency refers to the time it takes data to travel from one point to another or, put differently, the delay between request and response in an ICT system.

would likely introduce system slowdowns that would impede business operations. Organisations might also be reluctant to share security-relevant information with models hosted on external servers. Standard models pose the risk that guardrails designed to prevent them being used for cyberattacks could hinder legitimate defensive action, potentially leaving defenders vulnerable at critical moments.[156] Given all this, open-weight AI models that defenders can run and control on their own infrastructure are likely to be key to enhancing defensive capabilities. Third, the threat landscape requires defenders to use AI tools, yet these tools could be vulnerable to attack and require robust governance, which remains underdeveloped as AI adoption is still at a relatively early stage. These challenges are compounded by the fact that cyber defence is often bound by lengthy decision-making processes, guidelines or regulations, putting defenders at a structural disadvantage.

Even if defenders succeed in making systems significantly more secure, cyber risks will still persist. Essentially, there are two possible scenarios for how the AI-powered race between attackers and defenders might unfold. In one scenario, the current situation persists, with new AI models continually uncovering new vulnerabilities and exploits. In the other scenario, there is a convergence towards significantly safer systems as legacy vulnerabilities are progressively patched and adopting "security by design" principles during development leads to software becoming more and more impenetrable. Many AI labs are working to enable the latter scenario by granting trusted cybersecurity partners advanced access to their latest models, with cyber guardrails disabled. Even if these efforts succeed, however, cyber risks will persist as threat actors adapt. For example, attackers could use AI tools to amplify the scale, speed and effectiveness of social engineering attacks to gain system access via legitimate users. In addition, the geographical distribution of vulnerabilities could be impacted by geopolitical fragmentation and resulting access restrictions to AI models.

While cyber risks are not fundamentally new, advancements in AI come with two key risks. First, there is a tangible risk that cybersecurity teams and systems may become overwhelmed by the sheer volume of issues they have to address, leaving gaps that attackers could exploit. This risk is particularly acute during the transitional period, as AI-related risks continue to emerge and corresponding solutions and governance frameworks are still being developed. The challenge is compounded by the fact that defenders are not a homogeneous group but comprise security teams, software developers, open-source maintainers, researchers, consultants or IT staff within individual organisations. Second, AI has significantly altered the distribution of capabilities across threat actors. In the past, the most advanced and resourceful attackers were typically state or state-affiliated actors capable of executing high-impact attacks. However, these actors operate within the broader balance of power between nations, where national interests, geopolitical strategies and credible deterrence shape actions. Agentic AI now allows a wider range of threat actors to carry out high-impact attacks on a wider range of targets,

[156] During the incident, Hugging Face tried to understand what was happening in their systems, but as the guardrails of the US frontier models blocked their requests, Hugging Face turned to open Chinese models for help. See "Security incident disclosure – July 2026", Hugging Face, 16 July 2026.

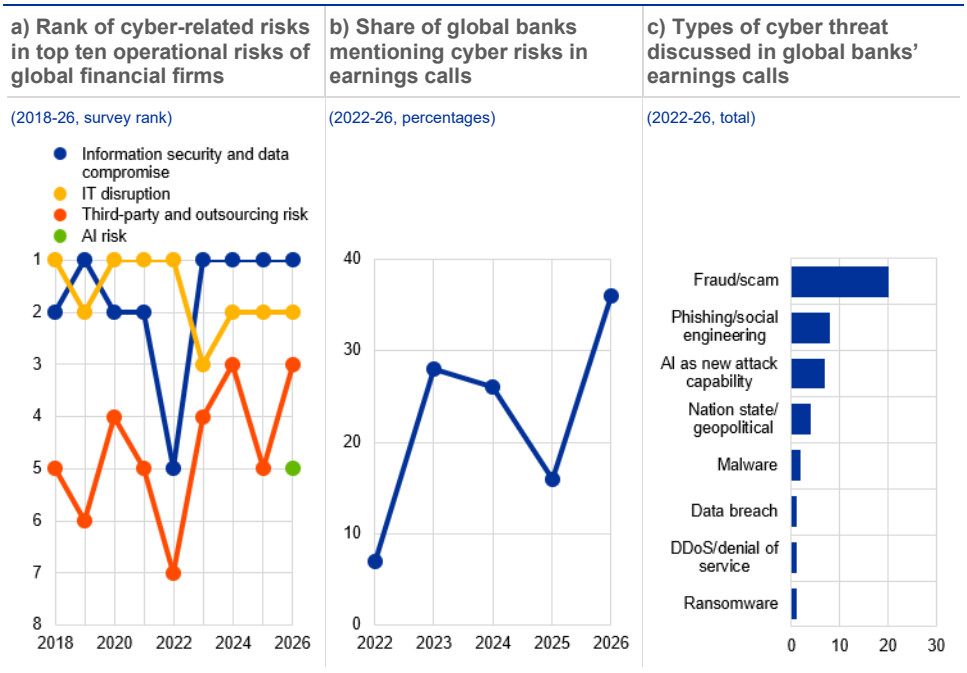
such as critical infrastructure. This elevates the risk of systemic disruption caused by "rogue" actors.

3 Implications for the euro area banking sector

Overall, banks are well aware of cyber risks and are increasingly acknowledging the additional challenges posed by AI. Compared with other industries, the financial sector demonstrates a relatively high level of maturity when it comes to cybersecurity.[157] In fact, survey results show that cyber-related operational risks have been a top priority for risk officers in the financial sector for many years now (**Chart B.6**, panel a). Although banks do not typically communicate extensively on cyber risks, more and more of them are addressing the topic in their earnings calls (**Chart B.6**, panel b). Some banks have explicitly highlighted the emerging risks associated with frontier AI models and emphasise that cybersecurity is a high-priority investment (**Chart B.6**, panel c). In addition to potential AI-enabled cyberattacks, banks face risks from their internal use of AI, including incidents arising from weak governance or issues with model alignment.

Chart B.6

Global banks are alert to cyber risks and are communicating more on the topic



Sources: Risk.net, earnings call transcripts and ECB calculations.
Notes: Panel a: data are based on a survey of financial firms identifying their ten most significant operational risk concerns for the year ahead. Panels b and c: analysis is based on the earnings call transcripts for 82 banks in the STOXX Global 1800 Banks Index.

Cyber incidents at euro area banks have not been systemic to date. There are only a few real-life examples of major cyber crises (such as the 2017 NotPetya attacks), and the euro area banking system has not experienced a systemic cyber

[157] See "Cyber Benchmark 2026: Progress slows as complexity rises", Wavestone, June 2026.

