DEUTSCHE BUNDESBANK
EUROSYSTEM

FINANCIAL STABILITY REVIEW 2022

CONTENTS

Boxes

Abbreviations and symbols

p Provisional
e Estimated
. Data unknown, not to be published or not meaningful
– Nil

Discrepancies in the totals are due to rounding.

PROLOGUE

Under the Financial Stability Act *(Finanzstabilitätsgesetz),* the Bundesbank is responsible for monitoring 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 functions at all times. In its annual Financial Stability Review, the Bundesbank documents relevant developments as well as vulnerabilities in the German financial system and highlights risks to its stability.

The functional viability of the financial system is of vital importance for the real economy. The financial system coordinates savings and investment, makes it possible to hedge against risks, and facilitates payments. Unforeseeable events, such as the outbreak of the COVID-19 pandemic, can jeopardise the stability of the financial system. The financial system should neither cause nor excessively amplify a downturn in overall economic activity. It therefore needs to be sufficiently resilient – in other words, able to absorb losses and, ultimately, reduce contagion or feedback effects.

The focus is on systemic risks that could jeopardise the stability of the financial system. For instance, distress at one or more market participants can endanger the functioning of the entire system. This may be the case if a market participant is very large or closely interconnected with other market participants. Interconnectedness may be a channel through which adverse developments are transmitted to the financial system as a whole, impairing its stability. Many market participants are connected to each other, either through a direct contractual relationship or indirectly. 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.

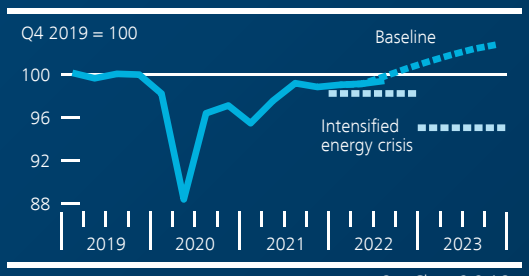
The Bundesbank also contributes its analytical findings to the work of the German Financial Stability Committee, which is the central body for macroprudential oversight in Germany. It provides the Committee with its assessment of the general risk situation. If the Bundesbank identifies systemic risks,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

OVERVIEW

Macro-financial environment

Gross domestic product

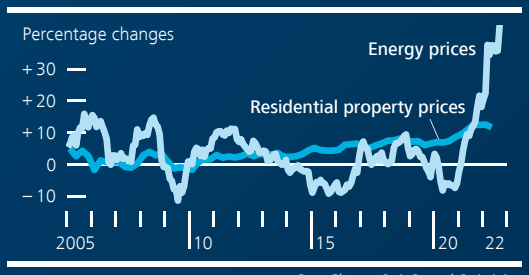
Economic developments have slowed considerably and major downside risks prevail.



See Chart 2.2.16

Energy and residential property prices

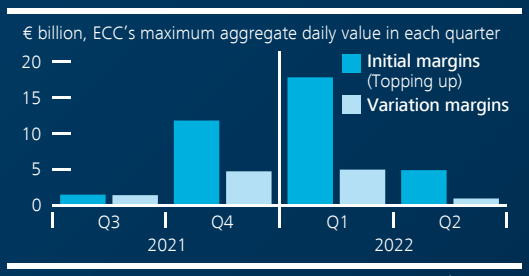
Energy prices have risen sharply while residential property price dynamics are slowing down.



See Charts 2.1.2 and 2.1.14

Margin calls

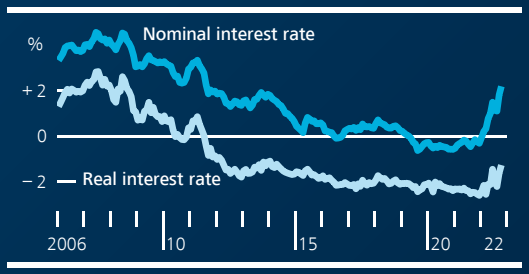
Sharp rises in energy prices drove up central counterparties' margin requirements – considerably at times.



See Chart 4.2

Nominal and real interest rates

Despite increasing nominal interest rates, real interest rates remain negative due to high inflation. This may give rise to a further build-up of vulnerabilities.

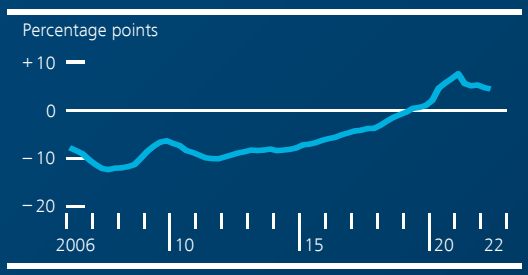


See Chart 2.1.2

Vulnerabilities and risks to financial stability

Credit-to-GDP gap

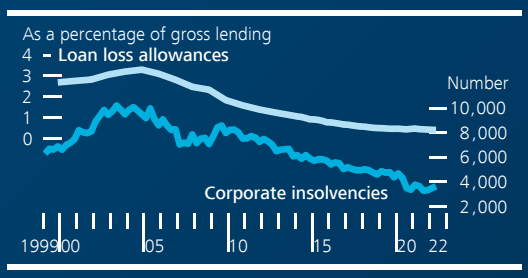
The upturn in the financial cycle is subsiding, yet vulnerabilities are still high in the financial system.



See Chart 2.1.4

Loan loss allowances

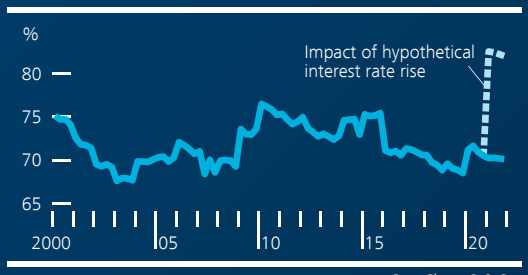
Loan loss allowances are low and have been declining in parallel with falling corporate insolvencies over the past few years.



See Charts 2.1.12 and 2.2.7

Banks' allocation risk

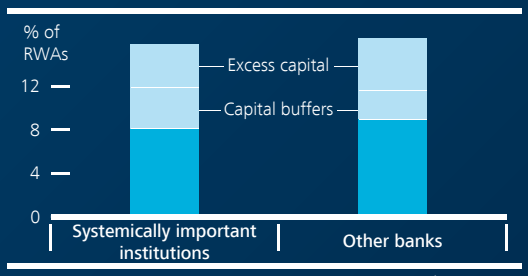
The share of relatively risky enterprises in banks' credit portfolio is high. Rising lending rates could increase this share and, with it, the probability of loan defaults.



See Chart 2.2.8

Banks' CET1 capital

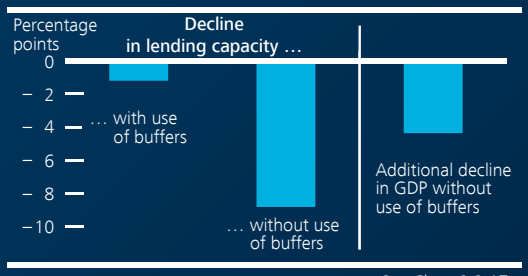
Excess capital and capital buffers are important for the functioning of the banking system during periods of stress.



See Chart 2.3.2

Intensified energy crisis

An intensified energy crisis would harbour the risk of high losses and real economic contagion effects.



See Chart 2.2.17

The **worsened macroeconomic** environment and **accelerated structural change** call for a functioning and resilient financial system.

All actors should preserve and enhance the resilience of the financial system as a whole. The **package of macroprudential measures** supports this aim.

Supervisors can react promptly if systemic risks materialise or build up further.

Financial market participants should take into account the **impact of adverse scenarios.** Given the high uncertainty, they should engage in **prudent risk provisioning** and exercise **caution when distributing profits**.

The experience of recent years should be used to **improve** regulation and, where necessary, **expand the macroprudential toolkit**.

OVERVIEW

The macroeconomic situation in the fourth quarter of 2022 has worsened substantially compared with the situation one year ago. Inflation and market interest rates have risen significantly, and economic activity has slowed down considerably. Uncertainty about future economic developments and downside risks are high. Massive increases in energy prices imply welfare losses. In Germany, price rises for imported goods, such as natural gas and crude oil, have been stronger than those for German export goods so far. This is reducing the German economy's real disposable income and is likely to accelerate structural change.

The real economic outlook was much brighter last year. The economy had started to recover from the fallout from the coronavirus pandemic; a steep upturn was expected. Market interest rates were low. At the same time, the upswing in the financial cycle, which had been underway for several years, continued and cyclical vulnerabilities increased further. Credit growth accelerated, risk premia were low and market valuations high – especially for real estate. Future risks, such as default and interest rate risk, may therefore have been underestimated whereas the recoverability of loan collateral such as real estate may have been overestimated. The package of macroprudential measures announced by the Federal Financial Supervisory Authority (BaFin) in January 2022 is addressing these vulnerabilities.

Owing to changes in the macro-financial environment, it remains an important task for macroprudential policy and all market participants to ensure adequate resilience in the financial system. Given the high risks to financial stability, the European Systemic Risk Board (ESRB) also advocates preserving or further enhancing the resilience of the European financial sector.

The German economy is currently at a turning point. Russia's war of aggression and the associated movements in energy markets will weigh heavily on future economic developments. There have already been significant price corrections in financial markets. Valuations have fallen and risk premia have risen. Market participants consider risks to be higher than a year ago. Market corrections in the German financial system have led to

write-downs on securities portfolios. High energy prices have sharply increased margin requirements on futures exchanges.

Given high downside risks to the real economy, risks from corporate loans are likely to increase. Higher energy and commodity prices, supply bottlenecks and tighter financial conditions are weighing on many enterprises. The currently still very low number of insolvencies is therefore likely to rise in the future. Ailing enterprises and corporate defaults could strain the financial system via loss allowances and write-downs on loans and securities.

Credit risk could mount in the household sector in adverse scenarios. This could be the case if a sharp economic downturn significantly worsens the currently stable situation in the German labour market. Households are vulnerable not only to high and rising energy costs but also to adverse developments in the housing market. Residential property accounts for a large proportion of household wealth and is a significant factor in driving household debt.

So far, no fundamental reassessment of credit risk has been observed. Loan loss allowances in the banking sector remain at a low level. At the same time, it has become more likely that the currently very high inflation rates will decline only gradually and that market interest rates will continue to rise. Uncertainty about future macroeconomic developments is high. Against this backdrop, the assessment of credit risk could change quickly and significantly.

The Federal Government's fiscal measures aim to ease the real economic headwinds of rising energy prices for enterprises and households.[1] Following three relief packages, the Federal Government decided this September to further ease the burden of rising electricity and energy prices.[2] The planned measures include, inter alia, a brake on electricity and gas prices and a cut in VAT on gas consumption and district heating.

Nevertheless, an increase in the prices of fossil fuels remains fundamentally necessary in order to combat climate change. An increase in prices is one aspect of the structural change related to the energy transition and necessitates adjustments in the real economy. However, as a result of the war against Ukraine, energy prices rose not only more sharply but also within a shorter period of time than in the international climate scenarios analysed so far by the Bundesbank.[3]

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1 See Deutsche Bundesbank (2022a).
2 See Federal Ministry of Finance (2022), Federal Government (2022a, 2022b).
3 See Deutsche Bundesbank (2021), pp. 86 f.

As a result of the structural change in the real economy, financial institutions' existing exposures are being revalued. Real economic adjustments triggered by structural change tend to take place gradually. Any losses that the financial sector incurs therefore also arise incrementally and over a long period of time. However, sudden adjustments, such as the current energy price shock, can spark tensions (see the chapter entitled "Current issues putting central clearing to the test" on pp. 115 ff.). In particular, they can produce abrupt changes in expectations and thus entail a sudden repricing of risks and assets.

Economic policy is torn in two directions. While damage to the real economy needs to be contained in the short term, long-term structural change should not be impeded. Transparency regarding the policy framework shaping the transformation processes and any changes to it in the future helps market participants to better gauge future risks and adapt accordingly (see the box entitled "Structural change and financial stability – challenges for macroprudential supervision" on pp. 83 ff.).

High vulnerabilities in the German financial system

The German financial system is vulnerable to adverse developments. Over the past two decades, an overall sound economic development has kept losses in domestic lending business low. Even during the Global Financial Crisis and the coronavirus pandemic, the German financial system has been largely unaffected by losses, not least due to the economic policy responses during these episodes. There is now a danger that risks are systematically underestimated and that market participants will not adjust their risk assessment sufficiently during periods of downturn and crisis.

The slowdown in economic activity has significantly increased credit and market risk. Credit losses and additional market losses could occur as a result of weakening economic activity. A sharp correction in the real estate market could additionally impair the value of collateral used to secure residential and commercial real estate loans and thus increase losses in the event of a credit default. If the energy crisis intensifies further, the financial system could come under pressure.

In the euro area, too, the changed macro-financial environment is interacting with existing vulnerabilities. The persistent low interest rate environment and the associated comparatively cheap loans helped drive private and public sector debt ratios to high levels by long-term standards in many European countries. This is primarily an issue if the financial system and the government budget are closely interlinked in countries with high levels

of government debt. As a result, government turmoil or disruptions in the financial system can quickly spread to other sectors and countries.[4]

Adequate resilience essential

Corporate leverage has grown in recent years, leaving firms more vulnerable to adverse macroeconomic developments. Balance sheet figures indicate that the majority of enterprises still appear to be in sound shape as far as their debt sustainability is concerned. However, relatively highly indebted enterprises are disproportionately highly represented in banks' loan portfolios. These allocation risks may even have increased since 2021 and could continue to rise further.

Households' debt sustainability currently appears to still be robust, but could deteriorate in light of sharp real income losses. Households' debt has tended to grow in recent years. In addition, high inflation has significantly depressed their real incomes. This lowers households' financial ability to repay debt. In the short term, long interest rate fixation periods limit their vulnerability to interest rate changes. One risk-mitigating factor is that a large share of housing loans were granted to households with relatively high incomes and wealth. These households are likely to be in a better financial position to cope with the current rise in inflation than lower-income households. In the medium term, however, financial burdens could increase. In addition, lenders may come under increasing pressure to loosen income-based lending standards in order to support new lending.

The financial system's ability to withstand adverse developments crucially depends on its resilience. Financial institutions' capital base, in particular, is of key importance here. It determines whether the financial system is able to support macroeconomic adjustment processes simultaneously. Banks' tier 1 capital ratios, i.e. the ratio of tier 1 capital to risk-weighted assets, have risen significantly since the financial crisis. In the second quarter of 2022, the aggregate figure for large, systemically important institutions was 17.1%, and 16.2% for non-systemically important institutions excluding special institutions. However, credit risk and therefore the risk weights used to determine banks' total exposure may have been underestimated in recent years owing to the upswing of the financial cycle. This particularly concerns the large, systemically important institutions, which use their own models to calculate capital requirements.

