DEUTSCHE BUNDESBANK EUROSYSTEM

Financial Stability Review 2024

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Our task

Under the Financial Stability Act (*Finanzstabilitätsgesetz*), the Bundesbank has a mandate to monitor the stability of the German financial system. It is tasked with identifying and assessing risks to financial stability. The Bundesbank understands financial stability as a state in which the financial system is able to fulfil its economic functions at all times. The financial system comprises financial intermediaries, securities markets and market infrastructures. In its annual Financial Stability Review, the Bundesbank documents relevant developments and vulnerabilities in the German financial system and also highlights risks to its stability.

The functional viability of the financial system is of vital importance for the economy. The financial system is where credit is provided and savings are invested; it enables risks to be hedged and facilitates payments. Unforeseeable events can jeopardise the stability of the financial system. The financial system should neither cause nor excessively amplify a downturn in overall economic activity. For this reason, the financial system needs to be sufficiently resilient – that is, capable of cushioning unexpected, abrupt changes rather than amplifying them.

The focus is on systemic risks that could jeopardise the stability of the financial system. For instance, if one or more market participants were to encounter distress, this could endanger the functioning of the entire system. This may be the case if market participants are very large or closely interconnected with other actors. Interconnectedness may be a channel through which adverse developments are transmitted to the financial system as a whole, impairing its stability. In addition, systemic risks can arise if a large number of market participants are exposed to similar risks or risks that are closely correlated with one another.

The Bundesbank also contributes its analytical findings to the work of the German Financial Stability Committee, the central body for macroprudential oversight in Germany. It provides the Committee with its assessment of the general risk situation. If the Bundesbank identifies systemic risks, it can make proposals to the Committee for warnings and recommendations to counter these risks. Afterwards, it evaluates the extent to which the recommendations were implemented.

The Bundesbank brings analyses and perspectives to bear at the European and global levels as well. The Bank addresses its primary topics in European and global bodies such as the European Systemic Risk Board (ESRB) and the Financial Stability Board (FSB).

This Financial Stability Review takes account of developments up to 18 November 2024.

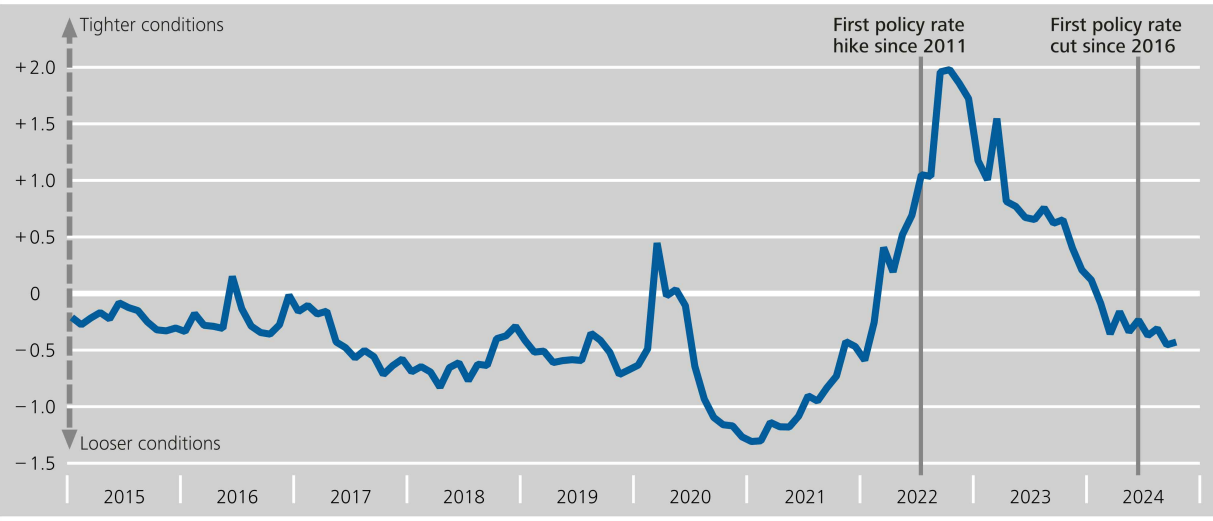
Key messages

The German financial system weathered the period of exceptionally strong interest rates increases well overall. The macro-financial environment gradually improved over the course of last year, but remains challenging in light of the economic environment and heightened geopolitical tensions, in particular.

Financing conditions

Against the background of lower inflation rates, interest rates have gradually fallen. Financing conditions have progressively improved in broad terms. Changes in the composite indicator of financial conditions reflect this development. The indicator decreased, having been significantly elevated as interest rates were rising.

Composite indicator of financial conditions



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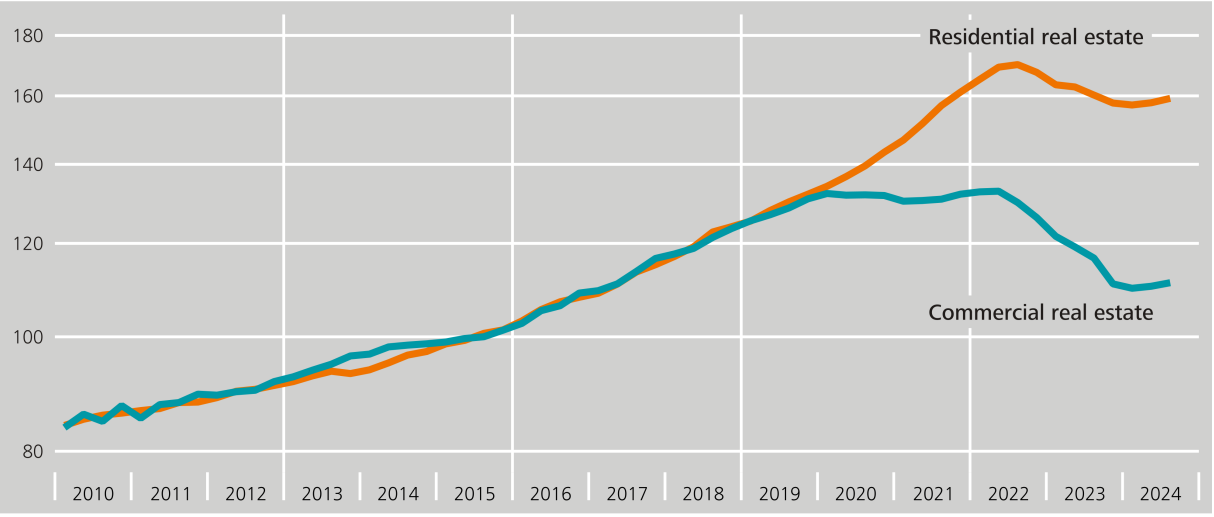
For more information, see Chart 4.1.1.

Asset prices

Residential real estate prices are stabilising and commercial real estate prices have not fallen any further. The risk of additional price drops for commercial real estate remains high, particularly in view of low transaction volumes. Looking at residential real estate, there is less of a chance that prices will fall again. Valuation levels in financial markets continued to rise, so the risk of market price corrections and the associated losses for financial intermediaries remains elevated.

Real estate prices in Germany

2015 = 100



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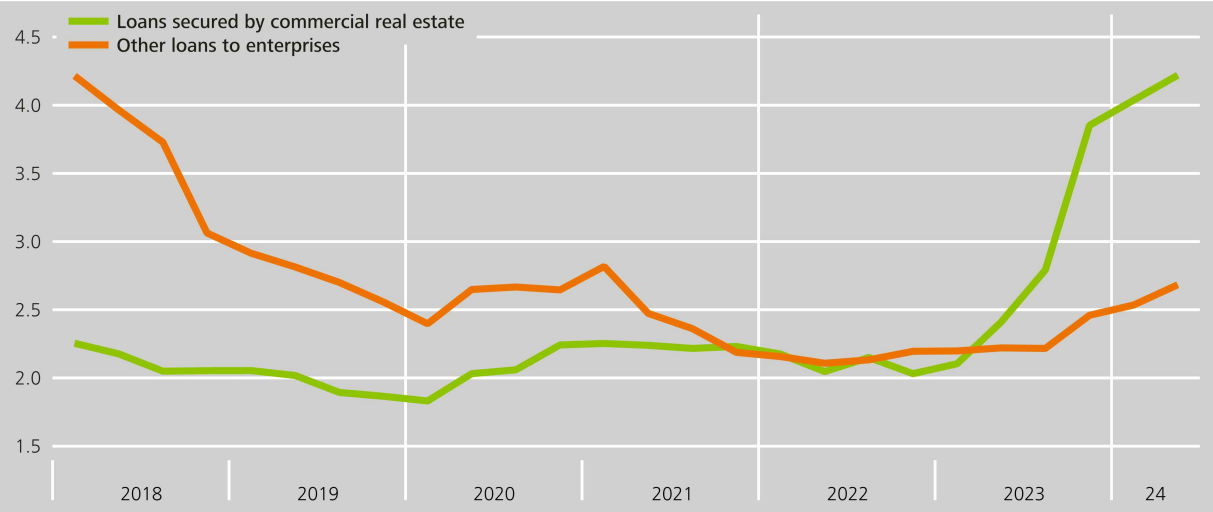
For more information, see Chart 4.1.6.

Commercial real estate

Risks from commercial real estate lending by banks remain high. One indicator of this is the high level of non-performing loans secured by commercial real estate. Risks from commercial real estate are concentrated amongst a small number of banks and insurers. So far, they remain manageable for the banking and insurance sector as a whole. Open-end retail real estate funds could amplify developments on the commercial real estate market; redemption notice periods and minimum holding periods are keeping prevailing risks in check.

Non-performing loans from German banks to non-financial corporations

As a percentage of the given credit volume



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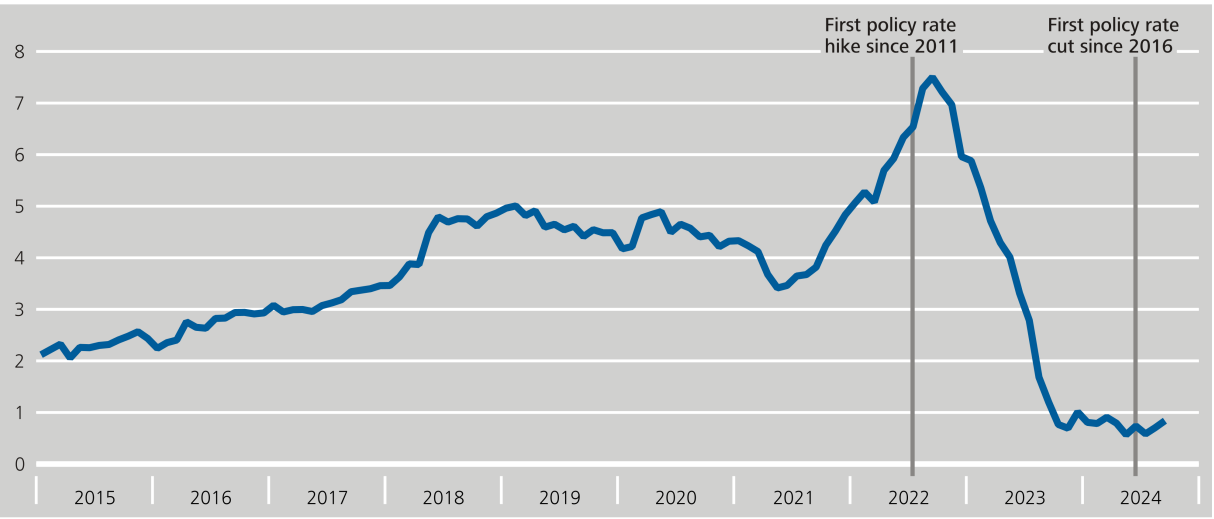
For more information, see Chart 4.2.8.

Loan growth

Having declined in the wake of rising interest rates, loan growth remains low, but it stabilised at a low level over the course of last year.

German banks' lending to the domestic private non-financial sector

Year-on-year percentage change



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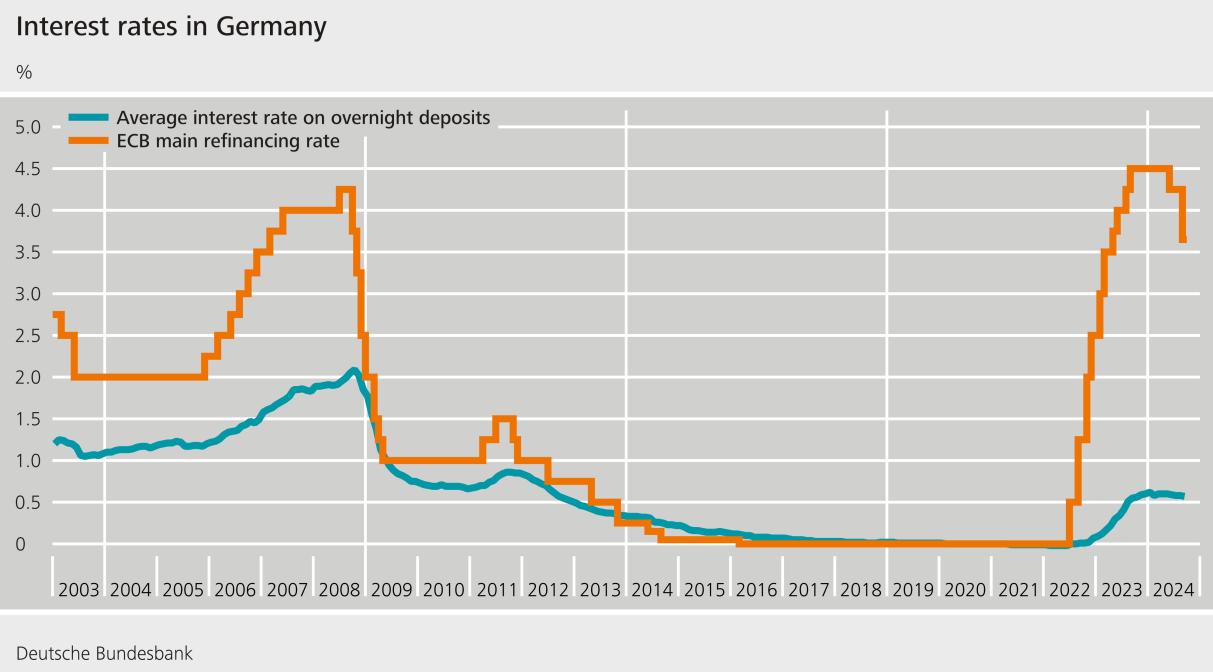
For more information, see Chart 4.1.4.

Funding costs of banks

Compared with periods of rising interest rates in the past, interest rates on overnight bank deposits rose far less significantly. This had a positive impact on banks' net interest income. Depositors shifting their holdings to deposit categories with higher remuneration, together with weak credit demand, could put pressure on net interest income in the future.

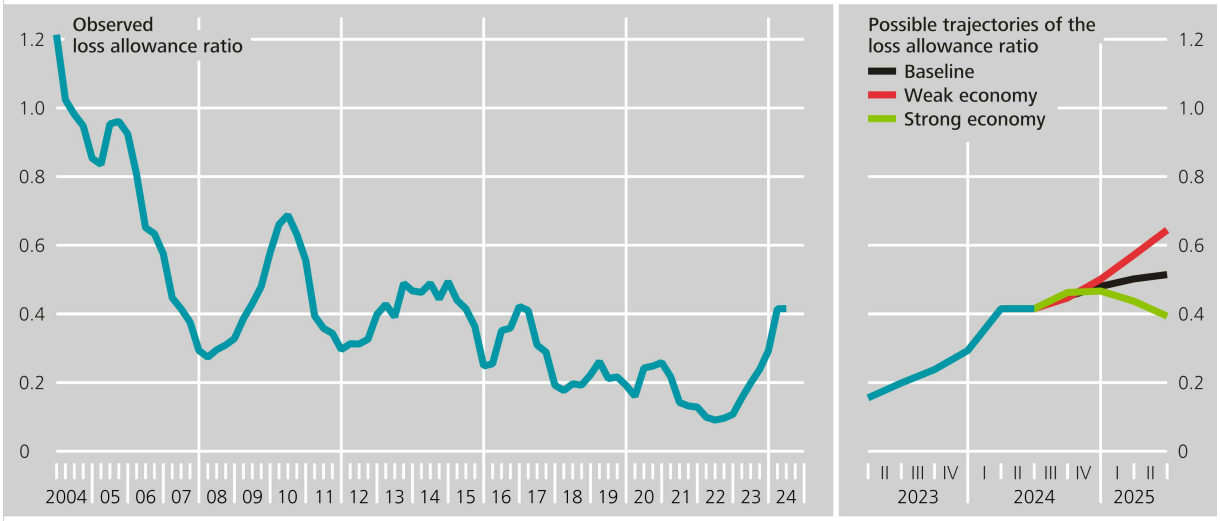


For more information, see Chart 4.2.3.

Risks in lending business

Banks' need to make loss allowances for loans has risen sharply overall, albeit from a very low level. As economic activity remains subdued and lending rates are higher, loss allowances are set to keep rising over the next few quarters – especially if economic activity is weaker than expected.

Loss allowance ratio in the German banking system



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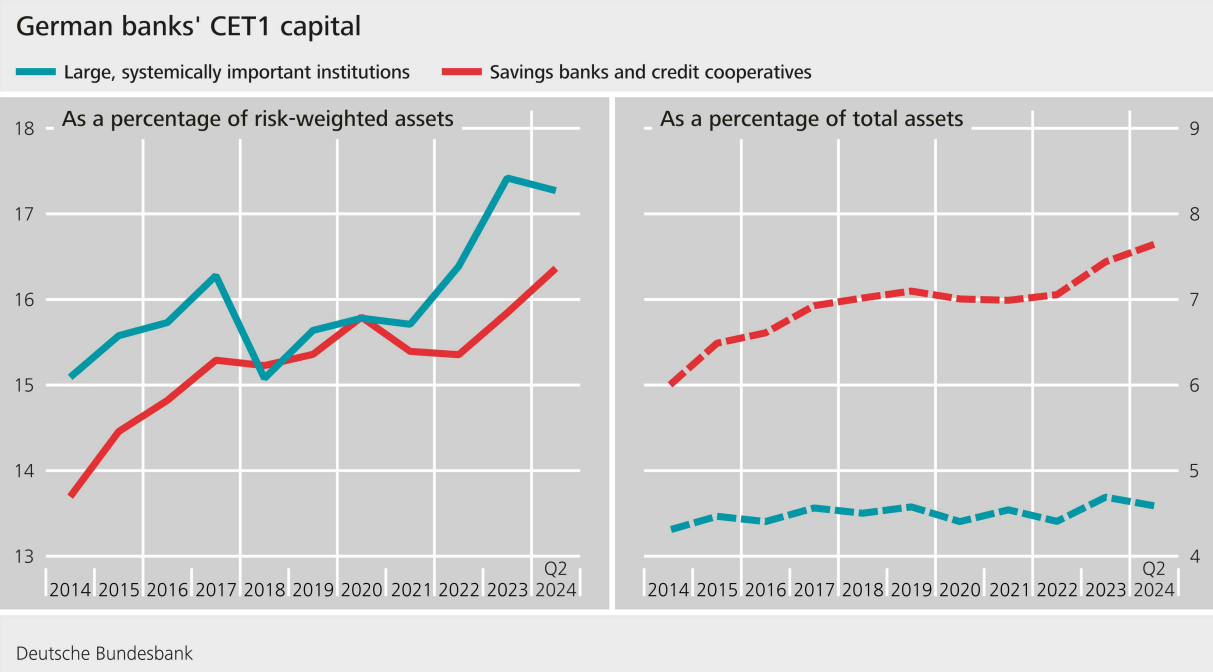
For more information, see Chart 4.2.6.

CET1 capital

Banks' capitalisation has improved steadily over recent years. Thanks to their capital reserves, banks can cope with larger losses without falling below the regulatory minimum requirements. The package of macroprudential measures adopted in early 2022 was one factor that contributed to this. However, the high ratios could be overstating banks' resilience, not least due to unrealised losses on their balance sheets and low risk weights.



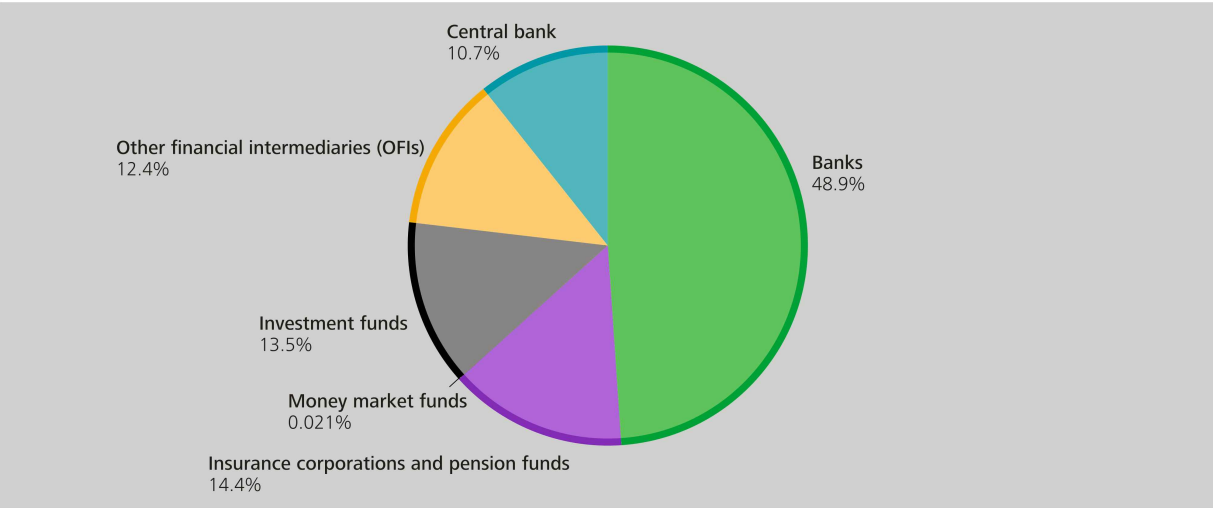
For more information, see Chart 4.2.13.

Significance and interconnectedness of non-bank financial intermediaries

Since the global financial crisis, the sector of non-bank financial intermediaries (NBFIs) has been growing in Europe and Germany. German NBFIs – i.e. investment funds, insurance corporations and pension funds as well as other financial intermediaries – together hold around 40 % of all financial assets in the German financial system. Additionally, German banks and investment funds have close ties with global NBFIs. This opens up direct and indirect contagion channels for the German financial system.

Structure of the German financial system

Shares of financial assets



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For more information, see Chart 4.3.1.

Unrealised losses of life insurers

Since the interest rate hike in 2022, life insurers have been buying and selling far fewer fixed income securities than in previous years. Unrealised losses on fixed income securities lessen the incentives for life insurers to trade securities. Life insurers might, then, in times of stress, stabilise financial markets less than they did in the past.

Changes in the bond porfolios of German life insurers

€ billion

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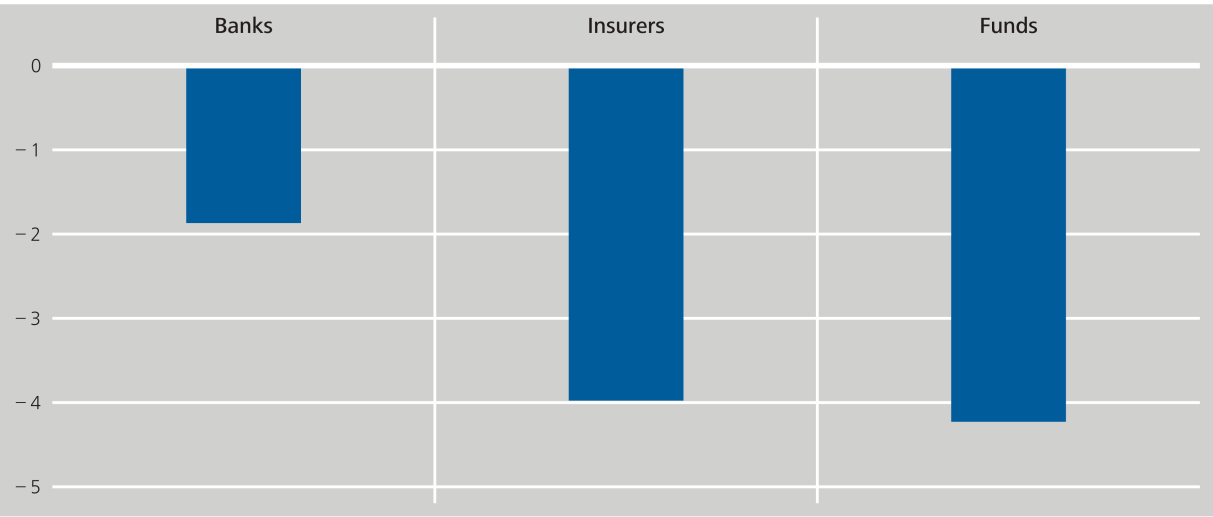
For more information, see Chart 4.3.4.

Vulnerabilities to climate-related transition risks

Risks stemming from an unexpected and immediate carbon price increase are likely to be manageable for the German financial system. A disclosure requirement for firms could reduce the impact of climate risks.

Vulnerabilities of German financial intermediaries in the carbon price increase scenario

Net losses as a percentage of stressed securities portfolios



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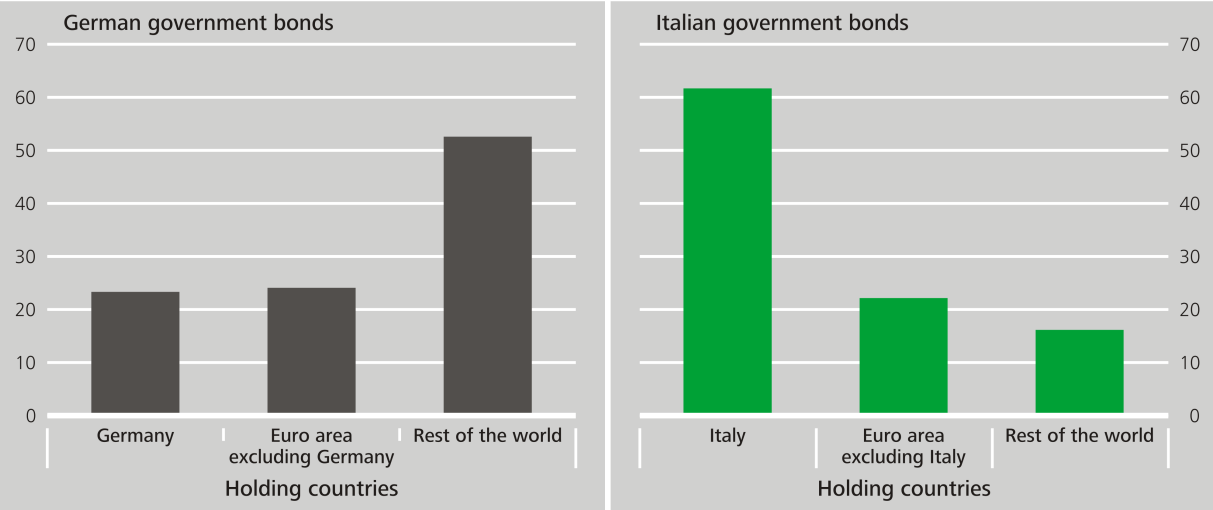
For more information, see Chart 5.4.1.

Government bond markets

The liquidity of government bonds plays an important role in the financial system. Differences in market and holder structure can affect the price discovery mechanism for government bonds and the propagation of shocks in the financial system. They thus affect the liquidity of government bonds. What is important here is whether more domestic or foreign investors are operating in the market and whether these are banks or NBFIs.

Stocks of domestic government bonds

As a percentage of outstanding volume, as at Q4 2023



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For more information, see Chart 6.2.1.

The **resilience of the banking system** is adequate thanks to high capital reserves. The vulnerabilities that built up during the protracted period of low interest rates are steadily diminishing, though only gradually. The period of exceptionally strong interest rate increases was weathered well overall. The **package of macroprudential measures is still appropriate**. Overall, an orderly reduction of vulnerabilities has become more likely. Macroprudential supervisors will monitor further developments in this area.

In order to safeguard the stability of the financial system, it is important for banking sector supervision and regulation to continually evolve. In this context, the **preventive orientation of macroprudential policy needs to be strengthened**.

Looking at the **regulation of insurance corporations and investment funds, the macroprudential perspective needs to be strengthened**, especially **with respect to liquidity risk**. Available data on NBFIs need to be shared between macroprudential authorities across Europe in the future, and worldwide data sharing likewise needs to be improved.

Climate policy should have a long-term focus and avoid unexpected and immediate carbon price increases. A consistent **disclosure requirement** concerning information

on carbon emissions will improve capital allocation and can reduce the risks faced by the German financial system.

Market participants' behaviour can have a decisive **impact** on **liquidity conditions on the government bond market**. Given the important role played by NBFIs on the German government bond market, it is vital that we expand our insights into their investment strategies and responses.

Overview

A year ago, the German financial system was facing major challenges following the strongest rise in interest rates in the past 25 years. During the protracted period of low interest rates spanning from the end of the global financial crisis to mid-2022, considerable vulnerabilities had built up in the German financial system. These had left the financial system – i.e. financial intermediaries and markets together with their infrastructure – susceptible to various shocks. The positive economic developments and steady decline in credit defaults had made it increasingly difficult to assess medium-term credit risk and had increased the likelihood of risks being underestimated. Risk provisioning was low in view of the low default rates, while credit growth was extremely dynamic. There were overvaluations in asset markets, such as residential real estate, as a result of which credit collateral would also be overvalued. In addition, banks were exposed to major interest rate risk and life insurers to earnings and solvency risk due to high guaranteed returns.

High inflation and the period of rising interest rates commencing in 2022 had left a significant mark by the time 2023 came to a close. The macroeconomic environment had fundamentally changed and vulnerabilities had, to a certain extent, been exposed. High inflation, the tense economic situation and increased interest rates weighed on household incomes and firms' profits. Real estate markets were experiencing a downturn. Credit risk had therefore risen. Even back in 2022, valuation losses on interest-bearing assets had already culminated in realised and unrealised losses on banks and insurers' balance sheets. In this environment, the risk of disorderly developments was elevated.

At the end of 2023, the transmission of high key interest rates to the real economy was not yet complete and it was difficult to gauge how this transmission to the financial system would continue to play out. Specifically, it was unclear how banks' significantly mounting interest expense would affect their future net interest income, notwithstanding the fact that banks were able to profit from low deposit rates in 2023. For life insurers, it was uncertain whether liquidity risk would materialise in the form of policy lapses in large numbers. At the same time, there was uncertainty regarding the duration and scope of the correction in the real estate markets. Given the combination of elevated interest rates and weak real economic activity, uncertainty also arose regarding the evolution of credit risk on financial intermediaries' balance sheets.

The macro-financial environment has gradually improved since last year, but remains challenging (see Chapter 4 "Stability situation in the German financial system "). Overall, there are signs of a return to price stability in the euro area and Germany, and so the ECB began to lower its key interest rates in June 2024. Even so, Germany's economy remains mired in a period of weakness, though distortions characterising a crisis are not expected. Risks in commercial real estate are still elevated. The corporate

sector is also encumbered by weak economic activity and structural change. Overall, disorderly developments have become less likely compared with last year, but geopolitical tensions entail significant downside risks (see the supplementary information entitled "Geopolitical risks: impact on financial stability").

German banks weathered the phase of rising interest rates well overall and have proved stable (see section 4.2 "Banking system: vulnerabilities and resilience"). As interest rates on overnight deposits have risen by surprisingly little, banks' profitability is at a comfortable level. The major vulnerabilities stemming from the period of low interest rates have so far been declining in an orderly manner, but only gradually. This is true of residential real estate loans, in particular. Risks remain high for commercial real estate loans. Banks' capitalisation is sound. As losses in the value of interest-bearing positions during the hike in interest rates often did not need to be reported, capital ratios were relatively high. Substantial unrealised losses have decreased considerably in the meantime. Average risk weights remain low and possibly underestimate existing credit risk. If risk weights were to rise sharply due to increasing credit risk, this would lead to a decline in risk-weighted capital ratios.

Although German non-bank financial intermediaries (NBFIs) likewise **weathered the phase of rising interest rates well, they continue to face liquidity risk** (see section 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience"). Liquidity risks in open-end real estate funds could amplify developments in the commercial real estate market. Redemption notice periods and minimum holding periods are keeping the liquidity risks of open-end real estate funds for the retail market in check. Investment risks from commercial real estate are manageable for the life insurance sector, in part due to its sound capital base. The liquidity risks of life insurers, by contrast, remain elevated, even if the risk of an upsurge in policy lapses is limited. Unrealised losses lessen the incentives for life insurers to trade actively during periods of stress and to purchase securities when prices have fallen sharply. As a result, they may absorb shocks in the financial system to a lesser extent than they did previously.

Given the overall risk situation, it is still vital that the German financial system remain sufficiently resilient (see section 4.4 "Overall assessment and implications for macroprudential policy"). The package of macroprudential measures announced by BaFin in January 2022, containing the countercyclical capital buffer (CCyB) and the sectoral systemic risk buffer (sSyRB), remains adequate. Downside risks are still high and economic developments pose a challenge to the corporate sector. The risk of adverse shocks remains high amid current geopolitical tensions. The downturn in the commercial real estate markets continued during 2024, albeit with weakened momentum. The developments currently unfolding in the residential real estate market point to slowly diminishing risks for residential real estate loans granted up to 2022. Overall, an orderly reduction of vulnerabilities in the residential real estate market has

become more likely. Macroprudential supervisors will closely monitor further developments, not least taking into account data collected since 2023 on the lending standards for newly issued real estate loans.

Macroprudential policy continues to evolve. In order to ensure that banks remain resilient in the long term, macroprudential supervisors must retain their scope for action, particularly in periods of stress. Against this background, a number of European countries have adjusted their macroprudential strategies for the banking sector. They tend to activate the CCyB at an earlier stage, and some have introduced a CCyB target rate that applies even when cyclical risks are not elevated (see the supplementary information entitled "The economic benefits of releasable capital buffers and the positive neutral rate"). The regulation of NBFIs, should strengthen its macroprudential perspective particularly with respect to liquidity risk. One major reason why this is important is because problems in the insurance and fund sectors may spread quickly to the banking sector due to their interconnectedness. In order to better assess risks arising from cross-border interconnectedness with NBFIs, foundations should be laid for European data sharing among macroprudential authorities. At the international level, such as in the Financial Stability Board (FSB), ways should also be found to better assess the global financial stability risks of NBFIs.

The financial system must cope with both real economic structural change and structural change in the financial system itself, such as digitalisation. Climate policy and climate change are driving structural change in the real economy and the financial system. A special chapter examines the risks arising from an unexpected and immediate carbon price increase for the German financial system (see Chapter 5 " Special chapter: Risks arising from an unexpected and immediate carbon price increase "). While the effects are likely to be manageable in isolation, a predictable climate action trajectory generally reduces climate risks. A consistent disclosure requirement for carbon emissions helps to mitigate the impact of climate risks and should continue to be pursued. Another driver of structural change in the real economy and financial system is digitalisation. This year's Financial Stability Review looks at the impact of the introduction of a digital euro on the banking system (see the supplementary information entitled "Digital euro: impact on bank liquidity and funding costs").

In addition, the Financial Stability Review highlights structural change in the financial system arising from the increased importance of NBFIs and banks' interconnectedness with NBFIs (see section 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience" and the supplementary information entitled "Contagion channels between banks and investment funds"). A special chapter compares the market and holder structure of the German and Italian government bond markets and of the repo market in which these government bonds are used as collateral (see Chapter 6 "Special chapter: The German and Italian government bond markets from a

financial stability perspective"). The Bundesbank's joint project with the Banca d'Italia reveals various differences: whilst Italian government bonds are mainly traded via a regulated electronic trading platform and centrally cleared, German government bonds are mostly traded bilaterally over the counter. In addition, German government bonds are held primarily by foreign investors as well as euro area-based investment funds. By contrast, Italian government bonds are held mainly by domestic banks and insurers. NBFIs play an important role in both markets. Their behaviour is crucial for price discovery and shock propagation mechanisms in the financial system, which in turn can affect liquidity.

Stability situation in the German financial system

4.1 The macro-financial environment and the situation in the real sector

4.1.1 The macro-financial environment improved over the course of last year

The end of 2023 marked the conclusion of a period of exceptionally strong rises in interest rates. The interest rate hikes in 2022 and 2023, which were rapid and substantial by historical standards, represented a turning point for the German financial system. This followed a long period of low interest rates, during which considerable risks to financial stability had built up. The European Central Bank (ECB) had raised its key monetary policy interest rates for the last time in the autumn of 2023. Thereafter, market interest rates gradually declined and, in June 2024, the ECB began lowering its key interest rates. Financial markets are expecting further gradual cuts in key interest rates. However, market participants do not expect that the coming quarters will see a return to the exceptionally low interest rate levels from the years prior to 2022.

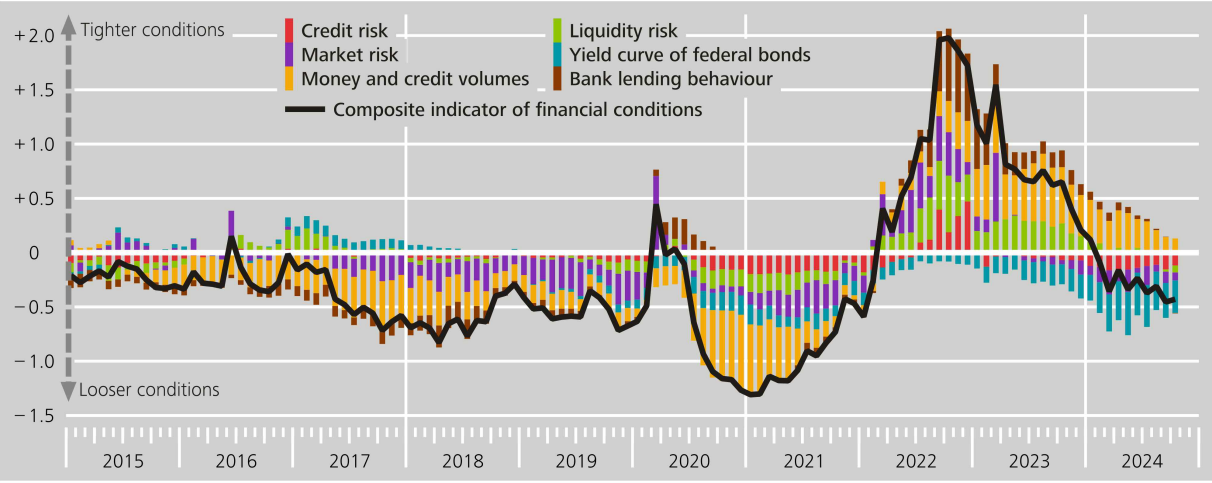
Given the gradual decline in short-term and longer-term interest rates, market financing conditions have successively improved over recent quarters. Longer-term real interest rates in Germany – i.e. the difference between nominal interest rates on five-year and ten-year federal bonds (Bunds) and expected inflation over these respective maturities – have fallen compared with the end of 2023 and are close to zero. [1)] The broad improvement in financing conditions is reflected by the Bundesbank's composite indicator of financial conditions, which has been below its historical average again since the beginning of 2024 (see Chart 4.1.1). [2)] The lower values mean that financial conditions have eased again and that tensions within the financial system have abated. The indicator weakened as both credit risk premia and liquidity risk premia decreased and volatility in financial markets lessened as well. Additionally, the flattening of the yield curve for federal bonds contributed to this development.