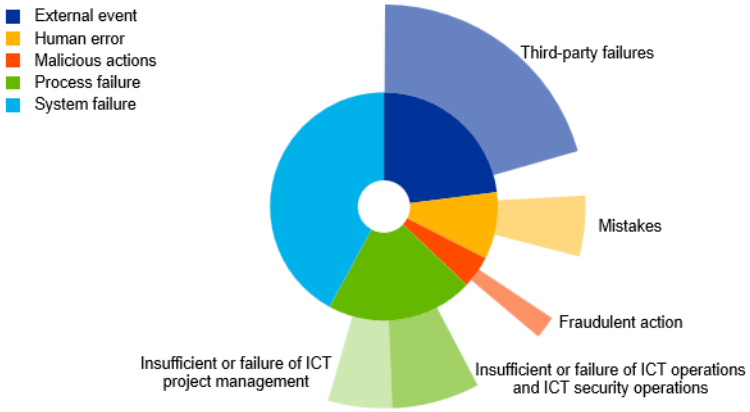
event to date.[158] Data collected under the EU's Digital Operational Resilience Act (DORA) show that malicious actions account for a relatively small share of major cyber incidents, with most incidents having limited impact (**Chart B.7**).[159]

Chart B.7

Major cyber incidents at euro area banks are rarely linked to malicious actions, while failures at third-party providers account for a significant share

Breakdown of high-level root causes triggering a major incident

(Q1 2025-Q3 2026, percentages)



Sources: ECB (DORA) and ECB calculations.

There are three key asymmetries that may make the euro area banking system vulnerable to the AI-enabled increase in cyber risks.[160] The first concerns countries with and countries without access to cutting-edge frontier models. This affects the euro area as a whole, as frontier AI models are predominantly developed outside the EU and EU entities have often faced restrictions in accessing the most capable models. This could hinder their ability to identify vulnerabilities within their systems and to respond effectively to cyberattacks. The second asymmetry is between attackers and defenders, with defenders currently at a structural disadvantage, as discussed above. This is a concern for organisations worldwide. The third asymmetry regards banks equipped with a sophisticated cybersecurity apparatus and those with more limited resources. This may be down to fixed cost and resource constraints and could pose a risk, as the weakest link in a network may affect the stability of the entire system. A survey conducted by the European Banking Authority showed that 56% of banks did not face a cyberattack in the first half of 2026 that either resulted or could have resulted in a major ICT incident, up from 49% in the previous half.[161] At the same time, 11% of banks saw 11 or more attacks, up from 7% previously. These results may be early indications of a bifurcation dynamic starting to play out between different sets of banks. All these asymmetries create

[158] NotPetya was a malware attack in 2017, mostly targeted at Ukraine, but with other victims worldwide. It is believed to be the largest cyberattack in history, causing damage estimated at USD 10 billion.

[159] See "2025 Report on major ICT-related incidents", European Supervisory Authorities, 3 June 2026.

[160] See "Warning on systemic cyber risks stemming from frontier AI models", European Systemic Risk Board, 7 July 2026.

[161] See "Risk Assessment Report of the European Banking Authority", European Banking Authority, June 2026.

structural cybersecurity disadvantages for euro area banks whose relative financial strength, at the same time, may make them attractive targets for cyber criminals.

Heavy reliance on third-party service providers could serve as a mitigating factor but it also poses additional risks with possible systemic implications. Euro area banks rely heavily on third-party service providers, particularly for their ICT systems. These dependencies are highly concentrated among a small number of large providers from outside the EU. On the one hand, outsourcing to such providers can enhance resilience, as they often have privileged access to highly cyber-capable frontier models and possess the expertise to make them work. These large providers are therefore well positioned to safeguard both their own systems and those of their clients. On the other hand, they face the same cybersecurity challenges posed by frontier models as everybody else, thereby increasing the attack surface for banks that rely on them. Strong concentration among third-party providers could create single points of failure and reduce substitutability as a mitigating measure. Thus, a cyber incident at a third-party provider could simultaneously affect large parts of the euro area banking system. Currently, around one-fifth of cyber incidents affecting euro area banks originate from third-party providers (**Chart B.7**). Also, outsourcing to non-EU providers creates critical dependencies that could expose euro area banks to risks emerging from geoeconomic fragmentation. Just as certain frontier AI models have been placed under export controls, in an extreme scenario similar restrictions could be applied to other software or services, potentially causing significant disruptions if they form a critical part of ICT systems and cannot be replaced quickly. This risk could be reinforced by lock-in effects if these providers are offering the most cyber-secure solutions due to their privileged access to frontier models. However, given the high costs such restrictions would inflict on affected software and service providers, this scenario is not especially likely in current circumstances.

AI not only increases cyber risk directly but may also amplify the mechanisms that could escalate a cyber incident into a systemic event. As mentioned above, agentic AI has the potential to significantly increase the sophistication, scale and speed of cyberattacks. This capability makes it possible for attackers to target a larger number of financial institutions simultaneously with fewer resources, thereby increasing the likelihood of systemic disruptions. Also, AI could enhance or specifically exploit amplification channels. A cyberattack might, for example, be paired with a targeted misinformation campaign on social media (automated and scaled using AI) to amplify the attack's impact by undermining customer or counterparty confidence. Moreover, growing AI-automation within financial institutions could further result in operational vulnerabilities, as certain processes could become harder to perform manually should an incident affect AI's ability to execute. Similarly, AI adoption could alter the network of financial interlinkages or the speed of market interactions, potentially increasing the speed or scope of contagion via direct exposures or financial interlinkages. Whether AI enhances amplification or, instead, increases reaction agility will depend on the nature of a cyber incident.

4 Conclusions

Rapid advances in the cyber capabilities of AI models are contributing to heightened cyber risks. These risks stem from the deployment of agentic attacks, an expanded attack surface and the potential for AI agents to act in ways not intended by their operators. While defenders also benefit from AI tools, they may face a structural disadvantage, at least in the short term. Looking ahead, two key risks stand out. First, in the near to medium term, the pace of AI-powered advancements in cyber capabilities could outstrip the ability of organisations to adapt, with the risk of defences becoming overwhelmed. Second, as AI models continue to evolve, the capabilities of different threat actors converge towards higher levels of sophistication, increasing the probability of more severe impacts. These risks are further exacerbated by geopolitical imbalances and competition over who should develop capable AI models, who should gain access to them and who should set the governance standards for their use. In particular, geoeconomically motivated restrictions to or the withdrawal of access to the most capable AI models or related critical ICT services could result in significant operational challenges.