4 See Deutsche Bundesbank (2022b).

In an adverse scenario, banks' capital ratios could fall sharply. So far, the change in the macroeconomic environment has not had a significant negative impact on banks' capitalisation. However, the analysis of an adverse scenario, such as a sharp economic downturn due to a further intensification of the energy crisis, indicates that the financial system could come under pressure given unfavourable conditions. Banks could then respond by excessively curtailing lending in order to stabilise their capital ratios. This reaction would further amplify the initial shock.

The financial system should be able to deal with losses in times of stress even without economic policy measures. When assessing future risks, financial market participants should not be guided by economic policy responses during past crises. This would contribute to an insufficient build-up of resilience. In order to safeguard financial stability in the long term, the financial sector has to focus on preparing for and preventing adverse scenarios. A functioning and resilient financial system is an important prerequisite for managing accelerating structural change.

The package of macroprudential measures announced by BaFin in January 2022 is helping to strengthen the resilience of the banking system.[5] The measures were taken on the back of analyses conducted by the Bundesbank last year indicating that significant losses could occur in the German financial system in the event of a severe macro-financial shock interacting with existing high vulnerabilities. The impact of the package of macroprudential measures is reviewed on a regular basis. So far, there is no indication that the package of macroprudential measures has significantly dampened bank lending.

Onus on all financial market participants

Overall, systemic risks have increased significantly. It is important that all participants act prudently and strengthen their resilience to adverse developments.

Given the high risks to financial stability, the ESRB advocates preserving or further enhancing the resilience of the European financial sector.[6] In its warning to European supervisory authorities, the ESRB notes that a number of severe risks to financial stability currently exist. These may materialise simultaneously, thereby interacting with each other and mutually amplifying their impact. The ESRB has therefore called on supervisory author-

5 The countercyclical capital buffer was raised from 0% to 0.75% of risk-weighted assets on domestic exposures and a sectoral systemic risk buffer of 2% of risk-weighted assets on loans secured by residential real estate was introduced. Banks were granted a transitional period until 1 February 2023. In addition, BaFin recommended that lenders take due account of sustainable lending standards with respect to residential real estate financing.
6 See European Systemic Risk Board (2022).

ities to take measures to preserve the resilience of the financial system, one of which is maintaining existing capital buffers. The ESRB's warning was welcomed by the German Financial Stability Committee and the ECB Governing Council.[7] Macroprudential supervisors are therefore closely monitoring how changes in the macro-financial environment are interacting with existing vulnerabilities in the financial system.

In the current situation, the onus is not only on supervisors but on all financial market participants. They should be aware that, despite the long period of low and declining losses in the financial system, losses stemming from credit defaults could rise substantially in the future given the considerable downside risks. Financial market participants should therefore scrutinise their risk management, for example by gauging the impact of adverse scenarios on their business models and taking necessary measures at an early stage.

Given the high degree of uncertainty, risks should be adequately assessed and reflected on balance sheets in a transparent manner. This means, in particular, that banks should revalue their exposures at an early stage if defaults are likely to materialise. In addition to prudent risk provisioning, banks should exercise caution when distributing profits in view of the high degree of uncertainty.

Operational risks should also be adequately addressed. The smooth functioning of payment systems and a stable cash supply are major cornerstones of economic activity. The risk of operational disruptions has risen significantly, for instance due to cyberattacks in connection with geopolitical tensions. Appropriate precautionary measures are therefore needed to increase operational resilience.

Capital buffers are necessary to ensure that the financial system can perform its functions even in the event of crisis developments. The reforms implemented since the Global Financial Crisis have, inter alia, increased banks' capital base and strengthened the resilience of the banking sector overall. In particular, given the high vulnerabilities in the German financial system and the current increased downside risks, it is essential that all financial market participants have a high degree of resilience. It is not the economic cycle but rather the financial cycle – i.e. lending dynamics and the build-up of new vulnerabilities – as well as the banking system's resilience to adverse scenarios that determine adjustments to the countercyclical capital buffer. In the event of highly adverse developments, macroprudential policymakers can respond by releasing the buffers. A prerequisite for releasing the buffers would be, for example, that substantial losses occur in the financial system or are clearly indicated and that there is a risk of lending being restricted excessively.

7 See German Financial Stability Committee (2022) and European Central Bank (2022).

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STABILITY SITUATION IN THE GERMAN FINANCIAL SYSTEM

The macro-financial environment has deteriorated substantially over the course of 2022. Inflation is high, interest rates and risk premia are rising and growth prospects are subdued. There have been significant market corrections. Banks, insurers and investment funds have suffered valuation losses. However, lending has not been curtailed and the financial system has fulfilled its functions. But major downside risks prevail. Specifically, an intensified energy crisis accompanied by a sharp economic slump would be a risk scenario for Germany's financial system.

The German financial system is vulnerable to adverse developments. These vulnerabilities have built up over a period of several years. The persistent low interest rate environment – and thus also comparatively cheap loans –, strong asset price growth and sound overall economic developments have contributed to this build-up. As a result, banks, insurers and other financial market players may have underestimated credit risk. They are also vulnerable to interest rate changes and strong market price corrections.

All financial system participants should prepare for adverse scenarios and further enhance their resilience. A package of macroprudential measures aimed at strengthening the resilience of the financial system was announced at the beginning of 2022. The countercyclical capital buffer was raised and a sectoral systemic risk buffer was introduced. If necessary, supervisors can release the macroprudential buffers to stabilise lending. This would particularly be the case if substantial losses occur in the financial system or if they

are clearly indicated and there is a risk of excessive restrictions on lending in the banking system.

THE MACRO-FINANCIAL ENVIRONMENT AND THE SITUATION IN THE REAL SECTOR

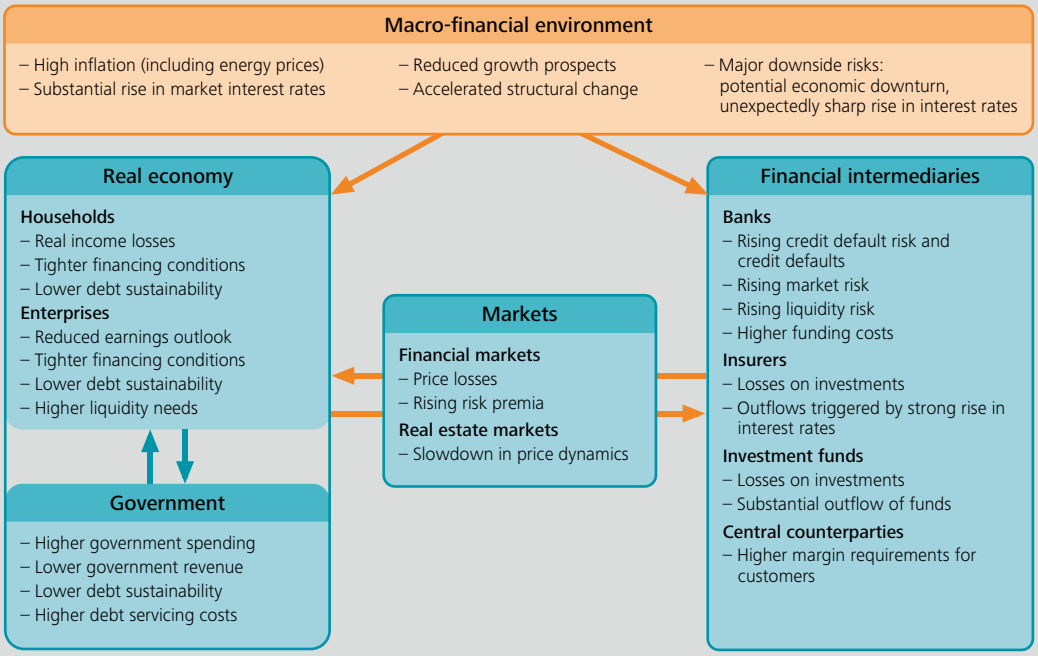
Macro-financial environment

The macro-financial environment has changed substantially in the course of 2022. It is characterised by high inflation, rising interest rates, subdued growth prospects and downside risks. The impact of the coronavirus pandemic, persistent supply bottlenecks and Russia's attack on Ukraine are key contributing factors. Around the world and in Germany, these developments are interacting with existing vulnerabilities both in the real economy and the financial system. Since the Global Financial Crisis of 2007-08, these vulnerabilities have been building up in an environment of low interest rates, low inflation, rising asset prices and sound overall economic developments. The change in the macro-financial environment poses major challenges to the German financial system (see Chart 2.1.1). In particular, an intensified energy crisis accompanied by a sharp economic slump would be a significant risk scenario for the German financial system (see the section entitled "Risk scenario for the German financial system" on pp. 66 ff.). Unexpectedly large rises in interest rates or an economic slump – for example due to a further intensification of the energy crisis – could expose existing vulnerabilities in the German financial system.

High levels of inflation have become entrenched in 2022. After marked price increases last year, inflation has continued to climb significantly in the course of 2022 (see Chart 2.1.2). Russia's war against Ukraine primarily pushed up the price of energy and agricultural commodities, especially in European countries that rely heavily on energy imports from Russia. In Europe, gas prices, in particular, are significantly higher than in other regions of the world. Compared with last year, gas prices in Europe have more than quadrupled at times. In its June forecast, the Bundesbank was already expecting inflation rates for Germany of 7.1%, 4.5% and 2.6% for the years 2022 to 2024. The price outlook is likely to have shifted upwards again since then, especially in the short term. Market

Negative short and medium-term effects of the current macro-financial environment on the real economy and the financial system

Chart 2.1.1



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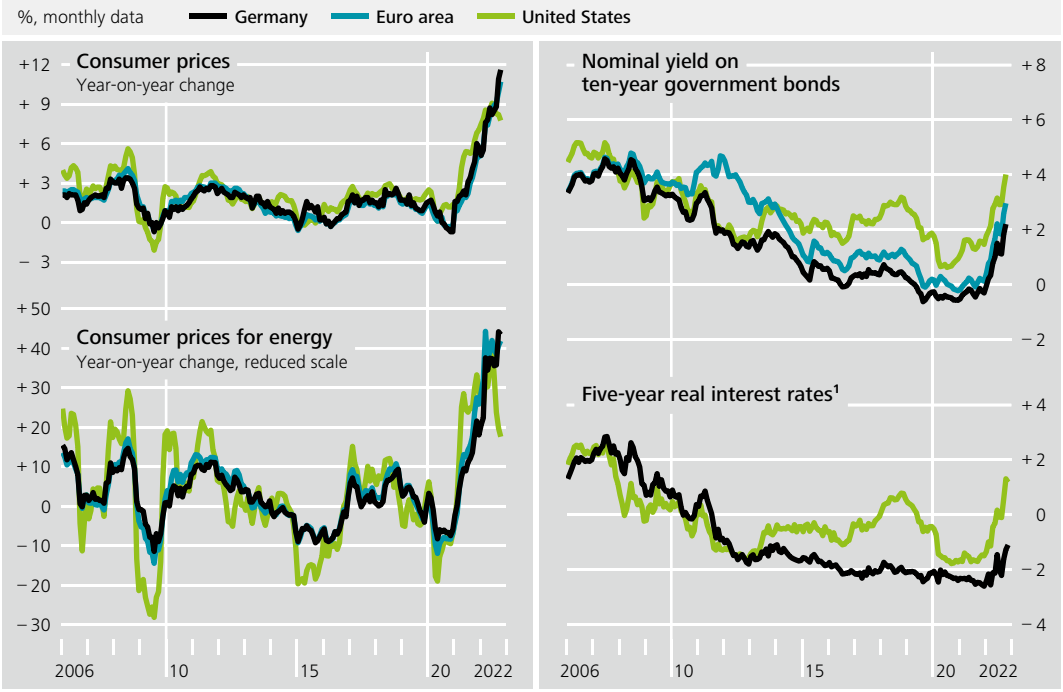
expectations and surveys among German households and enterprises likewise suggest that medium-term inflation expectations are high and have risen.[1] Similar developments can be observed in other euro area countries.[2] If longer-term inflation expectations, too, were to increase significantly, inflation expectations could become de-anchored. This could make it more difficult to achieve the objective of price stability and could necessitate stronger monetary policy measures.

Interest rates have risen significantly in response to persistently high inflation and inflation expectations, but real interest rates remain negative. Government bond yields were already on the rise at the end of 2021 (see Chart 2.1.2). In view of persistently high inflation, central banks have raised interest rates markedly over the course of this year.[3] However, longer-term real interest rates, i.e. the difference between nominal interest rates and expected inflation, remain negative in Germany and the euro area (see Chart 2.1.2). Market participants expect further monetary policy tightening in the euro area – amidst high uncertainty. This is also reflected in the prices of interest rate derivatives,

1 See Nagel (2022).
2 See Banque de France (2022).
3 For example, the US Federal Reserve raised interest rates from 0.25% to 4% in six steps between March and November, while the Bank of England increased its rate from 0.1% to 3% in eight steps between December 2021 and November 2022. The Eurosystem, too, has taken three interest rate steps since June 2022, raising the rate from 0% to 2%.

Inflation and interest rate environment

Chart 2.1.2



Sources: Bloomberg Finance L.P., Consensus Economics, Eurostat, ECB, S&P Global, U.S. Bureau of Labor Statistics, U.S. Department of Commerce and Bundesbank calculations. **1** Five-year ex ante real interest rates based on the weighted inflation expectations of Consensus Economics.

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which are currently trading at elevated price levels for hedging against both a rise and a fall in interest rates.

Global economic activity has weakened significantly in the course of 2022 and uncertainty about future economic developments has risen. Having projected global growth of 4.4% in 2022 at the beginning of the year, the International Monetary Fund (IMF) lowered its forecast to just 3.2% in October[4] and was expecting global growth of 2.7% in 2023. All in all, a scenario involving high inflation and weak economic growth appears increasingly likely.[5] At the same time, there is considerable uncertainty about future economic developments, with downside risks having risen significantly.