1 Data source: Deutsche Bundesbank. Calculated from the yields on ten-year and five-year Federal securities as well as from weighted inflation expectations (consensus forecast).

2 See Metiu (2022).

Composite indicator of financial conditions* Chart 4.1.1

Monthly data, standardised from 2003, as at October 2024



Sources: BIS, Bloomberg Finance L.P., ECB, Bundesbank statistics and Bundesbank calculations. * See N. Metiu, A Composite Indicator of Financial Conditions for Germany, Deutsche Bundesbank Technical Paper No 03/2022.

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The declining interest rates and improved financing conditions reflect the significantly lower inflation rate compared with last year. In its June forecast, the Bundesbank projected that the inflation rate would fall to 2.8 % in Germany in 2024, down from 6.0 % the year before. By 2026, inflation is projected to further decline to 2.2 %.[3)] Hence, the inflation rate in Germany, as well as in the euro area as a whole, is gradually approaching the ECB's target of 2 % over the medium term. Market participants also consider it increasingly less likely that average euro area inflation over the coming years will be significantly above target. The majority of market participants now expect an average inflation rate of up to 2 % over the next five years. In their view, the probability of an average euro area inflation rate above 3 % has dropped noticeably since last year (see Chart 4.1.2). Over the medium term, however, the upside risks to inflation still predominate. This is due, in particular, to strong wage cost dynamics, which are partly a consequence of the high inflation in previous years as well as a result of the structural shortage of labour.[4)]

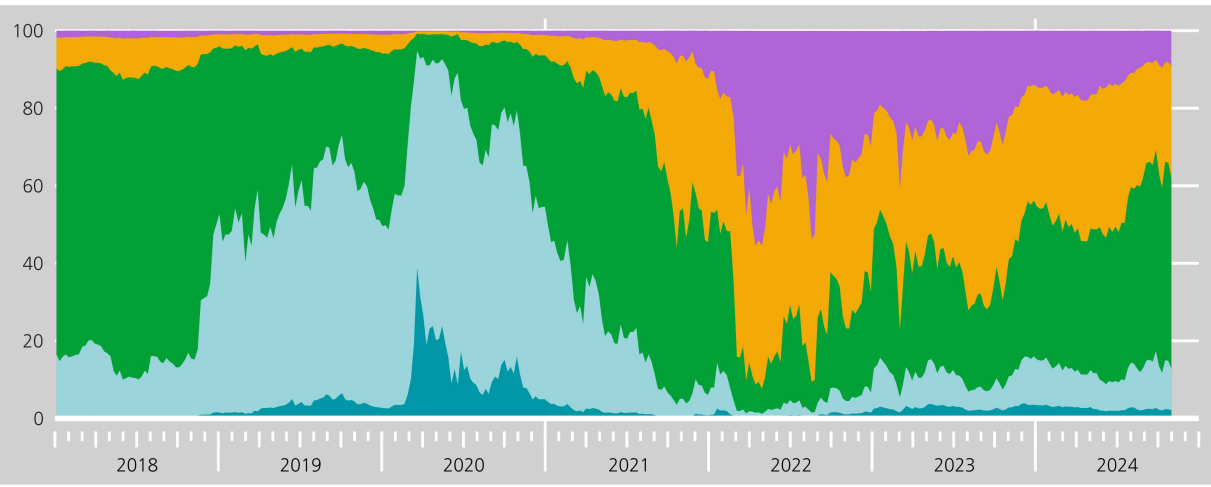
3 See Deutsche Bundesbank (2024a).

4 See Deutsche Bundesbank (2024a).

Inflation probabilities for the euro area for the average of the next five years*

Chart 4.1.2

End-of-week levels, %, as at 1 November 2024



Sources: Bloomberg Finance L.P., Fenics Market Data and Bundesbank calculations. * Probabilities derived from inflation options with maturities of five years, based on the Harmonised Index of Consumer Prices (HICP) excluding tobacco for the euro area.

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The German economy is still experiencing a period of weakness. It has been treading water since the start of Russia's war of aggression against Ukraine more than two years ago. In addition to elevated uncertainty surrounding economic policy, higher financing costs are continuing to make themselves felt and are weighing on corporate investment activity. Exports remain subdued, although there are signs of a slight recovery in foreign demand. At the same time, private consumption is still lacking momentum, despite real incomes rising broadly. Overall, gross domestic product (GDP) is likely to more or less stagnate this year.[5)] The performance of the German economy is therefore weak in an international comparison.

At the same time, the German economy is still facing profound structural challenges that are weighing on the medium-term growth outlook. Higher energy prices tend to affect Germany to a greater degree than other countries and decarbonising the economy is a major challenge. In Germany, the manufacturing sector makes a comparatively large contribution to economic output, and energy-intensive sectors also have a relatively high weight by international standards.[6)] In addition, demographic change is dampening the supply of labour and thus potential growth. Given the rapid

5 See Projektgruppe Gemeinschaftsdiagnose (2024).

6 See Boysen-Hogrefe et al. (2024), Wollmershäuser et al. (2024).

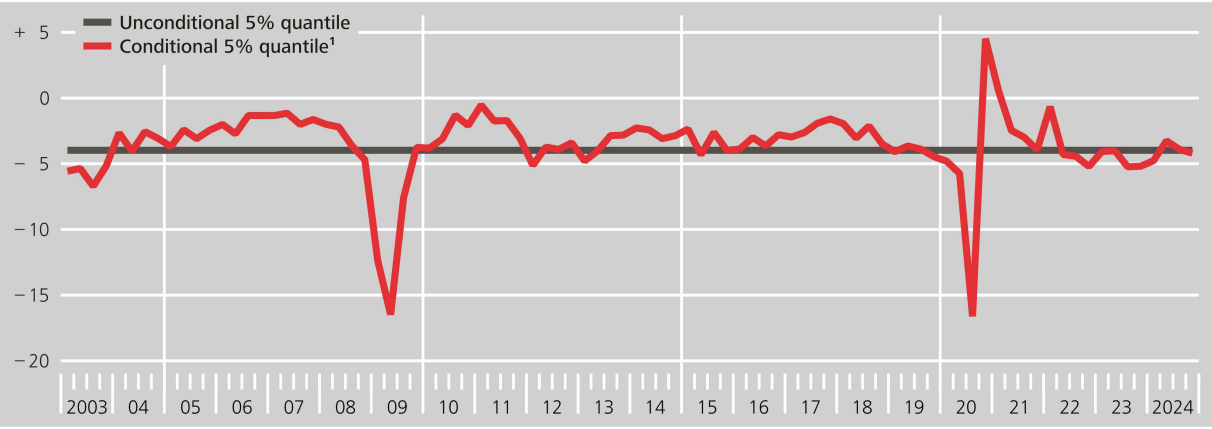
ageing of German society, the labour market is likely to become tighter over the coming years. [7)]

Despite the ongoing period of weakness, Germany so far appears to be returning to price stability without any major disruptions to the real economy. In the past, declines from high inflation rates were often accompanied by larger losses in growth than those observed in the current episode thus far. [8)] If the macro-financial environment develops as expected, disorderly developments will have become less likely than they were at the end of 2023. Accordingly, the short-term downside risks to GDP growth, as measured using a growth-at-risk estimate, have also decreased compared with last year. The conditional 5 % quantile of GDP growth has risen over the course of 2024. This indicates that the chances of particularly low growth rates have decreased (see Chart 4.1.3). [9)]

Growth-at-risk for Germany*

Chart 4.1.3

%, annual GDP growth rates at quarterly level, as at Q3 2024



Sources: ECB, OECD, Federal Statistical Office and Bundesbank calculations. * 5% quantile of the distribution of annual growth rates of gross domestic product based on a quantile regression. The estimation period begins in Q1 1970 and the 5% quantile is estimated using conditioning variables from the preceding quarter. **1** Conditional on the development of financial stress, a sentiment indicator for enterprises, and growth in German industrial output.

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7 See Deutsche Bundesbank (2024a).

8 See Deutsche Bundesbank (2024b).

9 See Deutsche Bundesbank (2019, 2021). This specification does not take geopolitical developments into account. In the past, adverse geopolitical developments were less frequently associated with short-term downside risks to economic output, which are measured by the 5 % quantile. Nevertheless, adverse geopolitical developments may have a noticeable impact on economic developments (see the supplementary information entitled "Geopolitical risks: impact on financial stability").

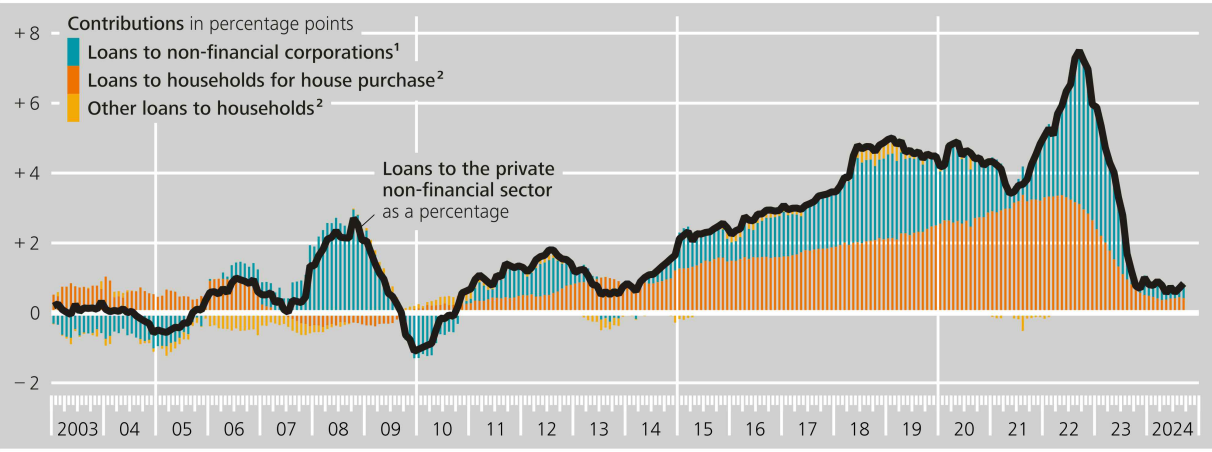
4.1.2 Downturn in the financial cycle is slowing

Against the backdrop of developments in the macro-financial environment, the downturn in the financial cycle slowed last year. The financial cycle describes fluctuations in financial variables such as credit growth and asset prices.[10] Amid high inflation, rising interest rates, subdued economic prospects and falling real incomes, the upswing in the financial cycle began to wane from 2022 onwards. Since 2023, the financial cycle has been experiencing a downturn. Given the gradual improvement in the macro-financial environment last year – particularly the more favourable financing conditions and gradually rising real incomes – the downturn slowed considerably.

Contributions to changes in German banks' lending to the domestic private non-financial sector*

Chart 4.1.4

Year-on-year change, monthly data, as at September 2024



* Nominal loans and bill-based loans from domestic monetary financial institutions (excluding the central bank). **1** Including debt securities. **2** Including non-profit institutions serving households.

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Credit growth – which, alongside asset prices, is an important financial cycle indicator – stabilised at a low level over the course of last year. Year-on-year growth in gross lending remains subdued, both for loans to non-financial corporations and for

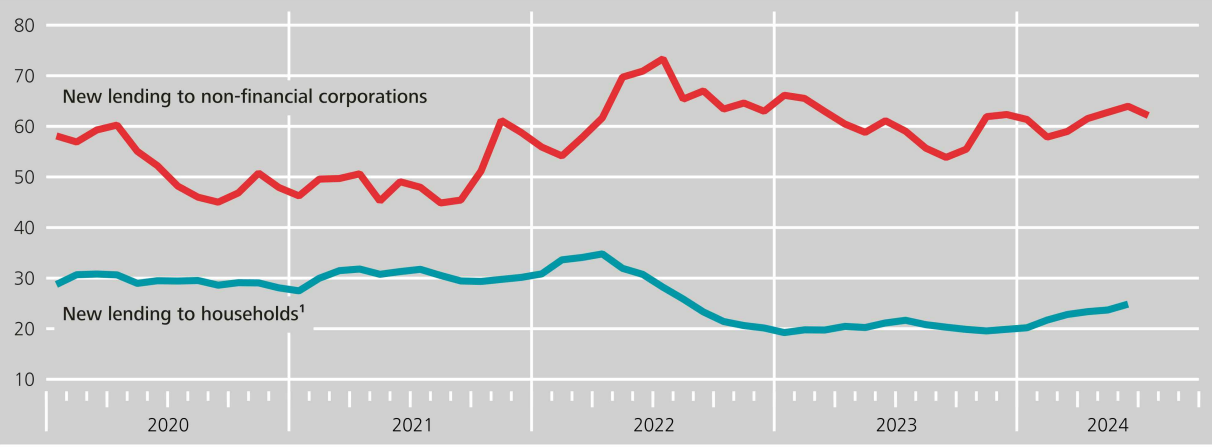
10 Empirical studies suggest that these fluctuations are often medium term in nature. By comparison, fluctuations in the economic cycle tend to be shorter. See Borio (2014). Cyclical vulnerabilities build up during an upswing in the financial cycle. This makes the financial system vulnerable to adverse developments. For example, a cross-country analysis suggests that, in the past, recessions that began a few quarters after a peak in the financial cycle have tended to be deeper and more protracted. See Deutsche Bundesbank (2022a). One possible explanation is that the financial system reduces lending excessively during such episodes, thereby amplifying the recession.

loans to households. However, the downward trend from last year did not continue: growth in gross lending to both non-financial corporations as well as to households has stabilised in slightly positive territory over the past quarters (see Chart 4.1.4). [11)] While new lending to households is still at a low level compared with the period before the interest rate hikes, it has shown visible signs of recovery since the start of the year (see Chart 4.1.5). There are also first signs of a revival in new lending to non-financial corporations. In line with this development, demand for loans to households for house purchase and demand for loans in the corporate sector also appear to be stabilising, according to the German banks responding to the Bank Lending Survey (BLS). The surveyed banks expect this trend to continue in the fourth quarter of 2024, with demand in both segments rising on balance. [12)] Nevertheless, surveys indicate that banks' lending behaviour has remained restrictive in 2024, too, particularly towards enterprises. [13)] The economic situation as well as enterprise-specific and household-specific factors have led to a greater assessment of risk. By contrast, bank-specific factors, such as their capital situation, did not play a role according to the BLS.

Chart 4.1.5

True new lending:*
Loans to households and loans to non-financial corporations

€ billion, 3-month moving average, as at August 2024



* First-time granting of a loan without any existing loan agreements being refinanced or prolonged. 1 Includes loans for house purchase, consumer credit and other lending to households.

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11 See Deutsche Bundesbank (2024c).

12 The majority of the banks surveyed as part of the LSI stress test also reported that they were expecting an increase or major increase in demand for loans (data as at May 2024). See Deutsche Bundesbank and Federal Financial Supervisory Authority (2024).

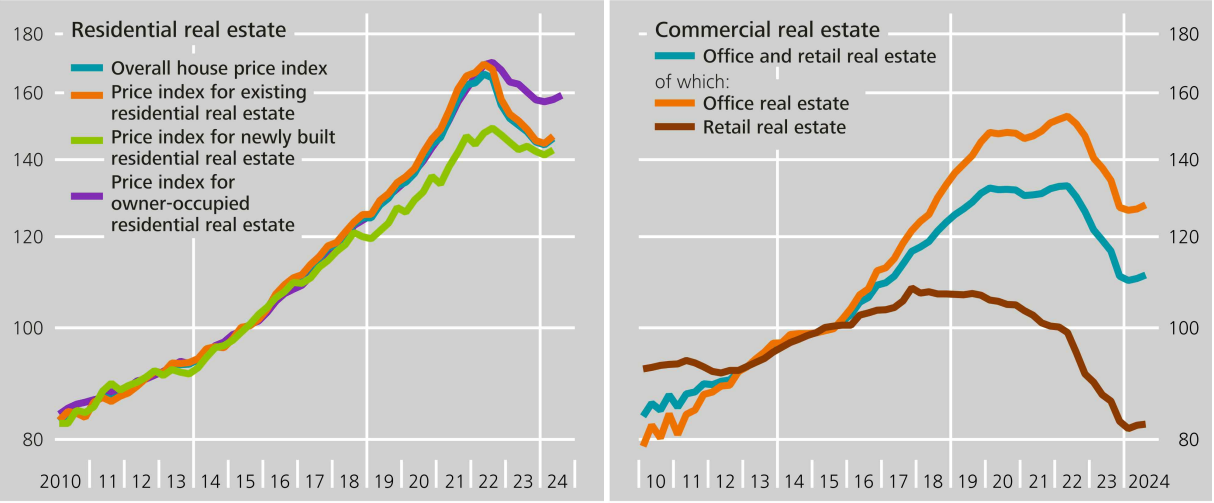
13 This is indicated by business surveys (Bundesbank Online Panel – Firms (BOP-F) and the ifo Credit Constraint Indicator) as well as the results of the BLS.

Residential real estate prices are stabilising as demand for housing loans recovers. Starting in mid-2022, higher costs of living and increased financing costs, in particular, led to a turnaround in demand for purchases of residential real estate.[14] According to the Federal Statistical Office, prices for residential real estate fell by around 13 % from their peak in mid-2022 to the first quarter of 2024 (see Chart 4.1.6).[15] Overvaluations from the low interest rate period have declined significantly, but have not yet been fully eliminated.[16] In the second quarter of 2024, residential real estate prices rose again compared with the previous quarter for the first time in two years.[17] Model estimates show that the probability of further sharp declines in prices has recently decreased.[18] The recently slightly lower financing costs, higher incomes and weak new construction activity are supporting residential real estate prices. Overall, an orderly reduction of vulnerabilities in the residential real estate market has become more likely.

Real estate prices in Germany

Chart 4.1.6

2015 = 100, log scale, quarterly data, as at Q2 or Q3 2024



Sources: Federal Statistical Office and Association of German Pfandbrief Banks.
Deutsche Bundesbank

14 See Deutsche Bundesbank (2023a).

15 At just under 15 %, the fall in prices for existing residential real estate was significantly larger than that for newly built housing, which only saw a price decline of just over 4 %. This is likely to be attributable to the growing significance of energy efficiency for residential real estate as well as increased construction costs.

16 See Deutsche Bundesbank (2024d).

17 See Federal Statistical Office (2024a).

18 See Hafemann (2023). According to the estimation using a price-at-risk approach, the interest rate hike in 2022 initially resulted in a significant increase in the potential for setbacks in residential real estate prices in 2022 and 2023. Over the course of 2024 so far, the estimated further potential for setbacks has declined again on account of slightly lower financing costs for residential real estate loans, lower risk premia, and reduced downward momentum in residential real estate prices.

Commercial real estate prices did not fall any further in the first half of 2024, but the risk of additional significant drops in prices has increased compared with last year. Following still substantial price declines in the second half of 2023, commercial real estate prices began to stabilise in the first half of 2024 (see Chart 4.1.6). [19] However, these price dynamics are based on just a small number of transactions, which could distort the picture. The market correction has been largely orderly thus far. In contrast to the residential real estate market, however, model-based analyses point to the possibility of further price declines in the commercial real estate market. Compared with the previous year, the expected situation has even deteriorated on average, and larger declines in prices have become more likely overall. [20] This is indicated by a price-at-risk analysis for German commercial real estate prices (see Chart 4.1.7). Compared with the same quarter of the previous year, the estimated distribution of the growth rate of prices for the fourth quarter of 2024 shifted further to the left, with the median of the distribution also falling. For the fourth quarter of 2023, the median of the estimated distribution of price growth was still around - 8 %; for the fourth quarter of 2024, it is close to -11 %. At the same time, the probability of particularly low growth rates for commercial real estate prices (5 % quantile) has also risen again. [21]

19 While prices stagnated in a quarter-on-quarter comparison in the first, second and third quarters of 2024, they continued to fall in a year-on-year comparison.

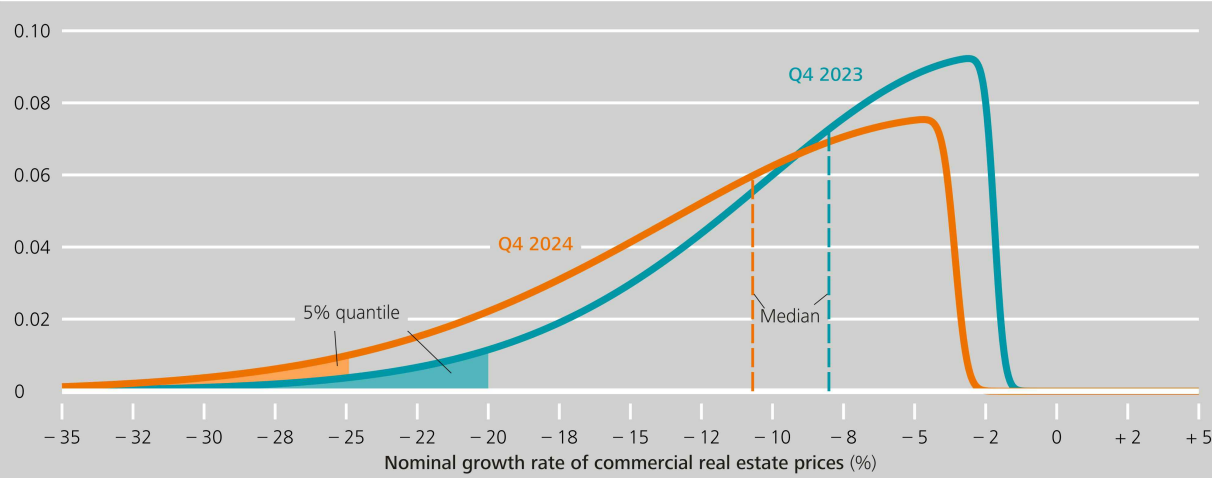
20 According to a survey, the majority of credit institutions are also expecting prices to either stagnate or fall over both the short and medium terms. See Deutsche Bundesbank and Federal Financial Supervisory Authority (2024).

21 See Herbst et al. (2024).

Price-at-risk analysis for German commercial real estate prices*

Chart 4.1.7

Probability density, as at Q4 2023



Sources: ECB, Jones Lang LaSalle, Federal Statistical Office and Bundesbank calculations. * Distribution of the forecast with a one-year horizon. Curve labels denote the quarter for which the respective yearly growth rates were estimated.

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The ongoing downturn in commercial real estate prices could be exacerbated by fire sales among financial intermediaries or by the liquidation of loan collateral. For example, a worsening situation among project developers could lead to banks becoming more active on the seller side by liquidating real estate collateral (see section 4.2 "Banking system: vulnerabilities and resilience"). In addition, an increase in net outflows from open-end retail real estate funds, which are still moderate at present, could further reinforce price declines on the commercial real estate market if a larger number of funds need to sell real estate (see section 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience").[22)] Moreover, structural factors are weighing on developments in the commercial real estate market. Key factors include, above all, the significant rise in the importance of online retail, the increased prevalence of remote work, and higher energy standards.

Valuation levels in financial markets continued to rise over the course of last year, partly because market participants were expecting a soft landing for the global real

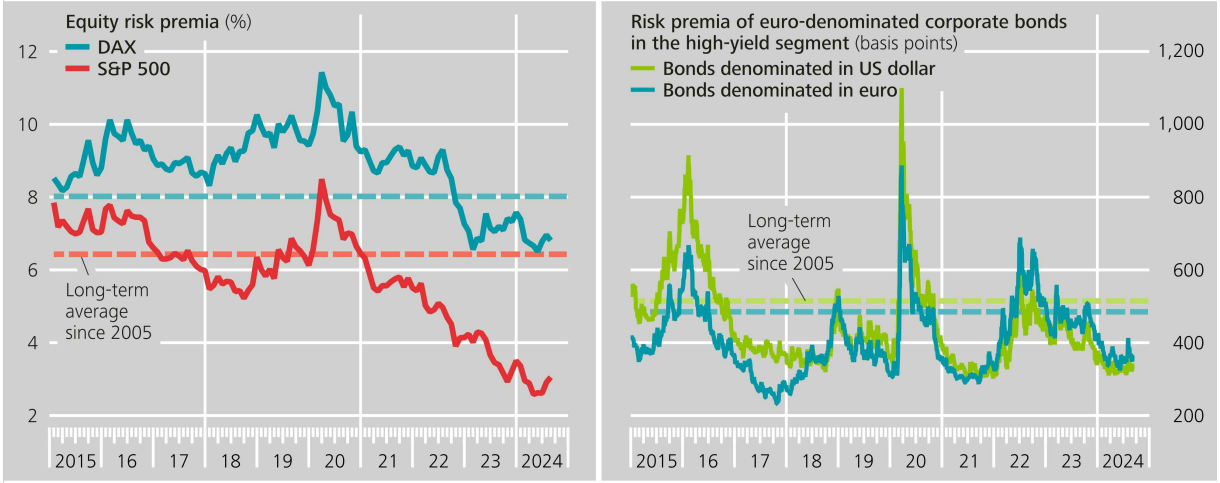
22 In recent years, real estate funds have been among the most important net purchasers on the commercial real estate market in Germany. However, this role could be reversed if outflows of funds grow. This also holds true for real estate groups that became increasingly prominent as net purchasers after the coronavirus pandemic. Institutional investors, particularly life insurers, would also not be able to function as countercyclical purchasers in this downturn (see section 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience").

economy. In equity markets, risk premia for both European and US equities are below their long-term averages (see Chart 4.1.8), despite existing downside risks in the macro-financial environment (see section 4.1.5 "Globally high debt levels render the financial system more vulnerable to adverse developments" and section 4.1.6 "The macro-financial environment remains challenging").[23] In corporate bond markets, too, risk premia in the euro area and the United States have fallen to even lower levels compared with the previous year, which may not fully compensate investors for existing risks. This holds particularly true for high-yield corporate bond markets (see Chart 4.1.8).[24]

Risk premia in equity and corporate bond markets

Chart 4.1.8

As at 5 November 2024



Sources: Bloomberg Finance L.P., ICE data used with permission from ICE Data, OECD (2024), Real GDP long-term forecast (indicator) (doi: 10.1787/d927bc18-en, last accessed on 6 November 2024), and Bundesbank calculations.

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The high valuation levels suggest a significant potential for setbacks in financial markets. The risk of market price corrections and the associated losses among financial intermediaries remains elevated. Price declines could be amplified by factors including the unwinding of leveraged positions by hedge funds and other investors as well as, in some cases, substantial share redemptions amongst investment funds (see

23 Equity risk premia can be derived using a residual income valuation model. According to this model, current equity prices correspond to the current book value of equity plus the future residual income discounted using the equity cost rate ((return on equity minus equity cost rate) multiplied by the book value of equity in the previous period).

24 According to a regression model, the risk premia on euro-denominated corporate bonds from the high-yield segment are significantly lower than their estimated "fair" value based on fundamentals such as GDP growth forecasts, the standard deviation of growth forecasts, and corporate debt. The estimation using fundamentals is based on a model developed by the International Monetary Fund (IMF). See International Monetary Fund (2023). Data from ICE Data, the ECB, Refinitiv and Bloomberg Finance L.P. were used in this context.

section 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience"). The global financial market turbulence in early August, triggered by concerns about the US economy, shows that negative developments after long periods of large risk appetite and high valuations can quickly cause significant corrections and high volatility. [25)]

Overall, the vulnerabilities in the German financial system have been declining in an orderly manner thus far. However, this decline is occurring only gradually. The vulnerabilities in the German financial system that built up during the upswing in the financial cycle over the course of the low interest rate period and the coronavirus pandemic therefore remain substantial (see section 4.2 "Banking system: vulnerabilities and resilience" and section 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience").

4.1.3 Despite burdens, enterprises are largely robust

Economic weakness and rising costs are putting pressure on enterprises. The current slump in growth is dampening demand for goods and services. At the same time, enterprises are facing higher costs. The strong growth in actual earnings seen since 2023 has resulted in higher wage expenditure amongst enterprises. [26)] In addition, the rise in interest rates led to significantly higher borrowing costs. Since the end of 2021, yields on euro-denominated corporate bonds have risen by more than 2.5 percentage points, despite lower risk premia in some segments. Interest rates on new loans have even increased by just under 4 percentage points (see Chart 4.1.9). If existing loans are taken into account, the rise in average interest rates amounts to just 1.8 percentage point overall. This is because some enterprises are still benefiting from comparatively favourable financing costs. For fixed interest loans that were taken out in or before 2021, the mean and median of current interest rates are no greater than 2 % (see Chart 4.1.9). These account for just under half of the outstanding loan volume (see section 4.2 "Banking system: vulnerabilities and resilience").

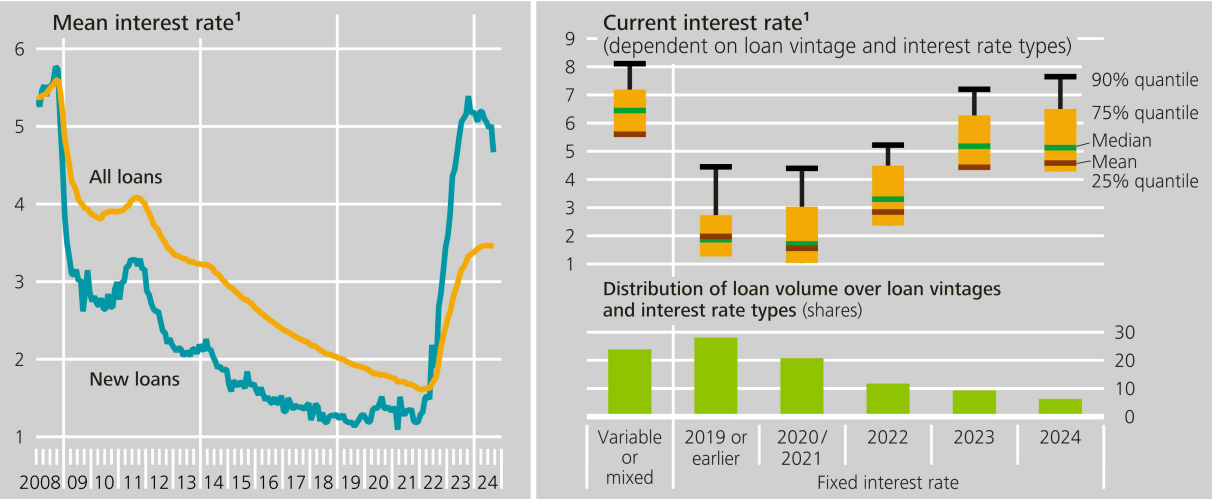
25 See Aquilina et al. (2024), Deutsche Bundesbank (2024e).

26 While commodity prices have remained roughly constant compared with last year, they have risen markedly over the long term when compared with 2020. For more information on developments in wages and commodity prices, see Deutsche Bundesbank (2024e).

Interest rates and loan vintages of corporate loans

Chart 4.1.9

%, as at September 2024



Sources: AnaCredit and Bundesbank calculations. **1** Mean values are volume-weighted; quantiles (including median) are unweighted.

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Ultimately, the corporate sector must face up to structural change. Structural change caused by digitalisation, demographic change and climate change presents both opportunities and challenges for the corporate sector. It requires investment, for example in new technologies, and implies that resources will be reallocated between different sectors of the economy. On the one hand, new enterprises may emerge, such as in the fields of renewable energy, e-mobility or in the platform economy. On the other hand, reallocation processes may be accompanied by an increase in insolvencies in sectors that are particularly affected by structural change. This is because, given structural change, some business models may prove to be outdated and no longer profitable, causing enterprises to disappear from the market. The policy measures accompanying structural change set out the regulatory framework, but may also have undesirable side effects and trigger sudden developments (see Chapter 5 "Risks arising from an unexpected and immediate carbon price increase").

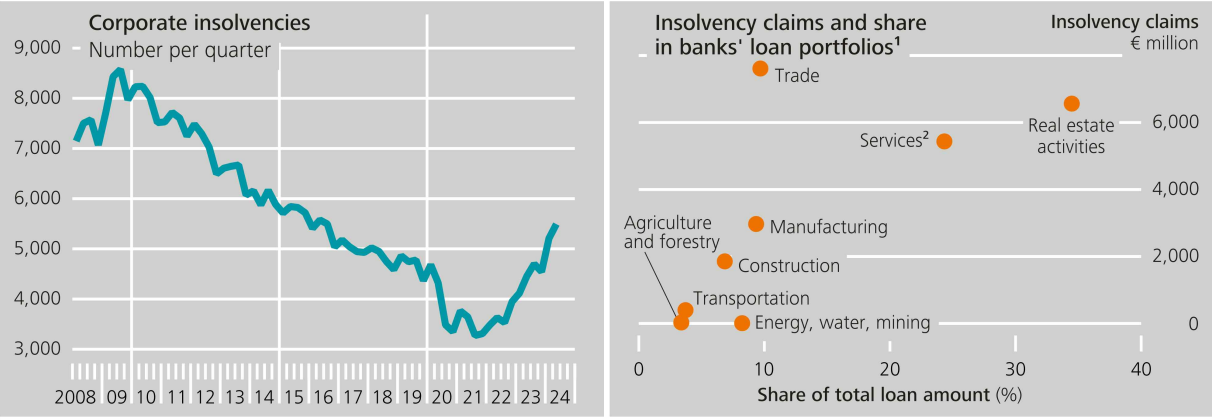
Corporate insolvencies have risen further in 2024. After the number of corporate insolvencies dropped sharply in 2020 and 2021 as a result of government assistance measures and the suspension of the obligation to file for insolvency, this figure has risen again considerably since 2022 (see Chart 4.1.10). In the first half of 2024, it was 25 % higher than in the previous year. However, when viewed over the long term, the

number of corporate insolvencies was not exceptionally high.[27] Nevertheless, expected insolvency claims have grown significantly. For example, insolvency claims, especially against trading companies, have been very high since October 2023. Likewise substantial, but somewhat smaller, are the claims against companies in the real estate activities sector and various services sectors (see Chart 4.1.10).[28] The defaults in the real estate activities sector in particular are directly related to financial stability, as around one-third of outstanding bank loans are accounted for by this sector. However, the share of secured loans is higher in this sector than in others, which is likely to result in lower loss given default rates.

Corporate insolvencies in Germany

Chart 4.1.10

As at Q2 2024



Sources: Federal Statistical Office and Bundesbank calculations. **1** Total prospective insolvency claims of all creditors from October 2023 to June 2024. Bank loans as at December 2023. **2** Includes accommodation and food service activities; information and communication; human health services; professional, scientific and technical activities; education; arts; and administrative and support service activities. Due to differing classification systems, the sectoral data from the Bundesbank and the Federal Statistical Office are not mutually convertible without error. For this reason, some minor inaccuracies may occur.

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Nevertheless, most enterprises' fundamentals are still largely sound. In nominal terms, interest expenditure rose slightly on the year but so did earnings overall, meaning that the aggregate debt service ratio remained low by international standards.[29] However, the earnings situation could be strained for some enterprises. Surveys show that the percentage of enterprises whose earnings declined was higher in 2022 and 2023 than the percentage of firms with rising earnings.[30] Adjusted for inflation, enterprises' aggregate earnings have declined in almost every quarter since the end of

27 In the first half of 2024, it was, on average, around the same as in 2016.
28 For the definition of the services sector, see the explanation in Chart 4.1.10.
29 Data source: Bank for International Settlements.
30 See European Central Bank (2024a).

2022.[31] By contrast, their capitalisation still appears to be sound.[32] Enterprises held significantly less liquidity in the first half of 2024 than in previous years.[33] Surveys do not indicate increased liquidity problems, however.[34]

Default risk for non-financial corporations is likely to remain elevated in 2025. A significant number of corporate insolvencies are likely next year given ongoing structural change and the continued economic weakness. In addition, insolvencies often lag the economic cycle and may continue to rise even as an economic recovery sets in.[35] The higher interest expenditure where follow-up financing is required could also contribute to more defaults. At present, fixed interest loans with interest rate fixation periods ending in 2025 are still comparatively cheap at a median interest rate of 2.6 %, as a large percentage of these loans were concluded in the low interest rate period before 2022 (see Chart 4.1.9). If enterprises need to refinance their loans in 2025 and take out new loans with an interest rate fixation period of three to five years, the mean interest rate could then rise to approximately 4 %. This is suggested by rough estimates based on current terms and conditions for new lending business. That said, loans with interest rate fixation periods ending in 2025 account for only 9 % of the volume of outstanding fixed rate loans (see Chart 4.1.11). When loans are refinanced from 2026 onwards, the differences between the existing and the newly agreed interest rates are likely to be smaller, for the most part. First, the existing interest rates tend to be higher already and, second, the interest rates agreed upon then are likely to come down should market expectations be confirmed. Sound fundamentals mean that the vast majority of enterprises should be able to cope with these burdens. If, on the other hand, developments in the macro-financial environment are noticeably weaker than forecast, higher default risks are to be expected.

31 Data source: National accounts, as at June 2024; prices adjusted using consumer prices, data source: Federal Statistical Office, as at June 2024.

32 This is suggested by various data sources. According to the latest available balance sheet data from the financial statement statistics, enterprises' average equity ratio declined somewhat in 2022, but actually improved slightly in the 25th percentile. More recent data from financial accounts and the consolidated financial statement statistics suggest that the equity ratio remained stable in 2023 and in the first half of 2024 and is at least at the long-term average.

33 Measured by the stock of cash and deposits, prices adjusted using producer prices for industrial products in domestic sales. Data sources: Financial accounts and Federal Statistical Office, as at June 2024.