Effective cyber risk mitigation requires coordinated efforts and decisive action. As AI proliferates and the risk of agentic cyberattacks increases, swift action is essential to prevent (or at least mitigate) the emergence of systemic cyber risks to euro area financial stability. Where not done already, adapting cyber defences at the level of individual firms is clearly crucial. This could include adopting principles of defence in depths and assumed compromise, heightened monitoring of any traffic with AI models and promoting awareness and a speak-up culture to build resilience to social engineering. However, addressing these challenges only at the level of individual institutions would fall short of achieving this objective. Instead, a coordinated effort is needed between banks, AI developers, software and ICT providers, cybersecurity firms, open-source maintainers, and national and international authorities. This entails enhancing operational and cyber resilience at the firm level, as well as collective contingency planning and corresponding frequent testing of established contingency mechanisms. Cyber mapping could help to identify common exposures and single points of failure in ICT supply chains. Raising societal awareness and preparedness (e.g. holding sufficient cash) is equally important to strengthen resilience more broadly. In this regard, EU policy initiatives like the AI Act and DORA already play an important role in addressing AI-related risks as well as third-party dependencies and concentration risks. Besides ensuring the effective implementation of existing frameworks, authorities need to continue their efforts on strengthening coordination between stakeholders and further developing European crisis management structures. The continuous evaluation of emerging gaps in both crisis prevention and management frameworks will be the key to retaining agility and keeping pace with technological developments.

C Financial stability risks from large IPOs, equity issuance and passive investing

Daniel Dieckelmann, Lavinia Franco, Paraic O'Gorman and Chiara Scommegna[162]

A new wave of equity issuance, concentrated in AI-related sectors, has brought public equity financing back to the forefront of capital markets. SpaceX's record initial public offering (IPO) has led the way, with OpenAI and Anthropic planning to follow. This special feature assesses the financial stability implications of large IPOs and equity issuance in general, as well as how these interact with the trend towards passive investing. Primary equity financing supports financial stability by absorbing losses and limiting leverage at the firm level, but aggregate equity issuance is highly cyclical and strongly influenced by investor sentiment. Issuance peaks have historically been associated with late-cycle exuberance and weaker future returns, while equity funding tends to dry up in downturns when the ability to recapitalise matters most. The rise of passive investing is increasing the relatively inelastic demand for equities, leading to larger equity offerings and making equity financing conditions more dependent on investor flows. Although these developments do not currently constitute a systemic financial stability risk, they could amplify market cyclicality and the sensitivity of equity financing to changes in sentiment.

1 The current equity issuance landscape

With the AI investment boom, initial public offerings (IPOs) and equity issuance in general are once again taking centre stage in equity markets. US IPO volumes have climbed back towards levels last seen during the dotcom bubble.[163] These volumes are concentrated in a small number of listings by firms in AI-related sectors. Of these the largest – SpaceX (which has already taken place), Anthropic (anticipated in November 2026) and OpenAI (expected during 2027) – each rank among the biggest (expected) IPOs on record (**Chart C.1**, panel a).[164] Market analysts project US IPO proceeds of around USD 225 billion for 2026, up from roughly USD 44 billion in 2025.[165] Seasoned equity offerings (SEOs) in the United States are also running at historic highs. The euro area has seen no equivalent surge in IPOs, likely reflecting its smaller AI exposure.

Public equity markets are once again becoming a viable source of external funding after a long period of shrinking supply of public equity. After decades of widespread share buybacks in the United States financed from strong corporate cash flows, net public equity issuance is likely to turn positive this year (**Chart C.1**, panel b). High equity valuations and higher long-term interest rates have created an

[162] This special feature has greatly benefited from data support provided by Fabian Wagner.

[163] For changes in IPO volumes over time, see Chart C.3, panel a.

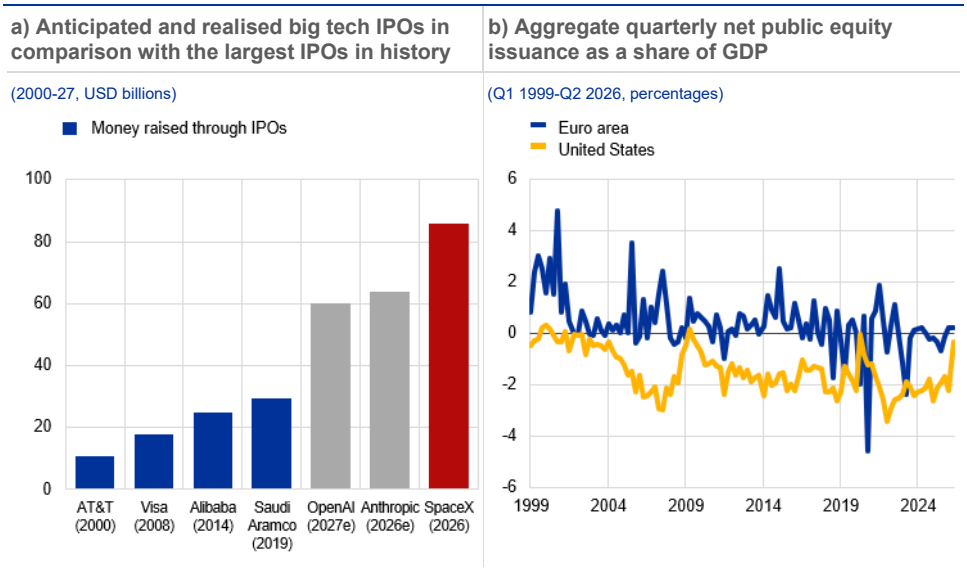
[164] This analysis reflects information available up to 10 November 2026, including Anthropic's amended registration statement filed with the SEC on that date. At the time of writing the Anthropic IPO had not yet occurred, and Anthropic's shares had not yet begun trading.

[165] See "IPO surge: a red flag for markets?", *Top of Mind*, Goldman Sachs Global Investment Research, Issue 150, July 2026. A November estimate by ECB staff puts the number at USD 212 billion.

environment in which firms are now finding that equity financing is once again relatively cheap compared with the alternatives. Additionally, the rise in passive investing over the past 20 years has created stable, predictable and potentially inelastic demand for equities worldwide.[166] In the euro area, by contrast, net public equity financing has historically been positive, as European firms have a lower propensity to return capital to shareholders via share buybacks.