The sharp rise in energy prices is holding back economic activity in Germany, too. At the end of 2021, Germany's economy was still expected to undergo a strong recovery in 2022, but the outlook has become increasingly gloomy since then. Overall, signs of a recession in the German economy in the sense of a significant, broad-based and sustained decline in economic output have piled up recently.[6] Moreover, prices for imported goods have so far risen more strongly than those for German export goods, not least owing to

4 See International Monetary Fund (2022a, 2022e).
5 See International Monetary Fund (2022b, 2022e).
6 See Deutsche Bundesbank (2022e).

the surge in energy prices and the weak euro. This is placing an additional strain on German households' disposable income. Especially the dependence on foreign gas imports harbours considerable downside risks to economic development.[7]

Extensive government measures have been taken or announced in order to cushion the short-term real economic effects of higher energy prices in Germany. Providing swift support for the hardest-hit households and enterprises is crucial. The measures taken so far include transfer payments and tax relief to mitigate the direct impact of high energy prices on households. Enterprises may apply for subsidies or liquidity assistance. Generally speaking, the measures ease the burden on the real economy and mitigate solvency risks stemming from high energy prices. This also reduces potential losses in the financial sector. However, the reduction in energy consumption will depend on the specific design of government measures in Germany and Europe and the incentives they create. In general, higher energy costs can ultimately only be redistributed. At the aggregate level, it is not possible to eliminate them. If gas rationing became necessary, it could result in adverse real economic developments. By contrast, containing temporary real economic disruptions, for example by increasing the supply of energy, would help to maintain financial stability.

At the same time, it is important to manage the structural change that is being accelerated by Russia's war against Ukraine and the corresponding structural adjustment processes in the real economy in a forward-looking manner. Energy prices rose significantly more sharply this year and within a shorter time frame than in the international climate scenarios analysed so far.[8] Current government measures may cushion unexpectedly high energy costs for enterprises and households, but should also be aligned with long-term climate policy objectives. The current support measures provide only temporary relief. Eventually, in light of the likely shift towards climate-friendly technologies, the business models of some enterprises could prove unsustainable. This could increase risks to financial stability (see the box entitled "Structural change and financial stability – challenges for macroprudential supervision" on pp. 83 ff.).[9]

Russia's attack on Ukraine in spring 2022 led to disruptions in financial markets. The outbreak of the war and the swift sanctions imposed by western countries initially triggered price slumps, especially in the case of Russian securities. Prices also fell in other market segments. German financial intermediaries proved robust because of their low exposure to borrowers in Russia and Ukraine. The increase and volatility in energy prices had a much more noticeable impact on the German financial system. As a result, central

7 See Deutsche Bundesbank (2022c).
8 See Deutsche Bundesbank (2021).
9 See Buch (2022).

counterparties' margin requirements for transactions involving energy derivatives increased considerably and some non-financial corporations from the energy sector encountered liquidity problems (see the chapter entitled "Current issues putting central clearing to the test" on pp. 115 ff.).

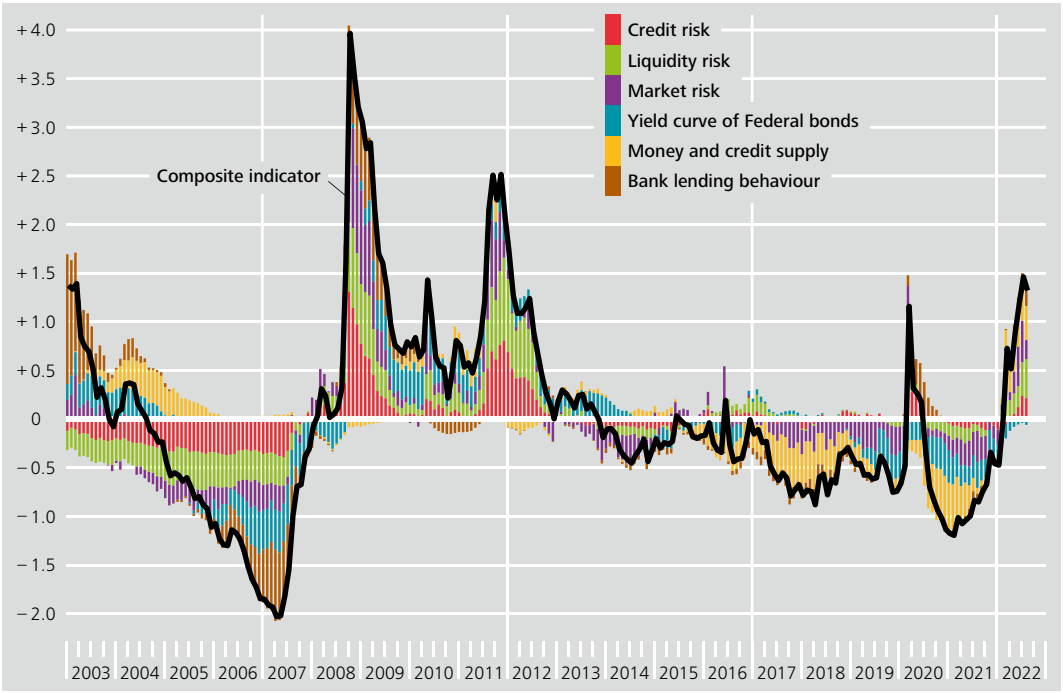
The attack by Russia on Ukraine led to significant corrections in equity and bond prices. All in all, uncertainty has increased significantly since the second quarter of 2022. Moreover, the worsened macroeconomic outlook and tighter financial conditions were also key factors causing price corrections. A breakdown of price developments in the German DAX and US S&P 500 share price indices shows that the large losses in value since the start of the year were mainly due to the rise in risk-free interest rates.[10] For bonds, risk premia on euro-denominated bonds have widened and are now above the levels justified by the fundamentals.[11] However, given the tense situation in commodity markets and the increased risk of a recession – especially in Europe – further significant price corrections cannot be ruled out. Price declines may also be stronger than in previous years as market liquidity is noticeably lower. For example, the premia and discounts in corporate and government bond trading are significantly higher than in the past few years. Particularly during periods of stress, price markdowns on sales of securities are likely to expand markedly, leading to relatively larger losses for market players that find themselves forced to sell securities.[12]

Financial conditions in the euro area and in Germany have tightened considerably. Financial conditions influence lending rates for enterprises and households, for example. They are therefore an important channel through which changes in the financial system impact the real economy. Composite indicators, which combine a broad range of financial variables, can provide information on changes in financial conditions and their drivers. Financial conditions can be illustrated by means of a composite indicator developed by the Bundesbank. This indicator combines monthly price-based market data, quantity-based metrics and several macro-financial indicators.[13] It thus captures information from several areas of the financial system and provides timely indications of current developments in the financial system. Although, in mid-2022, the composite indicator was still below the values recorded in past financial crises (see Chart 2.1.3), it recently reached a level last seen at the beginning of the coronavirus pandemic. The main contributing factors to the tightening of financial conditions were elevated volatility in financial markets

10 For details on the methodology, see Claus and Thomas (2001).
11 For details on the methodology, see Deutsche Bundesbank (2021) and International Monetary Fund (2019).
12 See Bank of England (2022) and International Monetary Fund (2022d). Here, market liquidity refers to market participants' ability to trade larger volumes of securities without triggering any major price effects. Periods of stress can significantly worsen market liquidity. See Aldasoro et al. (2022).
13 The composite indicator for financial conditions is made up of several sub-indicators. Composite indicators for financial conditions are more broadly based than financial stress indicators and, in addition to market data, usually also include quantity-based metrics and other macro-financial indicators that capture information from several areas of the financial system, such as on financial intermediaries and the private non-financial sector. For further information, see Metiu (2022).

Composite indicator for financial conditions Chart 2.1.3

Normalised from 2003, monthly data



Sources: ECB, BIS, Bloomberg Finance L.P., Banque de France, Bundesbank statistics and Bundesbank calculations.
Deutsche Bundesbank

and increasing credit and liquidity risk premia. A slowdown in lending and in real monetary growth also caused the indicator to increase.

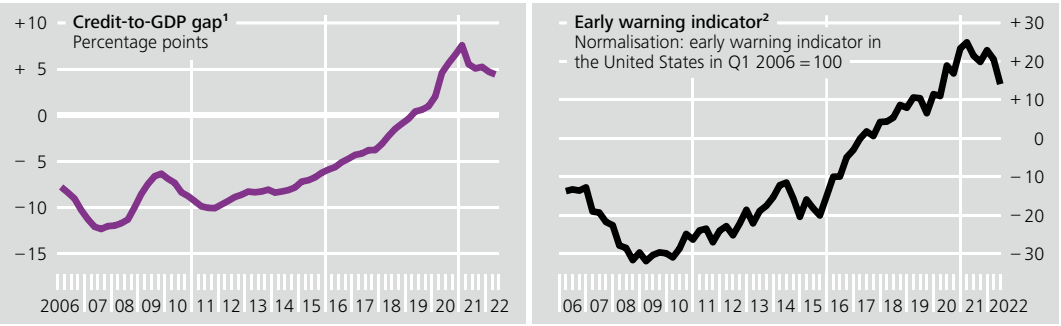
The major changes in the macro-financial environment are interacting with existing vulnerabilities in the financial system in Germany. In an environment of low inflation, rising asset prices, sound economic developments overall and persistently low risk premia, particularly in bond markets, there has been a build-up of vulnerabilities to growing credit, market and interest rate risk.[14] The upswing in the financial cycle also continued during the coronavirus pandemic.[15] Despite the downturn in the real economy, house prices as well as lending to the non-financial sector grew dynamically. Risk premia rose considerably but only temporarily, before quickly returning to their low pre-pandemic level.[16] This development was not confined to Germany, but was also observed in other euro area countries (see the section entitled "Vulnerabilities in the euro area" on pp. 25 ff.). An upswing in the financial cycle can lead to a decline in market participants' risk awareness and to an associated cyclical underestimation of risks.[17] As a result, they often increasingly

14 See Deutsche Bundesbank (2019, 2020a, 2021).
15 See Deutsche Bundesbank (2021). The financial cycle marks movements in financial variables such as lending and asset prices. Empirical studies suggest that these are often medium-term movements. By comparison, fluctuations in the economic cycle tend to be shorter. See Borio (2014).
16 See Deutsche Bundesbank (2021).
17 See Deutsche Bundesbank (2021). There were already signs of a systematic underestimation of risks during the unusually long economic upturn in Germany before the pandemic. See Deutsche Bundesbank (2019).

lose sight of potential economic downturns. Overall, at the end of 2021, banks were already in danger of underestimating credit risks on their balance sheets and potentially failing to set aside sufficient provisions against risks. Moreover, the banking system, insurers and funds were vulnerable to interest rate risk. These vulnerabilities persist, not least in the case of longer-term loans in intermediaries' portfolios. The worsened macro-financial environment also reduces enterprises' and households' debt sustainability (see the sections entitled "Situation in the corporate sector" on pp. 27 ff. and "Situation in the household sector" on pp. 33 ff.). At the same time, banks assessed their credit risk to be low in 2022 as well, and risk provisioning remained at a historically low level (see the section entitled "Risk situation of the German banking system" on pp. 45 ff.). A further interest rate rise and a simultaneous deterioration in economic conditions could increase banks' loan loss allowances. Adverse scenarios could lead to considerable losses due to the high level of vulnerabilities in the German financial system (see the section entitled "Risk scenario for the German financial system" on pp. 66 ff.).

The upturn in the financial cycle is easing considerably, but its future trajectory is uncertain. It is difficult to predict credit growth in particular in an environment of high inflation and uncertainty regarding future economic and thus income developments. On the one hand, indicators suggest that the financial cycle is not expanding any further. A broad indicator of credit developments is the credit-to-GDP gap. Following an increase during the coronavirus pandemic, this gap has been declining for several quarters but remains well above the pre-pandemic level (see Chart 2.1.4).[18] The Bundesbank's early warning indicator, which has already been decreasing for several quarters, also recorded

Indicators for the financial cycle in Germany Chart 2.1.4



Sources: BIS, Eurostat, Haver Analytics, IMF, OECD and Bundesbank calculations. **1** Cyclical deviations of the credit-to-GDP ratio from its long-term trend. The calculation is based on the national method and includes loans granted by domestic monetary financial institutions (excluding central banks) to the domestic private non-financial sector. **2** Includes house prices, share prices, the gross fixed capital formation-to-GDP ratio, the current account-to-GDP ratio and the credit-to-GDP ratio. For more information, see Beutel et al. (2019).
Deutsche Bundesbank

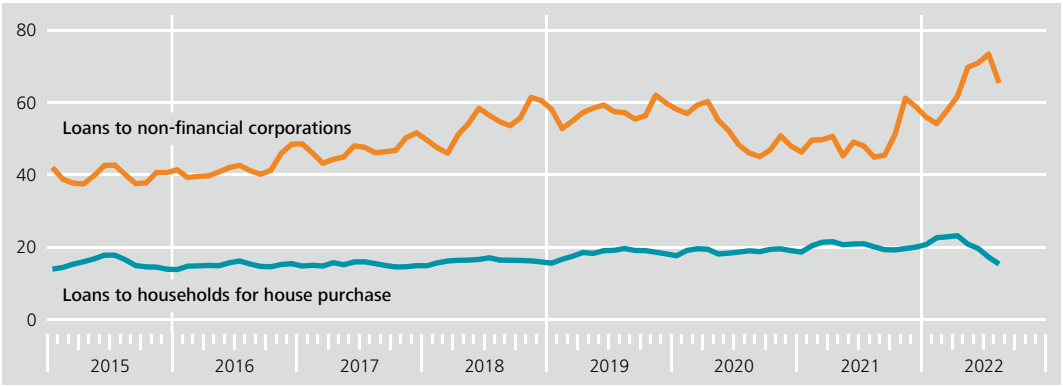
18 The credit-to-GDP gap measures the extent to which loans granted in a given country are growing faster than that country's economic output. The widening of the gap over the course of the coronavirus pandemic was overshadowed by the sharp drop in GDP in 2020. Despite its decline during the economic recovery, the gap remains well above the threshold of 2 percentage points that warrants activation of the countercyclical capital buffer.

a drop in the second quarter of 2022.[19] The reduction in real income prospects could further dampen momentum in the future. New housing loans granted to households were already declining visibly at last count amid higher cost burdens and more restrictive financing conditions (see Chart 2.1.5). Although German banks continued to lend dynamically to non-financial corporations in the third quarter of 2022, the increase in lending is partly attributable to special factors (see the section entitled "Situation in the German corporate sector" on pp. 27 ff.). On the other hand, longer-term real interest rates remain negative even after the recent nominal interest rate increases, which is why an incentive to borrow and thus to build up vulnerabilities still exists.

New lending by domestic banks*

Chart 2.1.5

€ billion, three-month moving averages



* Real new business, borrowers in the euro area.