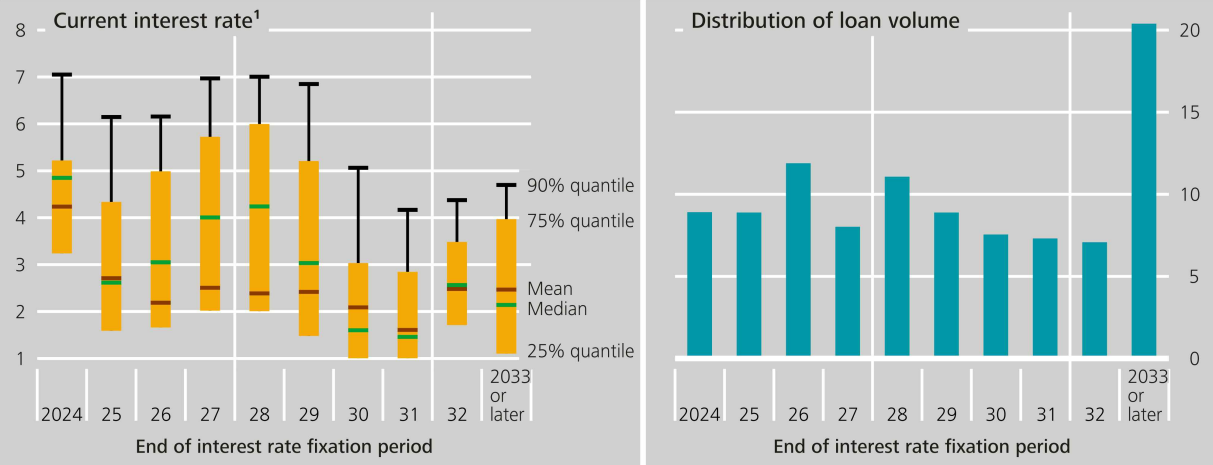
34 Bundesbank study on the financial situation of enterprises (Bundesbank Online Panel – Firms, or BOP-F).

35 See Alter et al. (2021).

Interest rate and volume of outstanding fixed interest loans to enterprises by interest rate fixation period

Chart 4.1.11

%, as at 31 August 2024



Source: AnaCredit. **1** Mean values are volume-weighted; quantiles (including median) are unweighted.

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4.1.4 Declining debt ratios and rising nominal incomes support households' debt sustainability

The predominantly robust labour market situation continues to contribute to the resilience of households. Despite the economic weakness, the unemployment rate has only risen relatively moderately over the past two years.[36)] With demand for labour high, employees were in a strong bargaining position and therefore able to achieve significant increases in nominal wages in 2024 as well.[37)] Further developments in the labour market are fraught with uncertainty. Due to the demographic decline in the working-age population, labour shortages are likely in the medium term. Nevertheless, the structural challenges faced by the German economy (see section 4.1.3 "Despite burdens, enterprises are largely robust") also imply downside risks for the labour market.

36 A massive deterioration in the labour market situation is not expected in the near future either; see Deutsche Bundesbank (2024f).

37 The sharp increase in nominal wages and the comparatively weaker rise in inflation led to further growth in real wages in 2024, after employees had, on average, seen real wages drop between the end of 2021 and the beginning of 2023; see Federal Statistical Office (2024b).

Nominal wage increases support the resilience of households. The long interest rate fixation periods for residential real estate loans granted in the previous low interest rate period are protecting most households from rising debt service costs for the time being. The burden from interest and redemption payments on existing residential real estate loans generally remains constant in nominal terms for the duration of the agreed interest rate fixation period. Rising nominal incomes therefore tend to improve the ability of households with existing loan contracts to service their debt. If, however, the interest rate fixation period of an existing loan contract ends and follow-up financing at higher interest rates becomes necessary, households could face rising debt service costs. [38)]

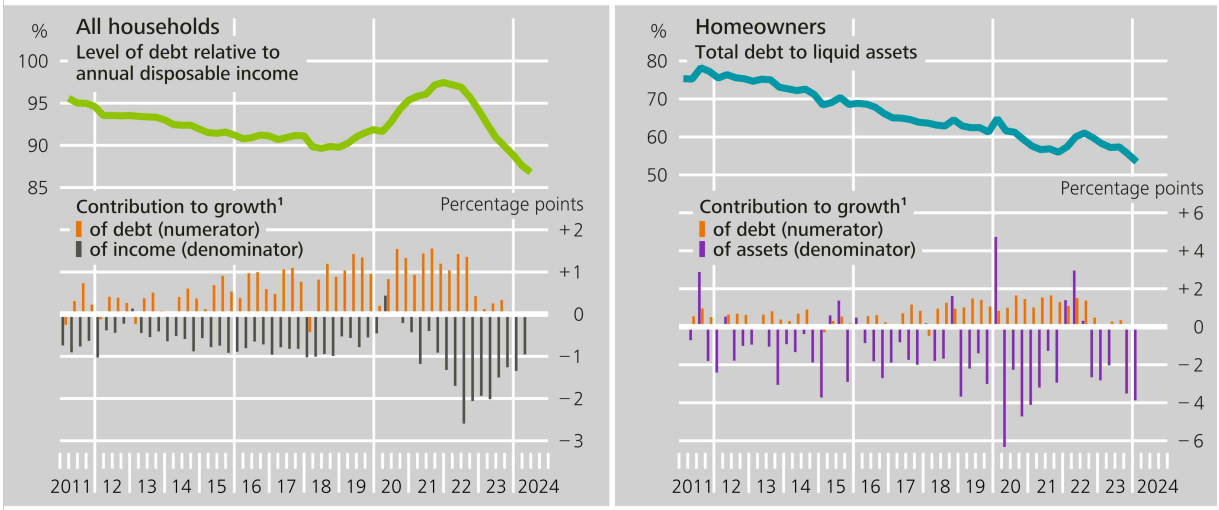
The debt sustainability of households in Germany has improved overall. By mid-2024, households' aggregate debt-to-disposable-income ratio fell to around 87 % – corresponding to a decline of around 11 percentage points compared with the peak at the end of 2021 (see Chart 4.1.12). This decline is not only due to rising incomes, but also to a drop in new lending compared with the period before the increase in interest rates (see section 4.1.2 "Downturn in the financial cycle is slowing"). Looking at households that own residential property, the ratio of liquid assets to outstanding debt has improved overall (see Chart 4.1.12). This indicates that these households are more resilient. [39)]

38 Follow-up financing for residential real estate loans taken out during the low interest rate period is likely to increase from 2028 in particular. However, the debt burden is likely to remain sustainable overall even then, due to repayments already made and increased incomes; see Deutsche Bundesbank (2023a).

39 Liquid assets comprise the sum of cash and deposits, debt securities, listed shares and shares in investment funds; see Deutsche Bundesbank (2022b).

Household debt in Germany

Chart 4.1.12



1 In each case, contribution to the quarter-on-quarter percentage change in the ratio.

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4.1.5 Globally high debt levels render the financial system more vulnerable to adverse developments

Public and private debt levels remain high worldwide. In many advanced and emerging market economies, government debt had reached historical highs even before the coronavirus pandemic. During the pandemic, government debt increased even further due to the measures taken to address the public health crisis (see Chart 4.1.13).[40] Despite coming down slightly from 2022 onwards, government debt ratios are still significantly elevated both in a long-term comparison and relative to the pre-pandemic period.[41] In the private non-financial sector, until the outbreak of the coronavirus pandemic, changes in debt relative to GDP were largely shaped by the legacy of the global financial crisis: debt rose especially in economies that had recorded more moderate debt growth in the decade leading up to the financial crisis. By

40 See Boone et al. (2022).

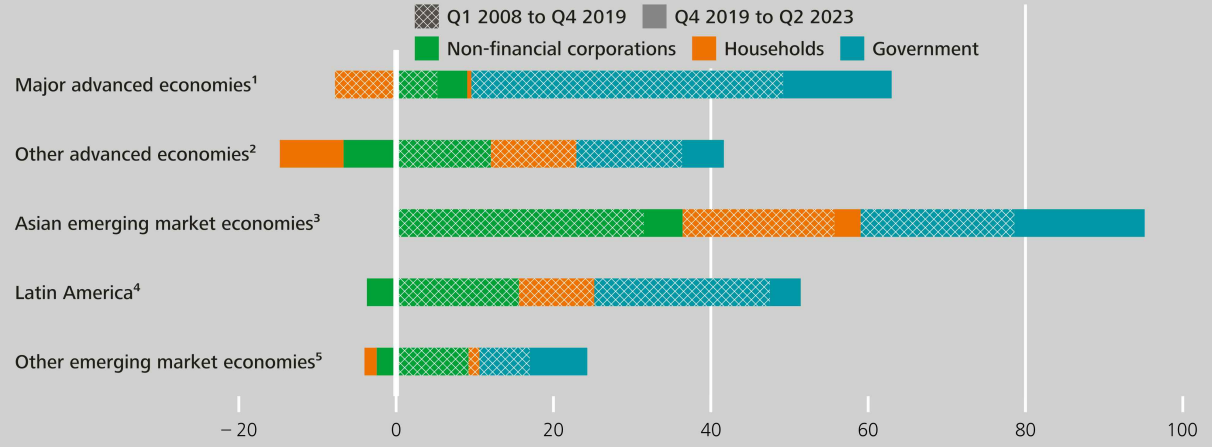
41 See International Monetary Fund (2024). Although the government debt ratio in the euro area has declined since 2020 owing to high inflation rates, it remains above the pre-crisis level of 2019, at 90 % relative to GDP. In the United States, the government debt ratio stood at 97 % at the end of 2023, just under 18 percentage points above the level of 2019. See Committee for a Responsible Federal Budget (2024), Congress of the United States Congressional Budget Office (2020).

contrast, non-financial corporations and households tended to reduce their debt in economies where debt had risen particularly sharply before the crisis. During the pandemic, debt rose significantly in the private non-financial sector, particularly amongst enterprises.[42)] Since then, debt ratios in the private non-financial sector have remained consistently high in many advanced and emerging market economies. In some countries, debt ratios have even increased further (see Chart 4.1.13).

Changes in debt relative to GDP

Chart 4.1.13

In percentage points, data as at September 2024



Sources: BIS and Bundesbank calculations. **1** Euro area, Japan and United States. **2** Australia, Canada, Switzerland, Denmark, United Kingdom, Norway, New Zealand and Sweden. **3** China, Hong Kong, Indonesia, India, South Korea, Malaysia, Singapore and Thailand. **4** Argentina, Brazil, Chile, Columbia and Mexico. **5** Czechia, Hungary, Poland, Russia, Saudi Arabia, Türkiye and South Africa.

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High levels of debt render the global financial system vulnerable to macroeconomic shocks. High levels of debt and debt service costs reduce the options available to governments and private actors when it comes to cushioning the impact of unexpected negative developments. In addition, debt service costs are likely to increase in the future: when financing expires, it may have to be renewed at higher interest rates given that rates have risen in recent years. Adverse developments could cause a sudden increase in default risk and risk premia.

Government debt is expected to rise further in some euro area countries and in the United States.[43)] According to forecasts by the US Congressional Budget Office, the US government debt ratio is expected to increase significantly over the next ten years,

42 See Bank for International Settlements (2022).

43 See European Commission (2024).

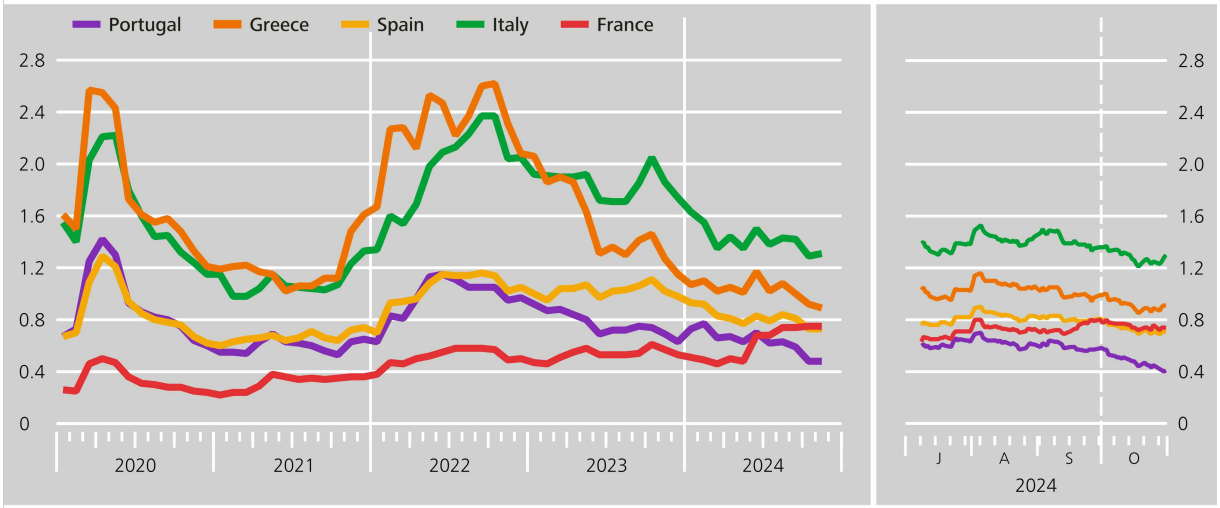
rising more than 20 percentage points by 2034 from a level of 99 % of GDP in 2024.[44)] This development could trigger concerns about the sustainability of US debt in the financial markets, causing yields to rise.[45)] Two factors could limit a possible rise in US bond yields. First, US government bonds have always been considered a safe haven. Second, the US dollar remains the world's most important reserve currency. The increase in risk premia for French government bonds after snap elections were called in June 2024 highlights how sensitive markets can be to the risk of rising government debt. The interest rate premium on French government bonds has not come back down since. It remains elevated when compared with other European countries owing to ongoing concerns about France's debt sustainability (see Chart 4.1.14).

Yield spreads on ten-year government bonds vis-à-vis Germany

Chart 4.1.14

Percentage points, monthly averages; as at October 2024

Daily data



Source: Bloomberg Finance L.P.
Deutsche Bundesbank

Concerns over debt sustainability in other countries, especially in the euro area and the United States, can ultimately affect the German financial system through real economic and financial interconnections. Banks, investment funds and insurers in Germany are interconnected with foreign non-financial debtors through loans and investments. Foreign government bonds, in particular, play a central role, serving as both investment and collateral. However, these direct links are not the only channel of contagion. In the euro area, national banks, and to a lesser extent insurers and pension

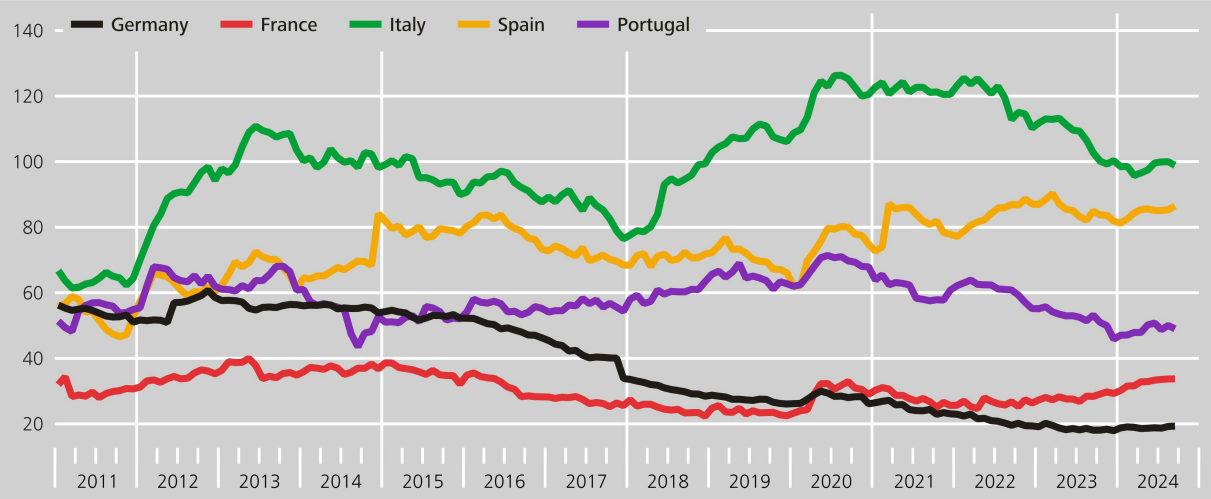
44 See Congress of the United States Congressional Budget Office (2024).

45 For more on concerns about the sustainability of US government debt, see Auerbach and Gale (2024), Bureau of the Fiscal Service (2024).

funds, too, remain significant buyers of their home country's government bonds. This is particularly the case in Italy (see Chapter 6 "The German and Italian government bond markets from a financial stability perspective") and Spain (see Chart 4.1.15).[46] Should doubts about a sovereign's debt sustainability emerge, this could initially affect that country's financial system through the sovereign-bank nexus and, ultimately, spill over to the German financial system through interconnections with German intermediaries. In addition, concerns about a country's creditworthiness, especially in the case of the United States, could trigger a shock in global financial markets. As a result, the prices of numerous securities could fall – including some that were not directly affected by the shock. The German financial system could indirectly suffer additional losses through these market price effects.[47]

Domestic government bonds in the portfolios of monetary financial institutions* Chart 4.1.15

As a percentage of total capital, monthly data, as at September 2024



Source: ECB. * Credit institutions and money market funds, excluding central banks.
Deutsche Bundesbank

4.1.6 The macro-financial environment remains challenging

An unexpected deterioration in the macro-financial environment could challenge the financial system. While the likelihood of disorderly developments has decreased

46 See Deutsche Bundesbank (2024g).

47 See Deutsche Bundesbank (2019). For more on the effects of a shock in the United States on global financial markets, see Eickmeier et al. (2024).

compared with 2023 (see section 4.1.1 "The macro-financial environment improved over the course of last year"), downside risks nonetheless persist. If, unexpectedly, there were a more severe economic downturn and the anticipated economic recovery were delayed, default risk in both the household and the corporate sector could rise more sharply.

In particular, elevated geopolitical risks are causing uncertainty in the macroeconomic outlook and harbour significant downside risks for macroeconomic developments. Geopolitical risks can have a significant impact via real economy and financial channels (see the supplementary information entitled "Geopolitical risks: impact on financial stability" below). As geopolitical tensions rise, the hybrid threat situation is also intensifying. Cyberattacks, in particular, may jeopardise financial stability. Geopolitical risks have characteristics comparable to those of systemic financial stability risks. From a systemic perspective, enterprises and financial market players may not take geopolitical risks sufficiently into account when planning their individual supply and value chains. In the real economy, as in the financial system, interconnectedness can imply that losses and difficulties faced by individual market participants affect the system as a whole and amplify the initial effects of geopolitical shocks. Government action can influence the impact shocks have and who ultimately bears risks. Systemic risk requires appropriate regulation which focuses on the system as a whole. Geopolitical risks may also require macroprudential measures to safeguard financial stability.

Supplementary information

Geopolitical risks: impact on financial stability

Geopolitical developments could significantly hamper economic growth in Germany. The extent to which cyclical downside risks are correlated with changes in geopolitical risks can be estimated using a growth-at-risk approach. Quantile regressions are used to estimate the overall probability distribution of future GDP growth depending on various factors. If, in addition to the current growth in German industrial output, the regressions also account for a sentiment indicator of business climate, financial stress as well as geopolitical risks, the estimated distribution shifts to the left. [1] The probability of lower GDP growth rates in Germany tends to increase (see Chart 4.1.16). [2]

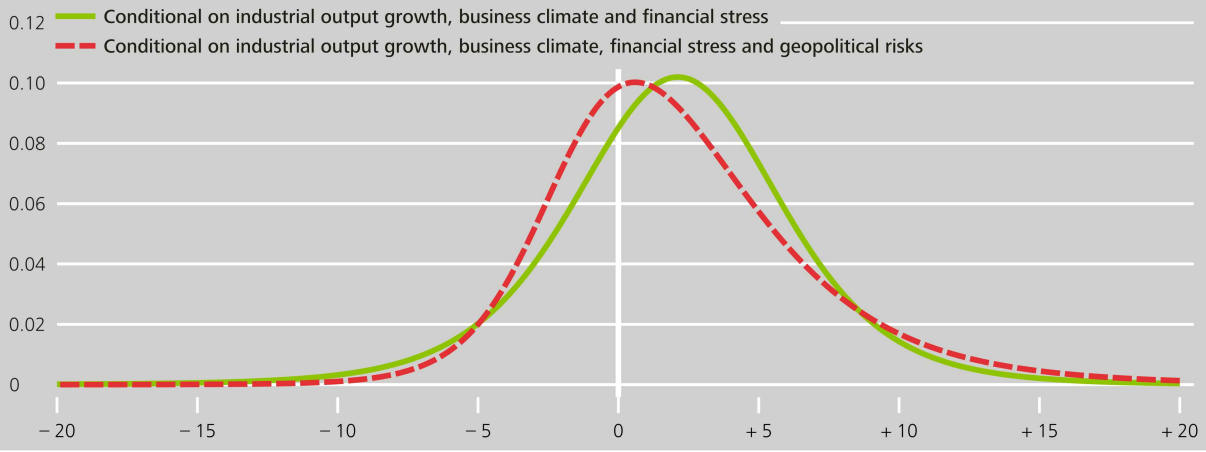
1 The current geopolitical risk level is approximated using a historical geopolitical risk index; see Caldara and Iacoviello (2022). This allows some aspects of geopolitical risks to be measured empirically. The index is based on coverage of geopolitical threats and incidents in three English-language newspapers. It reflects global geopolitical risks from an Anglo perspective. Given the central role of the United States, in particular, for the global economy and global financial system, the index provides a good metric for assessing the impact of geopolitical risks on the global macro-financial environment. Higher index values indicate a greater probability or intensity of adverse geopolitical events and shocks. However, its design implies that the index does not fully reflect two central dimensions of geopolitical risks: cyber incidents and hybrid threats.

2 This relationship is also evident when using an index for geopolitical risks based on reporting in German newspapers. See Bondarenko et al. (2024).

Distribution of GDP growth rates in Germany*

Chart 4.1.16

Probability density, as at Q1 2024



Sources: ECB, OECD, Federal Statistical Office, Caldara, Dario and Matteo Iacoviello (2022), Measuring Geopolitical Risk, American Economic Review, April, Vol. 112, No 4, pp. 1194-1225, and Bundesbank calculations. * Estimated density functions based on quantile regressions for real GDP growth in Germany (%, annualised) for the first quarter of 2024 based on data from the fourth quarter of 2023.

Deutsche Bundesbank

In the short-term, risks to financial stability from geopolitical developments arise from abrupt changes, in particular, that can have a substantial macroeconomic impact via real economy, financial and hybrid channels. [3)] The real economy channel describes how geopolitical events affect production and value added processes. The financial channel refers to the impact on the financial system, for example on risk premia, financing conditions, asset prices and capital flows. The hybrid channel refers to geopolitical threats and actions that can hamper the functioning of critical infrastructure – for instance, the energy supply, communications and payment systems. Cyberattacks are typical examples of such actions. Through these channels, geopolitical shocks can create uncertainty in the financial system and increase liquidity and credit risk. Typically, a shock is transmitted through several of the channels simultaneously.

3 In addition to the macroeconomic impact of geopolitical shocks, geopolitical tensions lead to structural changes in the economic and financial system in the medium term, if, for example, de-risking or a friend-shoring strategy is pursued. As part of such strategies, supply chains are diversified and reshored to countries with similar values. Abrupt adverse developments stemming from geopolitical shocks may then become less likely. At the same time, less use may be made of the efficiency gains from the international division of labour. In addition, broad-based fragmentation, i.e. a move away from global economic and financial integration on the grounds of geopolitical considerations, reduces the opportunities for diversifying risks globally over the medium and long term. Studies indicate that increasing fragmentation could significantly hamper global economic growth. See Aiyar et al. (2023), Baba et al. (2023), Cerdeiro et al. (2021).

Amid mounting geopolitical tensions, geopolitical shocks could increase in frequency and intensity in the future. The macroeconomic and macro-financial consequences of geopolitical shocks can be illustrated using a factor-augmented vector autoregressive (FAVAR) model.[4] The model captures the interaction between a geopolitical risk index and a small number of unobserved factors estimated on the basis of monthly data for the G7 countries and selected euro area countries.[5] These factors reflect the information that is available in a large international dataset and thus enable Germany's economic and financial links with other advanced economies to be taken into account.[6] Global geopolitical shocks are identified in the model based on the assumption that they occur exogenously from the perspective of the country in question and can directly influence the macro-financial environment.

The global macro-financial environment may deteriorate substantially following a geopolitical shock. Chart 4.1.17 shows the estimated responses of selected variables to an adverse geopolitical shock. The results suggest that geopolitical shocks directly increase uncertainty and risk aversion in the international macro-financial environment. Equity market volatility rises immediately, and corporate credit spreads widen. Economic policy uncertainty grows, and business confidence dwindles. Furthermore, geopolitical shocks can, via supply chain disruptions and disruptions to critical infrastructure, lead to supply-side bottlenecks and dampen international trade and global oil and natural gas production.[7] Taken together, these developments weigh on private consumption, output growth and lending, and create inflationary pressures.[8]

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4 See Bernanke et al. (2005) and Eickmeier et al. (2024).

5 See Caldara and Iacoviello (2022). Developments in the euro area beyond the G7 are represented by aggregated variables that assign a weighting to the countries included (Austria, Belgium, Finland, Ireland, the Netherlands, Portugal and Spain) according to their average real GDP adjusted for purchasing power in the years 1999 to 2023.

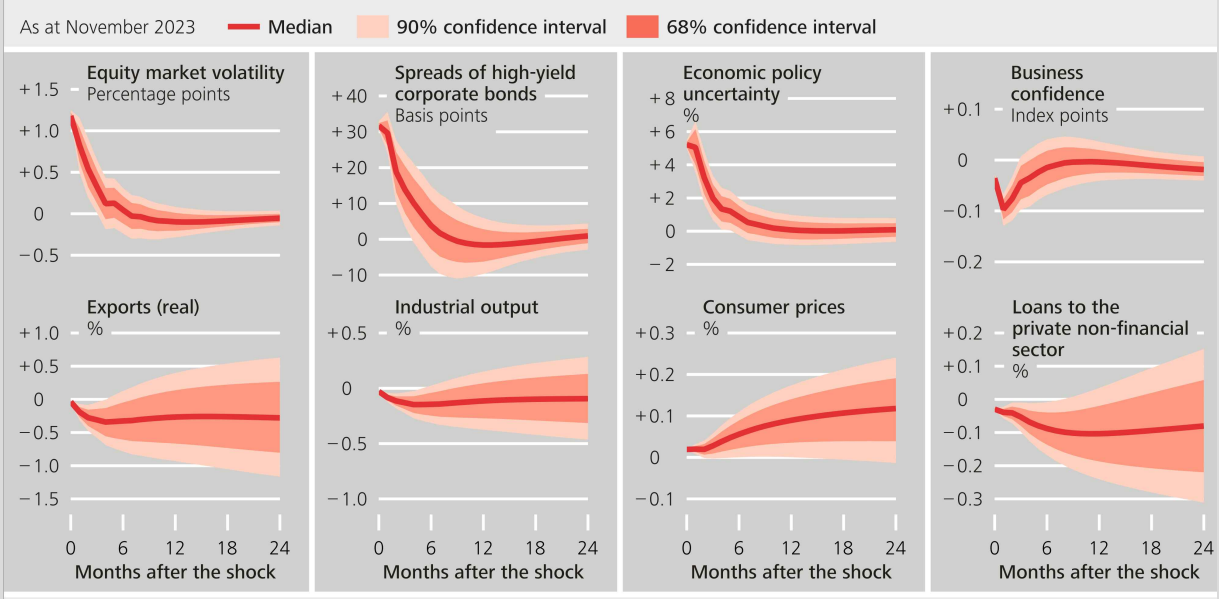
6 The dataset is an unbalanced panel containing 195 monthly time series for the period from January 1990 to November 2023. Indicators for the real economy, price level, business climate, economic policy uncertainty and international trade are modelled. Time series for the equity, bond, foreign exchange, commodity and precious metals markets are taken into account for the transmission across the financial markets. The unobserved factors are estimated using an approach that allows for missing observations; see Buch et al. (2014). The variables are transformed to ensure their stationarity; see Stock and Watson (2002). The data are also adjusted for outliers; see Stock and Watson (2005). Outliers are observations from the stationary data with absolute median deviations greater than five times the interquartile range.

7 Depending on the trigger, a geopolitical shock can affect the real economy not only on the supply side, but also on the demand side. In view of heightened economic policy uncertainty and eroding business confidence, a geopolitical shock can also have a dampening impact on global demand and international trade. Economic activity deteriorates and consumer prices tend to fall as a result. Given the broad range of geopolitical shocks covered by the geopolitical risk index, demand-side and supply-side effects overlap in the model results; see Caldara and Iacoviello (2022). On balance, the model results suggest that inflationary effects more than offset deflationary effects. See Caldara et al. (2024).

8 In line with the FAVAR model estimates, analyses conducted by the ECB also show that a geopolitical shock leads to a deterioration in the macro-financial environment, with adverse effects on macroeconomic activity and uncertainty in the financial markets. In addition, ECB analyses show that equity funds experience capital outflows and that banks' funding conditions (including creditworthiness) deteriorate as a result of a geopolitical shock. See European Central Bank (2024b).

International effects of a negative geopolitical shock*

Chart 4.1.17



Sources: Bloomberg Finance L.P., Federal Reserve Bank of St. Louis, data from ICE used with permission from ICE Data, U.S. EIA, Caldara, Dario and Matteo Iacoviello (2022), Measuring Geopolitical Risk, American Economic Review, Vol. 112, No 4, pp. 1194-1225, and Bundesbank calculations.
* Impulse responses (GDP-weighted average for the G7 and selected euro area Member States with 68% and 90% confidence intervals) to a geopolitical risk shock with one standard deviation, estimated using a factor-augmented vector autoregressive (FAVAR) model for data from January 1990 to November 2023.

Deutsche Bundesbank

The German financial system is vulnerable to geopolitical shocks given Germany's global trade and financial ties. In view of rising geopolitical tensions, risks to financial stability could increase further going forward. From a macroprudential perspective, it is therefore important to understand how geopolitical shocks can affect the financial system given macroeconomic linkages. For instance, monitoring geopolitical developments can help identify risks early on. Even in the wake of Russia's war of aggression against Ukraine and the energy price crisis that followed, losses in domestic lending business remained small, not least due to economic policy responses. Partly because of this experience, there is a risk of geopolitical risks being systematically underestimated. Market participants should proactively consider geopolitical risks in their business decisions to pre-emptively mitigate the impact of potential geopolitical escalations.

In addition, the hybrid threat situation is intensifying in the wake of geopolitical tensions – particularly the threat posed by cyberattacks. This is why supervisors and the financial sector should prepare for specific hybrid threat scenarios. A cyberattack on large, internationally interconnected credit institutions may have a substantial impact on the real economy if the institutions' systems are no longer accessible. Investment in cyber resilience in the financial sector is therefore of vital importance.

Enhancing cyber resilience is also a key focus of microprudential and macroprudential supervision in Germany and Europe. Furthermore, macroprudential policy is tasked with enhancing the resilience of the financial system against other types of geopolitical shocks as well.

4.2 Banking system: vulnerabilities and resilience

Overall, the German banking system coped well with the sharp rise in interest rates in 2022; however, vulnerabilities remain. After the sharp rise in interest rates led to considerable volatility in the international financial markets, the markets initially focused on banks' market and liquidity risks.[48)] German banks were barely affected by deposit withdrawals, but recorded significant losses in their securities portfolios in 2022. The high losses in value were a result of the high interest rate risk that banks had built up in the previous phase of low interest rates. In addition to the losses reported on balance sheets, high unrealised losses (losses in value not recognised on balance sheets) accumulated in their banking books for a time, but have since subsided significantly, albeit not completely. The sharp increase in funding costs that was feared on account of the rise in interest rates in 2022 did not materialise. Nevertheless, as lending rates rose, banks were able to generate unexpectedly good net interest income in 2023.

In view of the economic situation, credit risk is now increasingly coming under the spotlight. In the past, the Bundesbank has repeatedly drawn attention to institutions' low risk provisioning. This low provisioning reflected low insolvency rates in the corporate sector, but future credit risk could have been underestimated.[49)] This is because a sharper rise in insolvencies was prevented in no small part by the fiscal policy interventions in favour of the corporate sector during the global financial crisis and also during the pandemic. Institutions could now expect similar measures in times of crisis. The macro-financial environment has since changed significantly. While loan loss allowances have risen, the assessment of future default risks has remained virtually unchanged overall. Hence, there is a danger that banks might continue to underestimate these risks. The interconnectedness with non-bank financial intermediaries (NBFIs) could further weaken the resilience of the banking system during periods of stress (see the supplementary information entitled "Contagion channels between banks and investment funds" and section 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience").

48 Market risk refers to the risk of changes in the value of market-traded instruments. Liquidity risk is defined as the risk that banks will no longer be able to meet their immediate payment obligations in full or on time, or only at prohibitive cost.

49 See Deutsche Bundesbank (2021).

4.2.1 Unrealised losses in banks' banking books are declining

The value losses resulting from higher interest rates only had to be partially recognised on banks' balance sheets, but the unrealised losses that have arisen could potentially depress future income. Under the German Commercial Code (*Handelsgesetzbuch*), banks value securities assigned to long-term assets using the lower of cost or market value principle. Similarly, under the International Financial Reporting Standards (IFRSs), banks can measure securities at amortised cost. Unrealised losses arise when the market value of securities falls below their balance sheet value.[50] The formation of unrealised losses does not therefore have an impact on profit or loss and does not have an adverse effect on banks' balance sheet equity. Nonetheless, unrealised losses do entail economic costs. The institutions in question miss out on the commensurate amount of higher interest income from securities that have become cheaper. They therefore merely spread out the securities losses over a longer period of time, especially as long-term securities are normally not sold before maturity.

Unrealised losses arose not only for securities but the banking book as a whole. The banking book contains all the interest-bearing assets and liabilities of a bank, regardless of whether they are marketable or not. Unlike interest-bearing securities, which form part of the banking book, the market values of other items in the banking book are not readily available. This is particularly true of loans. Nevertheless, an economic value can be assigned to such items through their present value. This is defined as the sum of the values, discounted using current interest rates, of all future payments of the respective item. The present value of the banking book is a supervisory metric for interest rate risk, which banks are required to determine on a regular basis. According to estimates, in the third quarter of 2022 the unrealised losses in the banking books of savings banks amounted to around 20 % of common equity tier 1 (CET1) capital, and were even as high as around 29 % in the case of cooperative banks (see Chart 4.2.1). Since the end of 2022, unrealised losses in the banking books of savings banks and credit cooperatives have fallen significantly, standing at around 6 % and 15 % of CET1 capital, respectively, in the second quarter of 2024. The decline in unrealised losses is due to interest rate developments and interest rate positions reaching maturity or approaching their maturity date (pull-to-par effect).[51]

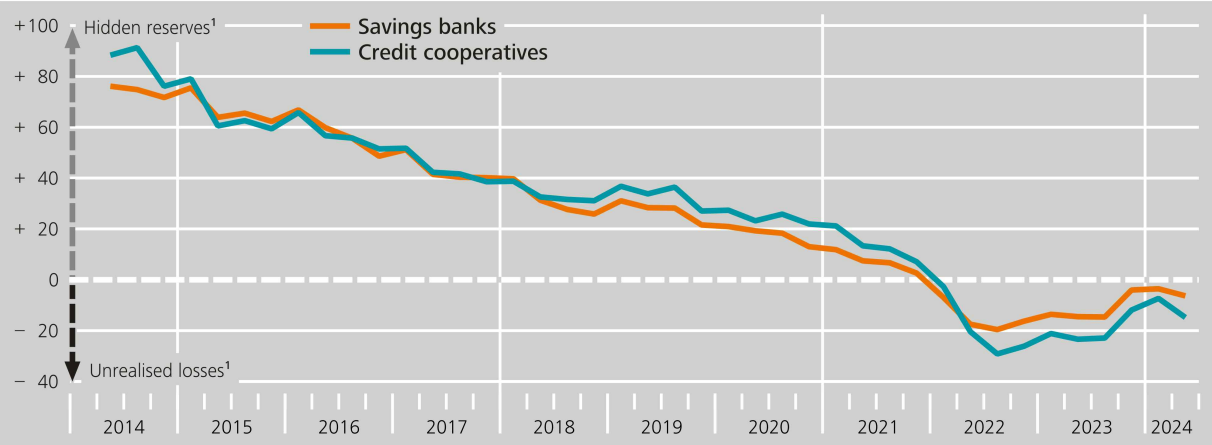
50 Hidden valuation reserves arise when the market value of securities rises above their balance sheet value.

51 At maturity, the price of a bond is normally equal to its nominal value. The pull-to-par effect describes the price of a bond converging to its nominal value over time.

Hidden reserves and unrealised losses in the banking book of German savings banks and credit cooperatives*

Chart 4.2.1

As a percentage of CET1, as at Q2 2024



* Includes only primary institutions with no trading book positions. **1** Hidden reserves and unrealised losses in the banking book calculated as the banking book's present value less its book value (the latter being approximated as recognised equity and the fund for general banking risks).

Deutsche Bundesbank

Unrealised losses are also declining at large, systemically important banks. If viewed purely in relation to securities, unrealised losses at other systemically important institutions (O-SIIs) fell significantly to 2.2 % of CET1 capital at the end of 2023. For the banking book as a whole, however, it is difficult to assess the evolution of unrealised losses at large banks. This is mainly due to the difficulty of using supervisory reporting data to determine what the banking book contains when institutions conduct complex transactions on a large scale. However, developments in the present value of the banking book at large, systemically important banks indicate that these institutions have suffered lower present-value losses in relation to their banking book as a whole. This is probably because large institutions actively manage interest rate risk to a greater extent, for example using derivatives.