Chart C.1

A wave of large AI-related IPOs is expected to cause net public equity issuance to turn positive this year in the United States after decades of mainly net buybacks



Sources: Federal Reserve System, Eurostat and ECB (QSA), LSEG and ECB calculations.
Notes: Panel a: "e" stands for estimated. Figures for OpenAI* and Anthropic** are expected proceeds as reported by Reuters.
*) Wang, E., Cai, K., Seetharaman, D. and Hu, K., "OpenAI lays groundwork for juggernaut IPO at up to $1 trillion valuation", Reuters, 29 October 2025
**) Wang, E., Saini, M. and Basil, A.K., "Anthropic eyes $1.4 trillion IPO valuation in test of Wall Street's AI fervor", Reuters, 10 November 2026.

Public equity markets provide financing in two ways: IPOs and SEOs. An IPO involves the initial sale of company shares to the public. Such offerings are typically underwritten by investment banks and marketed to institutional – and to a lesser extent retail – investors and tend to inject large amounts of cash into a firm. SEOs, on the other hand, involve any additional issuance of shares by a company whose shares are already traded in public markets.[167] IPOs are currently providing frontier AI companies with new funds after many years of them securing funding through private channels. At the same time, established tech firms are using primary SEOs to complement their debt and cash flow financing of AI infrastructure investments.[168]

166 See Dieckelmann, D., Siciliano, E. and Sowiński, A., "Passive investing and its impact on return co-movement, market concentration and liquidity in euro area equity markets", *Financial Stability Review*, ECB, November 2024.

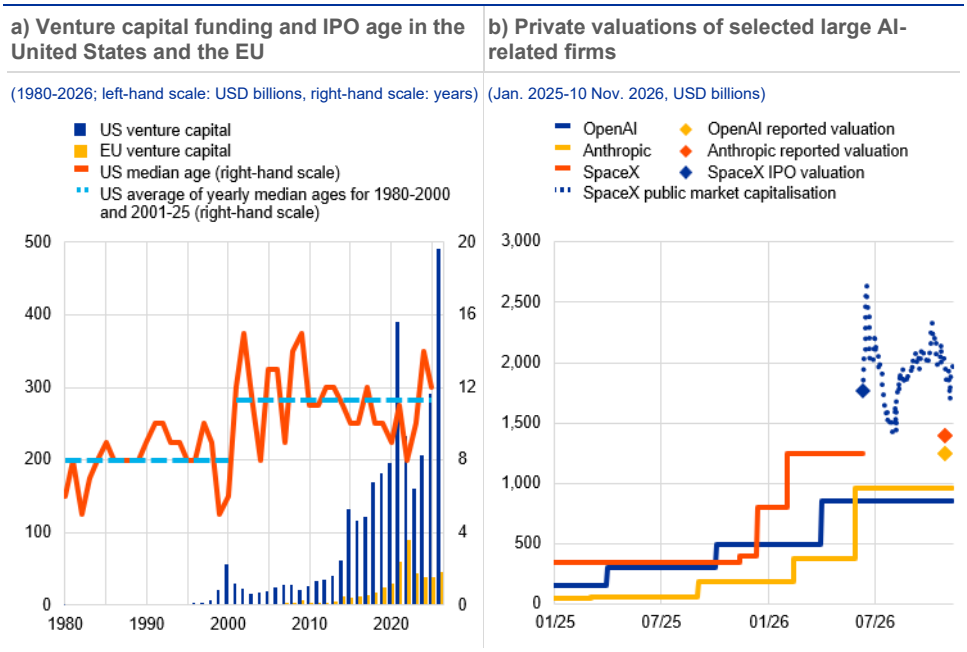
167 IPOs and SEOs can have both a primary and a secondary portion. The shares issued in primary offerings increase the number of outstanding shares of the company, diluting existing ownership. The cash proceeds go to the firm and increase its capital. By contrast, the shares issued in secondary offerings belong to existing shareholders, such as venture capital investors, and the proceeds are paid to the selling shareholders. SEOs are sometimes also referred to less accurately as secondary offerings. Unless otherwise stated, this special feature refers to both primary and secondary offerings.

168 See Duquerroy, A., Furtuna, O., Rahmouni-Rousseau, I. and Vaz Cruz, L., "Big tech, big debt: when US tech giants tap the euro area bond market", *The ECB Blog*, ECB, 31 August 2026.

Firms today are far less reliant on public markets to fund their growth and may prefer to stay private for longer. The expansion of venture capital and other forms of private financing, particularly in the United States, has allowed companies to forgo a public listing and raise substantial volumes of capital while remaining private for longer. As a result, the average age of US firms at IPO has risen from around eight years before 2000 to over 11 (**Chart C.2**, panel a). Based on successive private funding rounds, OpenAI, Anthropic and SpaceX have been valued at USD 852 billion, USD 965 billion and USD 1.25 trillion respectively (**Chart C.2**, panel b). With valuations being undertaken less frequently in private markets and under less public scrutiny, pricing these firms accurately is a challenge. Also, staying private could shield firms from pressure to improve short-term performance as disclosed in quarterly reports. It could instead enable a focus on long-horizon investments, but at the cost of the discipline imposed by a public listing. Market capitalisations of OpenAI and Anthropic are expected to surpass their latest private valuations after their respective IPOs, as happened with SpaceX.

Chart C.2

Firms have been staying private for longer since the dotcom bubble burst, exploiting ample funding available in private markets and increasing the size of public offerings



Sources: PitchBook, The IPO Initiative (University of Florida), Reuters, Bloomberg Finance L.P. and ECB calculations.
Notes: The cited data has not been reviewed by PitchBook analysts and may be inconsistent with PitchBook methodology. Panel a: median IPO age as calculated by Ritter*. Panel b: private valuations of SpaceX, OpenAI and Anthropic are based on the price at which they raised equity capital during funding rounds. Dotted line shows market capitalisation post-IPO, based on publicly traded stock price. OpenAI and Anthropic reported valuations are taken from Reuters** and ***.
*) Ritter, J.R., "Initial Public Offerings: Median Age of IPOs Through 2025", University of Florida, 31 December 2025.
**) Hu, K., "OpenAI secures $11 billion funding at $1.25 trillion valuation, Bloomberg News reports", Reuters, 6 November 2026.
***) Wang, E., Saini, M. and Basil, A.K.," Anthropic eyes $1.4 trillion IPO valuation in test of Wall Street's AI fervor ", Reuters, 10 November 2026.

Private investors often realise their investments through IPOs, while the risks accumulated privately are passed on to public markets. Not all IPOs are primary offerings that result in an increase in the equity of the issuing firm. In secondary

offerings, IPOs are used by insiders to sell their stake.[169] By providing a mechanism for private investors to realise their gains, IPOs in public markets foster the private equity investment that finances innovative firms.[170] The size of the IPOs seen to date in 2026 has led to fears that the current wave of equity issuance is driven less by a need for capital than by informed insiders seeking to de-risk while conditions are still favourable.[171] Since private markets are typically accessible to institutional investors with long investment horizons, a large IPO can transfer unquantified risk onto less informed investors, including retail and price-insensitive passive investors.