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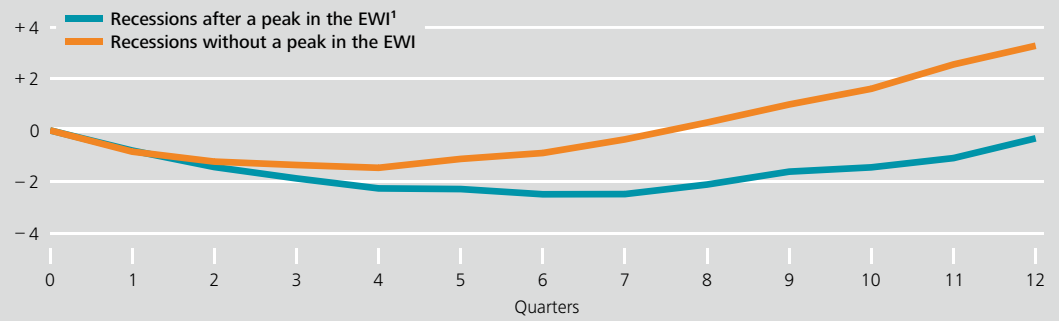
In the past, risks to financial stability from existing vulnerabilities have often increased following a downturn in the financial cycle. Cyclical vulnerabilities build up during an upswing in the financial cycle, making the financial system vulnerable to adverse developments. For example, a cross-country 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 Chart 2.1.6).[20] One possible explanation is that the financial system reduces lending excessively during such episodes, thus amplifying the recession.[21] Another analysis shows that downside risks to real GDP tend to rise after a peak in the financial cycle. This means that crisis developments can follow a turning point in the financial cycle.[22] Although a sustained downturn in the financial cycle could imply that cyclical vulnerabilities tend to decline over the medium term, overall the analyses suggest that in

19 For more information on the early warning indicator, see Beutel et al. (2019).
20 For the relationship between recessions accompanied by a downturn in the financial cycle, see Drehmann et al. (2012), Borio (2014) and Jordà et al. (2013).
21 See Antony and Broer (2010).
22 In the past, both the early warning indicator and the financial cycle indicator had already declined several quarters before a crisis occurred. For more information on the early warning indicator, see Beutel et al. (2019). For more information on the financial cycle indicator, see Schüler et al. (2020).

Developments in gross domestic product after the start of a recession* Chart 2.1.6

Average percentage change in GDP relative to the start of a recession



Sources: BIS, Eurostat, ECB, IMF, OECD, Refinitiv, Federal Statistical Office and Bundesbank calculations. * The analysis is based on the Bundesbank's early warning indicator (EWI) dataset. The following 15 countries are included in the dataset: Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, the United Kingdom and the United States. **1** Recessions associated with a peak in the EWI are those that start up to 8 quarters after a peak in the EWI.

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the case of a potential slowdown in the financial cycle, risks to financial stability due to existing vulnerabilities remain elevated in the near term.

Vulnerabilities in the euro area

Vulnerabilities have built up in the euro area over several years, which may increase the risks to financial stability in Germany in the current environment. Persistently low interest rates and thus comparatively cheap loans contributed to private and public debt ratios rising to high levels in many European countries.[23] The coronavirus pandemic intensified this trend further. There has been a sharp rise in asset prices, especially in residential and commercial real estate prices.[24] In September 2022, the European Systemic Risk Board (ESRB) issued a warning on vulnerabilities in the euro area, highlighting risks stemming from commercial real estate and high government debt.[25] Despite their differences, euro area Member States also face similar levels of vulnerability to the energy crisis and tightening financial conditions.

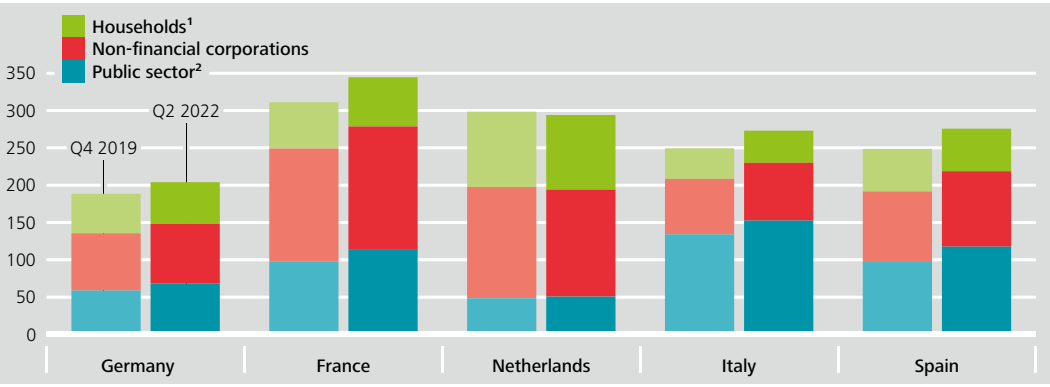
High debt levels and rising interest rates increase debtors' financial burden, especially when the economic outlook is deteriorating. Non-financial sector debt has risen significantly in the euro area since 2019. Although debt is distributed differently across sectors in euro area countries, government debt in particular has grown over the course

23 See Bank for International Settlements (2022b).
24 For instance, the European Systemic Risk Board (ESRB) notes that house prices have continued to rise, primarily in those countries that were issued with warnings and recommendations on account of high house prices back in 2019. See European Systemic Risk Board (2022a).
25 See European Systemic Risk Board (2022b).

of the coronavirus pandemic (see Chart 2.1.7). However, high private sector debt levels can also have a negative impact on a country's growth and financial stability.[26]

Indebtedness in selected euro area countries by sector Chart 2.1.7

As a percentage of GDP



Sources: Eurostat and ECB. **1** Including non-profit institutions serving households. **2** As defined in the Maastricht Treaty.
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The high level of government debt in the euro area represents a material vulnerability to interest rate rises. Many countries have used the prolonged period of low interest rates to borrow on favourable terms. In this context, some Member States have increased the average residual maturity of their government debt since the end of 2017, meaning financing costs will tend to adjust more slowly in the event of an interest rate rise. However, in large euro area countries, up to one-quarter of outstanding government bonds will reach maturity by the end of 2023. These government bonds will probably have to be refinanced at significantly higher costs. Risk premia on government bonds issued by highly indebted euro area countries increased in mid-2022.[27] A considerable share of euro area government bonds is now on central banks' balance sheets, making them vulnerable to write-downs. Asset purchases are accompanied by an expansion in financial institutions' deposits at central banks, which are subject to a short-term interest rate, and thus a higher risk of loss. This significantly increases the risk of loss in the event of interest rate hikes.[28]

The risk of contagion effects between euro area Member States is generally high due to their close economic, political and financial ties. This is primarily an issue if the financial system and the government budget are closely interlinked in countries with high levels of government debt, such as via guarantees or large holdings of domestic govern-

26 See Bank for International Settlements (2022b). The negative effects of high levels of private and public sector debt during periods of stress can also be mutually reinforcing. See Moreno Badia et al. (2022).
27 See Deutsche Bundesbank (2022f).
28 See Deutsche Bundesbank (2022f).

ment bonds. As a result, government turmoil or disruptions in the financial system can quickly spread to other sectors and other countries.[29]

Several countries have already taken extensive measures this year to address the increase in vulnerabilities. Macroprudential measures have been taken in many countries to preserve or further enhance the resilience of their financial systems (see the section entitled "Overall assessment and implications for macroprudential policy" on pp. 77 ff.). In its warning, the ESRB called on all actors in the European financial system to prepare for adverse scenarios and to preserve and further enhance resilience in the financial sector. The fiscal support measures help to limit vulnerabilities. Should any disorderly market developments pose a serious threat to the uniform transmission of monetary policy in the euro area, they can be countered by the Eurosystem's new Transmission Protection Instrument (TPI).[30]

Situation in the corporate sector

The outlook for the German corporate sector has deteriorated. Companies' leverage has grown in recent years, leaving them more vulnerable to unfavourable macroeconomic developments. The economic outlook for Germany for the next year has deteriorated significantly.[31] Higher energy and commodity prices as well as supply bottlenecks are making production more expensive. European businesses have been hit harder by higher energy costs, for instance for gas, than competitors in other economic regions (see Chart 2.1.8). This could lower the profitability of energy-intensive German enterprises, as these companies face international competition and can therefore pass through only some of the higher energy costs to their customers. Moreover, many enterprises are likely to increasingly feel the effects of tighter financing conditions. Over the next few years, the currently still very low number of corporate insolvencies is therefore likely to rise. Distress and defaults in the corporate sector are reflected in impairment losses and write-downs on loans and securities in the financial system.

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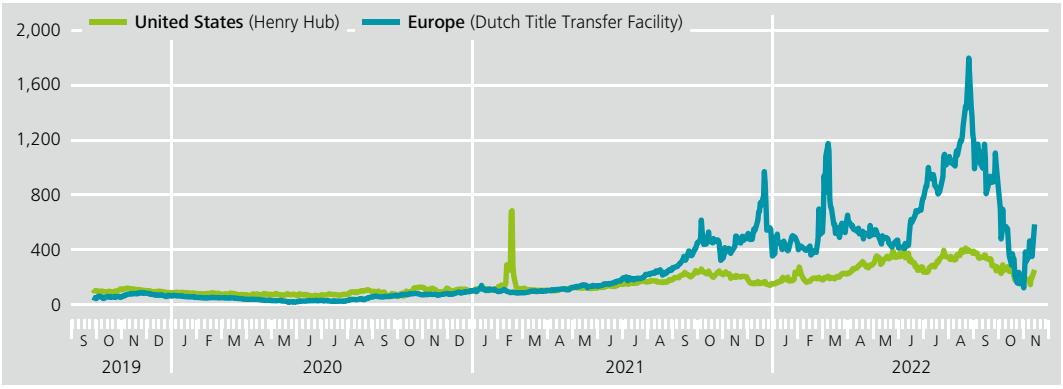
29 See Deutsche Bundesbank (2022d).
30 The ECB Governing Council approved the establishment of the Transmission Protection Instrument (TPI) on 21 July 2022. The TPI is intended to support the effective transmission of monetary policy and ensure the singleness of monetary policy. Under the TPI, the Eurosystem will, subject to certain conditions, be able to make secondary market purchases of securities issued in Member States experiencing a deterioration in financing conditions not warranted by country-specific fundamentals. Before the TPI is activated, the ECB Governing Council will, amongst other things, consider a cumulative list of criteria to assess whether the jurisdictions in which the Eurosystem may conduct purchases under the TPI pursue sound and sustainable fiscal and macroeconomic policies. See https://www.bundesbank.de/en/tasks/monetary-policy/outright-transactions/transmission-protection-instrument-tpi--896158
31 See Deutsche Bundesbank (2022e).

Gas prices

Chart 2.1.8

31 December 2020 = 100, spot prices



Source: Bloomberg Finance L.P.
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Higher costs and debt weighing on the corporate sector

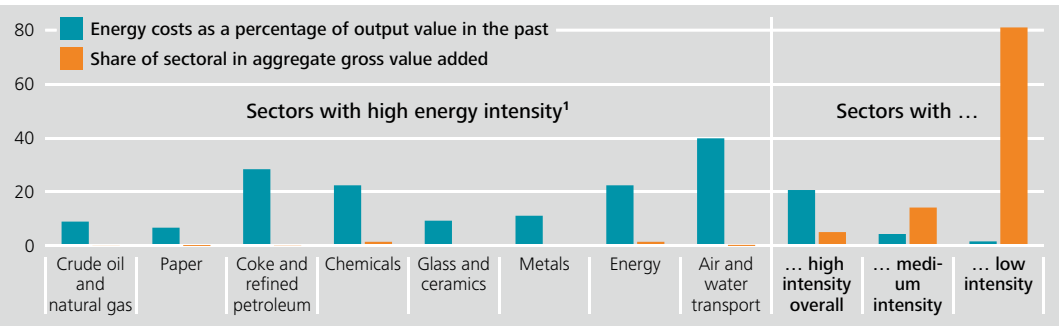
In recent years, corporate debt levels have risen. After remaining relatively stable for years and even falling slightly to 37% of GDP in 2014, the German corporate sector's net debt has been rising again since 2018. In the second quarter of 2022, it amounted to 51%.[32] Developments in net debt were driven, first, by an extended period of low financing costs, which provided incentives to expand debt. Second, some firms had to take out additional loans in order to bridge liquidity bottlenecks during the COVID-19 pandemic and offset losses. Even if German firms' debt is still fairly low by European standards, the increase of 14 percentage points leaves them more vulnerable to adverse macroeconomic developments.

Higher energy and commodity prices as well as supply chain problems are significantly increasing production costs and weighing on the corporate sector. In the past, only around 5% of German firms had significant energy costs in relation to output value.[33] The sharp rise in energy prices naturally hits enterprises in energy-intensive industries especially hard (see Chart 2.1.9).[34] However, high energy prices can also take a – sometimes heavy – toll on enterprises from sectors with low or medium energy intensity, or are

32 Data source: Financial accounts.
33 Output value is measured as the value of all goods and services produced in a sector.
34 A sector's energy intensity is measured on the basis of energy consumption in 2018 (in terajoules) in relation to gross value added (in € million) in the same year. Sectors with a ratio larger than 5 are classified as energy intensive or as sectors with high energy intensity. Sectors with a ratio between 1 and 5 are classed as sectors with medium energy intensity, and sectors with a ratio smaller than 1 are classified as sectors with low energy intensity.

Energy costs and macroeconomic significance of the sectors

Chart 2.1.9



Sources: Federal Statistical Office, World Input-Output Database and Bundesbank calculations. **1** Classification of energy intensity depending on energy consumption of sectors in 2018 (in terajoules) in relation to gross value added (in € million). Sectors with a ratio smaller than 1/between 1 and 5/larger than 5 are classified as sectors with low/medium/high energy intensity. Energy costs determined using value of intermediate inputs from the sectors coke and refined petroleum products as well as energy.

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already doing so: both directly through the rise in energy prices and indirectly through higher prices for intermediate products. In addition, higher prices for other commodities and supply chain bottlenecks are hurting firms, although the latter have eased somewhat recently.