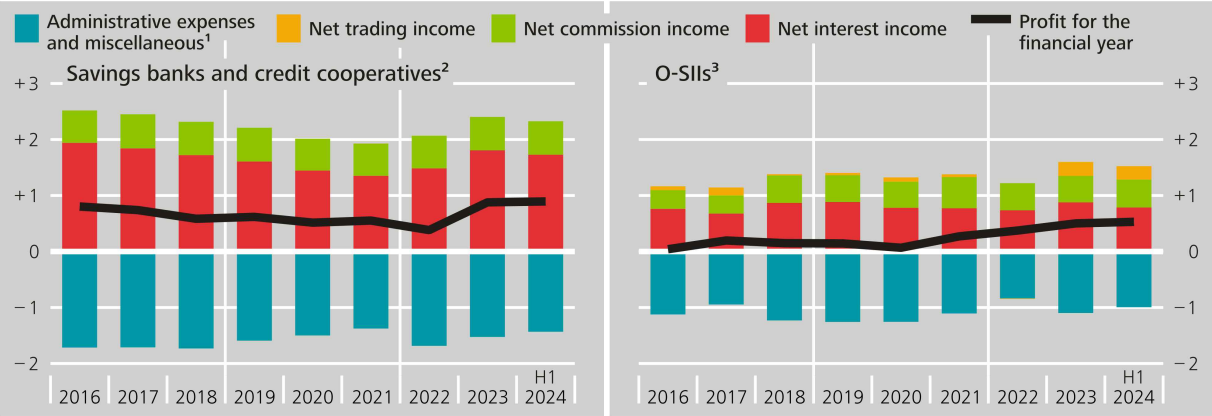
4.2.2 Net interest income remains good, but risks to income are increasing

After very high net income for the year in 2023, banks' profitability is continuing to develop positively. In 2023, savings banks and cooperative banks, in particular,

recorded high net interest income in absolute terms.[52] In relation to total assets, however, net interest income for these banks, at 1.8 %, was no longer quite as exceptional, but roughly matched a level last seen in 2017 (see Chart 4.2.2). The large, systemically important banks, for which traditional lending is less important, also performed strongly in 2023 by this measure, posting net interest income amounting to 0.88 % of total assets. In addition, these banks generated good net trading income, which stood at 0.24 % of total assets in 2023 and continued on this positive trend in the first half of 2024.[53] Developments in banks' other profit components were unremarkable.

Pre-tax profits* Chart 4.2.2

As a percentage of total assets, as at H1 2024 (annual data up to end-2023, annualised data for H1 2024)



* Contributions of profit components to profits. **1** Encompasses, inter alia, risk provisioning in lending business, the valuation result of the liquidity reserve and the valuation result of fixed assets and participating interests and shares in affiliated enterprises. **2** The time series are based on individual institution data. **3** Comprises 15 other systemically important institutions (O-SIIs), with the three institutions that relocated a significant portion of their banking business to Germany following Brexit only being included as of 2022. The time series are based on group data, where available, and otherwise on individual institution data.

Deutsche Bundesbank

Banks continue to benefit from low interest rates in deposit business and correspondingly low funding costs. Interest rates on overnight deposits normally correlate significantly with market interest rates, even if their levels differ. Up until interest rates began going up in 2022, the interest rate on overnight deposits was well approximated by a transformed, deposit-equivalent market interest rate (see Chart 4.2.3).[54] This relationship partially broke down following the rise in interest rates in 2022: while the deposit-equivalent market interest rate rose from 0.06 % at the end of

52 See Deutsche Bundesbank (2024b).

53 For small and medium-sized banks, by contrast, net trading income plays a minor role.

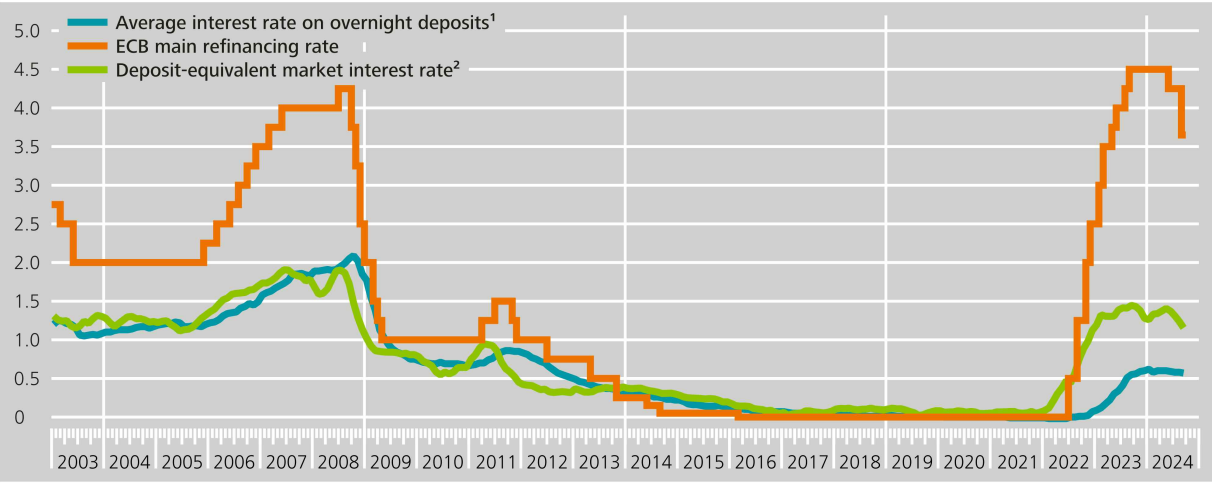
54 The risk-free interest rate for a term of two years was used here. This risk-free interest rate reflects the yield on federal securities with the same maturity. The transformation (deposit rate # 0.32 + 0.36*market rate) was estimated using a regression analysis.

2021 to 1.31 % in July 2024, the average interest rate on households' overnight deposits increased from - 0.01 % to just 0.58 %. This is less than half of the deposit-equivalent market rate. In addition, the rise in interest rates on overnight deposits began much later than for market interest rates and monetary policy interest rates. One reason for the weakened pass-through of monetary policy interest rates could be that German banks have high excess liquidity due to the long period of unconventional monetary policy and also have high deposit holdings. Due to the high level of excess liquidity, banks could be less reliant on deposits than before. At the same time, banks have an incentive to show considerable restraint when increasing interest rates on the large holdings of overnight deposits because the impact on funding costs of any increase would be commensurately high.

Interest rates in Germany

Chart 4.2.3

%, as at September 2024



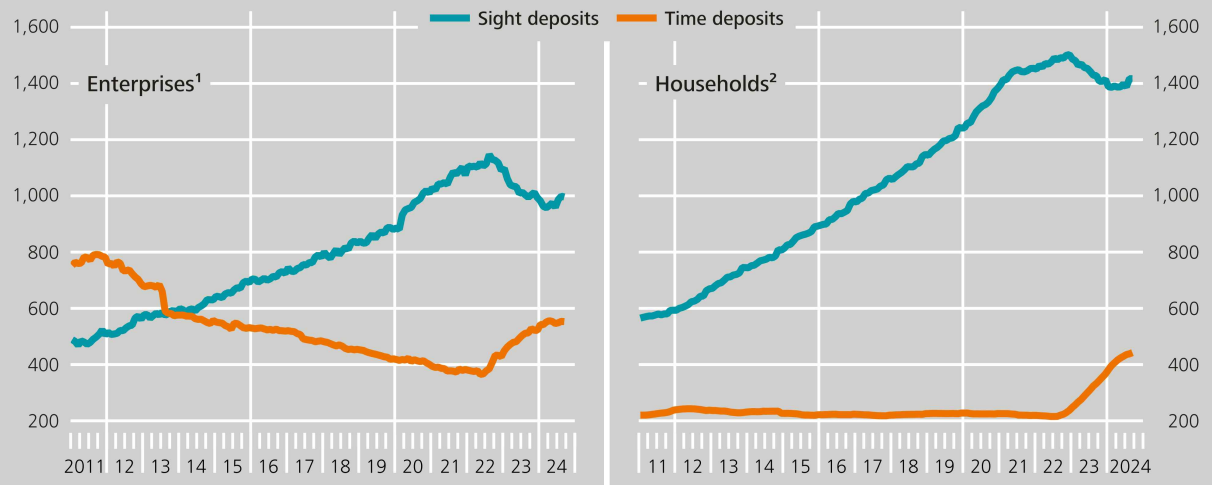
1 Effective interest rates of banks for new overnight deposits from households. **2** Two-year interest rate derived from the estimated Bund yield curve; scaled and shifted.

Deutsche Bundesbank

Banks' funding could become more expensive in future, despite the recent interest rate cuts. After a moderate increase, deposit rates appear to be stabilising at what remains a low level. At the same time, however, customers have reallocated some of their funds from sight deposits to higher yielding investments, such as time deposits (see Chart 4.2.4). This holds true both for enterprises and households. These developments, if sustained, tend to increase the funding costs of credit institutions. Higher funding costs have an impact, in particular, on banks with strong deposit business. While the reallocation of funds now seems to be slowing, it is not yet possible to say whether the process is complete.

Overnight deposits and time deposits of enterprises and households* Chart 4.2.4

€ billion, as at September 2024



* At banks and money market funds. **1** Enterprises and self-employed persons. **2** Households and other persons.

Deutsche Bundesbank

Nevertheless, net interest income this year could be roughly as good as the previous year's levels in the case of savings banks and cooperative banks, but might well decline at large, systemically important banks. For example, net interest income at savings banks and cooperative banks was stable in the first half of 2024, but declined slightly at O-SIIs (see Chart 4.2.5). According to scenario calculations, net interest income from securities holdings and business with enterprises and households is likely to be better for all categories of banks in the second half of 2024 than in the same period of the previous year.[55)] For 2024 as a whole, this results in the developments shown in Chart 4.2.5. The reason for the projected increase in net interest income in the second half of 2024 is that low-interest loans and bonds are expiring and being replaced by instruments at the current interest rate. In the assessment, this effect exceeds the negative contribution of the reallocation of funds from low-interest sight deposits to higher-interest time deposits. Even unexpectedly strong reallocations would probably have only a limited impact on net interest income.[56)] It should be borne in mind that the scenario calculations do not take into account all balance sheet

55 See Memmel et al. (2024).

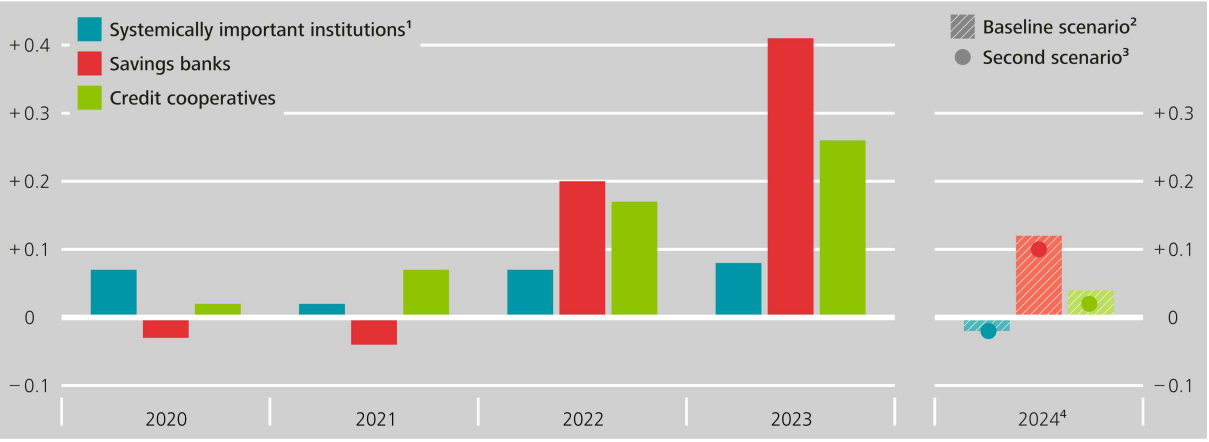
56 In the baseline scenario, it is assumed that just under 5 % of sight deposits will be reallocated to time deposits in 2024. In the adverse scenario, these reallocations amount to just under 9 %. The values are based on historical relationships.

items contributing to net interest income.[57)] As some of these items are sensitive to the interest rate cuts that have taken place, institutions' net interest income could therefore be more subdued overall than calculated in the scenarios.

Net interest income of selected categories of banks in Germany*

Chart 4.2.5

As a percentage of total assets, year-on-year change, as at Q2 2024



* As of 2024 change in net interest income based on scenario calculations of reallocations from sight deposits to time deposits. **1** Comprises the 15 other systemically important institutions (O-SIIs) for 2024 in Germany. **2** Reallocation of 4.7% of sight deposits to time deposits in line with developments since the interest rate reversal in summer 2022. **3** Reallocation of 8.8% of sight deposits to time deposits. **4** Change in second half of 2024 is projected.

Deutsche Bundesbank

4.2.3 Risks in lending business are rising significantly

Institutions have made significantly higher loss allowances for loans to enterprises and households in recent quarters. In relation to the exposure amount, annualised additions to loss allowances amounted to around 0.4 % in the second quarter (see Chart 4.2.6), thus reaching their highest level in over seven years. The increase is likely to be due to weak economic developments and the higher lending rates. In the coming quarters, loss allowances could increase further. In a model analysis, the Bundesbank examined possible developments in the loss allowance ratio. In the baseline scenario,[58)] additions to loss allowances could, it found, increase again significantly over the course of one year. The loss allowance ratio could then reach 0.5 %, close to the historical average since the global financial crisis. If economic activity were significantly

57 They do not include, for example, loans and deposits with financial counterparties or the central bank, issued bonds, derivatives or foreign exposures.

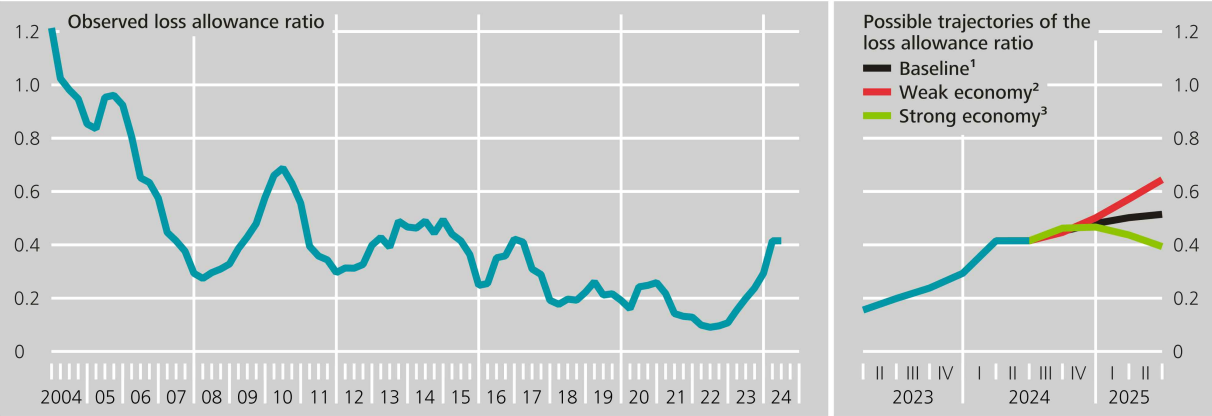
58 The baseline shows a development based exclusively on historical relationships. It does not draw on any forecasts of future economic developments.

weaker, loss allowance ratios could rise to levels that correspond to the highs seen after the global financial crisis. In this scenario, where annual growth in real gross domestic product (GDP) is 2.5 percentage points lower than in the baseline scenario, the loss allowance ratio is more than 0.6 %. This corresponds to a decline in CET1 ratios of only 7 basis points compared with the baseline. In view of German banks' capital reserves (see section 4.2.4 "Banks have high capital reserves"), these additional losses seem manageable. If the economy performs better, however, this development in the loss allowance ratio could soon peak.

Loss allowance ratio* in the German banking system

Chart 4.2.6

%, as at Q2 2024



* Loss allowance ratio measured by annualised additions to loss allowances in relation to the credit volume with enterprises and self-employed persons. Results are based on a vector autoregressive model covering the loss allowance ratio, real GDP and the ifo business climate index. **1** Unconditional forecast of the loss allowance ratio for Q3 2024 to Q2 2025. **2** Annual growth in real GDP 2.5 percentage points lower than the baseline, ifo business climate index at 85 points on average. **3** Annual growth in real GDP 2.5 percentage points higher than the baseline, ifo business climate index at 100 points on average.

Deutsche Bundesbank

Systemically important banks still estimate the probability of default of their corporate borrowers to be low, despite weak economic developments. These institutions quantify the risk of their borrowers on the basis of probabilities of default (PDs), which they calculate using models based on financial mathematics or statistics. These PDs quantify the risk of a borrower not being able to service its liabilities in full within one year. Across all loans to enterprises, the PDs calculated by banks increased only slightly on average, after having actually fallen slightly in the second half of 2022 despite the rise in interest rates (see Chart 4.2.7).[59)] They currently stand at around 1 % . In the case of new loans, the increase in the first half of 2023 was initially stronger, but the respective PDs had also fallen more sharply prior to this. The present low values

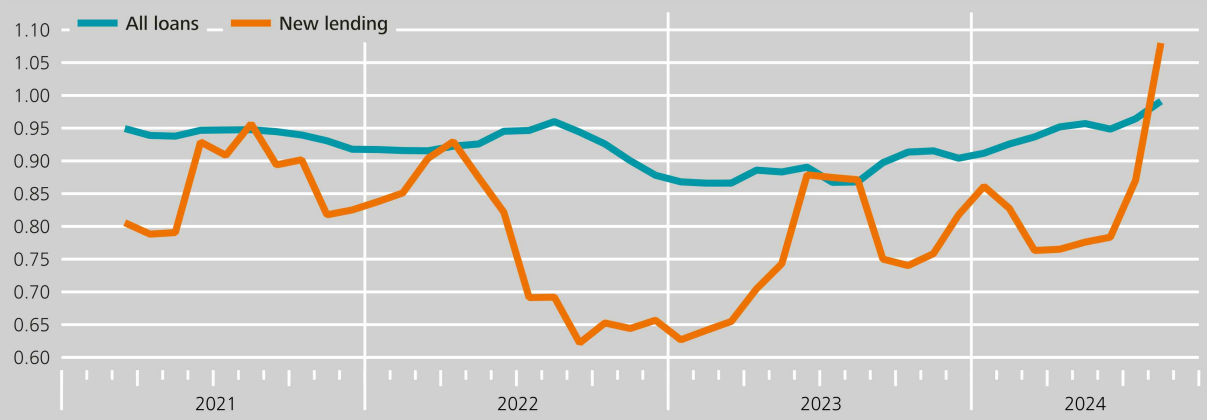
59 The values shown in Chart 4.2.7 relate to all banks that calculate PDs using the internal ratings-based (IRB) approach. In addition to the large, systemically important institutions, these also include some other institutions.

may underestimate current credit risk, also partly because systemically important banks calculate PDs based on long-term averages. This avoids large fluctuations in capital requirements. However, low PDs normally also lead to low risk weights in the calculation of own funds requirements. This aspect is discussed in more detail later in this article. However, it is to be expected that higher interest burdens on enterprises and increased risks given the structural challenges facing the entire sector (see section 4.1.3 "Despite burdens, enterprises are largely robust") will also be reflected in higher mean values in the medium term and thus in the reported PDs.

Probability of default for loans granted by German IRB approach banks to domestic non-financial corporations*

Chart 4.2.7

%, three-month average, as at August 2024



Source: AnaCredit * Average probability of default (PD) weighted by credit exposure for all loans and new lending, with a forecast horizon of one year. Only PDs lower than 40%, reported by 33 banks that calculate their own funds requirement under the internal ratings-based (IRB) approach using their own risk models and have consistently made PD reports in AnaCredit since January 2021.

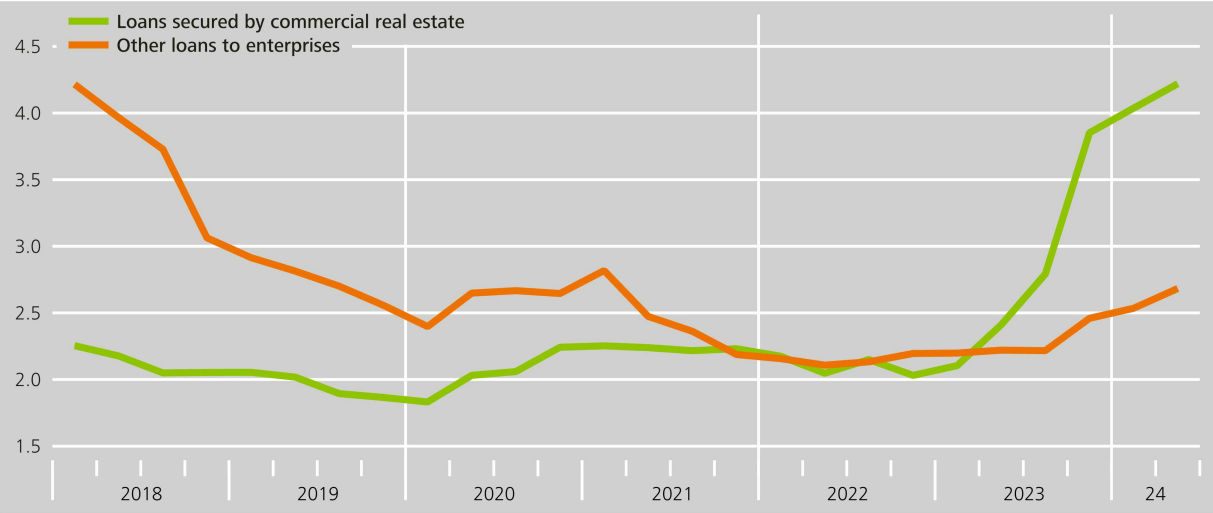
Deutsche Bundesbank

The heightened geopolitical risks could lead to high losses in the banking system, should they materialise. The Russian war of aggression against Ukraine and the ensuing energy price crisis were manageable for the financial system, mainly owing to economic policy responses. The measures taken have greatly mitigated the impact of the rise in energy prices on firms and households. Without these measures, the financial system might have suffered significant losses. Geopolitical risks can arise through various channels (see the supplementary information entitled “Geopolitical risks: impact on financial stability”). It is questionable whether banks are sufficiently factoring in the current geopolitical risks in the low PDs reported for their borrowers, even if these risks are difficult to quantify.

Non-performing loans from German banks to non-financial corporations

Chart 4.2.8

As a percentage of the given credit volume, as at Q2 2024



Deutsche Bundesbank

The rise in loss allowances for commercial real estate loans is substantial. The downturn in the commercial real estate (CRE) markets continued during 2024, though with weakened momentum. As a result, banks that are particularly active in these markets had to make large loss allowances in some cases. The non-performing loans (NPL) ratio for loans secured by commercial real estate has doubled since the end of 2022, albeit from a low level. The aggregate ratio in the second quarter of this year is 4.2 % (see Chart 4.2.8), while the NPL ratios of significant institutions (SIs) for the same period are higher than average, at 5.1 %.[60)] One reason for this is that these banks have above-average exposure to the particularly affected US market. The NPL ratio of SIs is 12.6 % for such US exposures, but just 3.3 % for German exposures. Less significant institutions (LSIs), on the other hand, have a significantly lower NPL ratio for commercial real estate loans, at 3.4 %, owing to their focus on the domestic commercial real estate market.[61)] Some specialist financiers, such as Deutsche Pfandbriefbank,

60 Significant institutions are all banks that are directly supervised by the ECB.

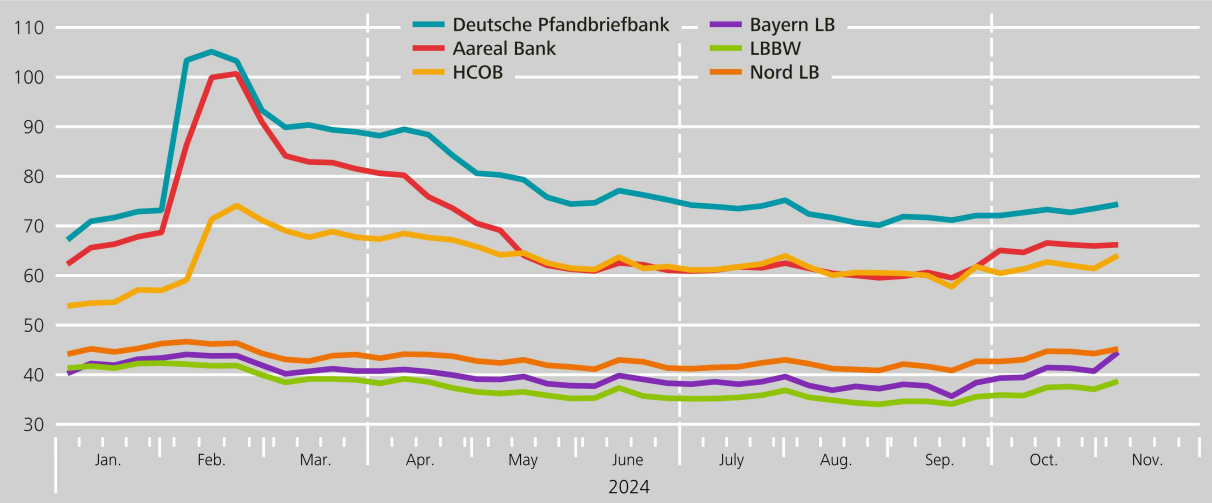
61 LSIs are all banks that are subject to national supervision and are therefore not directly supervised by the ECB .

Aareal Bank and Hamburg Commercial Bank, were also impacted by market reactions. Spreads on Pfandbriefe from these banks rose sharply at the beginning of the year, after risk provisions were significantly higher than expected. However, contagion effects on other banks were largely absent. Spreads on bonds issued by the affected banks have now fallen significantly again (see Chart 4.2.9).

Spreads of selected Pfandbriefe of German banks in the jumbo mortgage Pfandbrief market*

Chart 4.2.9

Against benchmark, weekly data, as at calendar week 45 of 2024



Source: Bloomberg Finance L.P. * The sample is initially formed of German banks whose mortgage Pfandbriefe have a spread of at least 50 basis points in the observation period against maturity-matched Federal bonds (Bunds). These banks – Deutsche Pfandbriefbank (pbb), Aareal Bank and Hamburg Commercial Bank (HCOB) – are specialist financiers that focus, inter alia, on commercial real estate financing. The sample is expanded to include all other systemically important institutions (O-SIIs) that issued a jumbo mortgage Pfandbrief (minimum issue volume €500 million) secured primarily with commercial real estate loans with a maturity date in 2029. The spreads considered are adjusted for the value of embedded options.

Deutsche Bundesbank

The banking system is likely to cope if credit defaults for commercial real estate increase more strongly than expected. The Bundesbank analysed the risks arising from commercial real estate using a scenario calculation.[62)] One risk scenario, featuring a limited commercial real estate downturn, stressed the particularly affected

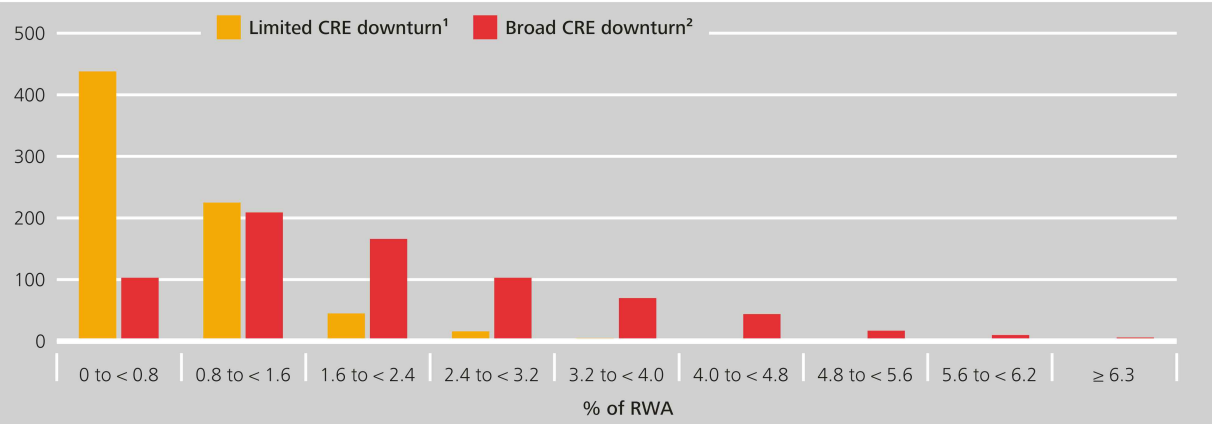
62 The stressed loans also include loans to enterprises secured with real estate for residential purposes, e.g. apartment buildings, a categorisation analogous to the definition in ESRB Recommendation 2016/14 in conjunction with 2019/03; see European Systemic Risk Board (2016, 2019).

sub-segment of real estate development.[63] The result: German banks' aggregate CET1 ratio fell by 0.8 percentage point over the course of a year. These losses, however, were not evenly distributed, but were instead concentrated within one part of the banking system (see Chart 4.2.10). The banks affected would suffer comparatively high losses. Very few banks fall into this category, primarily smaller to medium-sized institutions.

Distribution of losses in a commercial real estate risk scenario calculation for the German banking system*

Chart 4.2.10

Number of banks, as at Q4 2023



Sources: AnaCredit, prudential data, Bulwiengesa, Listenchampion and Bundesbank calculations. * Commercial real estate (CRE) losses in relation to risk-weighted assets (RWA). **1** The real estate development subsector is placed under particular stress. **2** The entire CRE market is placed under stress, not just real estate development.

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By contrast, a broader CRE downturn shows the banking system being affected across the board. If a sharp downturn were to affect not only real estate development but also the entire commercial real estate market, the median CET1 capital ratio would fall significantly more sharply, at up to 1.6 percentage points, owing to losses from credit risk.[64] A significant proportion of banks would experience losses of more than 2.4 % of risk-weighted assets (see Chart 4.2.10). Risks could be heightened by contagion of other banks. Model calculations show that a number of small and medium-sized banks would likely no longer be able to meet their aggregate buffer requirements. These banks could then try to meet their buffer requirements again by deleveraging.[65] The banking system as a whole would still have the capacity to provide sufficient loans,

63 Real estate developers, such as the now insolvent Signa Group, plan and implement both new construction projects and the refurbishment of existing buildings. Their aim is to achieve higher resale value or higher rental income.

64 In addition to real estate development borrowers, the risks facing other commercial real estate borrowers would also increase in such a scenario. These include construction companies or real estate companies with a focus on renting apartments.

65 Deleveraging describes a reduction in the balance sheet with the aim of reducing the debt share.

though, but it is not always possible for firms to switch to a new bank without any problems.

Credit defaults remain low for residential real estate financing. First, given the rise in interest rates, the typically long fixed interest rate period for loans concluded during the period of low interest rates initially protects most households from an increase in debt service. Second, nominal income has risen as a result of higher wage settlements (see section 4.1 "The macro-financial environment and the situation in the real sector"). However, the situation could change in the event of an unexpected, significant increase in unemployment. In this case, defaults would likely rise more sharply, especially for borrowers with high debt servicing. Empirically, the individual default risk of an unemployed borrower increases disproportionately if their debt service rises to over 30 % of original net income.[66] According to household data, around 15 % of borrowers have a debt service ratio of 30 % or higher.[67] The probability of default among these households could increase as unemployment rises.

The structural challenges facing the German economy increase the risks with regard to labour market developments in individual sectors (see section 4.1.3 " Despite burdens, enterprises are largely robust"). If structural changes spark changes in the corporate landscape, an unfavourable scenario could lead to an increase in job losses in industry. High-income employees, who are disproportionately represented as borrowers in private residential real estate financing, would also then be affected. In such a scenario, credit defaults in residential real estate financing could also increase more strongly across the board.

Setting aside the low default rates, the recent decline in real estate prices has tended to increase losses on residential real estate loans. If housing prices fall, the value of the available credit collateral that can be used in the event of a credit default decreases. One indicator of impending loss rates is the ratio of outstanding loan size to current real estate value (current loan-to-value, cLTV). This can be estimated from available data. Households with a cLTV of over 100 % are of particular interest. In such cases, the residual debt would exceed the current value of the property, which could potentially lead to increased losses in the event of the borrower's default. In 2024, the share of loans for house purchase with a cLTV over 100 % increased on the year, reaching around 17 % (see Chart 4.2.11). Newer loan vintages often have an elevated potential for loss due to decreased collateral values as a result of the recent significant fall in residential real estate prices. The underlying properties were often purchased at high prices and little of the loans has been repaid so far.

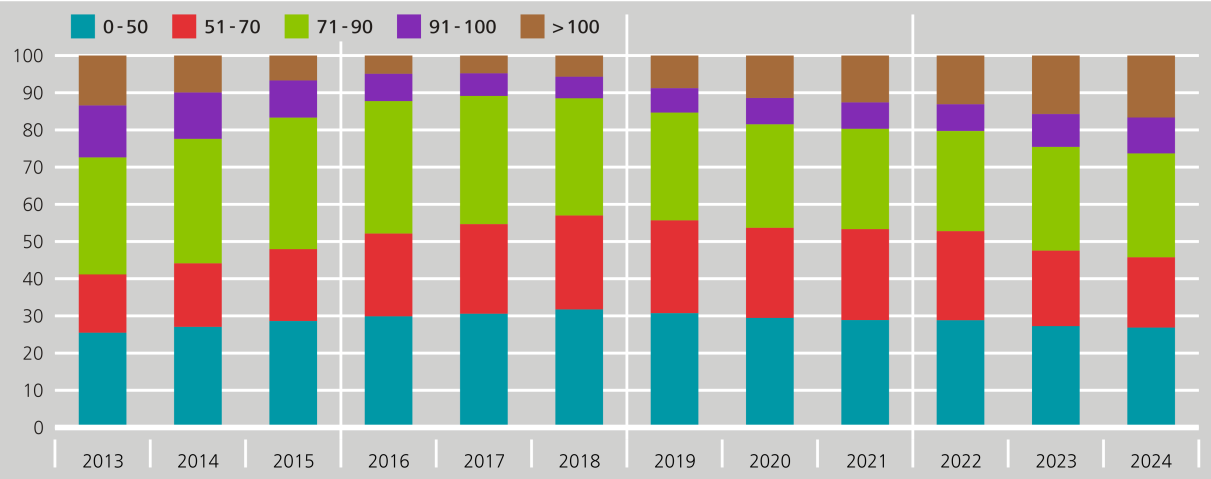
66 See Möhlmann and Vogel (2024).

67 See Deutsche Bundesbank (2023b).

Estimated distribution of current-loan-to-value* in each calendar year

Chart 4.2.11

%, as at October 2024



Source: Bundesbank calculations based on the residential real estate stress test, following Barasinka et al. (2023). * Ratio of outstanding loan size to current real estate value.

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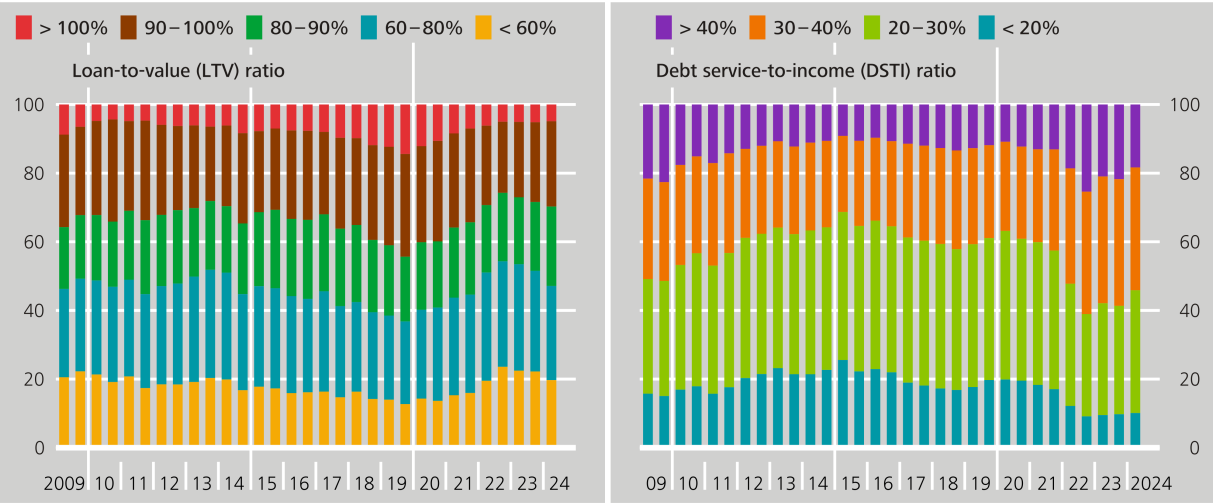
Lending standards in residential real estate financing show rather limited changes on the year. The loan-to-value (LTV) and borrower's debt service-to-income (DSTI) ratios are key metrics here. According to data from the mortgage broker platform Interhyp, loans with a high LTV (90 % and above) accounted for a substantial share of new lending business, last measured at 30 % in the first half of 2024 (see Chart 4.2.12). A default on a loan of this kind usually results in a significant loss rate for the bank. The share of new loans with a high DSTI (40 % and above) is also significant, at 18 %. Borrowers with a high DSTI are more likely to no longer be able to service a loan if their economic situation worsens. After the average LTV of new residential real estate loans fell in the wake of the interest rate reversal (74 % in 2023), the average proportion of borrowed funds rose again to 76 % in the first half of 2024. As a result of higher lending rates, average DSTI rose somewhat from 2022 onwards. It was last measured at 32 % in the first half of 2024, roughly the same level as in the previous year. The debt service of new loans has recently been relatively stable because initial repayment rates have fallen. The risk situation for new loans is therefore mixed, but the available data do not, overall, point to significantly increased risk-taking in private residential real estate

financing.[68] Nevertheless, future LTV and DSTI developments should be closely monitored.

Lending standards for new residential real estate loans in Germany

Chart 4.2.12

As a percentage of total volume[1]; as at the first half of 2024



Sources: Bundesbank calculations based on data provided by Interhyp Group. **1** Weighted using data from the Socio-Economic Panel (SOEP).
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In order to improve the data on private residential real estate financing, the Bundesbank has been collecting data from banks on lending standards since 2023. At the start of this collection process, different reporting institutions implemented the definitions differently.[69] As a result, the Bundesbank and reporting institutions agreed on measures intended to aid harmonisation of this dataset, which is of central importance for macroprudential supervision. These should be implemented by the beginning of 2025, meaning macroprudential supervisors will analyse the data more intensively in future.

In addition to risks from the real sector, macroprudential supervision is also turning its attention to consequences arising from the banking sector's interconnectedness with non-bank financial intermediaries (NBFIs). Direct interconnectedness is when

68 Macroprudential requirements or recommendations in other countries often provide for an LTV ceiling of 80 % to a maximum of 100 % for owner-occupiers. Macroprudential ceilings between 35 % and 50 % are common for DSTI. Macroprudential supervision may allow a free quota. The free quota framework allows the relevant lender to proportionately exceed the requirement at the loan portfolio level.