From a financial stability perspective, primary equity issuance has significant benefits over debt as a source of external funding. Unlike debt, equity carries no fixed repayment schedule and has no maturity. Thus, it does not generate rollover risk, nor does it trigger defaults. Financial crises are often caused by excessive leverage, and a large debt overhang can turn asset-price corrections into systemic events. By contrast, equity acts as a cushion by absorbing losses, spreading the risk across many shareholders rather than concentrating it in leveraged intermediaries. It should be noted, however, that primary equity issuance dilutes existing shares. It can trigger an adverse market reaction and can be perceived as a sign of financial trouble which comes with a stigma, potentially deterring firms from raising equity.[172] Two financial stability risks associated with equity issuance are examined below: (i) the cyclicality of equity issuance and its links to investor sentiment, and (ii) its growing reliance on demand for equities from passive investment.

2 The cyclicality of equity issuance and investor sentiment

Equity issuance, whether through IPOs or SEOs, is generally cyclical, with high issuance activity often following periods of strong equity market performance. This pattern is most visible for primary IPOs. Firms tend to enter public markets in waves when financing conditions are favourable, while volumes fall sharply when valuations, liquidity or investor demand deteriorate (**Chart C.3**, panel a). SEOs follow a similar pattern, with more firms issuing equity when net inflows into equity funds are high and particularly when such inflows come from retail

169 For reference, between 2023 and 2026 the share of primary offerings in IPOs was 76%.

170 This is one reason why Europe's private funding market is far thinner than that of the United States: it lacks the deep public markets needed to realise these investments.

171 See, for example, Parik, T., "Why IPO mania could signal top of the market", *The Financial Times*, 24 May 2026.

172 For example, Alphabet's share price fell by 4% overnight after it announced the sale of shares worth USD 80 billion on 1 June 2026. This was Alphabet's first equity issuance since its 2004 IPO. For negative market reaction to equity issuance announcements, see Veld, C., Verwijmeren, P. and Zabolotnyuk, Y., "Wealth Effects of Seasoned Equity Offerings: A Meta-Analysis", *International Review of Finance,* Vol. 20, Issue 1, 2020, pp. 77-131. For evidence that firms often issue equity when facing cash shortfalls, see DeAngelo, H., DeAngelo, L. and Stulz, R.M., "Seasoned equity offerings, market timing, and the corporate lifecycle", *Journal of Financial Economics,* Vol. 95, Issue 3, 2010, pp. 275-295.

investors.[173] In addition, high stock returns trigger issuance primarily when accompanied by strong institutional demand.[174]

The cyclicality of equity issuance reflects an interaction between real financing needs, market conditions and investor sentiment. Sentiment-driven changes in valuations and investor demand create windows of opportunity during which firms are more likely to issue equity. At the same time, elevated sentiment creates opportunities for existing shareholders to sell their stakes through secondary offerings. When sentiment is elevated, investors are more willing to finance young, high-growth and difficult-to-value firms. This increases the demand for IPOs, allowing firms to issue equity at more favourable valuations.[175] To exploit informational asymmetry, managers may try to time the market, issuing equity when they perceive their firm's stock to be overvalued compared with fundamentals best known to themselves.[176] Firms have a greater incentive to raise external capital when investment opportunities and expected profits are high and may also respond to reductions in the cost of equity. Beyond sentiment, and from a theoretical point of view, waves of IPOs can also arise rationally: declines in expected market returns or increases in expected aggregate profitability raise firms' valuations through lower discount rates or higher expected profits respectively, encouraging firms to go public. Additionally, an increase in uncertainty about future aggregate market conditions may incentivise many firms to go public at the same time, before conditions change, creating wave-like IPO patterns.[177] Incidentally, the cost of equity has recently fallen relative to the cost of credit, making equity financing comparatively attractive (**Chart C.3**, panel b).

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[173] See Chiu, H.H. and Kini, O., "Equity Issuances, Equity Mutual Fund Flows, and Noise Trader Sentiment", *Review of Finance,* Vol. 18, Issue 2, 2014, pp. 749-802.

[174] See Altı, A. and Sulaeman, J., "When do high stock returns trigger equity issues?", *Journal of Financial Economics,* Vol. 103, Issue 1, 2012, pp. 61-87.

[175] Baker and Wurgler consequently identify IPO volume and the equity share of total corporate issuance as indicators of aggregate investor sentiment. See Baker, M. and Wurgler, J., "Investor Sentiment in the Stock Market", *Journal of Economic Perspectives,* Vol. 21, No 2, 2007, pp. 129-151.

[176] See Dittmar, A., Duchin, R. and Zhang, S., "The timing and consequences of seasoned equity offerings: A regression discontinuity approach", *Journal of Financial Economics,* Vol. 138, Issue 1, pp. 254-276.

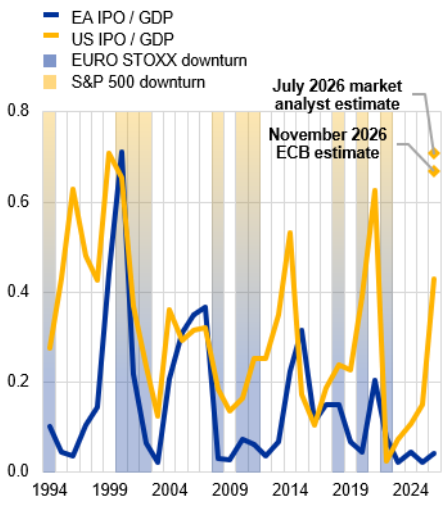
[177] On a rational theory of IPO waves, see Pástor, Ľ. and Veronesi, P., "Rational IPO Waves", *The Journal of Finance,* Vol. 60, No 4, 2005, pp. 1713-1757. What fundamentally causes the changes in expected market returns, profitability or uncertainty to which firms react rationally is not explicitly assumed. Instead, the three dimensions of market conditions are modelled as exogenous stochastic processes.