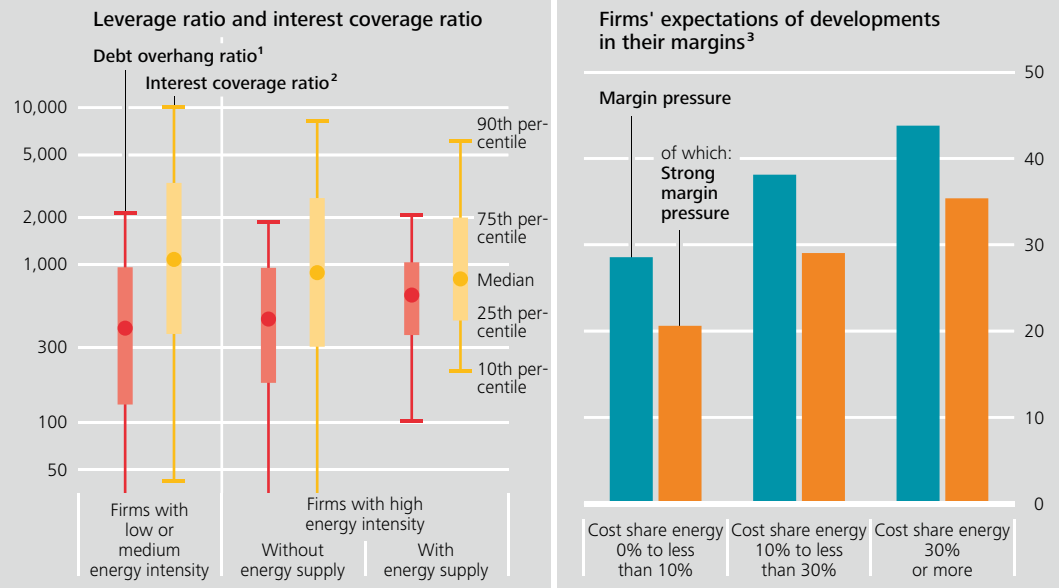
Unless enterprises can pass through their higher costs to customers by raising their prices, their profit margin will tend to shrink. The energy price shock is hitting European firms harder than competitors in other economic regions. A significant proportion of German enterprises are pessimistic about their future profit margins. According to a survey conducted as part of the Bundesbank Online Panel – Firms (BOP-F), around 30% of firms expect production costs to rise more rapidly than sales prices up to the end of March 2023.[35] Among firms where energy makes up a comparatively large share of costs, this percentage even comes close to 45% (see Chart 2.1.10). Firms that had already seen a sharp rise in production costs in 2021 feature prominently among those expecting high costs and a likely decline in profit margins.[36] The corporate insolvency rate, which is currently still very low, could therefore rise. Unless firms are able to absorb the additional costs through cost savings or government grants, this will likely tend to hit energy-intensive firms and those with low pricing power.

35 Results of the Bundesbank Online Panel – Firms (BOP-F). As part of the BOP-F, the Bundesbank surveys a representative sample of firms on their situation, assessments and expectations. However, the data do not allow any conclusions to be drawn regarding the extent to which the pessimistic expectations stem from current developments, the effects of the COVID-19 pandemic or structural factors.

36 63% of firms expecting margin pressure stated that they were already struggling with margin pressure in 2021. Among firms that expect no margin pressure, by contrast, this share is 26%. Data from sub-sample based on weighted quarterly data.

Debt, interest expenditure and earnings expectations Chart 2.1.10

%, log scale — Percentage of firms



Sources: Bundesbank Online Panel – Firms (BOP-F), Bundesbank statistics and Bundesbank calculations. **1** Ratio of debt to EBITDA (earnings before interest, taxes, depreciation and amortisation). **2** Ratio of EBITDA to interest expenditure. **3** Margin pressure is taken to mean that production costs rise more rapidly than sales prices. Where margin pressure is strong, the rise in production costs exceeds the increase in sales prices by at least 5 percentage points. Expectations refer to the change in prices for the period from March 2022 to March 2023. Sales prices and production costs as cited for Q2 2022; energy as a percentage of production costs pursuant to data for Q1 2022. The BOP-F data are taken from a sub-sample of weighted quarterly results with 660 observations.

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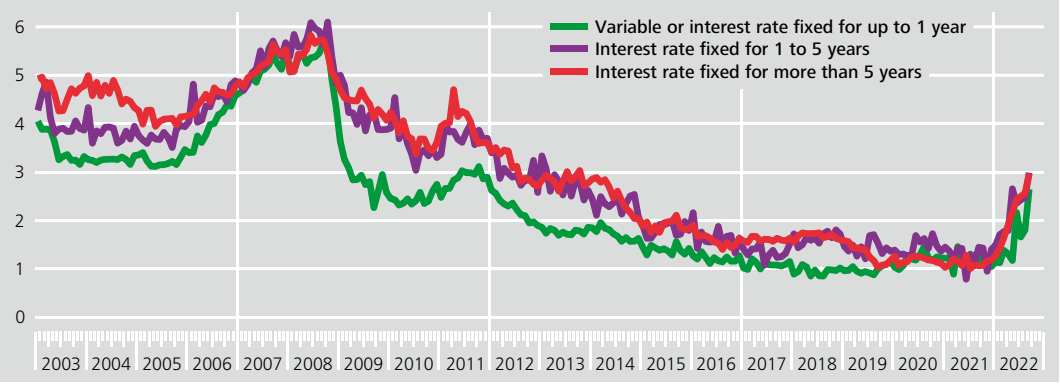
Credit supply stable while nominal financing costs are on the rise

Nominal financing costs have risen perceptibly since the autumn of 2021. By the beginning of November 2022, risk premia on bonds had roughly doubled in Europe, for firms with strong and weak credit ratings alike. Risk premia are significantly higher than the long-term median values and the very tight premia of recent years. In loan financing, which is more important for German firms, interest rates for new business also rose. Depending on the maturity and amount of the loan, interest rates went up by between 80 and 190 basis points (see Chart 2.1.11). However, real interest rates remain very low. Almost half of all bank loans to enterprises will either mature in the next two years and probably need to be renewed or they have variable interest rates.[37] A significant proportion of firms could then face higher nominal financing costs and, depending on how inflation develops, also higher real costs. In the long term, almost all German firms could be

37 Interest rates on medium and long-term loans can likewise sometimes be adjusted during a loan's life. For example, currently 16% of loans with an original maturity of more than two years allow interest rates to be adjusted over the next 24 months, although their residual maturity is still at least two years. Data source: MFI interest rate statistics.

Interest rates on loans to enterprises* Chart 2.1.11

%, new business



* Loans of over €1 million.

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confronted with higher financing costs. In 2020, German firms' average interest expenditure amounted to just 2.5% of their liabilities, as compared to 3.6% in the decade preceding the Global Financial Crisis.[38] Firms with a weak credit rating, in particular, would likely face markedly higher financing costs. Loans to this group of companies feature relatively prominently in banks' loan portfolios (see the section entitled "Default risk for loans to enterprises could increase significantly" on pp. 52 ff.).

In the year to date, the German banking system has issued a large volume of loans to enterprises. In June 2022, the volume of new business reached its highest level since the time series was introduced in 2003, and it was still very high in September.[39] New lending to enterprises from energy-intensive sectors rose particularly sharply. It doubled in the spring of 2022 compared with the previous year and, in July, was still slightly above the average for the previous year.[40] Overall, the high uncertainty and higher cost of energy, commodities and intermediate goods are contributing to an increased demand for liquid funds and short-term financing. Moreover, one-off factors such as government assistance programmes, e.g. promotional loans from the KfW Group to energy suppliers, are likely to have been one factor driving comparatively high new lending. Finally, the fact that the real interest rate remains low at present may also still be buoying demand for loans. By contrast, the gloomier economic outlook could be having a dampening effect on demand.

Access to loans for the corporate sector appears to be largely stable. New lending suggests that firms' access to credit is not being curtailed. The results of the Bundesbank Online Panel – Firms survey corroborate this assessment. For example, banks appear to have rejected roughly the same percentage of loan applications in 2022 as in 2021. How-

38 Data source: Financial statement statistics (extrapolated results), December 2021.
39 Data source: MFI interest rate statistics.
40 Data source: AnaCredit.

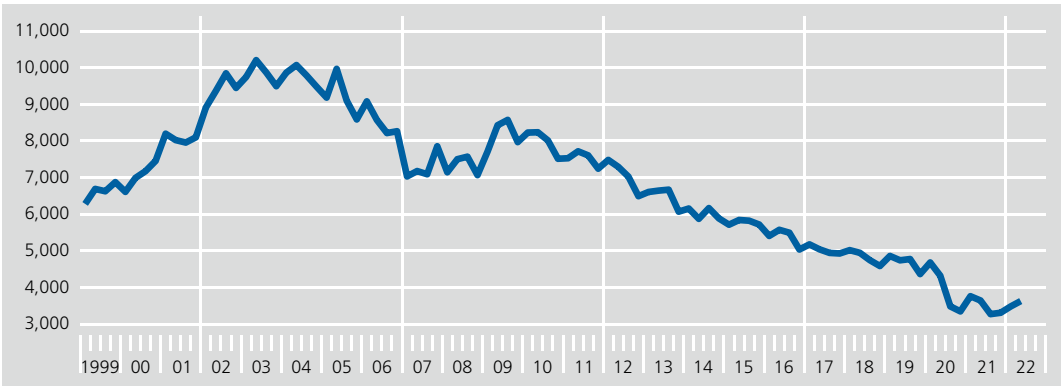
ever, some of the loans were granted subject to tighter terms and conditions. The Eurosystem's quarterly Bank Lending Survey (BLS) does indicate that banks tightened their lending standards in the third quarter of 2022. The key reason for this is that banks expect higher default risk in the corporate sector. However, banks' capital and liquidity situation was only a minor factor, according to the survey.

Insolvency risk heightened over the medium term

More corporate insolvencies are likely in the coming years. Since the autumn of 2021, the number of corporate insolvencies in Germany has risen slightly (see Chart 2.1.12).[41] In a long-term comparison, however, it is still very low across sectors and firm sizes. The low insolvency figures reflect firms' risk measures, which can be derived from fundamentals. In 2020, the majority of enterprises were on a sound footing as measured by their debt overhang ratio or their interest coverage ratio. This was true of both energy-intensive firms and non-energy-intensive ones (see Chart 2.1.10 on p. 30). The massively increased production costs are only reflected in balance sheet data with a time lag. They do, however, directly raise default risk – not only for energy-intensive enterprises, but also for other enterprises whose costs have risen sharply and whose scope for price setting is limited. Over the next few years, the slowdown in aggregate demand and potentially higher financing

Corporate insolvencies in Germany Chart 2.1.12

Number per quarter



Source: Federal Statistical Office.
Deutsche Bundesbank

41 This increase is probably partly attributable to the fact that many of the assistance programmes set up in response to the COVID-19 pandemic have expired and the obligation to file for insolvency has been back in force, with just a few exceptions, since May 2021. The suspension of the obligation to file for insolvency had previously helped keep the number of corporate insolvencies very low – despite considerably higher credit risk.

costs could, moreover, weigh on many businesses. Going forward, therefore, lenders will likely have to recognise more impairment losses and write-downs.[42] The gloomier outlook will probably also have a negative impact on the commercial real estate sector (see the chapter entitled "Commercial real estate and the German financial system" on pp. 97 ff.).

In the medium to long term, structural change in the German economy might also contribute to higher loan losses. Climate change, digitalisation, a relocation of supply chains and demographic trends are all leading to shifts in the production process, which also impact the financial system.[43] The current energy crisis is accelerating structural change. As a result, assets are losing value. For example, measures to combat climate change, such as higher carbon prices, are gradually eroding the importance of carbon-intensive industries. Structural change may mean that some business models are no longer profitable. To avoid impeding structural change, it is important that lenders do not renew loans to enterprises without a sustainable business model and, if necessary, accept losses. At the same time, there is a risk that lenders could incur losses if they have underestimated the risks associated with structural change in the past and have not priced them appropriately.

Situation in the household sector

High inflation reduces households' purchasing power and makes them more vulnerable to future shocks. The significantly increased cost of living is limiting the financial scope of households to repay debt or build up financial buffers (see the box entitled "Impact of the higher cost of living and interest rates on the vulnerability of households in Germany" on pp. 35 ff.). Both of these effects lower the resilience of borrowing households to shocks and tend to make them more likely to default. Owing to long interest rate fixation periods on loans for house purchase, households' exposure to interest rate risk is limited in the short to medium term. However, this interest rate risk is present within the banking system (see the section entitled "Risk situation of the German banking system" on pp. 45 ff.). In the first half of 2022, developments in the residential real estate market remained dynamic and overvaluations continued to increase. The vulnerabilities that had already existed are thus still high. In order to address systemic risk stemming from housing loans in a targeted way, a sectoral systemic risk buffer (sSyRB) of 2% was set for exposures secured by residential property as part of the package of macroprudential measures in January 2022 (see the section entitled "Overall assessment and implications for macro-

42 See Bank for International Settlements (2022a), pp. 19 ff.
43 For more on the risks climate change poses to financial stability, see Deutsche Bundesbank (2021), pp. 81 ff.

prudential policy" on pp. 77 ff.).[44] The situation changed considerably as the year progressed. Amid sharply increased lending rates and the higher cost of living, in particular, there are signs that demand for housing loans and thus loan growth is weakening. Much the same applies to house prices. If, however, income-based credit risk indicators should deteriorate owing to higher financing costs for households, vulnerabilities from new lending business could continue to build up. From a financial stability perspective, it is therefore important that lenders ensure that the debt sustainability of borrowers is sound when issuing new housing loans.

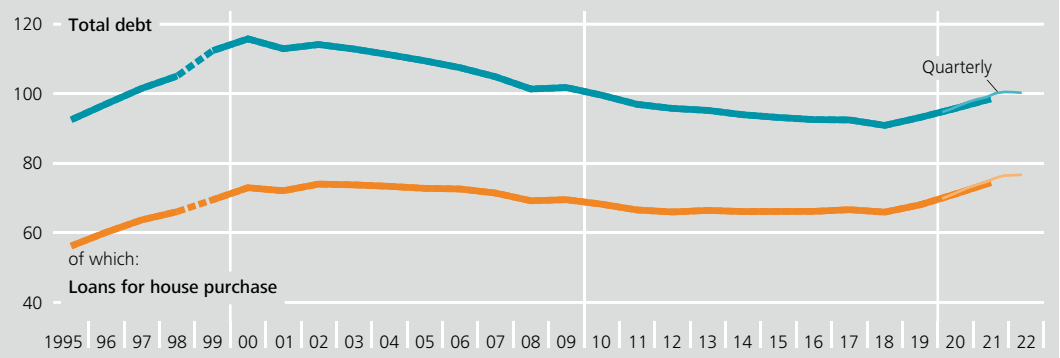
Household debt continued to mount

Debt sustainability in the household sector is good, even though it has worsened in the current and previous year. Aggregate debt relative to disposable income is fairly moderate from a longer-term perspective (see Chart 2.1.13).[45] However, it has gradually increased since 2018, as loans saw more dynamic growth than household income. As a result, households' ability to service their debt using disposable income has tended to deteriorate. High inflation poses a challenge for households.

Household debt in Germany*

Chart 2.1.13

As a percentage of disposable income



* Loans to households and non-profit institutions serving households. Up to 1998 according to ESA 1995 and from 1999 according to ESA 2010.