69 The primary objective of the collection of data on housing loans (*Wohnimmobilienfinanzierungsstatistik* or WIFSTa) is to identify and monitor threats to financial stability. The survey thus serves to fulfil the Bundesbank's tasks under the Financial Stability Act (*Finanzstabilitätsgesetz*). The data will also be used by banking supervisors for making cross-comparisons. Collecting the data involves recording aggregated information on indicators and their distribution as they relate to new housing loans to households.

there are contractual relationships between financial intermediaries, for example those resulting from credit relationships. If losses occur in the NBFI sector, these losses can impact the German banking system through the contractual relationships, for example due to higher risk provisioning. As at the second quarter of 2024, German banks' balance sheet exposure to the global NBFI sector amounted to around 12 % of the aggregate total assets of the German banking system. The NBFI sector is particularly closely linked to German O-SIIs. In addition to direct interconnectedness, there is indirect interconnectedness in which non-contractual transmission channels play the central role in the transmission of shocks (see the supplementary information entitled "Contagion channels between banks and investment funds" and 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience").

4.2.4 Banks have high capital reserves

The German banking system's capital base remains sound. The risk-weighted CET1 ratio stood at an average of around 17 % for O-SIIs in the second quarter of 2024, around 16 % for savings banks and credit cooperatives and around 20 % for other small and medium-sized banks (see Chart 4.2.13). CET1 ratios thus clearly exceed the regulatory minimum requirements.[70)] Capital reserves, i.e. CET1 in excess of minimum requirements, consist of regulatory capital buffers and freely available excess capital chosen by the banks themselves. Unlike minimum requirements, capital buffer requirements may be undershot during periods of stress. This is desirable from a macroprudential perspective, as it counteracts a sharp reduction in the balance sheet, which may adversely affect lending. However, failing to meet capital buffer requirements will result in a profit distribution ban.[71)]

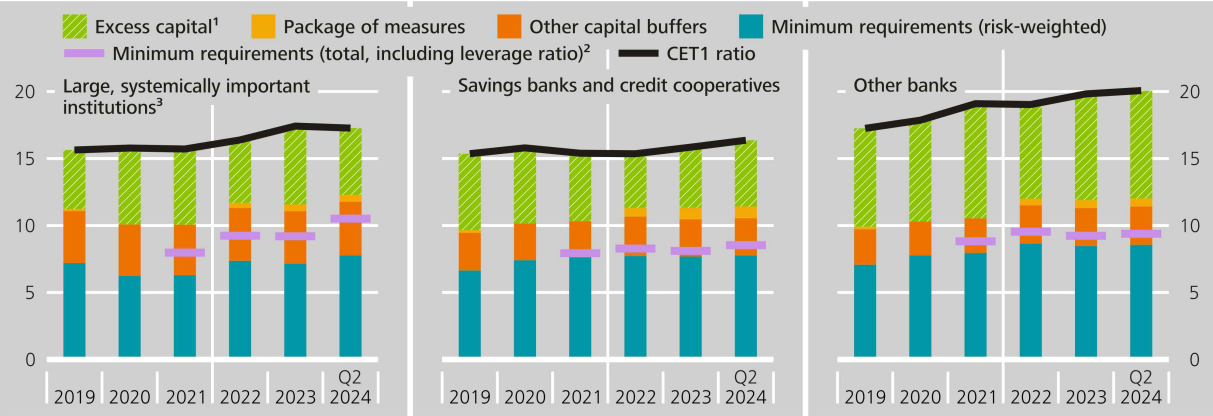
70 According to the rules of the Capital Requirements Regulation (CRR), banks must calculate a total risk exposure amount, which is the sum of their credit risk, their operational risk, their market risk and the risk of a credit valuation adjustment (CVA risk). This total risk exposure amount is compared with own funds (common equity tier 1 capital, additional tier 1 capital, tier 2 capital).

71 These buffers include releasable buffers, such as the countercyclical capital buffer. In periods of stress, supervisory authorities can lower these buffers so that banks do not fall below capital requirements if they wish to use the capital previously preserved by the buffers.

German banks' CET1 capital

Chart 4.2.13

As a percentage of risk-weighted assets at year-end, as at Q2 2024



1 Includes Pillar 2 requirements. **2** Banks must fulfil the maximum risk-weighted and unweighted requirements for common equity tier 1 (CET1) capital, all while fulfilling the requirements stemming from supervisory own funds and resolution frameworks (minimum requirement for own funds and eligible liabilities, MREL). Insofar as either of the unweighted requirements in these frameworks is binding, use of the combined buffer requirement is limited. **3** Comprises 14 O-SIIs (as at 2024, not including the Kreditanstalt für Wiederaufbau (KfW)); the three institutions that relocated a significant portion of their banking business to Germany following Brexit are included only as of 2022.

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Thanks to their capital reserves, most banks can also cope with larger losses without falling below regulatory minimum requirements. This was borne out by a Bundesbank and Federal Financial Supervisory Authority (BaFin) survey of small and medium-sized banks (LSI stress test).[72)] The package of macroprudential measures adopted in January 2022 contributed to good capitalisation (see Chart 4.2.13).[73)] The package of measures was introduced at the time to tackle sizeable vulnerabilities in the banking sector. These included dynamic lending, potential underestimation of credit risk and potentially overvalued assets. The package of measures included an increase

72 See Deutsche Bundesbank and Federal Financial Supervisory Authority (2024)

73 See German Financial Stability Committee (2022).

in the countercyclical capital buffer (CCyB) and the introduction of the sectoral systemic risk buffer (sSyRB).[74] The combined requirements of these two buffers amount on aggregate to 0.7 % of risk-weighted assets (see Chart 4.2.13). However, the amount contained within actually usable buffers is lower, as they may be constrained by parallel unweighted capital requirements from the minimum leverage ratio.[75]

4.2.5 Reported resilience may have been overestimated

Unrealised losses in the banking book are declining, but still a reality for many institutions. After the period of sharply rising interest rates, some banks recorded considerable unrealised losses. The value of bonds fell significantly in some cases. As banks often keep a large portion of these holdings in fixed assets, these losses only had to be recognised to a lesser extent.[76] This spared banks' equity. At the end of 2022, unreported losses in value for securities accounted for 4.1 % of CET1 capital for O-SIIs – at the end of 2023 this was 2.2 %. At savings banks and cooperative banks, unrealised losses can be estimated for the entire banking book as opposed to just in relation to securities, with the banking book containing, in particular, loans as well. Unrealised losses amounted to 6 % of savings banks' CET1 capital in the second quarter of 2024 (20 % in the third quarter of 2022) and 15 % of cooperative banks' CET1 capital (29 % in the third quarter of 2022). Unrealised losses affect the resilience of the banking system, in particular by reducing the economic value of equity. If items with unrealised losses must be liquidated, the previously hidden impairments are then revealed and corresponding losses realised.

Resilience could also be overestimated due to persistently low average risk weights for O-SIIs despite increased cyclical risks. O-SIIs usually use their own models to determine their capital adequacy requirements in lending business. They use these to calculate, among other things, their borrowers' probability of default (PD) (see section 4.2.3 "Risks in lending business are rising significantly"). Risk weights for individual credit claims and thus the risk-weighted assets in lending business are determined on

74 The CCyB is intended to allow the banking sector to weather systemic risks arising from the credit cycle. The CCyB currently stands at 0.75 % on domestic exposures. As foreign exposures are taken into account on the basis of reciprocity regulations, different institutions have different CCyB buffers. The sSyRB was adopted in the light of high valuations for residential real estate and dynamic lending, and amounts to 2 % on exposures to loans secured by residential real estate.

75 The leverage ratio expresses the relation between a bank's supervisory tier 1 capital (numerator) to its total exposure on and off the balance sheet (denominator). Unlike risk-based capital requirements, which are based on assumptions, in the leverage ratio the individual exposures are not risk-weighted but instead included in the metric value for the most part unweighted.

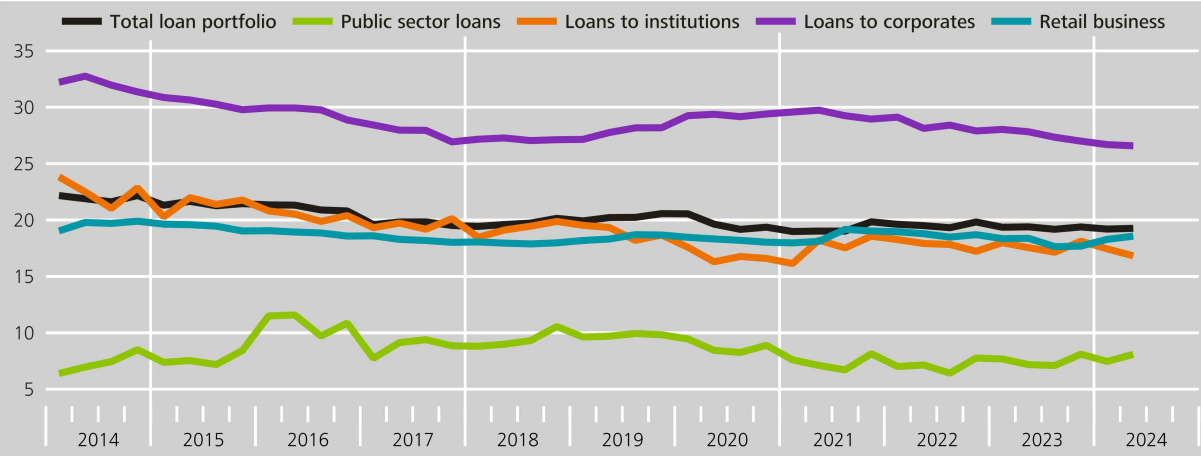
76 See Deutsche Bundesbank (2023a), pp. 35 ff.

the basis of PDs. Risk-weighted assets form the denominator in the risk-weighted CET1 ratio.

The low average risk weights for O-SIIs are the result of a favourable perception of risk. In the last decade, the average risk weights in the loan portfolio of large, systemically important banks have hardly changed (see Chart 4.2.14), especially not for corporate exposures. Even after the rise in corporate insolvencies since the end of 2021 (see Chart 4.1.10), there was no increase. This is not least a result of banks' low assessment of loan PDs (see Chart 4.2.7). Any underestimation of these PDs could in turn mean a commensurate overestimation of the current resilience of the banking system as measured by capital ratios.

Average IRB approach risk weight of systemically important banks* Chart 4.2.14

%, as at Q2 2024



* Measured using RWA density, which is calculated as the ratio of risk-weighted assets (RWAs) to respective gross exposures using an internal ratings-based (IRB) approach. Comprises 15 O-SIIs, with the three institutions that relocated a significant portion of their banking business to Germany following Brexit only being included as of 2022.

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Supplementary information

Digital euro: impact on bank liquidity and funding costs

Impact analyses of the introduction of a digital euro (D€) and its methodological refinements are one of the Bundesbank's key tasks. The ECB Governing Council's decision of 18 October 2023 marked the Eurosystem's launch of a two-year initial preparation phase for the introduction of the D€. One of the Eurosystem's current areas of focus is on impact analyses regarding holding limits for the D€. A holding limit is a maximum amount of D€ per depositor, with the aim being to prevent bank deposits being shifted to D€ holdings on a large scale. This could otherwise have an adverse effect on bank liquidity and financial stability.

Even if all depositors were to shift their balances up to a holding limit of €3,000, the impact on liquidity in the German banking sector would be limited. The analysis refers to a scenario from the previous year in which depositors fully utilise the holding limits (maximum-demand scenario).[1)] The liquidity buffer, which is derived from the liquidity coverage ratio (LCR), is key in this context. The buffer supplements the LCR with non-high-quality liquid – but eligible – assets as well as short-term liquidity available in bank networks. The liquidity buffer of individual banks is compared with the possible withdrawal of deposits upon introduction of a D€. If the buffer is not sufficient to cover the withdrawal of deposits, a liquidity shortfall arises. According to the latest data, only around 4 % of banks in Germany have a liquidity shortfall in the maximum-demand scenario with a holding limit of €3,000 (see Chart 4.2.15, left panel).[2)] In addition, the liquidity shortfall remains relatively small (see Chart 4.2.15, right panel). On aggregate, affected banks would have to add an additional 0.3 % of high-quality liquid assets to their stock in order to cover the liquidity shortfall. The comparatively low liquidity needs (around 0.5 % of interbank trading, as at the fourth quarter of 2023) could be provided via interbank trading. A supplementary analysis for the euro area shows that a small number of euro area banks would additionally be affected by a

1 Initial Bundesbank analyses from the previous year show that the impact on the German banking sector in the scenarios under consideration would be manageable for the holding limit of €3,000 currently being discussed; see Deutsche Bundesbank (2023a).

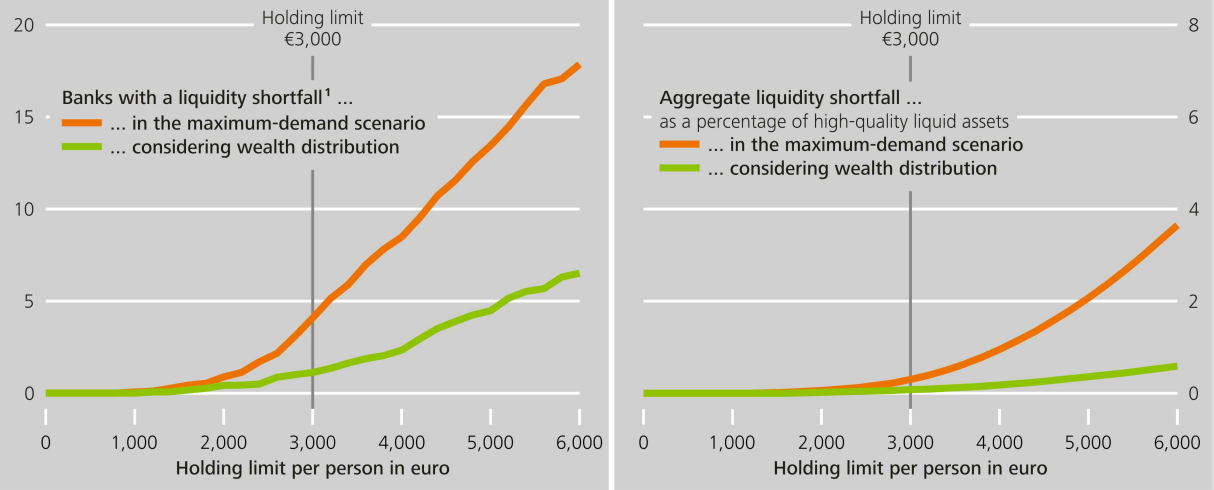
2 Besides the LCR, the systemic liquidity buffer (SLB), which assigns more conservative liquidity weights to high-quality liquid assets (HQLA) than the LCR, is taken into account as an alternative measure; see Krüger et al. (2024) Despite the more conservative liquidity weights of the SLB, the percentage of banks with a liquidity shortfall barely exceeds 6 %.

liquidity shortfall in the case of a holding limit of €3,000. In a scenario with a holding limit of €1,000, almost no banks in the euro area would have a liquidity shortfall.

Analysis of potential liquidity shortfalls for alternative holding limits

Chart 4.2.15

As a percentage of all banks; as at Q2 2024



1 Weighted by total assets.

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When the distribution of deposit balances among the population is taken into account in the maximum-demand scenario with a holding limit of €3,000, the impact on liquidity is reduced by around three-quarters. Bundesbank survey data suggest that only around 50 % of households in Germany permanently hold deposits in excess of €3,000 in their current accounts.[3)] Therefore, only these households would be able to fully utilise a €3,000 holding limit. In addition, it is unlikely that all depositors would liquidate their balances in full and shift them to D€ holdings. Further surveys indicate that even during periods of stress in the banking sector, depositors would be willing to transfer only around one-fifth of their balances to D€.[4)] This shows that households are willing to shift deposits to D€ holdings – but not in full. If the partial withdrawal of deposits during periods of stress as indicated by these survey results is taken into account alongside the distribution of deposit balances, almost no banks would have a liquidity shortfall in the case of a holding limit of €3,000.

If banks adjust their funding structure, they could significantly reduce the structural impact of the introduction of a D€. An analysis by the Bundesbank shows

3 See Deutsche Bundesbank (2024b).

4 See Bidder et al. (2024).

which trade-offs banks would face in a structural adjustment process towards a D€. Accompanying measures taken by the central bank to introduce a D€ are not taken into account. The focus is therefore on how banks can adjust their funding structure. In principle, banks could service outflows of deposits to D€ holdings by reducing their liquidity buffer and shrinking their balance sheet. This would avoid alternative, more expensive funding, but a lower liquidity buffer increases the risk of default. As a result, credit risk premia for wholesale funding – market funding, for instance – and therefore banks' overall funding costs would rise. [5)] These costs increase especially sharply if the liquidity buffer approaches the regulatory minimum requirements. [6)]

To avoid this, banks can adapt their funding strategies in two ways. First, they can raise deposit rates to reduce outflows of deposits to D€ holdings. [7)] Second, they can increase their market funding – by issuing bank bonds on the capital market, for instance – in order to compensate for deposit outflows. Funding costs depend on both funding strategies in a nonlinear way, since price and volume effects act simultaneously. An evaluation for a representative bank from the group of small and medium-sized institutions shows that, with a holding limit of €3,000, funding costs are highest if the bank neither raises deposit rates nor increases market funding (see Chart 4.2.16, point A). [8)] This passive approach leads to high deposit outflows and a rise in existing market funding costs. However, the increase in funding costs can be minimised by making an active adjustment that combines both funding strategies in a balanced way (see Chart 4.2.16, point B).

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5 In addition, the credit risk channel plays a role via the leverage ratio; see Bidder et al. (2024). An outflow of deposits leads to a decline in the leverage ratio and reduces the probability of default. This analysis assumes that, in the event of deposit withdrawals and an associated reduction in central bank reserves, the liquidity buffer channel dominates the credit risk channel.

6 A logistic regression model with a coefficient of - 2 is used for the analysis. This implies that, when a bank approaches the regulatory minimum requirements and/or a decline in central bank reserves of around 80 %, the bank's forecast probability of default on average corresponds to a non-investment grade rating. The value is in the lower range of other empirical estimates; see Chen et al. (2021), Filippopoulou et al. (2020).

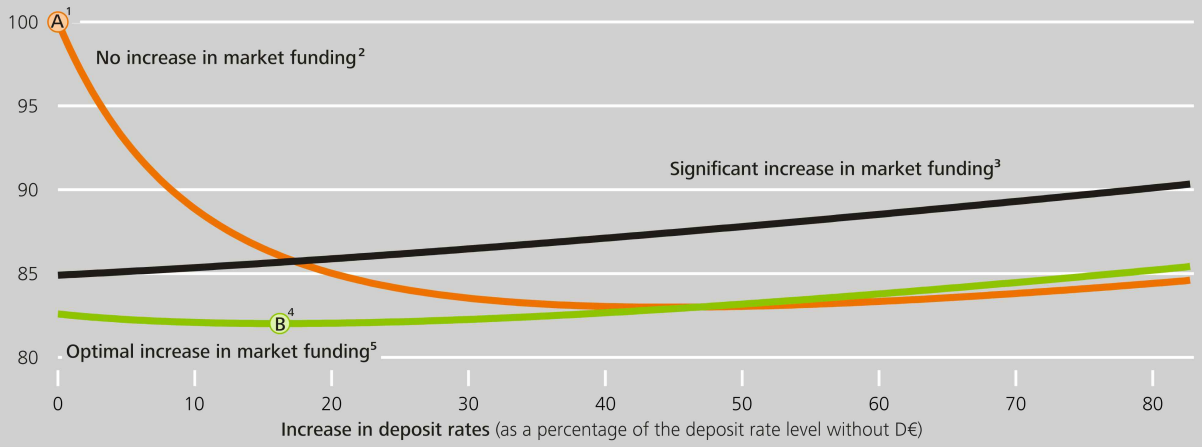
7 Survey results indicate that demand for a D€ is sensitive to the relative interest rate on deposits; see Bidder et al. (2024). Consequently, even a relatively low interest rate on current account deposits would be enough to significantly reduce any outflow that may arise.

8 The representative bank has average values for certain balance sheet items, such as central bank reserves. Long-term interest rate-sensitive demand is assumed, represented by the formula $\alpha - \beta * \Delta r$. In this context, α (0.3) describes the base benefit, which represents the share of deposits withdrawn at a deposit interest rate level prior to the introduction of the D€. The parameter β (165) describes the interest rate sensitivity of depositors to increases in deposit rates Δr. The assumed interest rate level before the introduction of a D€ lies within a low to moderate range with an average deposit rate of around 22 basis points.

Funding costs for a representative bank at different levels of market funding

Chart 4.2.16

Holding limit of €3,000, normalised, as at Q4 2023



1 Point A: The bank remains passive when a D€ is introduced and neither increases deposit rates to limit outflows nor expands market funding. **2** Compared with the level before the introduction of the D€. **3** Increase in market funding amounting to 1.4% of the balance sheet. **4** Point B: Optimal point at which funding costs are minimised. **5** Increase in market funding amounting to 0.6% of the balance sheet.

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4.3 Non-bank financial intermediaries: vulnerabilities and resilience

Non-bank financial intermediaries (NBFIs) serve important functions in the German financial system by bundling savings, financing the real economy and households, and hedging against risk. The NBFI sector is heterogeneous and comprises investment funds, insurance corporations and pension funds as well as other financial intermediaries.[77)] As active investors, NBFIs play a role in price formation in the financial markets. They also provide financing to enterprises, households and the general government sector, thereby complementing the banking system, which continues to provide the majority of funding in Germany (see section 4.3.1 "Structural change in the financial system is causing NBFIs to become increasingly important").[78)] Investment funds enable investors to spread their risk by investing in a variety of securities. Furthermore, investment funds grant investors access to specialised asset classes as well as to expertise. Insurance corporations offer households and enterprises protection against financial risk. This can contribute to the stability of the financial system as it diversifies the financial implications of unforeseen events, making them manageable for individuals. In addition, primary insurers and reinsurers contribute to the appropriate pricing of risks in the financial system through their expertise in risk management.

Although German NBFIs weathered the phase of rising interest rates well, they continue to face liquidity risk. Given the current risk situation on the commercial real estate market, the liquidity risks of open-end real estate funds are of particular relevance to financial stability – these risks are, at least in the case of open-end retail real estate funds in Germany, limited by minimum holding and redemption notice periods (see section 4.3.4 "Liquidity risk in open-end real estate funds reduced through notice periods and minimum holding periods"). Within the German NBFI sector, life insurers also play an important role due to their large holdings of assets and past

77 In line with the definition from the Financial Stability Board, the discussion on funds, insurance corporations, pension funds and other financial intermediaries in this Financial Stability Review fall under the umbrella term " NBFIs", see Financial Stability Board (2023). The other financial intermediaries sector comprises, inter alia, financial vehicle corporations and captive financial institutions.

78 NBFIs fund enterprises and the general government sector primarily via the capital market. Life insurers also provide financing to households in the form of residential real estate loans, but, compared with banks, this is only on a small scale. Lending by other financial intermediaries includes loans to enterprises.

promises of high guaranteed returns. The resilience of life insurers, measured by regulatory solvency under Solvency II, has been high since interest rates started rising in 2022 and remains so even in spite of recent interest rate cuts (see section 4.3.3 "Despite own funds being sound, life insurers' stabilising effect on the financial system could be less pronounced than before"). At the same time, however, unrealised losses built up on life insurers' balance sheets prepared pursuant to German GAAP. Such losses raise liquidity risk for life insurers whilst at the same time reducing their incentives to buy securities during periods of stress in which prices have fallen sharply. As a result, life insurers' stabilising effect on the financial system could be less pronounced in the next few years than it used to be.

European and global NBFIs are also vital to financial stability in Germany, as German financial intermediaries have close ties with foreign NBFIs. Since the global financial crisis, NBFIs – especially in Europe – have experienced significant growth (see section 4.3.1 "Structural change in the financial system is causing NBFIs to become increasingly important"). At the same time, German banks and investment funds have become more interconnected with foreign NBFIs. This is opening up direct and indirect contagion channels between banks and investment funds (see the supplementary information entitled "Contagion channels between banks and investment funds").

Supplementary information

Contagion channels between banks and investment funds

Contagion channels between banks and investment funds arise from both direct and indirect interconnectedness. [1] Direct contagion channels arise from contractual relationships based on financing instruments, such as loans, shares, fund shares or derivatives. If, for example, a real economic shock triggers a fall in the value of an investment fund, this has a direct impact on banks which hold the respective fund shares. However, investment funds can also transmit shocks to banks if they are not connected through a contractual relationship. This takes place through indirect contagion channels. If a fund manager sells securities as a result of a liquidity shock, for example, this can cause the price of the securities to drop. A fall in prices has an indirect impact on banks and other financial intermediaries which hold the same or similar papers on their balance sheets. The growing portfolio overlap in the fund sector can exacerbate price effects in the event of fire sales and thus increase indirect contagion risks (see section 4.3.5 "Growing interconnectedness within the fund sector may weaken resilience of open-end securities funds"). [2]

A European stress test model quantifies these contagion channels for banks and investment funds and shows that the contagion effects between banks and investment funds can be significant. [3] The model deals with a real economic stress scenario. It shows that losses for banks are underestimated if contagion effects emanating from investment funds are not taken into account. For example, banks' capital ratios in the observed stress scenario go down by one percentage point on average if the model includes investment funds as well as banks. The majority of losses are a result of indirect contagion effects as banks and funds hold the same or similar securities. It is therefore necessary to look at the financial system as a whole in order to

1 The term contagion effect describes the transmission of shocks or losses from one intermediary to another. This can occur via direct channels (e.g. reciprocal contractual relationships through loans) or indirect channels (e.g. similar business models, correlated portfolios or market price developments), with potential negative developments for agents who had initially not been affected by the shock. Contagion channels are thus the mechanism through which these effects are transferred to other intermediaries.

2 See Fricke and Wilke (2023).

3 See Sydow et al. (2024).

take into account the direct and indirect interconnectedness between various sectors of the financial system.

The results of this European stress test model cannot be applied to the German financial system on a one-to-one basis but they are relevant for the German financial system due to the cross-border linkages. In comparison with other European fund sectors, Germany boasts a large share of single-investor specialised funds (see section 4.3.1 "Structural change in the financial system is causing NBFIs to become increasingly important"). These funds have a lower liquidity risk compared to other funds. This means that fire sales and the resulting contagion effects are less likely. Possible contagion effects in Germany between banks and investment funds are not yet quantified in an integrated stress test model. As German banks and other financial intermediaries have close ties with foreign NBFIs, both a cross-sector and cross-country perspective is important when analysing transmission channels. It is only on this basis that second-round effects from abroad can be quantified for the analysis of German financial stability. One key prerequisite for this is the international exchange of data (see section 4.4.3 "Macroprudential oversight of non-bank financial intermediaries should be enhanced").

Direct contagion risks for the German banking system are posed, inter alia, by derivatives links with foreign hedge funds. This is because some large German banks are strongly interconnected with highly leveraged hedge funds. Furthermore, a large share of the derivatives between banks and hedge funds is settled bilaterally, meaning that the counterparties concerned need to have high risk management requirements in place. If a hedge fund faces payment difficulties, the banks involved in the derivatives transactions can suffer major losses. This is highlighted by the case of the US-based family office Archegos Capital Management which operated similarly to a hedge fund and ran into payment difficulties in 2021. Although international financial stability was not jeopardised in this case, some credit institutions suffered losses running into the billions. The limited reporting and disclosure requirements for family offices [4)] in the United States make it more difficult to identify such risks. [5)]

Sufficiently capitalised European banks, in particular, support group-affiliated investment funds during periods of stress. Much like in other European countries, investment companies in Germany mainly belong to large banks and insurance groups. Sufficiently capitalised European banks, in particular, provide support to group-affiliated investment funds during periods of stress by purchasing their fund shares

4 [4]

5 See Deutsche Bundesbank (2021).

when other investors return them.[6)] This can limit further outflows of funds, thereby strengthening the resilience of the fund sector. Key to the resilience of the financial system is the extent to which the supporting banks are able to assess the risks in the funds appropriately and their ability to bear them.

6 See Bagattini et al. (2023).

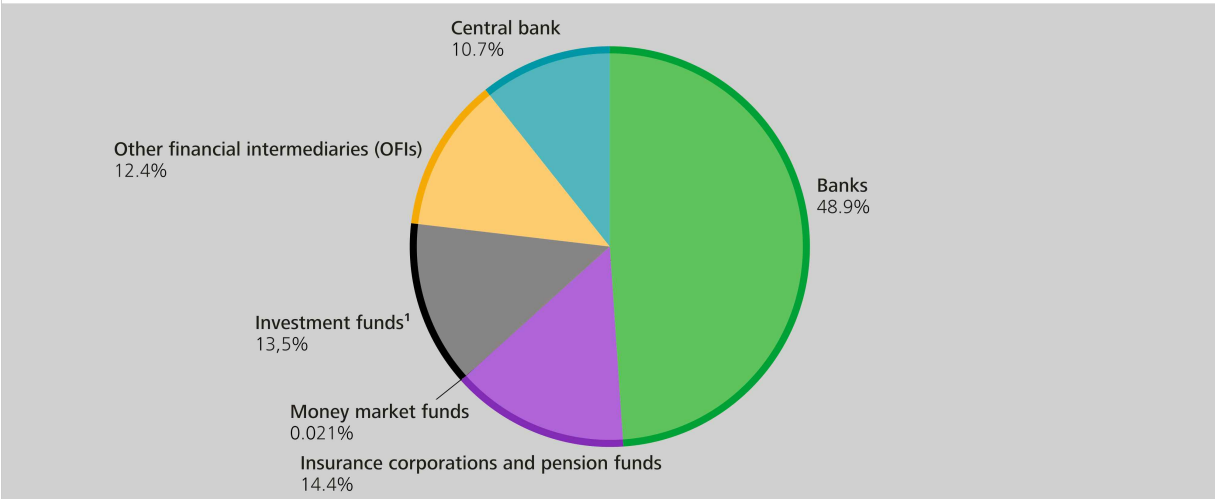
4.3.1 Structural change in the financial system is causing NBFIs to become increasingly important

The NBFI sector has grown significantly since the global financial crisis, both globally and in Germany. At the global and euro area levels, NBFIs hold around one-half of all financial assets.[79] In the euro area, this share has grown by roughly 18 percentage points since the global financial crisis. Additionally, NBFIs in the euro area provide around 40 % of financing to the real economy, with direct lending by NBFIs seeing particular growth.[80] German NBFIs – i.e. insurance corporations and pension funds, investment funds and other financial intermediaries – together hold around 40 % of all financial assets in the German financial system (see Chart 4.3.1). The share of NBFIs in the German financial system has risen by 15 percentage points since 2009, which represents a slightly smaller rise than that of NBFIs in the rest of the European financial system. The banking sector continues to play the biggest role in the German financial system, holding 49 % of all financial assets.

Structure of the German financial system

Chart 4.3.1

Shares of financial assets, as at Q2 2024



1 Excluding money market funds but including non-financial assets of open-end real estate funds.

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79 See Committee on Financial Integration (2022), Financial Stability Board (2023).

80 NBFIs provide financing to the real economy, i.e. to non-financial corporations, in the form of loans and securities such as bonds. In particular, the share of loans issued directly by NBFIs to enterprises has increased since the global financial crisis; see Committee on Financial Integration (2022), European Systemic Risk Board (2024).

By international standards, the provision of financing to the real economy in Germany remains heavily bank-based despite the growth in NBFIs.[81] In Germany, around 32 % of financing to the real economy is provided in the form of loans issued by German banks, while loans issued by German NBFIs only account for around 8 %. Additionally, German NBFIs provide financing to the real economy via purchases of capital market instruments such as corporate bonds. One of the objectives of the European capital markets union is to further strengthen the real economy's access to the capital market, including for small and medium-sized enterprises. This would enable enterprises to more greatly diversify their sources of funding and reduce their dependence on bank loans. This may have a positive impact on financial stability and the real economy. One precondition for this is that, besides the banking sector, the NBFI sector also needs to be resilient, especially in periods of stress.[82] It is therefore crucial that the macroprudential surveillance of the increasingly important NBFI sector be strengthened (see section 4.4.3 "Macroprudential oversight of non-bank financial intermediaries should be enhanced").

The German NBFI sector differs structurally from the global and European NBFI sectors. The largest NBFIs in Germany are securities funds and life insurers, which hold around 12 % and 6 %, respectively, of the financial assets in the German financial system. Unlike in other countries, the share of financial assets held by money market and hedge funds in Germany is very low, at less than 0.1 %. However, due to their interconnectedness with the German financial system, foreign money market and hedge funds play an important role (see the supplementary information entitled " Contagion channels between banks and investment funds").[83] Around 54 % of total fund assets in the German investment fund sector are held in single-investor funds. These funds have just one single investor, who therefore has no incentive to pull their assets from the fund before other investors. Since the global financial crisis, German life insurers, in particular, have invested more and more through funds, primarily single-investor funds, in order to manage their accounting profits.

81 In this section, "financing" refers to debt financing and the "real economy" refers to non-financial corporations.

82 See Nicoletti et al. (2024).

83 The case of the US family office Archegos Capital Management, which acted like a hedge fund, is one example of how a single market participant could pose a considerable risk to the German financial system through the use of leverage effects and a lack of transparency.

A Bundesbank analysis has confirmed that, in periods of stress, insurers withdraw less from funds than banks and other investment funds, with the same being true of households. At the same time, hoewever, investment funds in Germany are becoming increasingly important investors in other funds. This interconnectedness within the fund sector may weaken the resilience of funds in periods of stress (see section 4.3.5 "Growing interconnectedness within the fund sector may weaken resilience of open-end securities funds").

European and global NBFIs are vital to financial stability in Germany, as they have close ties with the German financial system. As lending to the German real economy largely takes place via banks, the contagion risks from NBFIs are particularly relevant to banks in Germany. These risks can result from both direct and indirect, i.e. non-contractual, ties between NBFIs and banks (see the supplementary information entitled "Contagion channels between banks and investment funds"). As at the second quarter of 2024, German banks' direct balance sheet exposures to the global NBFI sector amounted to around 12 % of the aggregate total assets of the German banking system. [84)] This share is up by one-fifth since the end of 2019. Over the same period, German banks' liabilities to the global NBFI sector rose by just over 2 percentage points to 13 % of aggregate total assets at present. Global NBFIs are thus important to German banks in terms of both their funding and the investment risk to which they are exposed. The direct and indirect interconnectedness between German banks and global NBFIs is a growing matter of concern for macroprudential supervisors. Available data on NBFIs need to be shared between macroprudential authorities across Europe in the future, and worldwide data sharing likewise needs to be improved (see section 4.4.3 "Macroprudential oversight of non-bank financial intermediaries should be enhanced").

84 These exposures do not include off-balance-sheet interconnectedness or derivatives.

4.3.2 Life insurers are exposed to elevated, but manageable, liquidity and investment risk

German life insurers' vulnerabilities stemming from unrealised losses are decreasing far more slowly than those of banks. As in the banking sector, the rise in interest rates in 2022 caused unrealised losses to build up on life insurers' balance sheets prepared pursuant to German GAAP due to the market values of fixed interest assets falling below their book values (see Chart 4.3.2).[85] Given the assets' long terms to maturity, the unrealised losses of life insurers are far larger than those of banks. Specifically, the unrealised losses of life insurers in the second quarter of 2024 amounted to around 9 % of assets at their book value (see the upper section of Chart 4.3.2). More than 80 % of German life insurers have unrealised losses (see the lower section of Chart 4.3.2). As long-term interest rates fell slightly in the third quarter of 2024, unrealised losses are also likely to have become somewhat smaller. Unrealised losses are partly offset by funds from the released additional interest provision (*Zinszusatzreserve*).[86] According to a survey conducted by the Federal Financial Supervisory Authority (BaFin), life insurers are planning to use part of the additional interest provision, more of which will be freed up from 2026, to realise unrealised losses.[87] However, this survey indicates that, if capital market conditions remain unchanged, unrealised losses will remain up to the end of the forecast horizon in 2036. Unrealised losses will thus decrease far more slowly among German life insurers than among banks.

85 Insofar as these losses in value are attributable solely to higher interest rates, life insurers are not required to recognise any corresponding write-downs on their balance sheets prepared pursuant to German GAAP provided that they intend to hold the securities to maturity.

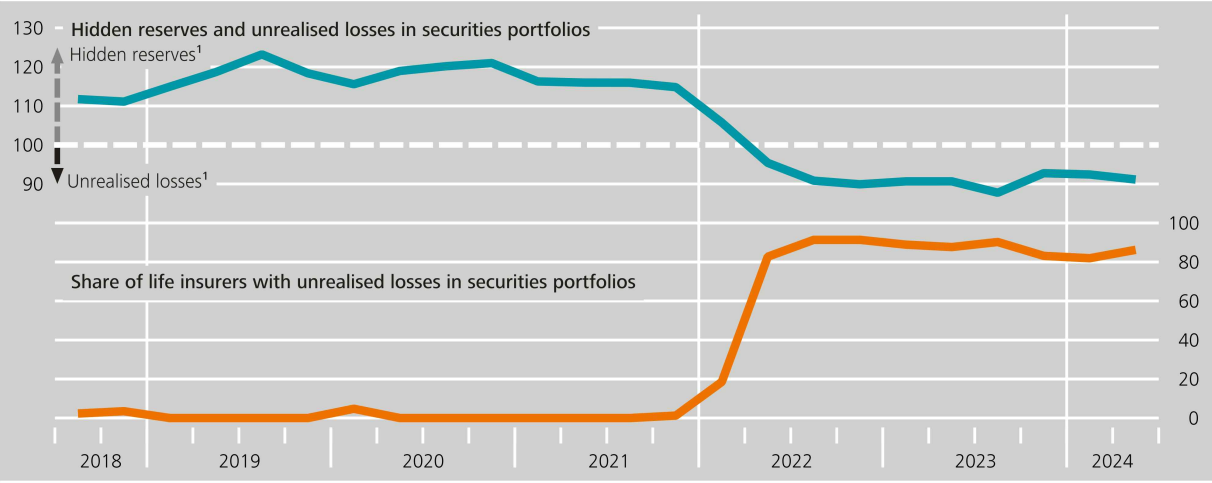
86 The additional interest provision is a reserve that was built up within the low interest rate environment to enable life insurers to honour their guarantee commitments to their policyholders in the long term.

87 In the unpublished BaFin survey, the extended forecast, life insurers are asked to predict important financial and regulatory metrics.