Chart C.3

Aggregate IPO volume is highly cyclical, reflecting investor sentiment, while equity has become cheaper relative to credit

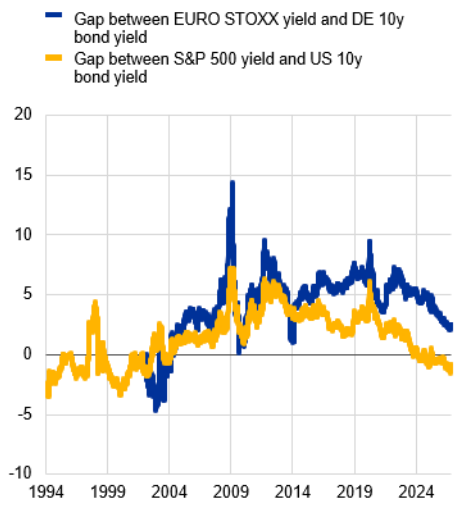
a) Aggregate IPO volume as a share of GDP, and stock market downturns

(1994-2026, percentages)



b) Cost of equity versus cost of credit in the euro area and the United States

(1 Jan. 1994-10 Nov. 2026, percentage points)



Sources: Dealogic, a service of ION Analytics, Bloomberg Finance L.P., World Bank, Federal Reserve Bank of St. Louis and ECB calculations.
Notes: Panel a: acquisition/restructuring vehicles, finance-capital pool companies and finance-special-purpose vehicles are excluded. Shaded areas indicate years with negative market returns. IPO data are aggregated annually and divided by respective annual GDP. EA stands for euro area. The market analyst estimate for US IPO volume was calculated by Goldman Sachs* in July 2026. The ECB estimate for US IPO volume was calculated in early November 2026 by (i) summing actual US IPO value from January to October 2026; (ii) forecasting November-December IPO value by adding the ten-year average share of annual IPO value falling in those two months to the January-October total; and (iii) adding Anthropic's estimated IPO volume, as per Chart C.1, panel a. 2026 GDP is based on GDP figures as at Q2 2026. Panel b: for EURO STOXX and the S&P 500, "yield" refers to the earnings yield which is defined as the ratio of aggregate earnings per share to the current index price, expressed as a percentage.
*) "IPO surge: a red flag for markets?", *Top of Mind*, Issue 150, Goldman Sachs Global Investment Research, July 2026.

Peaks in IPO volumes can be a sign of late-cycle exuberance and tend to be followed by weaker equity returns. Late-cycle exuberance can be reflected in firms raising new capital through primary offerings or insiders selling their stakes via secondary offerings. Periods of high IPO volumes have historically been associated with weaker future market returns (**Chart C.4**, panel a). When sentiment is elevated, investors engage in riskier behaviour, such as investing in young companies, but as sentiment reverses, investors pull back on these risky investments and valuations correct.[178] A relationship between equity issuance and stock performance also exists at the firm level: IPOs generally outperform the market in the short run (**Chart C.4**, panel b). Firms supported by positive investor sentiment can issue more equity at more favourable terms than firms generating less investor enthusiasm. In the long run, however, small IPOs approximately match the market return while potentially sentiment-driven large IPOs underperform. This indicates that, over time and as the initial enthusiasm fades, markets tend to value firms more realistically, reversing the initial outperformance of inflated IPOs.

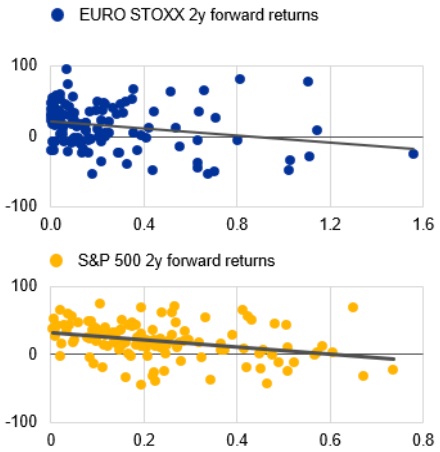
[178] Weaker returns following IPO waves can also have a rational explanation: lower discount rates can raise firm valuations and encourage IPOs en masse but also lead to lower market returns in the future.

Chart C.4

The size of IPOs is negatively correlated with future equity performance in aggregate, while at the firm level large IPOs underperform the market in the long run

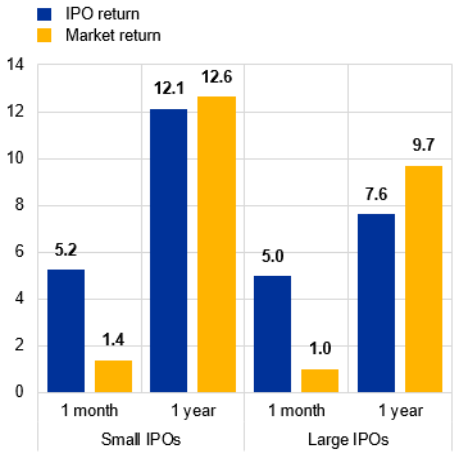
a) Aggregate IPO volume as a share of GDP against two-year forward market returns

(Q1 1995-Q3 2026, x-axis: IPO volume as a percentage of GDP, y-axis: two-year forward percentage returns)



b) Firms' median IPO performance after one month and after one year, compared with market returns and depending on the size of the IPO

(Jan. 1995-July 2026, percentages)



Sources: Dealogic, a service of ION Analytics, Bloomberg Finance L.P., World Bank and ECB calculations.
Notes: Panel a: IPO value is aggregated quarterly, based on companies' nationalities and adjusted by GDP. Forward market returns are calculated using end-of-quarter prices. US regression equation is y = -0.5231x + 0.3251 and R2 is 0.105. Euro area regression equation is y = -0.2517x + 0.2105 and R2 is 0.053. Panel b: the chart shows median returns for a sample of all stocks included in the past or present in the EURO STOXX 300 and S&P 500 between 1995 and 2026. IPO returns are weighted by issuance volume and market returns by market capitalisation. All primary, secondary and mixed IPO offerings are included. The observed long-term underperformance is even more pronounced for secondary offerings. Large IPOs have a size of at least €1 billion.

The current peak in equity issuance may be a harbinger of lower returns in the future while its procyclicality means that equity funding could dry up when it is most needed. Two financial stability implications arise from the cyclical nature of equity issuance. First, the current peak in issuance activity may be a signal of exuberance in the stock market and may be predictive of lower returns in the future, with implications for the ability of the stock market to fund the real economy effectively. Second, and linked to the real economy, the procyclical nature of equity issuance implies that it could dry up during an economic downturn at exactly the moment when sentiment is low but the ability of firms to recapitalise matters most. This is especially true in a correlated downturn, when credit financing conditions tighten significantly at the same time.