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This is because the loss of purchasing power associated with inflation has led to a significant decline in real incomes over the course of the year so far. If the inflation-related losses are not compensated for by corresponding wage increases, households will have less

44 In contrast to the sSyRB, systemic risk buffer (SyRB) is the general term used if the buffer is not targeted at sector-specific risk exposures and subsets, but is instead set for all domestic or foreign risk exposures. The SyRB or sSyRB can be deployed to address risks that are not already adequately covered by other macroprudential measures, such as the buffer for global or other systemically important institutions (G-SII or O-SII buffers).

45 The debt ratio does not appear exceptionally high compared to other euro area countries, either. See https://sdw.ecb.europa.eu/reports.do?node=1000004962

Impact of the higher cost of living and interest rates on the vulnerability of households in Germany

The rising cost of living and higher lending rates are currently posing challenges for households in Germany. The cost of living in Germany has gone up significantly since the middle of 2021 due, in particular, to the sharp increase in energy and food prices. As a result, households have less disposable income to service their debts (see the section entitled "Situation in the household sector" on pp. 33 ff.). Owing to the sharply increased interest rates since the start of the year, households with outstanding loans might also be faced with higher debt servicing costs.

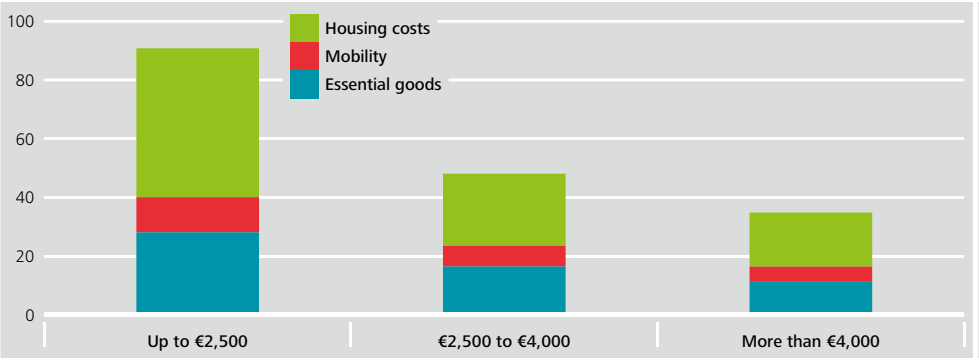
Households could limit their consumption due to higher expenditure. If disposable income falls, households tend to mainly consume less and carry on servicing their debts.[1] However, the more households restrict their consumption, the more this could dampen aggregate demand and slow economic activity. If economic conditions were to subsequently deteriorate further – in the form of higher unemployment, for example – this could have a negative impact on financial stability. This is because, should indebted households not be in a position to continue servicing their loans, it would result in an increase in credit losses. Instead of limiting their consumption, households could respond to additional burdens by saving less. This would cause their financial wealth to accumulate more slowly, or even decline, with a subsequent decrease in their financial buffers, and thus their resilience to adverse shocks.

The higher cost of living leaves households with less financial headroom, affecting households with lower incomes, in particular. Households with lower incomes spend a larger share of their income on basic needs such as energy, food, mobility and housing costs. According to the Bundesbank's survey on household expectations (Bundesbank Online Panel – Households, BOP-HH), households with a monthly income of less than €2,500 use 90% of this on average to finance basic needs (see the chart). Households with an income of more than €4,000, meanwhile, spend no more than just over one-third of their income on basic needs. Rises

1 See Elul et al. (2010) and Garriga and Hedlund (2020).

Household expenditure for basic needs

As a percentage of disposable household income



Source: Bundesbank-Online-Panel-Households (BOP-HH). Survey period: 2021 and 2022.
Deutsche Bundesbank

in the prices of goods and services for basic needs therefore hit low-income households particularly hard.[2] By contrast, households with higher incomes have a higher savings rate and larger financial reserves and thus tend to be able to reduce the amount they save and draw on savings without having to reduce their consumption. As the income groups in the sample are similar in size, the rise in inflation is likely, on the whole, to substantially reduce household savings and consumption.[3]

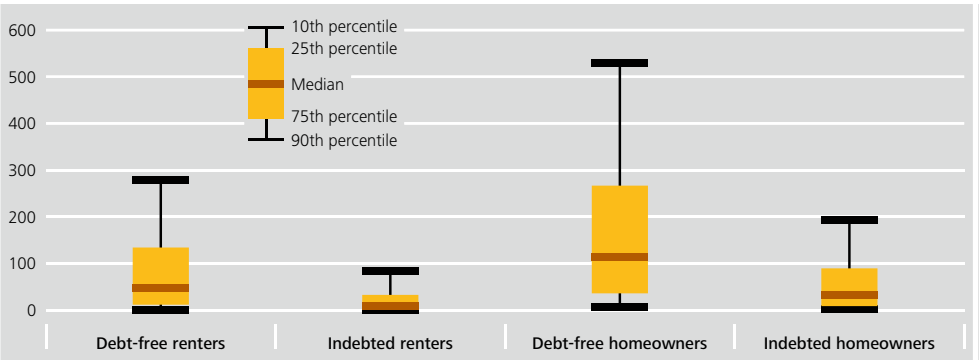
The risk of credit losses is limited in the short term, but the household sector has become more vulnerable. Loans for house purchase account for a large part of household debt in Germany. However, low-income households, particularly hard hit by price increases, are less likely to own their own homes and thus have fewer outstanding debts. Taken in isolation, the rise in inflation is therefore unlikely to lead to a sharp increase in credit losses in the household sector in the short term. That said, one in every two households owning residential property and with outstanding debts has financial wealth of less than four months' income (see the chart).[4] It is especially these households that are vulnerable to real income losses that reduce their ability to continue to service their debt and make it more likely they will draw on reserves.

The majority of households will initially be protected from an increase in lending rates owing to long interest rate fixation periods. Since the interest rate fix-

2 See European Central Bank (2022a).
3 See Deutsche Bundesbank (2022e).
4 In the sample, debt-free and indebted renters account for around 14% and 27% of the group, respectively, and indebted homeowners for just under 34%.

Household financial wealth*

As a percentage of disposable annual income



Source: Bundesbank Online Panel – Households (BOP-HH). Survey period: 2021 and 2022. * Sum of bank deposits and securities.
Deutsche Bundesbank

ation periods are usually long in Germany, higher lending rates will only marginally increase households' debt service ratios in the short term.[5] Interest rate conditions for the households concerned will not be adjusted until the interest rate fixation period expires, which means a large proportion of indebted households will not be directly affected by rising interest rates in the short term. Only a small proportion of these households therefore have to make short-term adjustments to their consumption or savings rate in response to a higher interest burden.

5 The average aggregate debt service ratio will also rise only marginally as a result of higher interest rates. See Deutsche Bundesbank (2022b).

financial scope to repay debt in the future. One risk-mitigating factor in this context is that a large percentage of housing loans were granted to households with relatively high incomes and wealth. Such households are likely to be in a better financial position to initially cope with the current rise in inflation than lower-income households. But even for high-income households, the loss of real wages is making it more difficult to build up the financial assets that can help cushion shocks. Should there be a deterioration in the German labour market, which is currently in a stable condition, credit risk is also likely to mount in the household sector. Unlike the higher cost of living, only some households would be affected by unemployment, but for those households the loss of income would be significantly higher. As residential property and housing loans account for the bulk of household wealth and debt, vulnerabilities in the household sector are closely linked to developments in the housing market.

Upturn in the housing market is tailing off

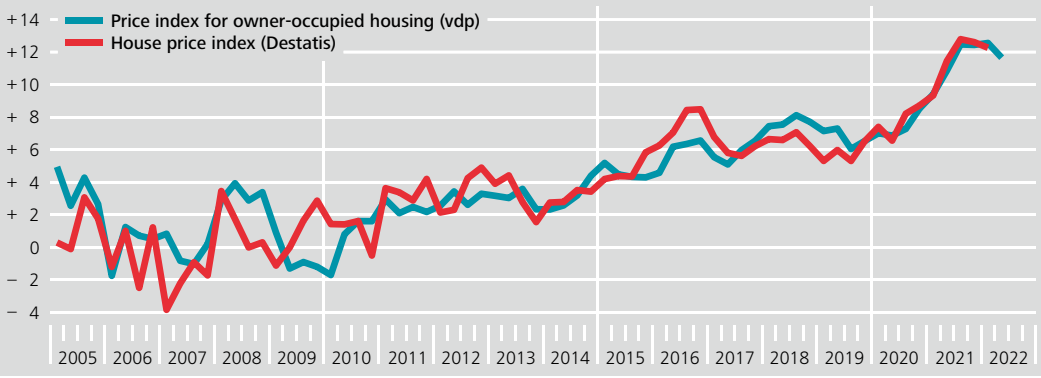
The upturn in prices in the residential real estate market, which has been ongoing since 2010, initially continued until mid-2022. Demand for residential real estate was robust going into 2022. However, it was slowed inter alia by the income trend, which was partly weak and uncertain, and by the sharply increased interest rates since the beginning of 2022.[46] In addition, shortages of building materials have hindered an expansion of the housing supply since 2021.[47] Overall, house prices rose by an average of 11.5% in 2021, according to the Federal Statistical Office's house price index, compared with 7.8% in 2020 (see Chart 2.1.14). Year-on-year price growth climbed to 11.6% in the first quarter of 2022, before dropping to 10.2% in the second quarter.[48] Price increases in more rural regions were roughly as strong as those in urban regions. Amid this strong price growth, overvaluations in the housing market have increased. In 2021, these ranged between 15% and 40% both in cities and towns and in Germany as a whole.[49]

There are initial indications of a slowdown in house price dynamics. In addition to the higher lending rates, households' loss of purchasing power due to high inflation is likely to be weakening demand for residential property.[50] Data from real estate platforms were already signalling waning momentum towards mid-2022. Asking prices stagnated

46 For developments in the German residential real estate market in 2021, see Deutsche Bundesbank (2022a).
47 In 2022 to date, an unusually large number of construction projects have been cancelled, making the future supply scarcer. See ifo Institute (2022).
48 Similar tendencies are shown, for example, by the price index for owner-occupied housing compiled by the Association of German Pfandbrief Banks.
49 The fundamental property price is estimated on the basis of an econometric model and depends on socio-demographic and economic explanatory factors. See Kajuth et al. (2016).
50 The expected relationship between real property prices and real income is consistent with empirical studies of the German housing market. See Deutsche Bundesbank (2020b) and Kajuth (2021).

Residential property prices in Germany Chart 2.1.14

Year-on-year percentage change



Sources: Federal Statistical Office (Destatis) and Association of German Pfandbrief Banks (vdp).
Deutsche Bundesbank

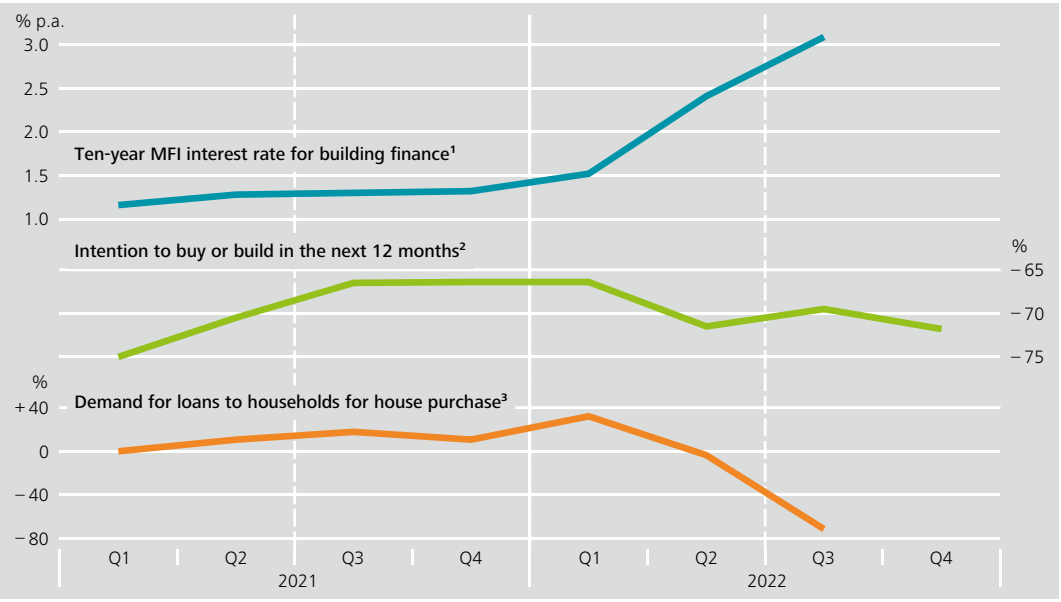
or fell slightly.[51] Near-time price indices for the third quarter of 2022 also suggest that nominal house prices could decline.[52] According to the results of the Bundesbank Online Panel – Households (BOP-HH) survey, households recently expected significantly weaker price growth for residential real estate over the next twelve months.[53] In September, about 20% of households were expecting property prices to fall, compared with less than 2% at the beginning of the year. If property prices were to fall, the value of the collateral used to secure real estate loans would also drop. Potential future defaults on loans would then entail commensurate higher losses for lenders.

A slowdown in housing loan growth is already evident in the second half of 2022, after the upward trend had initially continued in the first half of the year despite higher interest rates. The average interest rate on new housing loans increased from around 1.3% at the end of 2021 to just over 3% in September 2022. In conjunction with further increases in house prices and reduced real income, credit-financed real estate purchases are thus less affordable for many households. While demand for residential property and for loans was still moving in a generally positive direction in 2021, higher interest rates saw that trend reverse in the first half of 2022. In this context, survey data from German banks indicate that loan demand has declined markedly since the beginning of the year. Another survey among households shows, moreover, that intentions to purchase housing have tended to decrease over the course of 2022 so far (see Chart 2.1.15). Against this backdrop, new lending business recently saw a distinct contraction and was about

51 Data are based on advertised offers for July 2022. See https://www.immobilienscout24.de/unternehmen/news-medien/news/default-title/preis-update/. Transaction prices respond to shocks only after a delay. See de Wit et al. (2013) and Hort (2000).
52 According to the Hypoport overall index, house prices dropped marginally between the second and third quarters of 2022, while data from the Association of German Pfandbrief Banks show that prices for owner-occupied housing were virtually stagnant. The year-on-year growth rate of prices was still clearly in positive territory, however.
53 See https://www.bundesbank.de/en/bundesbank/research/survey-on-consumer-expectations/survey-on-consumer-expectations-848330 for more information on the survey.