Hidden reserves and unrealised losses of German life insurers

Chart 4.3.2

%, as at Q2 2024



Sources: Federal Financial Supervisory Authority and Bundesbank calculations. **1** Ratio of the assets' market value to book value in accordance with the Commercial Code. Values higher than 100% imply hidden reserves; values lower than 100% imply unrealised losses.

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The unrealised losses are raising the liquidity risk in the German life insurance sector. Life insurers and their customers are benefiting from higher market interest rates only gradually through new investments and reinvestments of maturing bonds. The bulk of life insurers' portfolio investment still dates back to the low interest rate period and is therefore, despite the recent interest rate cuts, still predominantly remunerated at rates lower than those on market-traded securities. This limits the attractiveness of life insurance policies compared with other investments.[88)] By contrast, when policyholders let their policies lapse, German life insurers often pay out fixed surrender values that are unaffected by interest rates. A policy lapse incurs no deductions even if the value of the portfolio investment has fallen and unrealised losses have arisen. It can therefore be worthwhile for policyholders to let their policies lapse and invest the money on the capital market.[89)]

However, the risk of a wave of policy lapses at German life insurers appears to remain limited. Policy lapses among German life insurers are currently at a slightly

88 Life insurance policies are understood to be all contracts offered by life insurers, including private pension insurance.

89 See Deutsche Bundesbank (2014, 2023a), Förstemann (2021).

higher level than they were prior to the rise in interest rates.[90] According to a Bundesbank survey, lapse rates in Germany would only surge if low-risk bank investments promised an annual return of at least 6 %.[91] In Germany, life insurance policies often also cover other risks, e.g. occupational disability. This reduces customers' incentive to let their life insurance policies lapse. While the risk of an upsurge in policy lapses among German life insurers therefore remains limited, it cannot be ruled out in the event of particularly adverse developments, such as multiple coinciding shocks (see section 4.1.6 "The macro-financial environment remains challenging"). To limit potential liquidity risks for life insurers during periods of stress, the planned adjustments to Solvency II set out additional powers for macroprudential supervisors (see section 4.4.3 "Macroprudential oversight of non-bank financial intermediaries should be enhanced").

Due to liquidity risk and an inverse yield curve, life insurers have made shorter-term investments. The average term to maturity of the fixed income securities in which they have invested and reinvested fell from almost 21 years in 2021 to a little over 13 years in 2023. Overall, data on the liquidity risk of life insurers are scarce. The planned adjustments to the Solvency II regulatory framework could result in more information on liquidity being available in the future (see section 4.4.3 "Macroprudential oversight of non-bank financial intermediaries should be enhanced").

Investment risks stemming from commercial real estate are concentrated amongst a handful of life insurers, but appear to be manageable for the sector as a whole. In June 2024, German life insurers had just under €80 billion invested in commercial real estate, equating to just over 7 % of their total investments. Around one-third of commercial real estate investments are investments made using debt instruments such as loans and bonds. The other two-thirds are equity-financed. These include investments in real estate funds, which altogether make up 23 % of German life insurers' investments in commercial real estate (see section 4.3.4 "Liquidity risk in open-end real estate funds reduced through notice periods and minimum holding periods"). Some of the losses in market value were already taken into account in the portfolios.[92] Further valuation losses would affect life insurers in very different ways. For example, around one-third of life insurers have excess regulatory capital exceeding their total investments in commercial real estate. Other life insurers, however, have invested more than three times their excess regulatory capital in commercial real estate, leaving them especially vulnerable.

90 Policy lapses are lower than they were during the COVID-19 pandemic and as a result of the global financial crisis, however.

91 See Deutsche Bundesbank (2023a).

92 See European Insurance and Occupational Pensions Authority (2024), pp. 64 ff.

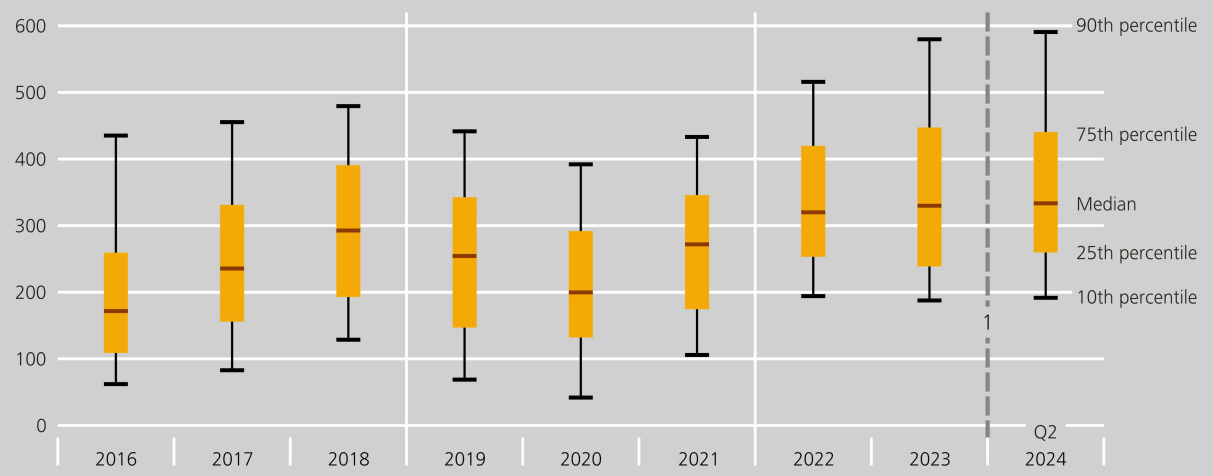
4.3.3 Despite own funds being sound, life insurers' stabilising effect on the financial system during periods of stress could be less pronounced than before

Life insurers have a sound amount of own funds. Since 2022, life insurers' solvency ratios without transitional measures have increased due to rises in interest rates (see Chart 4.3.3).[93] This is mainly because their liabilities have considerably longer maturities than their investments.[94] Consequently, when interest rates are raised, liabilities depreciate in value more sharply than investments. In the second quarter of 2024, the median regulatory solvency ratio of German life insurers was just over 300 %.[95] Even the 10 % of life insurers with the lowest capitalisation exhibited solvency ratios of as high as nearly 200 %. Hence, German life insurers have a sufficient amount of own funds, even in light of the latest cuts in interest rates.

Solvency ratios of German life insurers according to Solvency II*

Chart 4.3.3

%, as at Q2 2024



Sources: Federal Financial Supervisory Authority and Bundesbank calculations. * Shown here are the solvency ratios of the 70 life insurance companies for which reports are available throughout. 1 Up to 2023: without transitional measures. From 2024: with transitional measures (after recalculation).

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93 The introduction of Solvency II in 2016 was accompanied by transitional measures to enable a linear increase of solvency requirements from Solvency I to Solvency II levels by 2032. As of the second quarter of 2024, the regulatory solvency ratios with transitional measures are no longer comparable over time. This is because BaFin mandated insurers to recalculate a transitional measure for provisions (*Rückstellungstransitional*) in response to the rise in interest rates; see Wesker (2024). The new, recalculated regulatory solvency ratios now better reflect life insurers' economic resilience and are closer to the solvency ratios without transitional measures.

94 See Deutsche Bundesbank (2022a).

95 A solvency ratio of 300 % means that own funds are three times as high as regulatory capital requirements.

Under normal circumstances, the long maturities of life insurers' liabilities allow them to ignore short-term value fluctuations and invest countercyclically. [96] This dampens shocks in the financial system and thus contributes to resilience. A key prerequisite for life insurers to invest countercyclically during periods of stress is that they have a sufficient amount of own funds. If they had low levels of own funds, life insurers could sell risky assets to improve their solvency ratios during periods of stress. [97] In so doing, they would procyclically reinforce the shock to the financial markets, thereby undermining the financial system's resilience. [98] Since the interest rate hike in 2022, all German life insurers have exhibited sound solvency ratios. As a result, life insurers currently have little incentive to improve their solvency ratios by acting in a procyclical manner during periods of stress.

Since interest rates were raised, however, unrealised losses have reduced incentives for life insurers to invest countercyclically and thereby dampen shocks in the financial system during periods of stress. Since 2022, for example, life insurers have been buying and selling far fewer fixed income securities than they had in the low interest rate environment (see Chart 4.3.4). The reason for this may be that life insurers are managing their accounting profits. [99] In the low interest rate environment, life insurers had to build up an additional interest provision and thus restructured their portfolios in order to realise hidden reserves. [100]

96 Empirical studies show that, prior to the rise in interest rates, insurers and pension funds would largely buy securities when their prices had fallen and sell securities when their prices had risen, which is indicative of countercyclical behaviour; see Timmer (2018).

97 See Ellul et al. (2017). Given that European insurance regulation is risk-sensitive and based on market prices, mandatory capital requirements, in particular, could create incentives for procyclical behaviour.

98 This procyclical behaviour could be observed during the coronavirus pandemic among German life insurers with very low levels of own funds. By contrast, sufficiently capitalised life insurers exhibited countercyclical behaviour; see Deutsche Bundesbank (2022a).

99 The "gains from trade" theory assumes that intermediaries strive to optimise their balance sheet metrics at amortised cost. When trading for gains, assets with hidden reserves are sold, whilst assets with unrealised losses are kept on the balance sheet; see Ellul et al. (2015), Laux and Leuz (2010).

100 The additional interest provision is a reserve that was built up during the low interest rate environment to enable life insurers to honour their guarantee commitments to their policyholders over the long term.

However, since the rise in interest rates, life insurers have had unrealised losses and have no longer been required to build up any further additional interest provision (see section 4.3.2 "Life insurers are exposed to elevated, but manageable, liquidity and investment risk"). In order to optimise their accounting profits, life insurers could avoid selling investments with unrealised losses. This would cause a reduction in net investment income pursuant to German GAAP, and hence also in profit participation for policyholders as well as distributions to shareholders. [101)] To avoid rendering life insurance policies and their shares less attractive, life insurers could refrain from actively trading. Consequently, life insurers would not amplify any shocks, but they would also no longer dampen them either. Bundesbank analyses show that the German insurance sector, which consists largely of life insurers, has tended to invest countercyclically less frequently since the interest rate hike in 2022 than it did beforehand. [102)] Long-term interest rates declined in the third quarter, albeit only marginally. If long-term interest rates do not fall significantly, life insurers' unrealised losses will continue to recede only slowly in the future due to a slow pull-to-par effect. [103)] As a result, the incentives for life insurers to take on the role of stabilising investors during periods of stress will grow only gradually going forward. Overall, the stabilising effect from life insurers in periods of stress may be less pronounced over the next few years than it has been previously.

101 Profit participation for policyholders and distribution of dividends to shareholders depend on the profit and loss accounts according to the German Commercial Code (*Handelsgesetzbuch* – HGB). Although the Solvency II prudential regime for insurance undertakings is based on market prices, unrealised losses may arise under the Commercial Code due to amortised cost accounting.

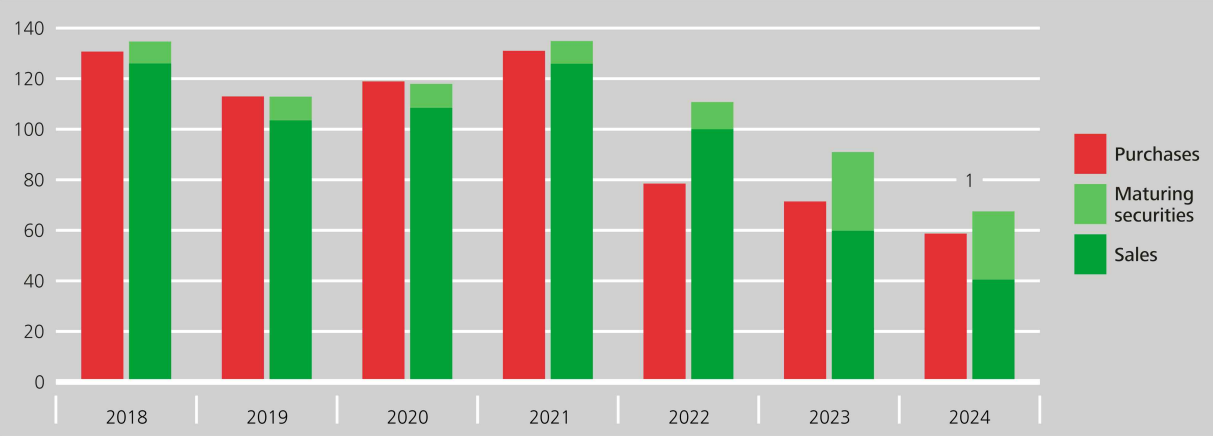
102 See Timmer (2018). The Bundesbank analyses apply this method to similar data and a more recent time frame.

103 At maturity, the price of a bond should be equal to its nominal value. The pull-to-par effect describes how the price of a bond converges to its nominal value over time.

Change in the bond portfolios of German life insurers*

Chart 4.3.4

€ billion, market prices, as at Q2 2024



Sources: Federal Financial Supervisory Authority and Bundesbank calculations. * Estimate of volume changes based on quarterly data with fund look-through; excluding assets invested for the purpose of unit-linked life insurance policies, at prices for the respective quarter or previous quarter. In the event of persistent structural price changes, adjustment for price effects is only possible to a limited extent. 1 Annualised based on data for the first half-year.

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At present, life insurers are unlikely to act as a stabilising force in the event of a sharper downturn in the commercial real estate market (see section 4.1.2 "Downturn in the financial cycle is slowing"). Despite the decline in prices, life insurers have hidden reserves in their commercial real estate investments. Given transaction costs and life insurers' long-term investment horizons, it is not very likely, in the current risk environment, that they will sell commercial real estate on a large scale with the sole aim of unlocking hidden reserves and managing their accounting profits.[104)] Although life insurers are not amplifying shocks in the commercial real estate market for this reason, they would not currently dampen any shocks either and would thus no longer act as a stabilising force in this segment.

104 For more information on managing accounting profits, see Laux and Leuz (2010).

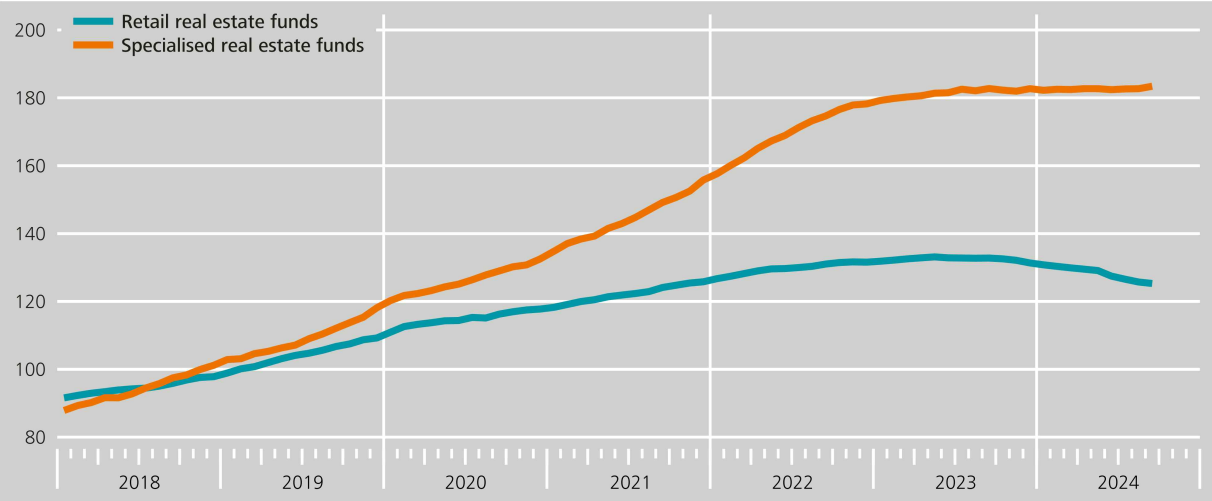
4.3.4 Liquidity risk in open-end real estate funds reduced through notice periods and minimum holding periods

Open-end real estate funds harbour liquidity risks that may exacerbate shocks in the commercial real estate market. Open-end real estate funds typically invest in commercial real estate. These are illiquid assets and often may take several months to sell. For this reason, real estate funds hold liquid funds in order to service fund share redemptions. German open-end retail real estate funds recently saw net outflows of funds, not least because investors expect alternative investments to yield higher returns in relation to their risk exposure. As a result, the assets of German open-end retail real estate funds decreased slightly (see Chart 4.3.5). Open-end specialised real estate fund assets remained virtually unchanged of late. This was probably on account of the lower number of investors compared with retail funds and the incentive patterns resulting from this.[105)] High net outflows from open-end real estate funds can exacerbate price declines in the commercial real estate market if funds are forced to sell real estate in an illiquid transaction market (see section 4.1.2 "Downturn in the financial cycle is slowing"). If, given this challenging market situation, real estate fund managers first offload assets that can be sold more easily, leaving the less attractive ones in the fund, the risk-return ratio for the remaining investors deteriorates. Fund investors therefore have an incentive to seize the first-mover advantage and withdraw funds as soon as problems arise. To date, this channel of reinforcement has been limited in that commercial real estate market risk materialised only for a few financial intermediaries, and regulatory provisions are keeping retail real estate funds' liquidity risks in check.

105 Households are virtually the sole investors in retail real estate funds. By contrast, specialised real estate fund shares are predominantly held by institutional investors such as banks, insurers, pension funds and other investment funds.

Net asset value of German open-end real estate funds* Chart 4.3.5

€ billion, as at September 2024



* Categorisation as retail real estate fund or specialised real estate fund based on Investment Funds Statistics.

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German real estate funds' existing liquidity buffers reduce liquidity risk. The liquid funds of German retail real estate funds – i.e. bank deposits, money market fund shares and liquid securities – are well above the liquidity ratio of 5 % of fund assets stipulated by regulators.[106] On a weighted average, bank deposits alone recently accounted for around 11 % of assets held by open-end retail real estate funds. However, there is wide dispersion in this share across the real estate fund sector, which means that some funds are more vulnerable to liquidity risk stemming from net outflows.

Minimum holding periods and notice periods are keeping German retail real estate funds' liquidity risk in check. The minimum holding periods and notice periods introduced in Germany in 2013 partly mitigate liquidity risk in retail real estate funds by protecting against sudden strong outflows. Since then, investors in retail real estate funds are required to announce fund share redemptions twelve months in advance and are subject to a minimum holding period of 24 months.[107] As a rule, this allows funds more time to respond to announcements of fund share redemptions in good time. In addition, minimum holding periods and notice periods may change the investor base of open-end real estate funds in favour of investors with very long-term investment

106 Specialised real estate funds are exempt from these provisions.

107 Investors who acquired shares in retail real estate funds prior to 22 July 2013 have certain allowances that are not subject to notice periods for redemption.

horizons. On the whole, this dampens real estate funds' procyclical behaviour during a downturn, reducing the risk of amplification effects in the commercial real estate market. Minimum holding periods and notice periods do not apply to open-end specialised real estate funds.

4.3.5 Growing interconnectedness within the fund sector may weaken resilience of open-end securities funds

Open-end securities funds continued to see net inflows, but liquidity risk persists. [108] Net inflows of funds since January 2024 amounted to just under €17 billion, which corresponds to around 0.7 % of aggregate fund assets. Liquidity risk in open-end securities funds arises because investors are often able to redeem their shares within one day, whilst a fund's liquidity is usually limited. In periods of stress, investors may therefore have an incentive to pull out their funds at an early stage, to the detriment of the remaining investors. Furthermore, fund managers tend to sell more assets than necessary to service net outflows in periods of stress. This is due to the fact that fund managers want to increase their liquid assets during periods of stress (cash hoarding). [109] Overall, open-end securities funds therefore mostly take procyclical action in periods of stress, potentially amplifying shocks. In the context of securities funds, liquidity risk should therefore be mitigated by deploying liquidity management tools (see section 4.4.3 "Macroprudential oversight of non-bank financial intermediaries should be enhanced").

The growing interconnectedness within the fund sector may result in open-end securities funds amplifying shocks in the financial system. [110] To diversify their portfolios and have access to liquidity, securities funds hold shares of other securities-based funds (cross-holdings). This is because securities fund shares may be redeemed at short notice. This interconnectedness within the fund sector has grown in many significant fund jurisdictions since the global financial crisis (see Chart 4.3.6). In Germany, shares of other funds accounted for as much as 23 % of fund assets at the end of the period under review. However, Bundesbank analyses show that funds' cross-holdings are largely comprised of securities that are more volatile or less liquid than their direct investments. [111] As a result, if a fund manager regards their shares in other funds as liquid assets because they may be redeemed at short notice, they will

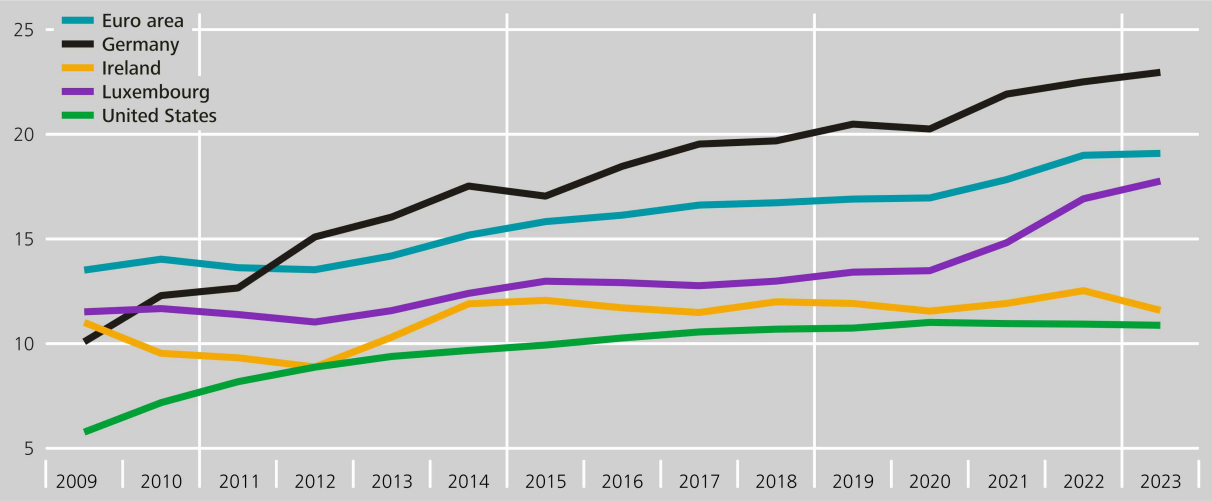
108 Hereinafter, "securities funds" refer to all investment funds except real estate funds.
109 See Fricke and Wilke (2023).
110 See Fricke and Wilke (2023).
111 See Fricke and Wilke (2023).

overestimate their own fund's liquidity in periods of stress. The rise in cross-holdings has made yields across the entire fund sector more procyclical and more volatile. In addition, through mutual cross-holdings of fund shares, the portfolios of individual funds have become four times more similar than they would have been without cross-holdings. Consequently, funds are increasingly affected by shocks in the same direction. This increases contagion risk.

Cross-holdings of fund shares in major fund jurisdictions

Chart 4.3.6

As a percentage of aggregate total net assets, as at Q4 2023



Sources: ECB Statistical Data Warehouse and Investment Company Institute 2020 Fact Book.
Deutsche Bundesbank

4.4 Overall assessment and implications for macroprudential policy

4.4.1 German financial system coped well with the exceptionally strong rise in interest rates

The German financial system coped well with the period of sharply rising interest rates overall and remained stable throughout the last year, too. Interest rates have peaked; in June 2024, the ECB began to lower its key interest rates. The transmission of the interest rate increase to the banking system is likely to be largely complete. Yet life insurers are only just now gradually feeling the impact of higher market interest rates since most of the fixed income instruments in their portfolios were acquired during the low interest rate period. The unrealised losses that had accumulated on financial intermediaries' balance sheets as interest rates were rising are now receding, though more slowly for life insurers than for banks. Existing unrealised losses increase liquidity risk and reduce the financial system's resilience. If banks would need to realise unreported losses, the relatively high capital ratios would be lower. For life insurers, unrealised losses reduce the incentives to act as stabilising buyers in the financial market during periods of stress, as they have in the past.

The high vulnerabilities that had built up in the German financial system over the long low interest rate period have been declining in an orderly manner thus far, albeit only gradually. Vulnerabilities in the German financial system remain substantial. Amidst improved debt sustainability and households' robust resilience, the risks to banks and insurers from residential real estate loans are tending to decrease, though. The non-financial corporate sector finds itself in difficult waters, however, owing to structural challenges and subdued economic developments. In addition, the refinancing of some of the existing loans to non-financial enterprises and households at higher interest rates is still pending. If the macro-financial environment develops as expected and does not deteriorate further, credit defaults are not expected to surge, however. Overall, loss allowance ratios, especially for bank loans to enterprises, are set to continue rising in the coming quarter, but should remain manageable for banks.

The commercial real estate market remains a source of elevated financial stability risks. Commercial real estate prices did not decline further in the first half of 2024, but

the risk of a further fall in prices remains heightened. Loss allowances with respect to commercial real estate exposures have increased significantly. The banking and insurance sectors appear capable of generally coping with investment risk from commercial real estate; however, such risks are highly concentrated among some intermediaries. Despite long minimum holding periods and notice periods, open-end retail real estate funds in Germany have still been seeing net outflows of funds recently. Should these outflows necessitate sales, this could exacerbate the situation in the commercial real estate market. Owing to unrealised losses on their balance sheets, life insurers are hardly likely to act as investors in the event of a more extreme commercial real estate market downturn.

The risk of adverse developments remains high amidst current geopolitical tensions. Geopolitical tensions can affect the financial system both through the macro-financial environment and also directly, for example in the event of major cyberattacks. Since the outbreak of the Russian war of aggression against Ukraine, cyberattacks on the financial sector have increased significantly. These cyberattacks have so far caused only moderate damage. Nevertheless, attack surfaces are tending to grow as a result of the ongoing digital transformation and the high level of operational networking, not least due to the increasing use of specialised IT services and software products.

The January 2022 package of macroprudential measures, containing the countercyclical capital buffer and sectoral systemic risk buffer, remains adequate given the overall risk situation. [112)] Uncertainty in the macro-financial environment remains elevated and vulnerabilities continue to exist. Against this backdrop, the countercyclical capital buffer (CCyB) strengthens the resilience of the banking system to cyclical risks. The sectoral systemic risk buffer additionally counteracts the specific risks in the real estate market that cannot be fully addressed by the countercyclical capital buffer. However, vulnerabilities in this area are declining only gradually. Overall, an orderly reduction of vulnerabilities in the residential real estate market has become more likely. Macroprudential supervisors will monitor further developments in this area closely.

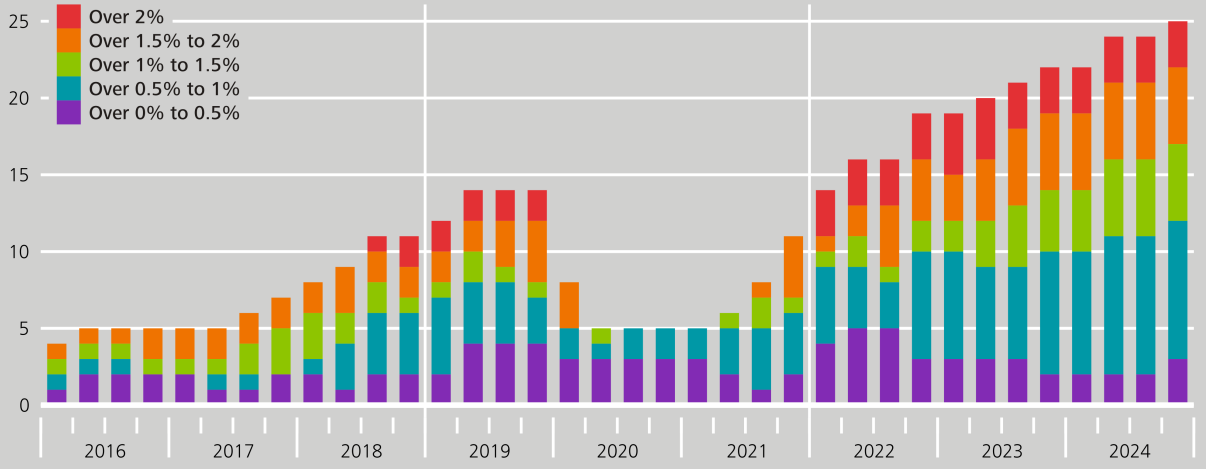
112 On 12 January 2022, BaFin set a countercyclical capital buffer of 0.75 % of risk-weighted assets on domestic exposures. It also introduced a sectoral systemic risk buffer of 2.0 % of risk-weighted assets on loans secured by residential real estate. Alongside the capital measures, supervisors admonished banks, insurers and other lenders in the residential real estate market to exercise particular caution when granting new loans. They expect conservative valuation and lending practices which restrict financing with a high loan-to-value (LTV) ratio and ensure borrowers' sound debt sustainability over the long term, i.e. including in periods of stress. See Federal Financial Supervisory Authority (2022).

4.4.2 Macroprudential policy in Europe is evolving

In order to ensure that banks remain resilient in the long term, macroprudential supervisors must retain their scope for action, particularly in periods of stress. Releasable capital buffers, as provided for in the current package of measures in Germany and other European countries, are a key macroprudential policy instrument. Unlike microprudential capital requirements, these capital buffers can be lowered in a crisis scenario, reducing the likelihood of undesirable adjustments, such as banks curtailing their credit supply in response to capital losses. For the releasable buffers to fulfil their purpose, they have to be sufficiently large.

Number of European countries with a positive countercyclical capital buffer rate* Chart 4.4.1

As at October 2024



* Comprises the countries of the European Economic Area (EEA) and the United Kingdom. Data refer to the quarter in which the competent authority announced a retention of or change to the countercyclical capital buffer (CCyB).

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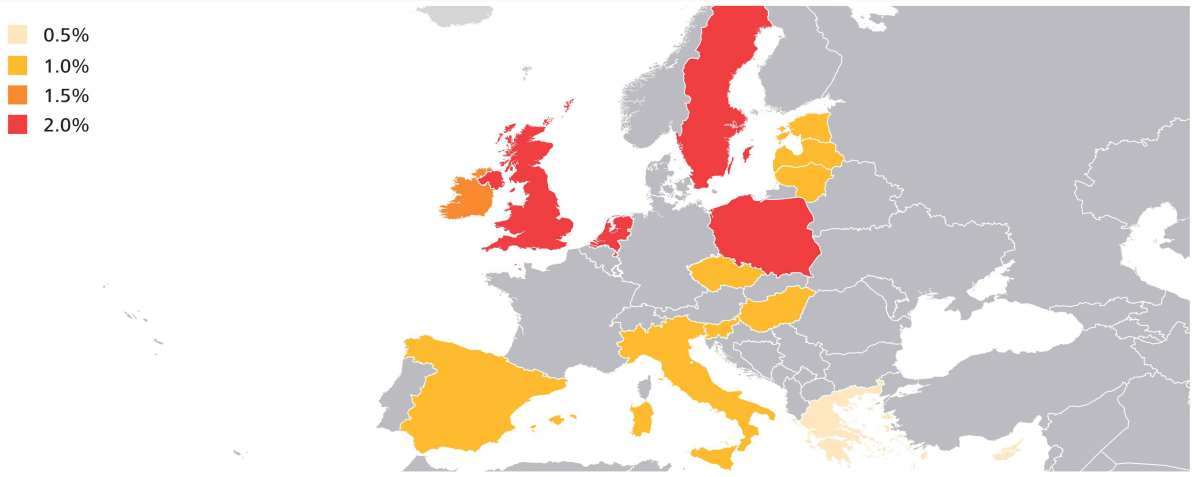
Against this background, a number of European countries have adjusted their macroprudential strategies for the banking sector. Prior to the coronavirus (COVID-19) pandemic, many countries had built up a CCyB only slowly and to a limited extent (see Chart 4.4.1), restricting their scope for macroprudential action when the pandemic broke out. Many countries were therefore quick to reactivate the CCyB after the pandemic, in many cases to a level significantly higher than before the pandemic. Some countries have also fundamentally changed their strategy for setting the CCyB. They introduced an explicit CCyB target ratio which applies even in cases where cyclical risks are not elevated. Should cyclical risks rise sharply, a further increase of the CCyB above the target ratio will be considered. These countries choose their positive neutral rate (

PNR) somewhere between 0.5 % and 2 % (see Chart 4.4.2). Bundesbank analyses confirm that a timely build-up of releasable buffers significantly reduces the likelihood of balance sheet contractions. Therefore, building up releasable buffers at an early stage and in a forward-looking manner generally fosters financial stability. The macroeconomic costs of this are low if the build-up phase is chosen such that banks build up capital buffers through retained earnings (see the supplementary information below entitled "The economic benefits of releasable capital buffers and the positive neutral rate"). [113)]

Positive neutral rate (PNR) in Europe*

Chart 4.4.2

As at October 2024



Sources: ESRB and national authorities. * Italy has a PNR for the systemic risk buffer (SyRB); the other highlighted countries have one for the countercyclical capital buffer (CCyB).

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The residential real estate sector often triggers crisis-like developments; the macroprudential policy toolkit for this sector should therefore be expanded. BaFin is currently not authorised to impose caps for income-based lending standards. With a

113 This is consistent with the fact that a more active macroprudential policy fosters economic growth, even over a longer period and in a global perspective. The stabilising effects generated through enhanced resilience and diminished vulnerability considerably exceed the potential costs. In addition, empirical results show that, even outside of periods of stress, the increased use of macroprudential measures does not act as a drag on economic activity. See Brandao Marques et al. (2020).

full set of instruments, BaFin could focus on limiting systemic risks to financial stability caused by rising house prices, mounting stocks of housing loans and deteriorating lending standards. [114)]

114 See also the recommendation of the German Financial Stability Committee (2015). It recommended not only the creation of a loan-to-value (LTV) ratio and the amortisation requirement, already accomplished in 2017, but also the creation of a legal basis for two income-based instruments: the debt-to-income (DTI) ratio and debt-service-to-income (DSTI) ratio. European and global organisations such as the ESRB and IMF have also repeatedly pressed Germany to create these instruments.

Supplementary information

The economic benefits of releasable capital buffers and the positive neutral rate

A structural model for the euro area banking sector illustrates how releasable capital buffers can significantly reduce the likelihood of a crisis-induced credit crunch and mitigate its macroeconomic impact. [1] It is particularly in times of stress, when banks incur very large losses, that the advantages of releasable capital buffers become evident. During such stress periods with large banking sector losses, capital ratios in the banking system can shrink to the point where banks undershoot, or are in danger of undershooting, regulatory minimum capital requirements. The banking system thus runs into hard balance sheet constraints. [2] The only way to meet regulatory capital requirements would be by sharp deleveraging, either by selling off securities, allowing loans or credit lines to expire or restricting new lending. Releasing sufficiently-sized available capital buffers can loosen this balance sheet constraint and reduce or even prevent excessive deleveraging. The model simulations show that releasable buffers amounting to 1 % of risk-weighted assets reduce the probability of a credit crunch to around 3 %. In the absence of releasable buffers, the probability would exceed 10 %. [3] A buffer of 2.5 % would reduce the probability to around 1 % (see Chart 4.4.3).

1 Based on Lang and Menno (2023). The calibration horizon for the euro area is from 2005 to 2019. For the analysis presented here, the time series were updated: the ratio of provisions to lending up to 2022 come from the "Cost of Risk" time series for significant institutions (SIs) for EU countries participating in the Single Supervisory Mechanism (SSM).

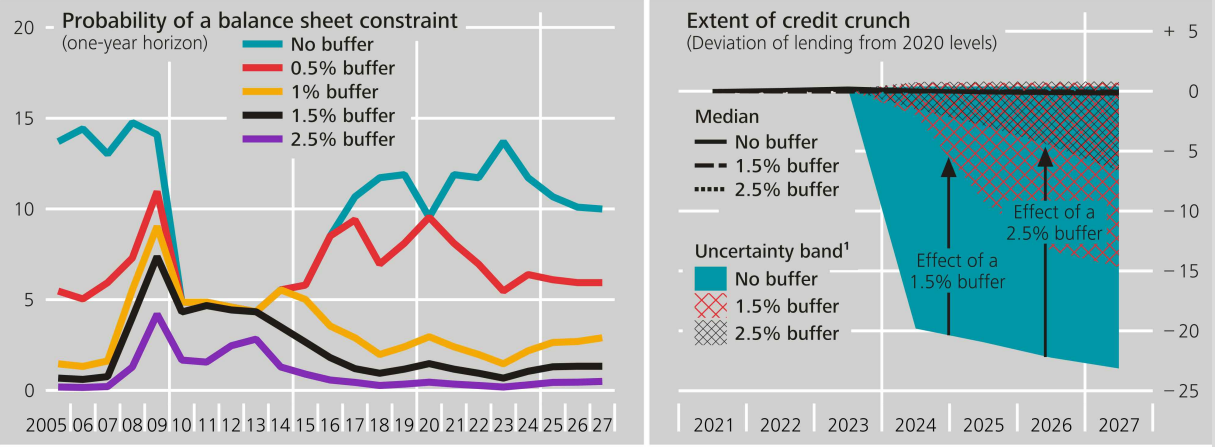
2 A balance sheet or capital constraint is assumed to be binding if the common equity tier 1 (CET1) ratio of the bank in the model falls below the regulatory minimum requirement owing to losses following a shock. This minimum requirement was set at 10 % in the model.

3 Following the financial crisis in 2009, the decline in the probability of encountering a balance sheet constraint was more pronounced in models without releasable buffers than in models with releasable buffers. That is because, in models without buffers, banks curtailed their lending considerably during the financial crisis in order to keep meeting supervisory minimum requirements. In models with buffers, balance sheets were shrunk less sharply during the crisis, leading to a relatively smaller decline in the probability of balance sheet constraints. As the balance sheet contraction was stronger, relatively speaking, in models without releasable buffers, the actual costs of the crisis were higher than in models with releasable buffers.

Probability of a balance sheet constraint in the banking system and extent of a credit crunch*

Chart 4.4.3

%, as at September 2024



* Calculations based on a structural equilibrium model calibrated for the euro area (see Lang and Menno (2023), The State-Dependent Impact of Changes in Bank Capital Requirements, Bundesbank Discussion Paper No 19/2023). **1** 1st to 99th percentiles.