3 Passive investing and the inelastic demand for stocks

The increasing role of passive investing may also have implications for the supply of equity and the dynamics of equity issuance. A growing body of literature finds that the rise of passive investing appears to have caused demand for individual stocks to become more price inelastic, as index-tracking investors have

limited discretion over the quantities of individual stocks they hold.[179] For primary equity issuance, this means that when passive ownership is at high levels, firms can issue additional shares yet incur a smaller impact on their share price. Consistent with this mechanism, recent evidence shows that firms respond to exogenous increases in index-fund demand by supplying additional shares.[180] This suggests that the rise of passive investing may make it easier for firms already – or soon to be – listed on stock indices to access equity markets and influence both the volume and the composition of their issuances.[181] This dynamic may also benefit secondary offerings, as passive investors help sustain demand for individual stocks, regardless of whether shares are newly issued or sold by existing shareholders.[182]

The growth of passive investing may make equity issuance more likely and may lead to larger volumes. While it is difficult to directly assess the impact of passive share ownership on IPOs, given that passive ownership is only observable after an IPO has taken place, this special feature examines its influence on SEOs and infers from the literature that the findings likely apply to IPOs as well.[183] The empirical analysis finds that the probability of a firm conducting an SEO increases if its passive ownership share increases (**Chart C.5**, panel a).[184] Also, a higher passive share is correlated with larger SEOs, after controlling for firm-specific characteristics that could otherwise influence the size of the equity issuance (**Chart C.5**, panel b). These findings suggest that firms exploit the price-insensitive demand of passive investors when issuing equity.[185] The existing literature suggests that passive demand may also affect primary equity markets. For example, IPOs that are expected to be included in indices shortly after listing achieve stronger returns and raise approximately 6% more capital than comparable IPOs.[186] Thus, passive

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179 See Haddad, V., Huebner, P. and Loualiche, E., "How Competitive Is the Stock Market? Theory, Evidence from Portfolios, and Implications for the Rise of Passive Investing", *American Economic Review,* Vol. 115, No 3, 2025, pp. 975-1018. The authors estimate that the rise in passive investing over the preceding two decades had made demand for individual stocks approximately 11% more inelastic.

180 See Sammon, M. and Shim, J.J., "Who Clears the Market When Passive Investors Trade?", *The Review of Financial Studies*, Vol. 13, Issue 10, 2026, pp. 3330-3377. The authors find that firms causally respond to exogenous passive demand and supply shares at a nearly one-for-one rate, predominantly through non-primary issuance.

181 Index providers add firms to indices based on published eligibility criteria, typically covering market capitalisation, free float, trading liquidity and, for some indices, sector or profitability. These criteria aim to ensure that an index is representative of the market it is tracking. Most providers also require a minimum trading period after listing, although in 2026 some shortened this for very large new listings.

182 Importantly, both primary and secondary offerings increase the free float of a company's shares, thus increasing the weight of the stock in indices based on free float market capitalisations. This, in turn, could increase future passive demand for the stock even further.

183 Using forward passive ownership would introduce endogeneity. To mitigate this, we use lagged passive ownership to assess SEO probability and size instead.

184 Similarly, increases in firms' ETF ownership are positively related to their propensity to conduct an SEO. See Evans, K.P., Leung, W.S., Li, J. and Mazouz, K., "ETF Ownership and Seasoned Equity Offerings", *Journal of Financial and Quantitative Analysis*, Vol. 59, Issue 4, 2024, pp. 1821-1848.

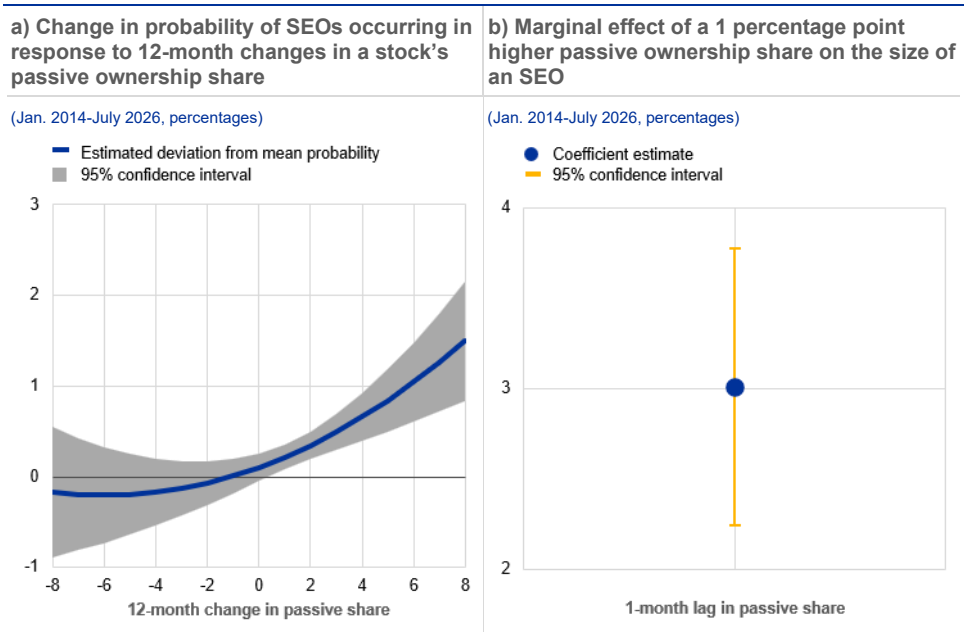
185 Our empirical results hold when we restrict our sample to primary and mixed offerings only. This is consistent from a theoretical point of view, as both primary and secondary SEOs generally increase the free float. Firms exploit the inelastic demand created by passive investing, which makes conducting SEOs more attractive, while secondary SEOs benefit existing shareholders.

186 See Murray, C. and Sammon, M., "Primary Capital Market Transactions and Index Funds", *The Review of Asset Pricing Studies*, Vol. 16, Issue 2, 2026, pp. 163-202. The authors investigate IPOs that are expected to be included in CRSP (now Morningstar) indices shortly after listing. On top of raising more capital, they also find that expected indexer demand drives fast-track IPOs to outperform their non-fast-track counterparts, with the advantage peaking at the index inclusion date and reverting within three weeks.

investing tends to make IPOs bigger in volume, more successful in the short run and less successful in the long run. With passive investing, equity funding is becoming more structurally flow dependent and less connected to fundamentals.