Interest rates on loans for house purchase and indicators of demand for residential property

Chart 2.1.15



Sources: Eurosystem Bank Lending Survey (BLS), European Commission and Bundesbank statistics. **1** Interest rate on loans for house purchase with interest rate fixation over ten years on the basis of the MFI interest rate statistics. **2** Balance of positive and negative responses about intention to purchase or build housing. Results for Q4 2022 based on survey in October 2022. **3** Balance of reported increases and decreases in demand for housing loans.

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20% lower in the third quarter of 2022 than in the same quarter of the previous year. At the end of the third quarter of 2022, the annual growth rate for the stock of loans to households for house purchase stood at 6.4%, following on from 6.9% in the previous quarter. The rate had been 7.1% at the end of 2021. The growth rate may have developed in this way partly because households brought forward real estate financing in the first half of the year in anticipation of further interest rate rises.

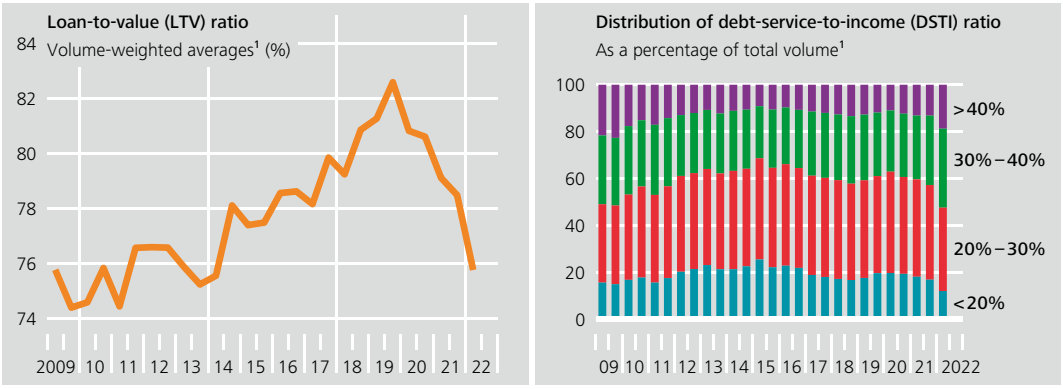
Income-based indicators to assess lending standards could deteriorate

The agreed credit terms and conditions for new housing loans have become tighter in part since 2020. According to the results of the Eurosystem's Bank Lending Survey (BLS), German institutions eased credit standards for loans for house purchase over multiple years prior to 2020. Since then, standards have been tightened again. For example, in the second and third quarters of 2022, the surveyed banks made their credit standards tighter than at any point in time since the introduction of the BLS in 2003. Data from a credit broker indicate furthermore that, for new lending, the average loan-to-value (LTV)

ratio fell from 83% in 2019 to 76% in the first half of 2022 (see Chart 2.1.16). As part of this, the share of loans with a high LTV, i.e. above 100%, also declined. This was partly driven by the fact that, when negotiating loans, more capital was required by lenders and contributed by borrowers. When it comes to borrowers, this can be explained by the fact that residential real estate loans were increasingly taken out by households with higher incomes.[54] These households generally also have greater wealth and can therefore contribute more equity when taking out a loan. Additionally, the higher share of equity is probably also the outcome of the incentive effect of higher interest rates. For households, it is worth contributing more equity – if available – in order to reduce the interest burden. From a financial stability perspective, the higher equity share should be viewed positively because the lower the LTV, the smaller the potential loss for lenders. The greater use of equity also played a part in the debt-to-income (DTI) ratio of new borrowers falling again slightly in the first half of 2022, for the first time since the start of the upswing in the housing market.[55]

Income-based risk indicators in new residential real estate financing have tended to deteriorate. A key indicator when assessing borrowers' default risk is the debt-service-to-income (DSTI) ratio. The higher the ratio of monthly debt service to income, the more likely it is that borrowers will face difficulties if, for example, inflation increases the cost of living, the interest rate fixation period expires or income shrinks. Owing to the lower lending rates, the average DSTI ratio declined over the past few years despite higher loan amounts. In the first half of 2022, however, financing costs increased considerably. At the same time, purchase prices and loan volumes remained high. This caused the average DSTI

Lending standards for new loans for house purchase in Germany Chart 2.1.16



Source: Bundesbank calculations based on Interhyp Group data. **1** Weighted using Socio-Economic Panel (SOEP) data.
Deutsche Bundesbank

54 See Association of German Pfandbrief Banks (vdp) (2021).
55 According to data from Interhyp Group, the average debt-to-income (DTI) ratio of new borrowers decreased from 6.9 in the second half of 2021 to 6.8 in the first half of 2022.

ratio to climb from 28% in the first half of 2020 to 31% in the first half of 2022. In particular, there was an increase in the share of new loans with a high DSTI ratio, i.e. above 40% (see Chart 2.1.16). On account of higher financing costs, borrowers have also reduced the repayment rates of their loans, which dampened the increase in the DSTI ratio. Given the current environment of higher interest rates and muted income growth, there is a risk that borrowing households' debt servicing capacity will come under pressure. As a result, lenders could further ease income-based lending standards for new loans in order to support lending, and thus their interest income, from the supply side. This is because, unlike the voluntary decision on the share of equity to contribute when taking out a loan – provided households have a sufficiently large amount of equity – borrowers have fewer options to increase their income in the short term as a way of securing better terms and conditions or even obtaining a loan at all.

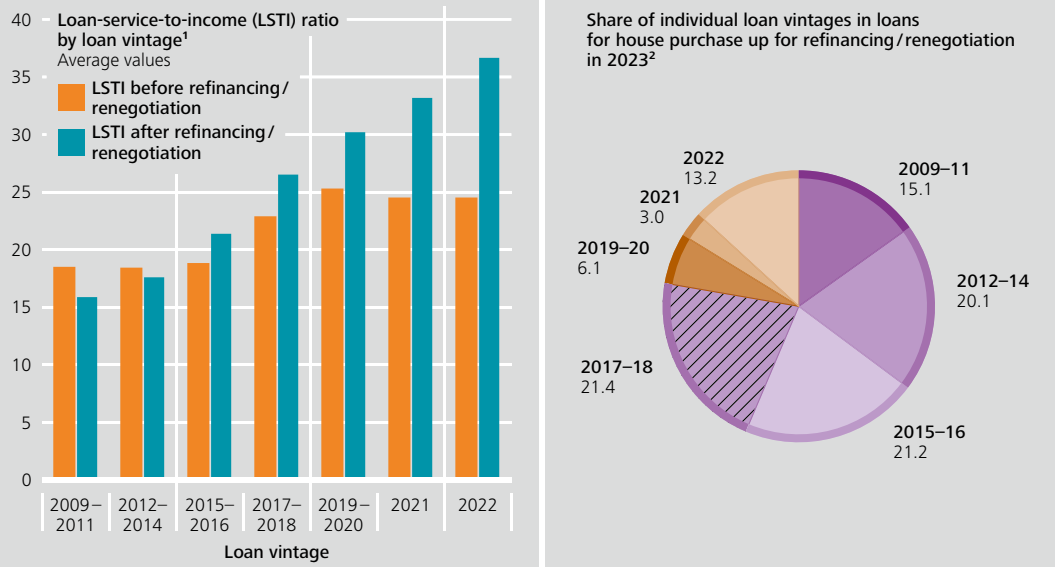
Long interest rate fixation periods limit households' interest rate risk in the short and medium term, but burdens could increase once those periods expire. Once the interest rate fixation period expires, loans have to be refinanced at the interest rates applicable at the time. Model calculations show that an increase in lending rates for housing loans to 3% – the average figure in September 2022 – would affect housing loans granted in the past few years to different degrees.[56] Older loan vintages would be only minimally affected by the interest rate rise (see Chart 2.1.17), seeing as loans for house purchase were still being granted at relatively high interest rates prior to 2019. On top of this, larger portions of the loan principals have already been repaid for older loan vintages. For loan vintages up to 2014, the average loan-service-to-income (LSTI) ratio could even decrease, because interest rates were above 3% at that time. Even for housing loans granted in 2017 and 2018, the average notional LSTI ratio would only increase by less than 4 percentage points to just under 27%. By contrast, for newer loans granted from 2019 onwards and thus when interest rates were at their lowest, an interest rate rise could significantly increase the burden on borrowers. However, this risk is limited by the long interest rate fixation periods. In the recent past, housing loans with an interest rate fixation period longer than five years accounted for more than 80% of new lending business. Thus, loans granted from 2019 onwards only make up a share of just over 22% of the loans that have to be refinanced in 2023 (see Chart 2.1.17). However, when the interest rate fixation period expires and loans granted when interest rates were at their lowest increasingly come up for refinancing, there is a risk that the credit burden on the households affected will increase.

56 For each loan vintage, the credit volume outstanding in 2023 and with an interest rate fixation period that expires in that year is approximated. In addition, for these loans that are up for renegotiation, the loan service is calculated after adjustment of the lending rate. The calculations are based on aggregated data from studies on the structures of residential real estate financing by the Association of German Pfandbrief Banks.

Short-term interest rate risk of loans for house purchase: model calculations for 2023

Chart 2.1.17

%



Sources: Association of German Pfandbrief Banks and Bundesbank calculations. **1** The average loan-service-to-income (LSTI) ratio of the respective loan vintages, both before and after refinancing/renegotiation of interest rate conditions in 2023, is approximated on the basis of model calculations for a lending rate of 3%. Data on volumes of new loans for house purchase are based on the MFI interest rate statistics. The assumed values for loan terms and conditions are based on data from the Association of German Pfandbrief Banks. **2** The outstanding volumes are approximated under the assumption that loans issued in the past are annuity loans.

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To be better able to act in future, macroprudential policymakers in Germany should additionally be given income-based instruments. On the whole, there is no sign that credit standards for new housing loans are being eased substantially at present. If the standards were to be eased and this should give rise to risks to financial stability, so far only two instruments are available in Germany to counter these risks. At present, BaFin can set an LTV limit and an amortisation requirement, for example in the form of a maximum repayment period. However, BaFin has not yet been authorised to impose limits on the DTI or DSTI ratios. In order for potential risks to financial stability posed by high levels of debt to be addressed in a targeted way, legal conditions should be created allowing such instruments to be used by macroprudential supervisors.

VULNERABILITIES AND RESILIENCE IN THE GERMAN FINANCIAL SYSTEM

The changed macro-financial setting is having a considerable impact on the German financial system. High rates of inflation, rising interest rates, subdued growth prospects and elevated downside risk are in some cases being reflected directly in the value losses recorded on the balance sheets of financial intermediaries. In other cases, these changes are having an indirect effect, such as through higher capital requirements. Macro-financial developments are affecting existing vulnerabilities in the financial system that had been building up in an environment of low interest rates and low inflation since the Global Financial Crisis of 2007-08. Abrupt rises in interest rates or an economic slump – off the back of a further escalation of the energy crisis, for example – could expose existing vulnerabilities in the German financial system. However, rising interest rates are also associated with positive effects in the medium term, such as growth in net interest income at banks.

Significant risk arises from exposures to corporates. Firms' leverage has grown in recent years, which has made them more vulnerable to adverse macroeconomic developments. Higher energy and commodity prices as well as supply bottlenecks are making production more expensive. Imbalances and defaults in the corporate sector would be reflected in loss allowances and write-downs on loans and securities in the financial system. These value adjustments might be stronger than in previous economic downturns as market participants may have underestimated default risk in recent years. For example, the number of insolvencies did not increase during the Global Financial Crisis nor more recently during the COVID-19 pandemic thanks to extensive support measures. The suspension of the obligation to file for insolvency is also likely to have played a role in this regard. Low risk premia on bonds and loans as well as low risk provisioning at banks could be a reflection of an overly optimistic assessment of credit risk. This was one of the reasons why the Federal Financial Supervisory Authority (BaFin) adopted a package of macro-

prudential measures at the beginning of 2022 in order to strengthen the resilience of the financial system (see the box entitled "Impact of the macroprudential measures" on pp. 58 ff.).[57]

In addition, the risks from residential real estate loans have increased. High inflation reduces households' disposable income and limits their financial leeway to repay debt. This increases the probability of default (PD) on loans granted to households and may result in higher loss allowances for banks amidst adverse developments. However, the potential losses are mitigated by the fact that banks can liquidate the real estate in the event of a credit default.

The rise in interest rates in 2022 had already prompted numerous significant corrections in the financial markets and thus led to changes in the value of investments held by financial intermediaries. This particularly affected small and medium-sized banks holding large bond portfolios to manage their cash flows as part of their liquidity management and as a reserve for unexpected deposit outflows, but big banks also suffered significant losses. Investment funds saw the negative consequences of an investment strategy that had expanded the share of long-term investments in recent years. Insurers recorded losses primarily in their bond portfolios owing to the rise in risk premia.

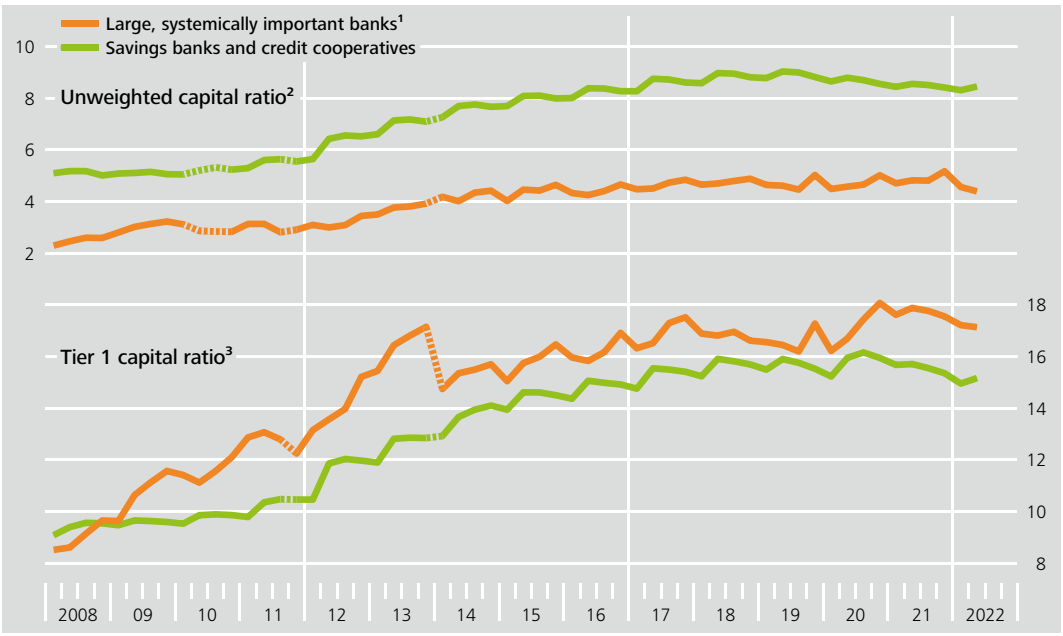
Risk situation of the German banking system

Banks' aggregate tier 1 capital ratio has fallen somewhat since mid-2021. The decline in the tier 1 capital ratio, i.e. the ratio of tier 1 capital to risk-weighted assets, is mainly due to stronger credit growth and not to an increase in the risk weights. Consequently, the unweighted capital ratio, i.e. tier 1 capital relative to total assets, has also narrowed. Up to the third quarter of 2022, the change in the macroeconomic environment has not yet had a significant negative impact on banks' capitalisation. At the end of the second quarter, the tier 1 capital ratio of savings banks and credit cooperatives stood at just under 15.2% (see Chart 2.2.1), and for the large, systemically important banks, this ratio stood at 17.1%. However, credit risk and therefore banks' total exposure may have been underestimated in recent years owing to the growth phase of the financial cycle.[58]

57 See Federal Financial Supervisory Authority (2022).
58 See Deutsche Bundesbank (2021).

Capitalisation of selected German banks*

Chart 2.2.1



***** In 2011 and 2014, the valuations of tier 1 capital and risk-weighted assets changed as a result of Capital Requirements Directives CRD III and CRD IV. **1** Includes the 14 other systemically important institutions (O-SIIs). **2** Tier 1 capital in relation to total assets; transitional period in 2010 pursuant to the Accounting Law Modernisation Act *(Bilanzrechtsmodernisierungsgesetz)*. **3** Tier 1 capital as a percentage of risk-weighted assets.