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The risk of banks sharply curtailing their credit supply in the case of a credit crunch would also drop significantly in the presence of releasable buffers. The model looks at a case of extreme losses. According to the simulations, there is a 1 % probability that lending would contract by more than 20 % without buffers (see Chart 4.4.3). With releasable buffers of 2.5 %, however, there is a 1 % probability that lending, under the same extreme conditions, would contract by only around 6 %.

A formalised target rate is one possible way of building up releasable buffers at an early stage and minimal costs. The impact of a positive neutral rate (PNR) can be studied in the model. This is implemented with a rule according to which the countercyclical capital buffer (CCyB) is always built up to the prescribed target PNR only in times when the banking sector generates sufficient profit and distributes sufficient dividends. In such periods, banks can raise the capital ratio gradually by retaining a portion of their earnings in each period, and while doing so continue to fund lending. The speed at which the buffers are built up to the target PNR thus depends on the profitability of the banking sector: if profitability is very high, the CCyB can be rapidly accumulated up to the target PNR, whereas if profitability is at average levels, a longer build-up phase is necessary. The costs of the PNR arise because banks have to fund a larger portion of their lending through own funds. In the model, however, lending rates rise only slightly: if a PNR of 1 % (2.5 %) is introduced, lending rates in the euro area rise by 0.12 (0.25) percentage point from an average level without buffers of 4.42 %.

4.4.3 Macroprudential oversight of non-bank financial intermediaries should be enhanced

The macroprudential perspective in the regulation and oversight of non-bank financial intermediaries (NBFIs) acts as a complement to what has thus far been primarily microprudential regulation. The macroprudential perspective on NBFIs is important, especially in order to analyse and mitigate liquidity risks and contagion arising from interconnectedness (see section 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience"). In Germany, with its bank-based financial system, the risk of contagion effects on banks is important in terms of the risks to financial stability posed by NBFIs (see the supplementary information entitled "Contagion channels between banks and investment funds"). The focus of macroprudential policy should be to strengthen the resilience of NBFIs pre-emptively. A comprehensive approach to the macroprudential perspective on NBFIs could be entity-based, i.e. directed at types of NBFIs(as is the case under the existing macroprudential framework), as well as activity-based, thus recognising the diversity of activities and risks in this sector. Macroprudential oversight and regulation of insurers is further evolved than that of funds.

In Solvency II, the European regulation for insurers, there are plans to incude new powers for macroprudential supervisors to enhance the resilience of the insurance sector. [115)] The accord achieved in the political process should be implemented by national legislators in a timely manner. It envisages a package of measures that can mitigate solvency and liquidity risk in the insurance sector and thereby enhance the resilience of the financial system as a whole. In the event of considerable liquidity risks, supervisors can, for instance, temporarily suspend repayments from life insurance policies. This can mitigate life insurers' liquidity risk in periods of stress and thus counteract procyclical behaviour. In addition, the following measures should be taken to close data gaps: insurers should, in future, develop liquidity risk indicators, prepare liquidity risk management plans and expand their own risk and solvency assessment (ORSA) to include scenario calculations that are of macroprudential relevance. [116)]

115 See European Parliament (2024a).

116 As part of their risk management, insurers are required to conduct their own risk and solvency assessment (ORSA) at single-entity and group level at least once a year. In an ORSA, insurers identify potential risks and assess both the efficacy of their risk management and the associated capital adequacy. Insurers then notify their competent authority of the results in an ORSA report.

The EU Insurance Recovery and Resolution Directive (IRRD) likewise contributes to mitigating financial stability risks in periods of stress. [117] The directive requires harmonised recovery and resolution instruments for the largest insurers and will enhance cross-border cooperation between national resolution authorities. [118] The new rules could help to deliver an early cross-border response in periods of stress and to mitigate the negative impacts of a looming insolvency of a major insurance company. [119]

A globally coordinated and consistent regulation of funds is important. The Financial Stability Board (FSB) recommends that funds introduce liquidity management tools and appropriate redemption periods in order to mitigate the liquidity risks of funds where these tools have not yet been created (see section 4.3 "Non-bank financial intermediaries: vulnerabilities and resilience"). [120] It also recommends enhancing the resilience of money market funds. Until 22 November 2024, the European Commission is conducting a consultation to see whether macroprudential policy for NBFIs needs to be adjusted. The Bundesbank believes that the FSB recommendations should be implemented in Europe in a timely fashion. In addition, the macroprudential toolkit for NBFIs should be expanded in a targeted manner and system-wide top-down stress tests introduced in the euro area. To this end, the exchange of granular data within Europe is crucial.

Given the interconnectedness of funds across national borders, macroprudential supervisors need a legal basis for data sharing in Europe. Owing to the high interconnectedness of the German financial system with European and global funds, national fund data are insufficient to comprehensively assess the risks to German financial stability. For instance, it is currently difficult for national macroprudential supervisors to assess contagion risks from other European countries since data on funds in other European countries are not shared. In addition, data gaps on other financial institutions hamper the assessment of risks relating to financial vehicle corporations and captive financial institutions. [121] The Bundesbank is therefore making the case for creating the legal framework conditions for improved access to and

117 See European Parliament (2024b). An EU directive for the recovery and resolution of banks has already been in force since 2015.

118 The largest insurers will be required in future to prepare preventive recovery plans such that, in all, at least 60 % of the national market is covered. For mandatory resolution plans, coverage is at least 40 %.

119 The threat of a major insurer filing for insolvency will have negative repercussions on the real economy and the financial system, particularly if critical functions are no longer discharged, such as regarding risk allocation and risk sharing.

120 For empirical evidence that liquidity management tools for Irish funds mitigated liquidity risks during the coronavirus pandemic, see Dunne et al. (2024).

121 See European Systemic Risk Board (2024).

sharing of data for national macroprudential authorities in Europe. The nature and scope of access to and sharing of data still have to be fleshed out. Above and beyond the European process, a basis for global data sharing would also be desirable.

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Special chapter: Risks arising from an unexpected and immediate carbon price increase

Politicians have to take action globally and put in place the framework conditions to mitigate anthropogenic climate change. The switch from fossil to climate-neutral technologies that this requires will give rise to additional costs for households and firms. Since both have ties with the financial market, the costs of transitioning to a net zero economy also have implications for the risk situation in the German financial system.

The 2021 and 2023 Financial Stability Reviews looked at the long-term impact of full decarbonisation on financial stability.[1)] *This report augments the analysis by examining the short-term impact of an unexpected, immediate carbon price increase on the economy and financial markets. This expanded analysis thus makes a contribution to the discussion of short-term risk scenarios that is currently ongoing in the international arena. It also shows how disclosure of climate-related information by firms, especially of greenhouse gas emissions, could mitigate the impact of this kind of shock.*

The results demonstrate that unexpected, immediate carbon price increases can drive up risk in the German financial system. In the scenario under analysis, the impact looks to be manageable for Germany's financial system. A consistent disclosure requirement helps to mitigate the impact both generally and in the face of unanticipated events.

The stress test simulations confirm that a credible and predictable stance on climate policy is advantageous. Disclosure requirements for firms and macroprudential instruments can also play a material role in the targeted identification and management of climate risk in the financial sector.

5.1 Carbon price increase: unexpectedness and immediacy can increase macroeconomic costs

The carbon price increase considered in the analysis is unexpected and immediate compared with a gradual carbon price increase in a stable framework for an orderly transition to net zero, and leads to greater risks to the financial system. An unexpected and immediate increase in the carbon price gives firms and households little time to gradually adjust their emissions. This drives up the costs of transitioning to net zero.[2)] Stress tests are used to examine how this would impact on the financial

1 See Deutsche Bundesbank (2021, 2023).

2 This could lead to higher costs of transitioning production, higher inflation and higher monetary policy interest rates.

system. One key finding is that requiring firms to disclose emission intensities can enhance financial market efficiency and reduce the negative impact of an unexpected increase in the carbon price.

The analysis exploits a dynamic macro model to examine the short-term impact of an unexpected and immediate carbon price increase on the economy and financial system. In a first step, a dynamic macro model which models macroeconomic relationships is used to determine how an unexpected and immediate carbon price increase in Europe impacts on the economy and financial system.[3)] This is benchmarked against a scenario in which the current carbon price is maintained. The effects in Germany and Europe are assumed to be comparable. In the second step, these results are used to analyse the impact on the German financial system and the risks to German financial intermediaries. The analysis builds on earlier work concerning carbon price sensitivities.[4)] While those analyses focused on medium to long-term impacts, this one is particularly concerned with short-term effects occurring over the course of one year.[5)] It thus examines short-term interactions in the overall economy and financial system that previously were not visible (for an overview of current analytical methods, see the supplementary information entitled "The Bundesbank's tools for sustainability-related financial stability analysis").

In addition, the macroeconomic impact of a disclosure requirement for firms is examined and evaluated in the context of the stress tests. If firms are required to disclose their carbon emissions, investors can factor in the impact of future climate policy and the aggregate reduction in carbon emissions on the firms they are considering financing. One outcome of full transparency is better functioning financial markets. The analysis focuses on how strong the positive effects of disclosure, as opposed to imperfect information, are for the overall economy.

3 The increase in energy commodity prices linked to Russia's invasion of Ukraine somewhat resembles the carbon price increase analysed in this text. The impact on end consumer prices of a carbon price increase would be one order of magnitude smaller than the gas price increases seen in 2021 and 2022 (see https://www.bdew.de/presse/pressemappen/gaspreis-und-co-2-preis/). However, the carbon price increase is permanent, whereas the gas price increases were only temporary.

4 See Deutsche Bundesbank (2021, 2023).

5 The modelling horizon extends over 30 years, however.

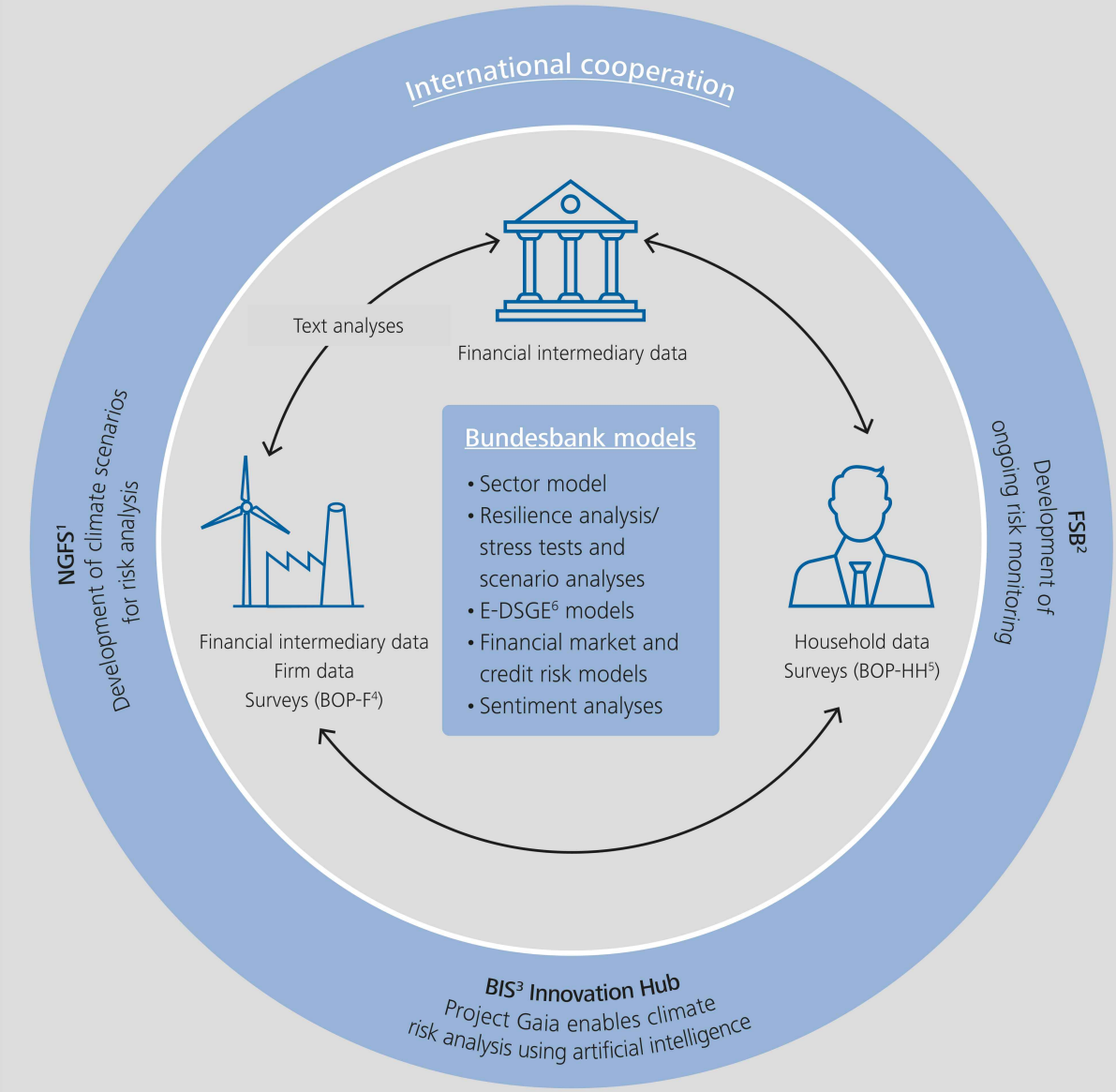
Supplementary information

The Bundesbank's tools for sustainability-related financial stability analysis

The analysis of sustainability-related impacts extends well beyond the macroeconomic relationships that are usually considered. Issues surrounding sustainability tend to be interdisciplinary in nature. Consequently, the methodological approaches and the data base underlying financial stability analysis need to undergo a continuous process of development and improvement. The Bundesbank engages in intensive cooperation with academia, and with international forums and bodies such as the Network for Greening the Financial System (NGFS), the Financial Stability Board (FSB) and the BIS Innovation Hub, a unit within the Bank for International Settlements (BIS) (see Chart 5.1.1).

Sustainability-related financial stability analysis at the Bundesbank

Chart 5.1.1



1 Network for Greening the Financial System. **2** Financial Stability Board. **3** Bank for International Settlements. **4** Bundesbank Online Panel – Firms. **5** Bundesbank Online Panel – Households. **6** Environmental dynamic stochastic general equilibrium.

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The Bundesbank is developing approaches of its own that enable it to harness models and data developed within other organisations and networks. These complementary strands of development are necessary in order to capture specific aspects of financial stability analysis from a German perspective. Since 2021, the

Bundesbank has been using an internally developed sector model [1] to disaggregate the NGFS scenarios, which were designed in partnership with a consortium of climate scientists. This model makes it possible to map the heterogeneity of effects across different sectors and account for the substitution and demand effects of carbon prices. The disaggregated scenarios produced in this manner are then put to work in stress tests and scenario analyses to assess financial intermediaries' resilience to vulnerabilities stemming from their exposure to various sectors. [2] Amongst other uses, the model has been employed by the ECB for sector disaggregation. [3]

In addition, two environmental dynamic stochastic general equilibrium (E-DSGE) models have been developed at the Bundesbank. The first of these is an E-DSGE model designed for financial stability analysis. Alongside the macroeconomic impacts of climate policy measures, such as changes in carbon prices, this model takes explicit account of macro-financial links via the financial system and behavioural changes. [4] The model is thus suitable for generating its own scenarios, such as short-term scenarios. This matters because the NGFS scenarios so far map only long-term developments spanning several decades, while conventional stress tests usually cover a short time horizon of only a few years. The model application is adapted accordingly in this Financial Stability Review: the risk assessment used in earlier Reviews is additionally complemented by an analysis of the short-term consequences of an unexpected and immediate increase in carbon prices for the economy and financial markets. [5] The second E-DSGE model is the environmental multi-sector dynamic general equilibrium (EMuSe) model. It is calibrated to three regions and a multi-sector production structure, and enables an analysis of climate policy adjustments with a real economic focus, also in an international context. [6]

For a comprehensive analysis of sustainability-related risks, the ability to include the behaviour of firms within regions and sectors is key. This applies to competition and production technologies, for example. On the one hand, it is necessary to have firm-level microdata that adequately reflect this heterogeneity. This information can be extracted, for example, from balance sheet data and market models. On the other hand, the formation of households' and non-financial corporations' expectations about

1 See Frankovic (2024). For information on the NGFS scenarios, see https://www.ngfs.net/ngfs-scenarios-portal/

2 See Deutsche Bundesbank (2021, 2023).

3 See European Systemic Risk Board (2022).

4 See Frankovic and Kolb (2024).

5 Short-term climate scenarios are also currently under development within the NGFS; see Network for Greening the Financial System (2023). In these scenarios, short-term carbon price changes should be consistent with a long-term transition to a net zero economy. This problem is also fundamentally addressed by Kaldorf and Rottner (2024).

6 See Ernst et al. (2023).

climate change and future climate policy is relevant in order to evaluate both risk awareness and plans to implement the transition to a low-carbon economy. This is because a lack of risk provisioning may lead to sudden financing needs in the financial sector.

Alongside relevant financial market and credit risk models, the Bundesbank is therefore adding to its toolkit the analysis of firm and household data, as well as surveys within the framework of the "Bundesbank Online Panel – Firms" and the "Bundesbank Online Panel – Households" surveys.[7)] In addition, the FSB is developing metrics for an ongoing and comprehensive monitoring of sustainability-related risks.[8)]

In the future, artificial intelligence (AI) can support the assessment of sustainability risks in the financial system. These new methods open up new possibilities, especially in the analysis of unstructured text data. For example, metrics on sentiment and risk can be derived from investor reports. The meaning of sentences in these reports is captured in order to better understand firms' assessments of transition and physical risks and feed these into the analysis.

Another method is currently being tested by the BIS Innovation Hub as part of Project Gaia.[9)] This project harnesses AI to extract climate-related indicators from corporate reports, such as data on investment volumes in green assets. Projects such as Gaia open up new avenues for collecting, processing and analysing both structured and unstructured data and can thus support the assessment of sustainability risks in the financial system going forward.

7 Survey on Consumer Expectations (Bundesbank Online Panel – Households, BOP-HH), see Survey on Consumer Expectations (BOP-HH) | Deutsche Bundesbank; Survey of Firms (Bundesbank Online Panel – Firms, BOP-F), see Survey on the expectations of firms in Germany | Deutsche Bundesbank

8 See Financial Stability Board (2023).

9 Deutsche Bundesbank (2024).

5.2 Scenarios of an unexpected, immediate carbon price increase

5.2.1 Transmission channels and analysis

The main scenario shows the risks of an unexpected carbon price increase. Putting a price tag on emissions of greenhouse gases such as CO_2 is considered an efficient instrument for reducing emissions.[6)] This is why the analysis also looks at a carbon price increase, specifically of €100/tCO_2 within one quarter for the main scenario. The increase starts from the current carbon price of around €75/tCO_2 (see Chart 5.2.1).[7)] A baseline with no further carbon price increase is used as a benchmark. The effects described below should therefore be understood as deviations in the main scenario from this baseline pathway.[8)] The assumption of the carbon price increase lines up with international studies and is based on historical market developments.[9)] Throughout 2021, the price of emission allowances in the EU Emissions Trading System (ETS) rose by around €70/tCO_2.[10)] Similar and larger carbon price rises are also possible in the future.[11)] This analysis assumes that the carbon price increase will be

6 Emission pricing mechanisms such as the EU Emissions Trading System typically cover emissions of other greenhouse gases (methane, for example) besides CO_2. The emission price is given in €/tonnes CO_2 (equivalents)

7 For the current price level, see Diluiso et al. (2021), Frankovic and Kolb (2024). This kind of drastic carbon price increase is also assumed, for example, in the Network for Greening the Financial System's "Delayed Transition" scenario for the period after 2030.

8 In the baseline scenario with an unchanged carbon price, future developments are known to market participants and priced into financial markets today. There is no unexpected, immediate carbon price increase from which losses could arise in the financial system. In the main scenario, on the other hand, the immediate and unexpected carbon price increase leads to changed future payment flows, which already affect financial market prices today and thus potentially result in losses for financial intermediaries. If, in place of the immediate transition, an orderly transition to net zero is used as the benchmark, the carbon price increase would likewise be unexpected but only in the long term. This would tend to produce greater stress than in the baseline scenario with no carbon price increase. However, whether the stress is higher or lower than in the scenario of an immediate carbon price increase assumed here hinges on the specific trajectories of carbon prices in each scenario. Their differing trajectories lead to changed future payment flows, which are already reflected in financial market prices today. For an analysis of climate risks in orderly transition scenarios, see Deutsche Bundesbank (2021, 2023). Because of the methodological approach (linearisation when calculating the macroeconomic model; see section 5.2.2 "Multi-stage model framework for scenario analysis"), the effects computed below relating to all other explanatory variables except the carbon price can be seen as additional to any baseline scenario.

9 See Allen et al. (2023), Network for Greening the Financial System (2023).

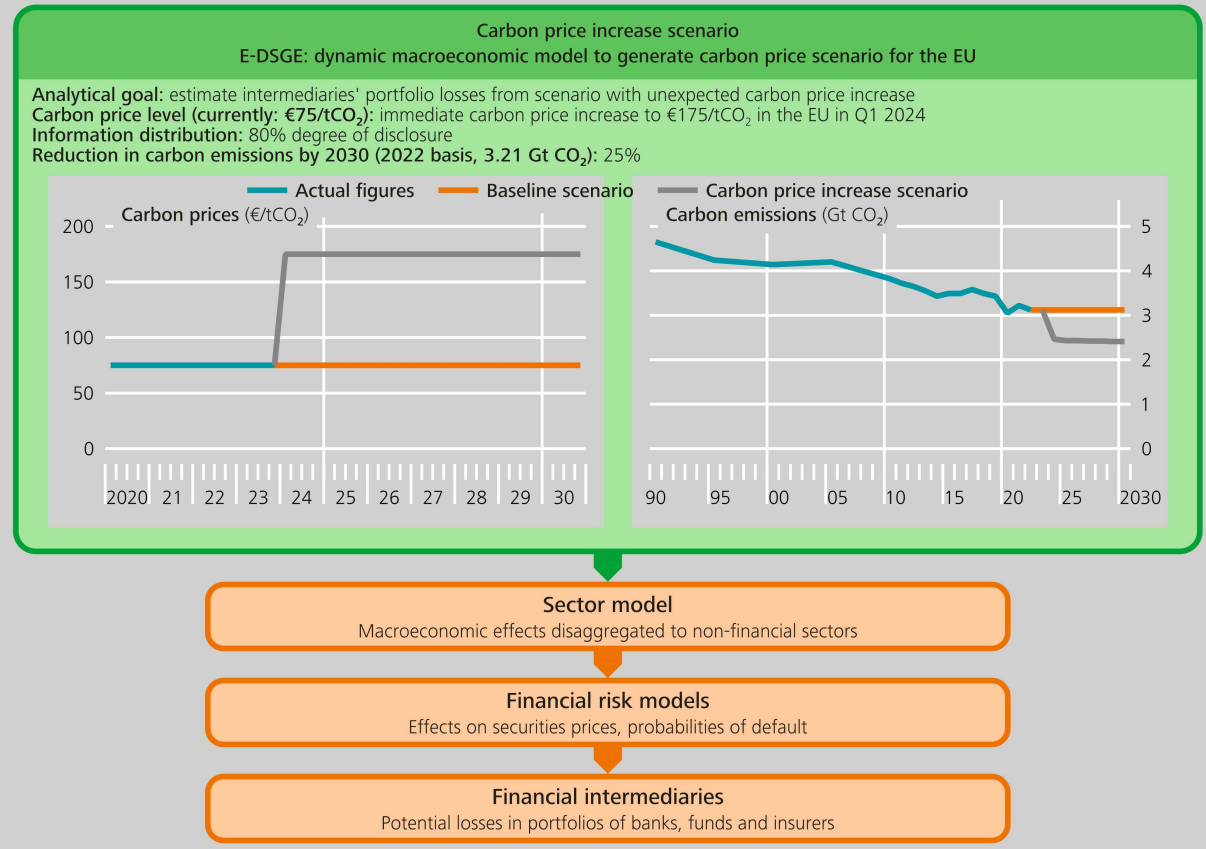
10 See https://www.umweltbundesamt.de/daten/klima/der-europaeische-emissionshandel#teilnehmer-prinzip-und-umsetzung-des-europaischen-emissionshandels

11 According to a current metastudy which evaluates almost 6,000 estimations worldwide, the socially optimal prices are around €116/tCO_2 (median) and roughly €177/tCO_2 (mean); see Tol (2023). The expansion of the EU ETS to buildings and road transport, in particular, could mean significant carbon price increases to roughly €150-300/tCO_2 if the carbon reduction targets are stringently pursued; see Agora Energiewende and Agora Verkehrswende (2023), Bachmann and Bayer (2023), Kalkuhl et al. (2023).

higher than observed in the past, in keeping with stress test logic (see Chart 5.2.1). Seeing as the EU ETS will be expanded to include buildings, road transport and additional sectors (industry not yet covered by the existing EU ETS) in future, the carbon price increase in the model covers the entire economy. [12)] In the model calculations discussed below, this leads to a 25 % reduction in net emissions in Europe by 2030. Unlike other studies, this analysis does not look at the further trajectory of the carbon price, but leaves it unchanged after the increase. The change in the carbon price is thus a one-off, sudden increase.

Model chain and outline of the carbon price increase scenario

Chart 5.2.1



Source: European Environment Agency, EEA greenhouse gases – data viewer, Dashboard, published 15 April 2024, modified 13 August 2024. See I. Frankovic, T. Etzel, A. Falter, C. Gross, J. Ohls, L. Strobel, H. Wilke, Climate transition risk stress test for the German financial system, Deutsche Bundesbank Technical Paper 04/2023; I. Frankovic and B. Kolb, The role of emission disclosure for the low-carbon transition, in European Economic Review 167 (2024), Article 104792; Deutsche Bundesbank, Financial Stability Review 2021; and Deutsche Bundesbank, Financial Stability Review 2023.

Deutsche Bundesbank

12 See Schrems et al. (2023).

Compared with an alternative "status quo" scenario, an unexpected and immediate carbon price increase gives rise to additional costs due to risks materialising in the short term. Very short-term adjustments in production and consumption in the wake of a carbon price increase result in additional costs especially for energy-intensive firms and consumers. This moment of surprise and the shorter horizon differentiate the main scenario from stress scenarios that examine the risks of long-term, continuous green structural change.

The costs and risks of the carbon price increase are independent of the assumed long-term transformation in the scenario. To assess risks to financial stability, a risk scenario (scenario of an unexpected, significant carbon price increase) is compared with a baseline pathway. The latter describes developments that are currently expected. The baseline pathway therefore simply extrapolates the status quo over the modelling horizon. It is also possible, however, to assume other future economic and climate policy trajectories, as the additional costs entailed by switching from the baseline to the carbon price increase scenario are not contingent on the selection of the baseline pathway itself. [13)]

Two alternative scenarios show how a gradual and partly anticipated increase in the carbon price as well as a disclosure requirement can reduce the risks posed by an unexpected carbon price increase. In the first alternative scenario, the price increase is spread across two quarters, at €50/tCO_2 each time, with the gradual raising of prices being announced at the time of the first increase, meaning that the second one no longer comes as a surprise. This phased increase gives market players more time to adjust. In the second alternative scenario, the carbon price is increased as in the main scenario; the difference is that a disclosure requirement allows market participants to assign the risks stemming from carbon emissions more accurately to the emitters. This results in better financing decisions and more efficient allocation of capital.

5.2.2 Multi-stage model framework for scenario analysis

The macroeconomic impact of the increase in the carbon price is examined using a dynamic equilibrium model. To analyse the effects on the financial system, the carbon price increase is first fed into a macroeconomic model. This simulates how the increase affects macroeconomic variables that are important for the financial market. The study

13 The effects calculated here are assumed to be independent of a baseline scenario (linear separability). The transition pathway in the baseline scenario could thus already assume a certain increase in carbon prices. The only condition for this is that it does not lead to a significantly disproportionate increase in the economic variables of interest – value added, enterprise values, inflation and the risk-free interest rate (non-linearities). See https://www.ngfs.net/ngfs-scenarios-portal/ for more on the NGFS scenarios.

exploits an environmental dynamic stochastic general equilibrium (E-DSGE) model.[14] An innovation in climate risk analysis is the endogenous inclusion of shocks to financing conditions. In addition, this allows the financing of energy-intensive and non-energy-intensive sectors to be mapped. It is assumed that participants in the economic and financial system do not expect the carbon price increase assumed here. This approach allows us to simulate the largest possible losses under the given model assumptions.[15] Only once the price increase occurs does the future carbon price pathway become known to all model agents. Transparency about carbon emitters is assumed to be limited in the main scenario of a carbon price increase. In the baseline, the degree of disclosure – that is, the percentage of emissions which investors can accurately assign to emitters – is set at 80 %.[16]

Market players are assumed to have very limited options for short-term adjustments. Given a carbon price increase at short notice, this can lead to significant additional costs for the economy as a whole. The exclusion of technological change or reinvestment of recycled carbon tax revenue plus the rising financing costs caused by interactions with the financial system increase the short-term risks.

Different sectors of the economy are affected to varying degrees by the carbon price increase. The results of the E-DSGE model are therefore fitted to German economic sectors.[17] It is assumed that the effects in Germany broadly match the results of the European E-DSGE model.[18] First, a sectoral equilibrium model is used to

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14 See Frankovic and Kolb (2024). The model is simulated under the assumption of perfect foresight and thus disregards uncertainty about further stochastic shocks. Compared with the medium-term calibration (three to six years) chosen in the article cited above, a number of parameters are modified for the short term in this analysis. In particular, the level of financial frictions and adjustment costs is increased and the degree of substitutability between forms of energy reduced. This raises the costs of the carbon price increase. Frankovic et al. (2023) document a procedure in which the effect on GDP is simulated for various sets of parameters. They then select the set of parameters which corresponds to the 5th percentile of the GDP effect, and is thus more adverse than 95 % of the other sets of parameters. In this exercise, the following parameters differ from the calibration in Frankovic and Kolb (2024): the elasticity of substitution between fossil and renewable energy sources is set to 0.2 instead of 3, investment adjustment costs are increased from 9.5 to 40 and portfolio adjustment costs from 0 to 5. Furthermore, financial frictions are intensified such that the bank capital ratio in equilibrium is 15 % instead of 8 %. All of these modifications reflect reduced flexibility in the short rather than the medium term and exacerbate the macro-financial effects of the carbon price increase.

15 If carbon prices are partly or completely expected, they will already be priced into today's asset prices. In this case, increases in emission prices result in lower losses.

16 See Frankovic and Kolb (2024), based on Carbone et al. (2022), for example. The assumption of partial disclosure is relaxed to full disclosure and associated impacts on key macroeconomic variables are examined.

17 See also the multi-sector E-DSGE model EMuSe, which is used to compare the sectoral impact of an orderly and a disorderly transition; see Deutsche Bundesbank (2022), Hinterlang et al. (2023).

18 Since these are macro variables for the upstream stress test scenario and the reference values come from the reformed EU ETS, it is assumed that the calibration for the euro area and Germany does not differ substantially. In Germany, the carbon share in production actually tends to be less of a risk driver than in the euro area as a whole, at 229 tCO_2 compared with 245 tCO_2 equivalents per million euro of GDP; this makes the present stress test even more conservative, if anything (see https://www.umweltbundesamt.de/daten/klima/treibhausgas-emissionen-in-der-europaeischen-union#hauptverursacher). Moreover, German firms are heavily interconnected with the rest of Europe.

determine how much the individual sectors' value added declines due to the carbon price increase. This makes it possible to allocate the overall effects on value added calculated in the E-DSGE model to the individual economic sectors. [19)]

In subsequent steps, financial market and credit risk models are used to calculate write-downs and losses on shares and corporate as well as government bonds in order to analyse the impact on the financial system. Based on historical data, relationships between credit default rates and firm metrics in the respective scenario are estimated. Projected firm metrics are then used to calculate firm-specific credit default rates in each scenario. In the same way, sectoral losses on shares are linked to the respective climate scenario variables. Bond prices change depending on the interest rate developments and yield spreads assumed in each scenario. Yield spreads of financial and non-financial bonds are estimated based on developments in sectoral variables, interest rates, and bond-specific metrics such as ratings and terms. [20)] Given that government bonds are assumed to be risk-free, only movements in interest rates affect their prices here.

5.3 Key macroeconomic and macro-financial impacts of carbon price increase

5.3.1 Main scenario: unexpected carbon price increase

The increased carbon price leads to lower economic output and lower enterprise values relative to the baseline. The focus here is on the impact on Germany's real economy and financial sector. The impact of the carbon price increase in Europe is examined to take into account strong trade links. [21)] GDP falls by around 1.4 % within the first four quarters. Enterprise values drop by about 28 % in the first quarter (see Chart 5.3.1). These strong decreases are attributable, in large part, to interactions with the financial system and their impact on the real economy. [22)] Since there are no further increases in the carbon price and new investment takes into account the adjusted carbon price pathway, enterprise values recover very swiftly, however. Next, the sector model is used to allocate GDP and enterprise values to the different

19 See Frankovic (2024).

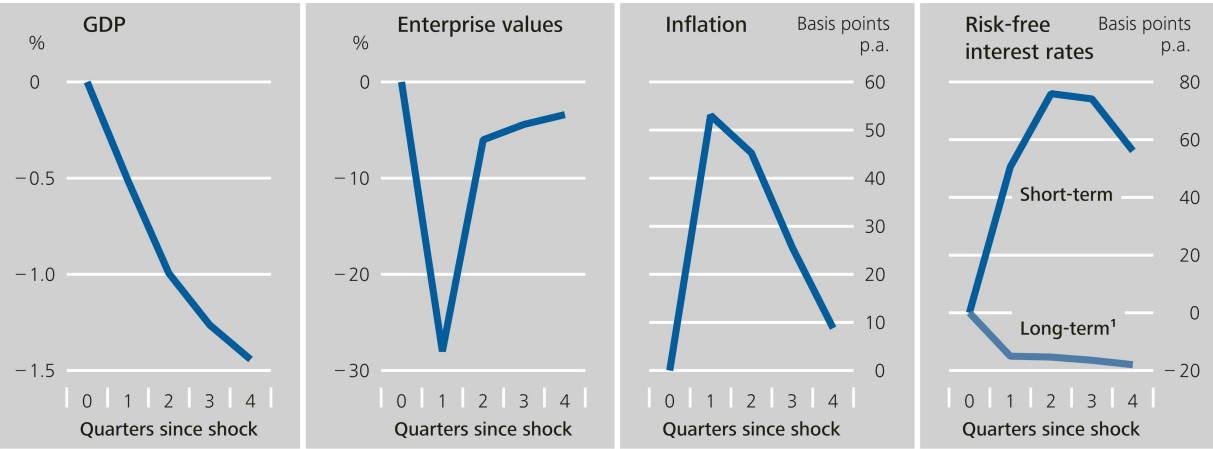
20 See Frankovic et al. (2023).

21 The global effects of the price increase are not modelled at the macroeconomic model level (ceteris paribus assumption). The model is based on the assumption that the EU's assumed climate policy shift will take place independently of and in addition to developments in the rest of the world. Developments outside Europe would be an added extra, including any additional losses.

22 See Frankovic et al. (2023).

economic sectors. Sector-specific developments are thus made ready for further use in the financial market and credit risk models (see section 5.5 “Anticipated, credible climate policy course and market transparency yield benefits”).[23] The initial sharp rise in inflation by around 0.5 percentage point compared with the baseline rapidly subsides again (see Chart 5.3.1). Seeing as there are no further carbon price increases and associated spikes in inflation, the risk-free interest rate only rises temporarily.[24] In the model, however, the long-term risk-free interest rate drops immediately due to the economic downturn.

Impact of the main scenario of an unexpected and immediate carbon price increase on macroeconomic variables in the euro area* Chart 5.3.1



* Dynamic reaction of model variables after an unexpected and immediate carbon price increase of €100/tCO_2. 1 Geometric mean of risk-free interest rates over 10 years.

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5.3.2 Alternative scenario 1: gradual carbon price increase

A first alternative scenario assumes a gradual and thus partly anticipated carbon price increase. Now, instead of a one-off unexpected carbon price increase, the rise is partially anticipated. The macroeconomic effects of the immediate carbon price increase of €100/tCO_2 are compared against the alternative scenario in which it is known that the carbon price is going to be rising. Both scenarios assume imperfect disclosure. The first alternative scenario supposes that the carbon price goes up unexpectedly by just €50 in the first quarter. The price does not rise again until the

23 See Deutsche Bundesbank (2021, 2023).

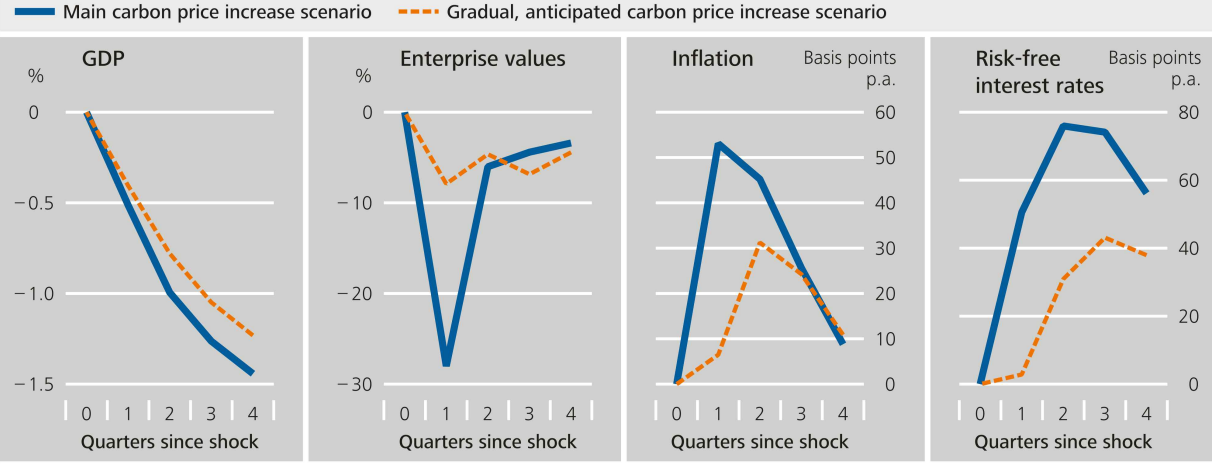
24 The short-term risk-free interest rate follows current inflation (Taylor rule).

second quarter, when it goes up by a further €50 to €175, the final carbon price level envisaged in the risk scenario outlined above. This second increase is already expected in the first quarter.