Chart C.5

The growth in passive investing and the associated increase in inelastic demand for stocks makes equity issuance more likely and larger in size



Sources: Dealogic, a service of ION Analytics, LSEG, Bloomberg Finance L.P. and ECB calculations.
Notes: Panel a: the analysis is based on a sample of 1,990 stocks that are or were constituents of the EURO STOXX (euro area) and S&P 500 (United States) over the period from January 1995 to July 2026. The regression analysis starts in January 2014, reflecting the availability of passive share information. The regression specification is based on Evans et al.* and is adapted as follows: $I(SEO_{i,t-11\to t}) = \alpha_t + \beta_1 \Delta Passive\ Share_{i,t-t_{12}} + \beta_2(\Delta Passive\ Share_{i,t-t_{12}})^2 + \beta_3 Controls_{i,t-12} + \varepsilon_{i,t}$, where i refers to the stock and t to the month. The dependent variable is a dummy variable that equals 1 in the month a firm performs a SEO and for the following 11 months, and 0 otherwise. Control variables at the stock (firm) level include the natural logarithm of total assets, the current ratio, the return on equity, the ratio of total debt to common equity and the 12-month stock return. Furthermore, we add year-month fixed effects to control for time-varying factors that are common across stocks and use robust standard errors. For ease of interpretation, the chart presents regression results after demeaning the dependent variable. Panel b: the analysis is based on the same sample of stocks as in panel a but only includes observations in which an SEO takes place. We estimate the following regression specification: $Log(SEO\ size_{i,t}) = \alpha_y + \beta_1 Passive\ Share_{i,t-1} + \beta_2 Controls_{i,t-1} + \varepsilon_{i,t}$. The dependent variable is the SEO size (in natural logarithm), while the main variable of interest is the one-month lagged value of passive share. *y* denotes the year. We employ the same set of control variables as those included in panel a. In addition, we include year fixed effects to account for common time-varying factors and use robust standard errors.
*) Evans K.P., Leung, W.S., Li, J. and Mazouz, K., "ETF Ownership and Seasoned Equity Offerings", *Journal of Financial and Quantitative Analysis*, Vol. 59, Issue 4, 2024, pp. 1821-1848.

Passive inflows have expanded the amount of equity funding available to firms, but this support may be asymmetric. Empirical analysis finds that a falling passive share is not associated with changes in issuance behaviour (**Chart C.5**, panel a).[187] Equity funding therefore expands as passive flows increase but does not contract when flows reverse. While firms supply shares when index funds buy, they do not buy back shares when index funds sell. Instead, the market is cleared by smaller institutions as well as by retail and foreign investors.[188] Whether the increase

[187] In our dataset, around 10% of observations are negative changes in passive share. Although this represents a small share of the sample, the size of the dataset (with its more than 100,000 observations) means that these changes are still relevant for the analysis. To assess robustness, separate regressions for sub-samples with positive and negative changes in passive share confirm the asymmetric effect.

[188] See Sammon, M. and Shim, J.J., "Who Clears the Market When Passive Investors Trade?", *The Review of Financial Studies*, Vol. 13, Issue 10, 2026, pp. 3330-3377.

in equity supply in 2026 can be absorbed depends, in part, on whether passive investors remain net buyers.

Recent changes to the criteria for inclusion on indices have raised questions about the role of passive investors in IPOs and other equity issuances. In early 2026 several index providers accelerated the entry of very large new listings onto headline benchmarks in view of the upcoming listings of SpaceX, Anthropic and OpenAI.[189] Firms may be incentivised to exploit this situation to obtain cheap funding. Demographic factors are creating continuing demand for passive saving vehicles, meaning that these dynamics are unlikely to change. While passive ownership in the euro area is still half that in the United States, investors are in any case exposed to these effects through their sizeable holdings of US equity.

4 Conclusion and policy considerations

Cyclical peaks in large IPOs and equity issuance in general are a symptom rather than a cause of financial stability risk, likely reflecting late-cycle exuberance. Peaks in equity issuance are associated with lower future returns, which could lead to negative wealth effects for euro area investors. They may also temporarily inhibit the stock market's ability to finance the real economy during a future correction, for example. The trend towards passive investing may increase the prevalence of equity issuance, as well as the sizes of IPOs and SEOs, by increasing inelastic demand for equities. Firms can exploit this price-insensitive demand, and the recent loosening of index inclusion rules has reinforced this dynamic. Price discovery may rest on a small pool of price-sensitive investors, which may make prices more volatile and less informative. IPOs inflated in both price and volume by passive investor demand may undermine consumer protection. This could occur because these price-insensitive investors bear the brunt of losses stemming from the market correcting prices towards the fair value of the company once price-sensitive investors take over.

Direct financial stability risks stemming from large IPOs and equity issuance are unlikely to be systemic. Even as a cyclical source of external funding, primary equity issuance is a stabilising form of finance. It carries no rollover risk, absorbs losses across a broad shareholder base and protects creditors' stakes, reducing the risk of corporate defaults and effectively lowering a firm's leverage ratio. A genuinely systemic episode would require a rapid build-up of debt financing, as the combination of leverage and mispricing has historically often been the cause of market corrections turning into crises. The last comparable IPO peak occurred during the dotcom bubble which, without a matching debt build-up, resulted in a sharp equity market correction but only a shallow recession. Recently, projected AI investment needs in the United States have started to push the financing mix towards debt. The direct but non-systemic financial stability risks arising from peaks

[189] The FTSE Russell and Nasdaq indices now allow large IPOs to enter within days, whereas the largest US index, the S&P 500, still requires firms to be listed for at least one year before entry. Nasdaq has also lowered its free-float requirement and now weights low-float entrants at up to three times their float.

in equity issuance and late-cycle exuberance could become acute if the expected productivity gains and earnings from AI investment fail to materialise. A change in investor sentiment could cause a sharp correction of highly valued asset prices, which would have wealth effects for the euro area, given the sizeable and concentrated exposures to US stock markets.[190]

The financial stability assessment of equity issuance strengthens the case for the EU's savings and investments union (SIU). Equity funding remains the most stabilising form of external financing, yet euro area firms' access to it is limited by fragmented capital markets and an underdeveloped venture capital ecosystem.[191] The SIU measures, including the savings and investment accounts recommendation and the pension package proposed by the European Commission, aim to deepen domestic equity demand, providing firms with an alternative to debt markets. Much of this demand would arrive through index-tracking products. For euro area firms, the growth of passive investment could then become an important source of funding, albeit one that may make equity financing more dependent on investor sentiment towards passive investing.

[190] Such wealth effects apply in the euro area mainly to wealthy households with low marginal propensity to consume, which likely limits the overall impact on aggregate consumer demand.

[191] See Anaya Longaric, P., Banu, E., Bellinghausen, L., Dumitrescu, A. and Gati, Z., "Closing the gap? Gauging the development and integration of Europe's capital markets", *Financial Integration and Structure in the Euro Area*, ECB, May 2026.

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