The fact that the carbon price increase is partly foreseeable significantly reduces the losses incurred by the economy as a whole. Chart 5.3.2 shows that the costs to the real economy are considerably lower: GDP and enterprise values decline less sharply, and inflation and interest rate levels do not climb by as much. The lower costs also benefit households and firms.

Impact of the carbon price increase scenario on macroeconomic variables in the euro area – the role of a gradual and anticipated carbon price increase*

Chart 5.3.2



* Main carbon price increase scenario as in Chart 5.3.1. Gradual and partially anticipated: in the first quarter there is an unanticipated jump in the carbon price from €75/tCO_2 to €125/tCO_2 and in the second quarter to €175/tCO_2. However, this is already anticipated in the first quarter. The degree of disclosure is 80% throughout, as in the main carbon price increase scenario.

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5.3.3 Alternative scenario 2: mandatory disclosure

Standards for the disclosure of sustainability-related information are increasingly being put in place, and policymakers are working on setting out reporting requirements. Mandatory disclosure is currently the subject of public discussion. Various policy initiatives have already made for improved disclosure by firms. Most notably, last year saw the International Sustainability Standards Board (ISSB) publish IFRS Sustainability Disclosure Standards.[25)] In Europe, more sustainability information, particularly with regard to large firms, is set to become available in the coming years

25 See European Commission (2023). See https://www.ifrs.org/groups/international-sustainability-standards-board/ for more information on the ISSB.

due to the Corporate Sustainability Reporting Directive (CSRD) and the EU Taxonomy Regulation. The Basel Committee on Banking Supervision (BCBS) is currently discussing a Pillar 3 disclosure framework for climate-related financial risks. In Europe, disclosure obligations around sustainability risks also form part of the banking package (Capital Requirements Directive VI and Capital Requirements Regulation III (CRR III)). [26)]

The disclosure of information allows market participants to better adapt. It enables them to accurately attribute the carbon emissions generated by production and consumption. This helps households, who operate as investors in the model, gain a better understanding of the actual costs of the carbon price increase. That, in turn, reduces the macroeconomic costs and lessens the risks to financial stability.

Better attribution of emissions to their source can mitigate an economic downturn. In the main scenario described above, disclosure is assumed to be imperfect, with households wrongly attributing 20 % of emissions to zero-emission sectors. [27)] The scenario presented in the following assumes full mandatory disclosure, which applies from the outset and allows emissions to be attributed with precision. In addition to the €100/tCO_2 carbon price increase, the degree of disclosure is also upped from 80 % to 100 %. Enhanced disclosure has two effects:

- First, the higher carbon price has a stronger impact on the fossil sector, as the additional expense is now fully visible in the financing costs.
- Second, the economic downturn is reduced by efficiency gains: while financing costs rise in the fossil sector, they decrease in zero-emission sectors. The increased level of information, and the possibility this creates to attribute higher financing costs to the fossil sector, enables households to make better investment decisions. There are also positive effects in terms of aggregate demand.

Enhanced disclosure significantly reduces the costs of the carbon price increase (see Chart 5.3.3). [28)] Enterprise values drop by roughly 7 %, around three-quarters less than

26 See European Commission (2024).

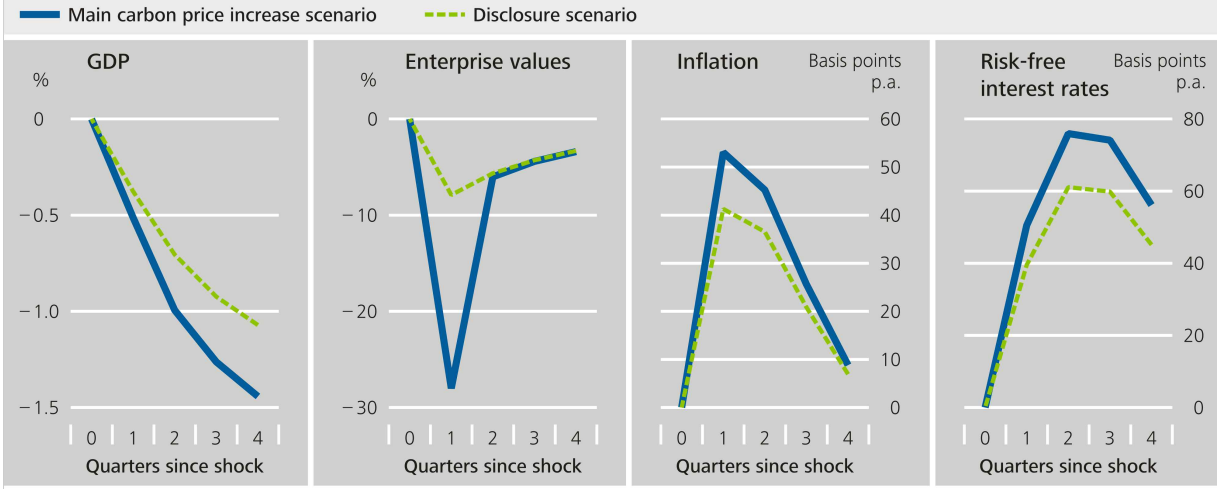
27 This is consistent with survey-based studies. These show that households regard insufficient information about firm emissions as a major factor preventing them from investing more sustainably. Such studies exist for a host of European countries, including Germany (see Gutsche and Zwergel (2020)), Sweden (see Anderson and Robinson (2022)), Italy (see Cucinelli and Soana (2023)), Switzerland (see Filippini, Leippold and Wekhof (2024 and the Netherlands (see Degryse et al. (2023)). Note here the model assumption that only households are imperfectly informed; firms, banks and the public sector, which levies the carbon tax, operate with perfect information. Furthermore, the true total amount of emissions is known to households as well. Nevertheless, it can be shown that, given imperfect disclosure, the model's financial friction results in excessive lending to the fossil sector and also gives that sector a financing cost advantage.

28 See Frankovic and Kolb (2024).

in the main scenario. GDP shrinks by around one-quarter less than in the main scenario, falling by slightly more than 1.1 %. The increases in inflation and the risk-free interest rate are each cut by around one-fifth. These effects place the economy on a better trajectory and indirectly bolster financial stability.[29] Mandatory disclosure does, however, come at a cost which may lessen the estimated benefits and even exceed them. Besides direct administrative costs, these also include competitive disadvantages created by information sharing.[30] Information relevant to the assessment of risk does not necessarily have to be disclosed to the public at large. Even just giving banks and insurers access to this information in the lending process is enough to improve risk assessment in financial markets and thus financial stability (see the supplementary information entitled "Prudential plans, transition pathways and scenario calculations").

Impact of the carbon price increase scenario on macroeconomic variables in the euro area – the role of enhanced disclosure*

Chart 5.3.3



* Main carbon price increase scenario as in Chart 5.3.1. Enhanced disclosure: in addition to the unanticipated jump in the carbon price from €75/tCO_2 to €175/tCO_2 in the first quarter, the degree of disclosure is increased from 80% to 100%.

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29 It should be noted, though, that the reduction in emissions brought about by the carbon price increase is slightly reduced in the model by the enhanced disclosure. This is because of the close linkage between GDP and emissions, which came about because the parameterisation of the model was fitted to the short-term horizon. The low degree of substitutability between energy forms, in particular, means that movements in emissions and economic output are strongly aligned here. The efficiency gains brought about by enhanced disclosure lessen the decrease in GDP, and thus also the decline of energy as a production factor. Because replacing fossil fuels with renewable energies is extremely difficult in the short term, slightly fewer emissions end up being saved – though it also means a significant reduction in the economic costs associated with the carbon price increase.

30 See Berger, Choi and Tomar (2024) and Farvaque, Refait-Alexandre and Saïdane (2011).

Supplementary information

Prudential plans, transition pathways and scenario calculations

In the future, the use of prudential plans or transition pathways in scenario calculations will improve the available prudential data and the risk assessments of banks and insurers. Under CRD VI, banks will provide prudential plans that identify their exposure to financial environmental, social and governance (ESG) risks and determine how they will address them. These will also include long-term risks stemming from the transition to a net zero economy. The plans will probably be expected to include scenario calculations. The design of the prudential plans is currently being finalised by the European Banking Authority (EBA). These plans are to be provided to supervisors only, and not disclosed to the general public.

The information on insurers that will be available in the future may expand macroprudential analysis. In the future, insurers will be legally required to specify their sustainability risks through adapted rules on the compilation of an own risk and solvency assessment (ORSA).[1)] Among other factors, insurance companies will need to assess their exposure to climate-related risks. If their exposure is significant, they will have to base their risk assessment on at least two long-term scenarios illustrating how climate-related risks could affect the company's business activities. This information may improve insurance companies' risk management going forward.

1 See European Parliament (2024). In an opinion issued in 2021, the European Insurance and Occupational Pensions Authority had already set out expectations on supervision of the use of climate change risk scenarios in the ORSA. This has not yet been accompanied by any legal requirements, as an opinion is not binding.

5.4 German financial system resilient in stress tests

The German financial system remains resilient when exposed to the risks of a sharp increase in the price of carbon. The national impact of the carbon price increase as derived from the E-DSGE model – the declines in GDP and enterprise values, for instance – are first transposed to sectors by means of the sector model. These sector-specific macro-financial variables are then fed through market risk models to derive financial market prices and changes in the value of financial market portfolios.[31] The unexpected and immediate carbon price increase triggers significant but temporary losses where shares are concerned, while bonds are less heavily impacted. The immediate decrease in the long-term risk-free interest rate tempers the declines in corporate bond prices and even puts government bond prices on an upward trajectory. The analysis covers a horizon of just one year; carbon prices remain at the same level after the initial jump, and the road ahead for climate policy is uncertain. By the end of the analysis horizon, the carbon price increase brings down emissions by approximately 22 %. Effects on the present value of securities stemming from the evolution of emission prices following the initial carbon price increase are not examined here.

Losses experienced by banks are moderate. In the first quarter, banking book securities post losses of 1.9 %, compared with recognisable losses of just 1.1 % (see Chart 5.4.1).[32] The limited magnitude of the effect is down to two factors. First, German banks hold comparatively small amounts of shares and non-financial bonds. Second, with the increase in the risk-free interest rate being only temporary, lower-risk bonds – which make up a greater share of the portfolios – only see a small drop in value. Potential credit losses in the stressed corporate lending portfolio after a year are minimal, coming in at 0.03 %. Default risks amongst enterprises disadvantaged by the transformation show a slower response than market prices because they adapt sluggishly to the economic changes.

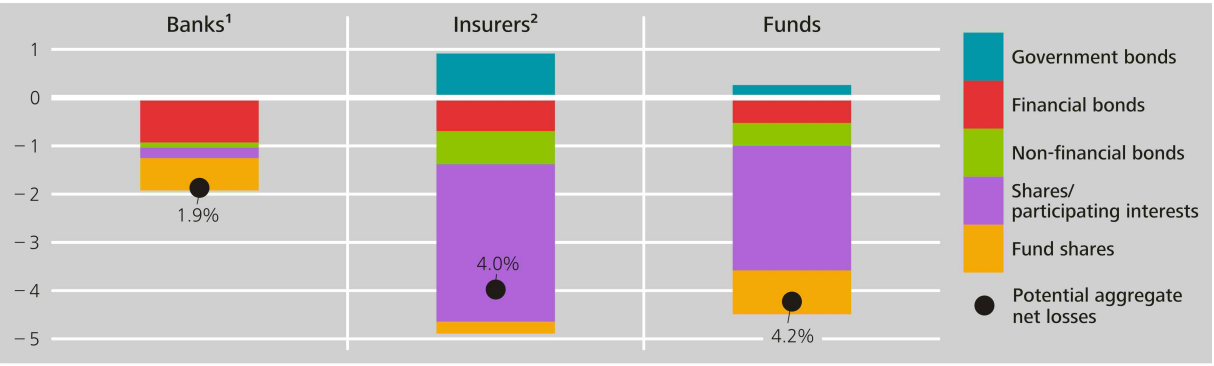
31 See Falter et al. (2021).

32 Institutions recognise a substantial portion of securities in the banking book at amortised cost, meaning that market price losses show up only partially as recognised losses.

Vulnerabilities of German financial intermediaries:
market risk in the carbon price increase scenario by asset class*

Chart 5.4.1

Changes in value as a percentage of stressed securities portfolios



Sources: Centralised Securities Database and Bundesbank calculations on the basis of the main carbon price increase scenario. * Potential effects of scenario-dependent market price changes in the main carbon price increase scenario compared with the baseline scenario in which the status quo is maintained. The analysis only looks at effects on the assets side. However, the changes in the risk-free interest rate within this scenario would also affect market values on the equity and liabilities side, especially in the case of life insurers. **1** Losses at market prices as a percentage of the securities in the banking book. **2** Insurers' holdings of German fund shares are assigned to the asset class of the securities held by the funds. The fund shares category itself only includes the portion for which this is not possible (e.g. foreign investment shares).

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In the insurance and fund sector, the unexpected and sharp increase in the carbon price results in significant losses. Overall, German insurers' securities portfolios lose 4.0 % of their value, though they do recover quickly. It is a similar story for German funds, whose securities portfolios shed 4.2 % of their value in the space of one quarter. Their net asset value tumbles by 3.9 %.

Overall, the losses incurred in the stress test scenario as a result of an unexpected carbon price increase are of a manageable magnitude for the financial system. The banking system sustains losses amounting to a maximum of 2.2 % of common equity tier 1 (CET1) capital. In the fund sector, the sizeable mark-to-market losses could prompt fund share redemptions, potentially triggering knock-on effects resulting from fire sales in financial markets. Insurers, meanwhile, experience mark-to-market losses amounting to 7.5 % of regulatory own funds in the second quarter of 2024. [33)]

33 The potential mark-to-market and credit losses computed here differ from the potential losses sustained by intermediaries calculated within the same model framework by Frankovic et al. (2023). The scenario design selected here is different in that the carbon price increase is smaller and the degree of disclosure is also lower. This means that GDP, in particular, declines by less but enterprise values are significantly higher. This leads to somewhat smaller declines in the value of bonds but similarly high declines when it comes to shares and participating interests.

The risks associated with full decarbonisation are not examined in this analysis. The stress test simulations focus on short-term responses by economic variables such as inflation, the risk-free interest rate and frictions in the financial system. These variables and the interplay between them are often neglected in long-term climate models in the interests of casting a detailed depiction of the transformation in full. The extent to which the unexpected carbon price increase lessens long-term risks up to 2050 is also left unaddressed. The carbon price increase brings the reduction in carbon emissions forwards in time, which reduces risks and vulnerabilities previously estimated on the basis of long-term scenarios. A full analysis of all risks is not possible at this time and requires a comprehensive analytical framework, which is currently under development within the NGFS. [34)]

5.5 Anticipated, credible climate policy course and market transparency yield benefits

Risks from the scenario positing a sudden carbon price increase are likely to be manageable for the German financial system. Losses in Germany's financial system are moderate and bearable. Banks' excess capital and insurers' solvency are both high enough that they can keep meeting the regulatory capital requirements.

The stress test analyses show the importance of a credible and predictable climate policy pathway, which revolved around the carbon price in this particular instance. Unexpected shifts in the climate policy trajectory drive up the aggregate costs and could delay the transition to climate neutrality. The short-term impacts of an unexpected and immediate carbon price increase on the aggregate economy and financial system are broadly independent of the long-term risks associated with the transition to climate neutrality which were explored in previous reports. [35)] Immediate and unanticipated adjustments in the expectations of financial market participants ought to be avoided.

34 See Network for Greening the Financial System (2023). This problem is also addressed by Kaldorf and Rottner (2024). Besides the direct carbon price increase supposed here, it is also possible for these to bring down the risks associated with the transition in future. In the current situation, where production and consumption still involve high shares of fossil fuels, a carbon price increase in particular is likely to entail threats to financial stability. This may change in later phases where low-emission technologies are more prevalent: it is to be expected that the economy as a whole and the financial system will then experience dislocations in the event of a reduction in the carbon price, exposing by-then established climate neutral technologies to hold-up risk.

35 See Deutsche Bundesbank (2021).

Mandatory full disclosure is another important instrument that policymakers can use to lessen the costs of transition. Imposing the fullest possible disclosure requirement on non-financial corporations and – within an appropriate framework – financial intermediaries and including, for example, the costs of red tape can reduce potential burdens for financial market players.

Financial intermediaries should keep an eye on the risks of higher greenhouse gas emission prices for firms and, where necessary, work to strengthen their resilience. Emission price rises that come as a surprise can act as a further drag on the real economy and financial sector, adding to the burdens already stemming from the planned, long-term structural change.

Macroprudential supervisors in Europe are looking into which instruments could be used to specifically counter potential climate-related risks in the financial sector. [36] Macroprudential instruments do already exist to curb climate-induced systemic risks, but the general resilience of the financial system could be bolstered by systemic risk buffers. However, this necessarily involves assessing climate risk to the financial system from a systemic viewpoint. Sector-specific capital buffers, by contrast, could capture climate-induced systemic risks with even greater precision. Operationalising this kind of systemic assessment could come at a greater cost to financial intermediaries and supervisory authorities, however.

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Special chapter: The German and Italian government bond markets from a financial stability perspective

The public sector issues government bonds to finance its expenditures. A stable government bond market, then, supports the state in the fulfilment of its duties. Government bonds are usually characterised by low liquidity risk. This risk describes how quickly and at what prices large holdings of securities can be traded. The low liquidity risk is a main factor that makes government bonds a central component of modern financial markets and renders them essential for financial stability.

The determinants of liquidity on the German and Italian government bond markets were explored in a joint project undertaken by the Bundesbank and the Banca d'Italia for this article.

After the Eurosystem, investors from China are the largest holders of German government bonds, followed by investors from the United States and the United Kingdom. Additionally, euro area-based non-bank financial intermediaries (NBFIs), particularly investment funds, hold large amounts of German government bonds. Thus the holder structure is not bank-centric, and the level of involvement of foreign investors and NBFIs is significant for the price discovery mechanism in the German government bond market. While the high share of foreign investors allows for more diversified holdings and therefore creates additional demand, international contagion may temporarily lead to higher market price volatility. The majority of Italian government bonds, on the other hand, are held by domestic banks, insurers and households. While this large domestic share creates stability in the investor base, it also implies a higher degree of interconnectedness within the economy.

German government bonds are mostly traded over-the-counter (OTC) and bilaterally on the secondary market. By contrast, trading in Italy mainly occurs via a regulated electronic trading system, and most transactions are cleared through a central counterparty. Both trading mechanisms have their own advantages and disadvantages, which relate to efficiency, transparency, trading costs and availability of information. Such mechanisms can influence market liquidity conditions.

Government bonds are also frequently used in repurchase agreements (repos). Repos can be used to bridge short-term liquidity shortages and to obtain specific securities. Shortages, as seen in recent years mainly with German government bonds, manifest through increased costs of borrowing such securities in the repo market. The type and investment strategy of market participants can influence the scarcity of securities in the repo market.

The analyses conducted in the joint project by the Bundesbank and the Banca d'Italia show that participants in the German and Italian government bond markets differ significantly, and that this may have divergent impacts on market dynamics. To support the resilience of government bond markets, it is crucial to better understand the

investment strategies and reaction behaviours of participants. This, in turn, requires the use of granular data, especially data which pertain to the securities portfolios of foreign investors and are not always available.

6.1 The importance of liquid government bond markets for financial stability

A liquid government bond market is essential for a functioning financial system. Government bonds from many advanced economies are considered by investors and regulatory authorities to be high-quality liquid assets (HQLA). Accordingly, these securities have a wide range of uses. They serve as collateral in various markets, particularly in the repo market, which predominantly handles government bonds. Central counterparties (CCPs) also accept government bonds as collateral (initial margin requirement). In order for government bonds to be used as collateral in various ways, it is crucial that this collateral can be sold quickly and easily in the market.

The liquidity of government bonds is also important because it supports their function as a safe investment in investors' portfolios. In times of higher market volatility, they are typically stable in value, particularly those issued by advanced economies. This makes government bonds a popular choice when it comes to diversifying investment portfolios. They sometimes serve as insurance against unexpected negative events.[1)] However, for government bonds to be considered a safe investment, it must be possible to sell them quickly and at a price justified by fundamentals even during times of economic uncertainty, or to use them in the repo market for short-term refinancing.

For investors, securities therefore have a higher value when they know they can sell them quickly, in large volumes, and without significant price discounts even in economically uncertain times, or temporarily exchange them for cash in the repo market. Confidence in the high liquidity of government bonds is often particularly strong, meaning that investors are willing to accept lower yields. This allows issuing states to obtain financing at favourable conditions, contributing to the stability of public finances.

The liquidity of government bond markets heavily depends on how they are organised and the market participants involved. Both factors may respectively influence vulnerabilities in the government bond market as well as financial stability.

1 See Dufour et al. (2017).

This became evident during the turbulence in the US and other international government bond markets in March 2020, when the reactions of different market participants impaired the liquidity of the government bond market. [2)]

2 See Barone et al. (2023), Financial Stability Board (2022), He et al. (2022) and Kashyap (2020).

6.2 The structure of the German and Italian government bond markets

The German and Italian government bond markets play a central role in their respective national financial systems, but they differ in their structure and in the way in which they function. In both markets, bonds are issued through auctions and traded on well-developed secondary markets. They offer a variety of bond types with different maturities of up to 30 years for German and 50 years for Italian government bonds. In both countries, the respective Ministry of Finance makes the strategic decision on the issuance of government bonds. In Germany, the Federal Republic of Germany – Finance Agency plays a central role in operational business. It handles debt management, borrowing, and cash management on behalf of the Federal Republic of Germany. In Italy, this role is predominantly assumed by the Ministry of Economy and Finance.

At the end of 2023, the Federal Republic of Germany had an outstanding nominal volume of Federal securities worth €1.8 trillion across various maturities.[3] The outstanding volume of Italian central government securities was €2.4 trillion at the same point in time.[4] These government bonds can be traded on the cash market.

A significant portion of German government bonds are held by foreign investors, whereas Italian government bonds are predominantly held by domestic investors.[5] The largest holder of both countries' issued bonds is the Eurosystem. Since the Eurosystem acts market-neutrally in monetary policy purchases, central bank holdings are not included in this analysis. At the end of 2023, foreign investors held about 77 % of German government bonds, with around 50 % being held outside the euro area (see Chart 6.2.1). Investors from China were the largest group of holders, followed by investors from the United States and the United Kingdom. In addition, euro area NBFIs,

3 See Federal Republic of Germany – Finance Agency (2024) for Germany and Banca d'Italia (2024a) for Italy.

4 In Italy, all debt securities are issued by central government, whilst in Germany, both the federal government and the regional governments can issue debt securities. The latter are not included in this study.

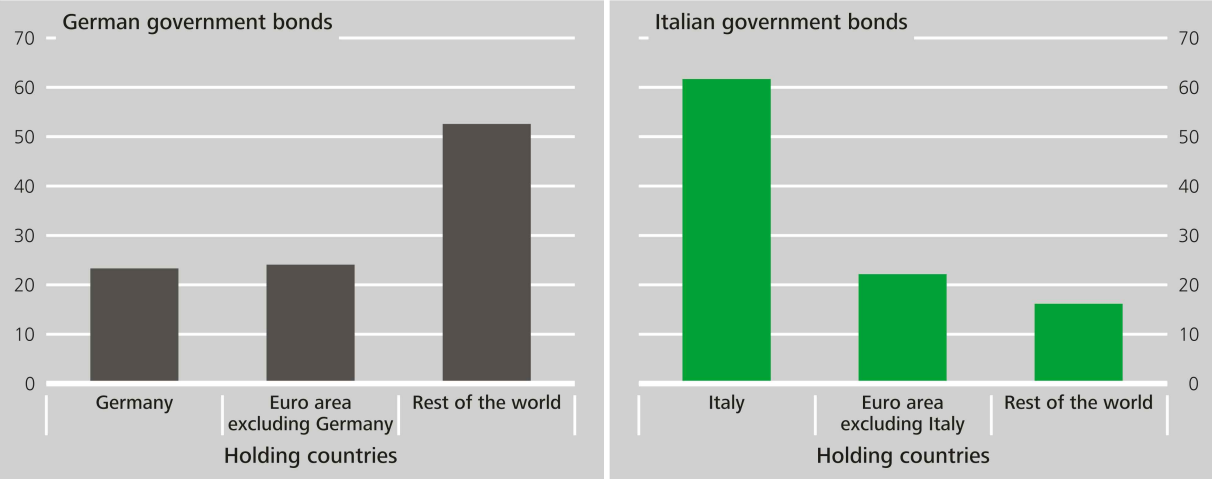
5 This information is based on aggregate holder data from the ECB's Securities Holdings Statistics by Sector (SHSS). The SHSS do not include the holdings of the ECB or the national central banks of the euro area. Moreover, there is no information on the sector to which holders outside the euro area belong.

in particular investment funds, held large shares of German government bonds.[6] By contrast, around 60 % of Italian government bonds were held by Italian investors at the same point in time. The largest share was held by domestic banks, followed by insurance companies and households.[7]

Stocks of domestic government bonds*

Chart 6.2.1

As a percentage of outstanding amount, as at Q4 2023



Sources: Securities Holdings Statistics by Sector (SHSS) and own calculations. * Comprises German and Italian government bonds issued by central government and not held by the Eurosystem.

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On the secondary market, German government bonds are mostly traded over-the-counter and bilaterally, whilst Italian government bonds are traded via a regulated electronic trading system that includes a settlement and clearing system. In Italy, trading predominantly occurs between dealers on the regulated trading platform MTS Italy, with transactions being cleared through a CCP. In other words, the trading mechanism in Italy is centralised, while that of Germany is decentralised. In Germany, a large portion of transactions between dealers and their end investors take place bilaterally. In 2023, the average daily trading volume between dealers and their end investors came to around €18 billion for German government bonds, compared with approximately €13 billion for Italian government bonds.[8] The non-bank sector, particularly asset managers and hedge funds, is strongly represented in both the

6 An alternative approach would be to estimate the creditor structure based on transactions involving the reporting members of the bidder group (see Federal Ministry of Finance (2023)).

7 In the case of Italy, similar estimates may be obtained from a combination of different data sources, including financial accounts, Assogestioni and the European Central Bank (see Banca d'Italia (2024b)).

8 See Federal Republic of Germany – Finance Agency (2024). For Italy, this figure only covers transactions in which at least one of the two counterparties is a primary dealer (i.e. specialists).

German and Italian markets and also plays an important role in government bond trading.

6.3 Government bonds on the repo market

The repo market is a part of the secured money market and serves the purpose of short-term procurement of funds and securities. In a repo transaction, a security is sold with the simultaneous agreement to repurchase the security at a later date at a predetermined price. This allows repos to be used to obtain short-term funds without permanently parting with a security. Additionally, repos can be used to obtain specific securities for a certain period.[9] Government bonds are by far the most commonly used securities in the repo market due to their typically low liquidity risk and credit risk, which reduces the risk of incurring losses in the event of a default on the part of the cash debtor.[10] High liquidity in the repo market enables smooth access to funds and securities. Dealer banks, in particular, use the repo market to obtain funds or in-demand securities. This creates confidence in holding government bonds and thus contributes to liquidity in the secondary market. Repo markets are therefore considered a central component of the financial system. Disruptions in the repo market can spread throughout the entire economy and pose a risk to financial stability.[11]

Repos backed by German and Italian government bonds are cleared in a similar manner, but differ in terms of total volume and counterparties. The daily transaction volume of repos using German government bonds increased from around €140 billion in August 2021 to about €180 billion in August 2024. At the same time, the transaction volume of repos with Italian government bonds grew from around €160 billion to about €280 billion. If we look at the repo market transaction volume as a whole, about 65 % of the German and 70 % of the Italian volume is cleared centrally. Both markets are dealer-based, meaning a dealer bank is involved in most transactions. Based on transaction volumes, NBFIs have a market share of about 15 % in German government bonds in the repo market, of which a large portion can be attributed to hedge funds. Looking at the countries of the final counterparties, most repos secured by Italian government bonds are traded between counterparties within the euro area,

9 See Bank for International Settlements (2019), Brand et al. (2019) and European Central Bank (2023).

10 Repo markets are also linked to the futures markets and play an important role in the implementation of arbitrage strategies that are aimed at balancing out price differences between the cash and futures markets, and thus at ensuring consistent prices. Additionally, they are used to borrow securities and fulfil delivery obligations in derivatives markets (see Kerssenfischer and Helmus (2024)).

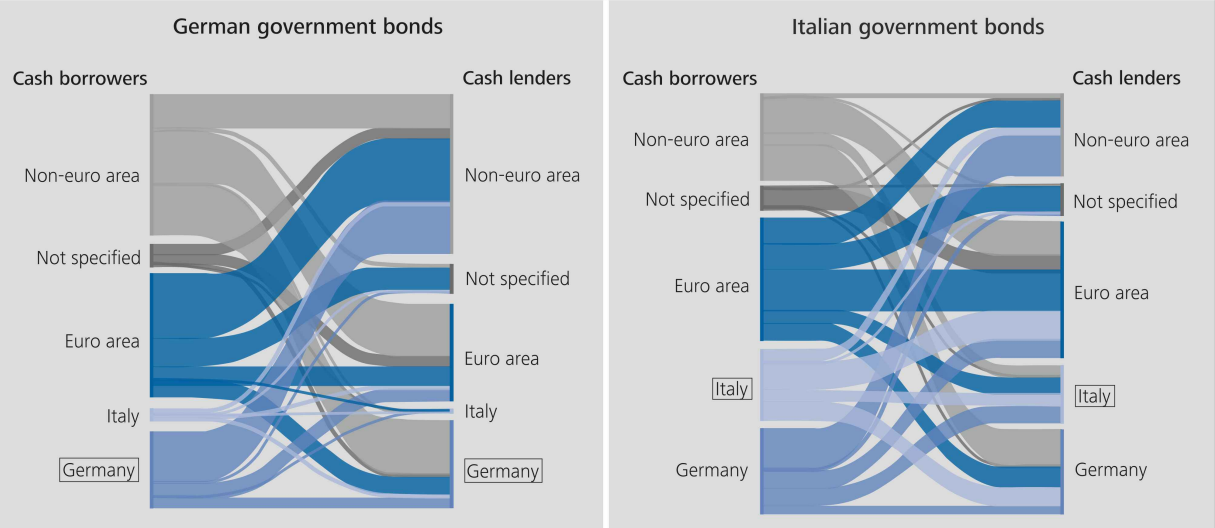
11 See Copeland et al. (2012), Hüser et al. (2024) and Mancini et al. (2016).

particularly counterparties from Germany (see Chart 6.3.1). [12] By contrast, repos with German government bonds often involve counterparties outside the euro area.

Countries of repo market counterparties* with German and Italian government bonds

Chart 6.3.1

Normalised to 100% (shares of transaction volume); as at 4 September 2024



Source: Own calculations on the basis of data from the Securities Financing Transactions Regulation (SFTR). * These are the countries of the final counterparties, i.e. a look-through of central counterparties (CCPs) is performed for centrally cleared repos.

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The interest rate for repo transactions is also influenced by the scarcity of the underlying security. Various market participants need to obtain specific securities for different reasons, sometimes at short notice (e.g. to fulfil delivery obligations from futures contracts). [13] Under certain circumstances, this can lead to an increase in demand for specific securities relative to supply, making it more expensive to obtain these securities in the repo market. Through the monetary policy asset purchases carried out in the context of quantitative easing, the Eurosystem acquired a large stock of government bonds, reducing the supply of government bonds available for trading. [14] The limited supply made it more expensive to obtain government bonds through the repo market. This was particularly the case for German government bonds, but was also observed – to a lesser extent – for Italian government bonds (see Chart 6.3.2). [15]

12 If the repo market is used to obtain a security (funding), the cash borrower (cash lender) is referred to as the final counterparty.

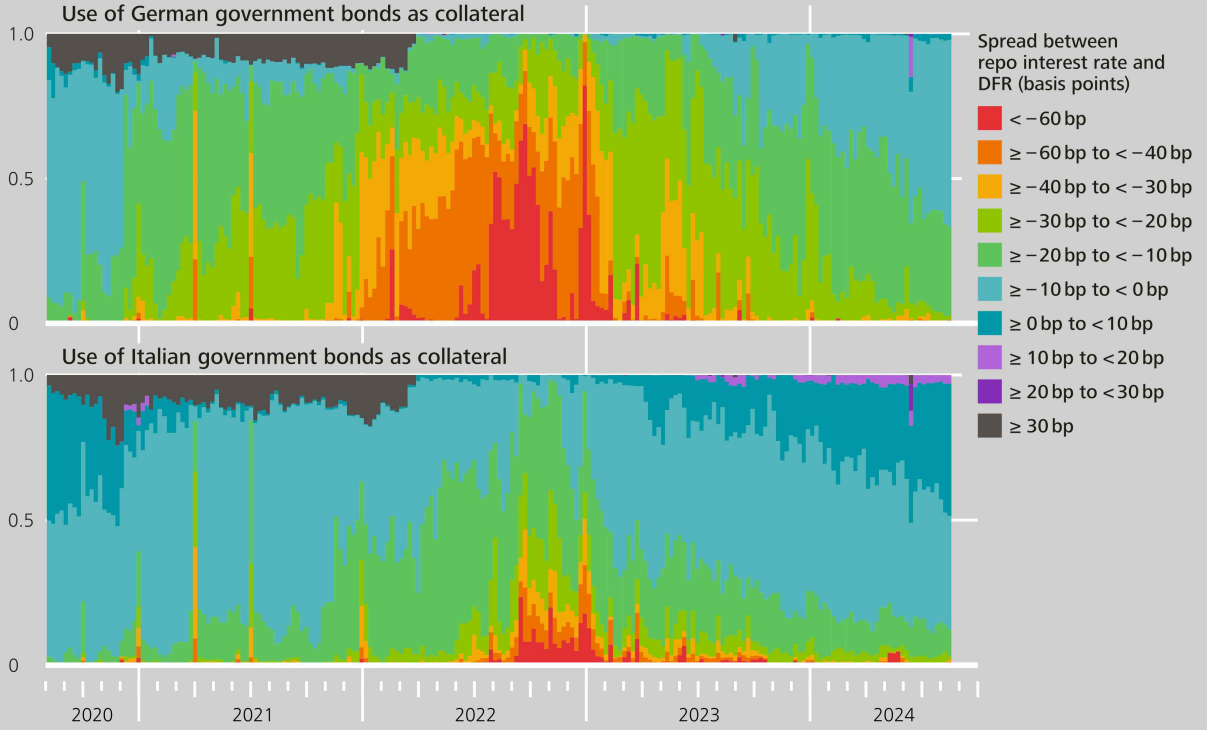
13 See Baltzer et al. (2022).

14 See Altavilla et al. (2021), Arrata et al. (2020), Carrera de Souza and Hudepohl (2024) and D'Amico et al. (2018).

15 See Altavilla et al. (2021), Banca d'Italia (2016) and Jank and Mönch (2018).

Scarcity on the repo market for German and Italian government bonds* Chart 6.3.2

Weekly data, as at 14 August 2024



Source: Own calculations on the basis of data from the Securities Financing Transactions Regulation (SFTR). * Relative share of transaction volume (in the range of 0 to 1) depending on the agreed repo interest rate and the spread between it and the Eurosystem deposit facility rate (DFR). A negative spread (repo interest rate lower than deposit facility rate) indicates that the underlying security is in relatively short supply.

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As the Eurosystem's balance sheet is gradually reduced, the stock of government bonds in circulation slowly increases, making more government bonds available to the market. The supply of government bonds in the repo market has been further increased by several measures, including securities lending by central banks and participation in repo markets by public authorities.[16] As a result, almost all repos with German government bonds continue to be traded at interest rates below the Eurosystem's deposit facility rate, meaning that a premium is paid for these bonds, although the difference from the deposit facility rate has significantly narrowed. This development is also evident for repos with Italian government bonds, where the premium paid to obtain Italian collateral is now less pronounced. Chart 6.3.2 illustrates this development, showing the relative traded transaction volume by the interest rates

16 See Federal Ministry of Finance (2023) for Germany and Department of the Treasury of Italy (2021) for Italy.

charged on repo transactions. If these repo rates are significantly below the Eurosystem's deposit rate, this indicates a relative scarcity of the underlying security. If the repo rates are at or above the deposit rate, the underlying security is not scarce, and the repo transaction is more likely to be used to obtain funds rather than to obtain the underlying security. This observation illustrates how a scarcity of securities may be accompanied by a price increase for short-term securities procurement in the repo market.

The investor base can also influence liquidity in the repo market. An analysis of the Italian repo market by the Banca d'Italia shows that when government bonds are predominantly held by "inelastic investors", the interest rates on these repos are relatively low, meaning premia are paid for borrowing these bonds.[17] The reason for this is that such investors are probably less likely to lend their bonds in the repo market, making these bonds less readily available.[18] It would seem fitting to gain an understanding of whether and how these inelastic investors could be encouraged to participate more actively in the repo market, since lending scarce government bonds could be profitable for them.

17 Inelastic investors are typically insurers, pension funds, households and non-financial corporations.
18 See Abbassi et al. (2024).

6.4 The results in the broader context of market participant behaviour

Our study suggests that the liquidity and the stability of the German and Italian government bond markets may depend on a variety of factors. These factors include how each government bond market is organised, how and by which investors transactions are conducted, and the heterogeneity and number of market participants.

Investors typically use OTC bilateral trading for German government bonds, whilst Italian government bonds are traded and settled using electronic trading systems. These trading mechanisms can each come with a range of trade-offs, most likely to be related to efficiency, transparency, trading costs, and availability of information, especially in economically uncertain times. [19)]

The holder structure of German government bonds exhibits a large share of foreign investors and investment funds. How and to what extent foreign investors and NBFIs are involved is significant for the price discovery and liquidity of government bonds. The high share of foreign investors across countries results in more diversified holdings of German government bonds and therefore creates additional demand, including in the event of changing market conditions. However, this may temporarily increase market price volatility due to the risk of potential international contagion.

By contrast, a large proportion of Italian government bonds are held by domestic investors, among which domestic banks are the largest holder group. This large domestic share leads to greater stability in the investor base, potentially mitigating adverse effects from changes in foreign investors' behaviour. However, it may also imply a higher degree of interconnectedness within the economy.

The behaviour of market participants can influence the liquidity conditions of government bonds. Given the important role of NBFIs in the holder structure of the German government bond market, it is particularly important to expand our

19 See Aquilina et al. (2024), Duffie et al. (2007) and de Roure et al. (2024).

understanding of their investment strategies and reaction behaviour, especially in economically uncertain times. This requires the use of more granular data, although these are not always available.

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