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The deteriorating macroeconomic environment harbours considerable risks for the German banking system. Some of these risks may materialise in the short term, whilst others could have a more medium-term horizon (see Table 2.2.1). For example, sharp interest rate hikes often lead to direct losses in banks' bond portfolios, which reduces capital if the losses are not offset by other profits. In addition, this loss in value can impair secured refinancing, as the value of the securities used or available for collateral also declines. In the short term, interest business also generally suffers when rapidly rising inter-

Transmission channels of interest rate hikes and economic downturns on bank balance sheets

Table 2.2.1

Assets	Liabilities
Loans – Higher loss allowances in the event of an interest rate hike/ economic downturn: short to medium-term – Higher income in new business in the event of an interest rate hike	Liabilities – Higher cost of refinancing in the event of an interest rate hike – Higher liquidity risk/margin requirement for secured financing in the event of an interest rate hike
Securities – Valuation losses in the event of an interest rate hike: short-term	Equity – Higher capital requirements in the event of an interest rate hike/economic downturn

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est rates make banks' funding more expensive. In the medium term, however, the positive effects arising from interest income in lending are likely to dominate. The changed macroeconomic environment will probably have a significant impact on lending in the medium term as well. It can be expected, for example, that loan loss ratios will rise markedly from their currently very low level. This is especially true of loans to enterprises, which in the past had benefited greatly from low interest rates and a favourable economic environment up to the pandemic (see the section entitled "Default risk for loans to enterprises could increase significantly" on pp. 52 ff.). Particularly strong effects are also likely to be seen on loans to enterprises in the energy-intensive sectors. Capital requirements will probably rise at the same time, especially for big banks. These institutions mainly use their own risk models to calculate their capital requirements (internal ratings-based approach, IRBA). The requirements are relatively sensitive to changes in economic activity.

In the short term, the changed environment will have a significant impact on the banking system

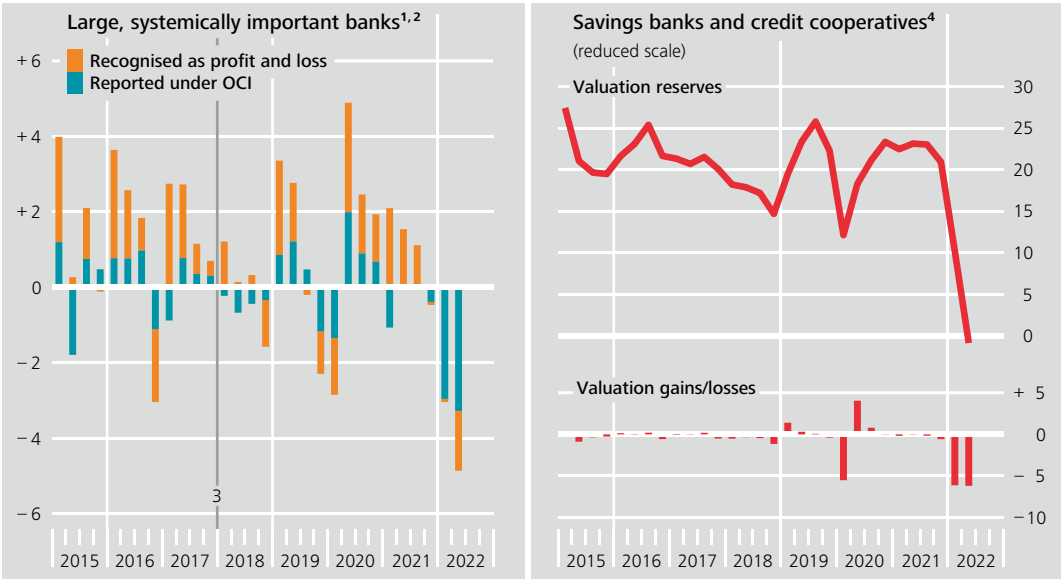
The rise in interest rates already led to considerable valuation losses in banks' securities portfolios in the first half of the year. For savings banks and credit cooperatives, write-downs on securities amounted to €12.3 billion (see Chart 2.2.2), corresponding to around 5.6% of common equity tier 1 (CET1) capital. Hidden valuation reserves prevented significantly higher losses.[59] For example, the hidden valuation reserves for securities held by savings banks and credit cooperatives declined by €21.8 billion in the first half of the year. As a result, banks on aggregate do not have any more hidden reserves available for the time being, which is why further losses in value would lead directly to corresponding write-downs and losses. However, small and medium-sized banks often hold securities to maturity. Since bonds are repaid at par at maturity, market value losses are offset by corresponding valuation gains at that point, if not before. In the meantime, however, the loss in value reduces banks' capital and with it their ability to absorb further losses from, say, lending business. For the large, systemically important banks, market price declines also resulted in considerable losses, albeit to a much lesser extent than for savings banks and credit cooperatives. In the first half of the year, they amounted to €7.9 billion, or 3.7% of CET1 capital. Losses were therefore lower because, inter alia, these banks more frequently undertake hedging transactions and some even made a profit in trading business.

59 According to the German Commercial Code *(Handelsgesetzbuch)*, valuation reserves arise when securities are not recognised at their respective market prices but at a lower value in the balance sheet. Hidden reserves and changes to them do not need to be reported separately in the balance sheet or the profit and loss account.

Profit and loss of selected categories of banks in Germany due to market price changes

Chart 2.2.2

€ billion



1 Recorded here are gains and losses on securities and derivatives recognised as profit and loss and their revaluations that are directly offset against equity or reported under OCI (other comprehensive income). **2** Includes the 14 other systemically important institutions (O-SIIs). **3** Transition to IFRS 9 accounting standard. **4** Gains and losses on securities in the banking book (liquidity reserve and non-current assets) are recorded here. Holdings of hidden valuation reserves of these securities calculated as a net volume of hidden reserves less hidden losses.

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By contrast, banks' secured funding so far appears to have been scarcely affected by an interest rate hike. In the case of secured funding, banks deposit collateral in the form of liquid securities that their creditors can realise in the event of a bank default. Collateral also plays a major role in derivatives trading. A rise in interest rates reduces the value of this collateral and may require banks to offset the loss by topping it up. Liquidity risk arises when banks find it difficult to submit additional collateral. Central bank refinancing is particularly relevant for the banking system. At the end of 2021, around 83% of the securities submitted to the Bundesbank – and thus available for collateralisation – by large, systemically important banks were actually used for refinancing. For small and medium-sized banks, the utilisation rate was significantly lower, at 72%. In a scenario in which risk-free interest rates rise by 100 basis points, the aggregate utilisation rate would increase marginally, but still remain well below the 100% threshold. In this scenario, some of the banks would be underfunded, i.e. collateral utilisation would be above 100%, but the overall shortfall would be minor. Obtaining funding in the interbank market is also important, especially for large banks. For funding via repo transactions, the utilisation rate is 33%. If interest rates were to rise, this would change only slightly.[60] The potential mar-

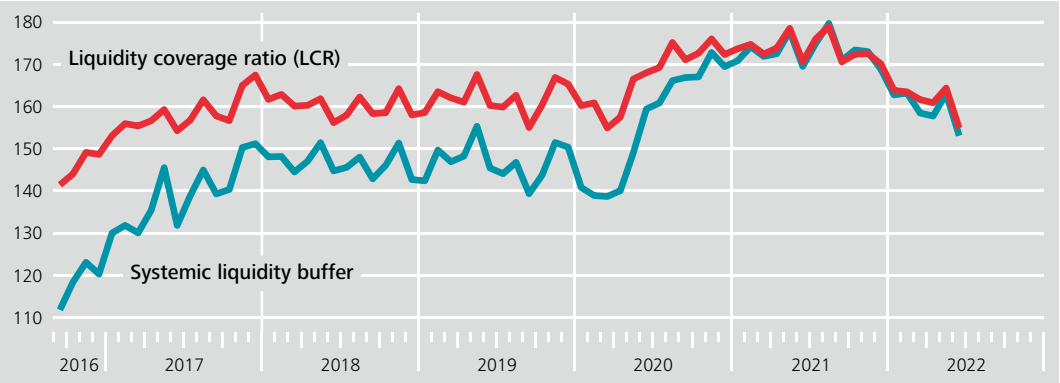
60 A repurchase (repo) transaction is the purchase of an asset combined with an agreement to buy back the asset at a later date. The assets involved in repurchase agreements are often securities. Economically speaking, a repo is a loan collateralised by securities. The difference between the purchase and selling price of the asset is the lending rate that the lender receives.

gin calls for derivative positions also appear to account for only a small share of the central bank balances of the banks concerned. Overall, a hike in interest rates appears to be manageable in terms of the available collateral.

Despite the rise in market interest rates, liquidity levels remain comparatively high. In order to service short-term, unexpected outflows of deposits, banks hold liquid securities, i.e. securities that can be realised quickly. High-quality fixed income bonds form a large portion of these securities. Regulatory provisions also require banks to have a certain level of liquidity. For example, the liquidity coverage ratio (LCR), i.e. the ratio of liquid assets to expected short-term liquidity outflows, must be at least 100%. For German banks, this ratio is high, averaging 157% (see Chart 2.2.3).[61] The systemic liquidity buffer can be used to assess liquidity in a stress phase. This is calculated in a similar way to the LCR, but takes into account additional stress assumptions. The systemic liquidity buffer, too, provides little indication that the rise in interest rates this year has had a marked impact on banks' liquidity levels. The ratio is still at a relatively high level.

Liquidity in the German banking system in the event of an interest rate hike Chart 2.2.3

Liquid funds as a percentage of liquidity outflow, as of June 2022



Source: Krüger et al. (2022).
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Risks from existing vulnerabilities could materialise in the medium term

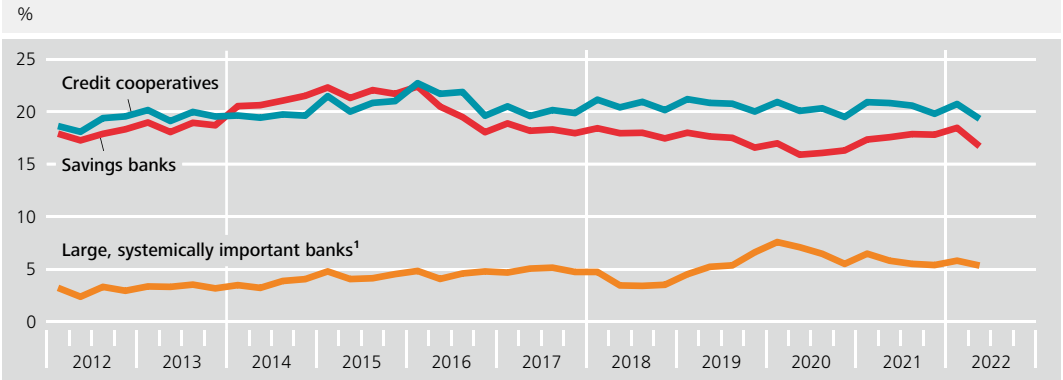
The German banking system has a high level of maturity transformation. Institutions exposed themselves to elevated liquidity and interest rate risk through maturity transformation. Institutions that conduct mainly traditional lending business, in particular, exhibit

61 Banks typically hold significantly more liquid assets than required in order to avoid falling below the regulatory threshold of 100% for the LCR.

above average maturity transformation levels. Positive maturity transformation means that the interest rate fixation period on investments exceeds that of liabilities. Liquidity risk could arise when deposits are withdrawn in unexpectedly large volumes and the bank in question is struggling or unable to service the outflows. If liquid funds were insufficient, the bank would be forced to refinance in some other way at higher costs or even to sell some of its assets at potentially large markdowns. During the Global Financial Crisis in particular, such fire sales played a major role in escalating the crisis. Interest rate risk arises from the fact that, owing to shorter fixed rate periods, rising interest rates are initially reflected more strongly in interest expenditure than in income. This is particularly the case for banks that refinance themselves in the market to a relatively large extent. By contrast, banks holding large shares of customer deposits with interest rates that tend to be less elastic are less affected.

Though maturity transformation declined slightly in the second quarter of 2022, it remains at a high level across large parts of the banking system. Maturity transformation can be approximated using the Basel interest rate coefficient. This is a key supervisory measure of interest rate risk in the banking book.[62] By changing the calculation formula, it can be turned into the aggregate duration of net assets. The Basel interest rate coefficient is comparatively high for savings banks and credit cooperatives owing to the significance of lending business. It is significantly lower for large, systemically important institutions (see Chart 2.2.4). Recently, the interest rate coefficient fell slightly. This could be because the present values underlying the calculation of the Basel interest rate coefficient decrease when interest shocks have already occurred.

Interest rate risk in the German banking sector* Chart 2.2.4



***** Present value loss on the banking book positions exposed to interest rate risk given an abrupt interest rate increase (200 basis points across all maturities), in relation to own funds (weighted average). Based on the institutions' reports on the Basel interest rate coefficient. **1** Includes the 14 other systemically important institutions (O-SIIs) in Germany.

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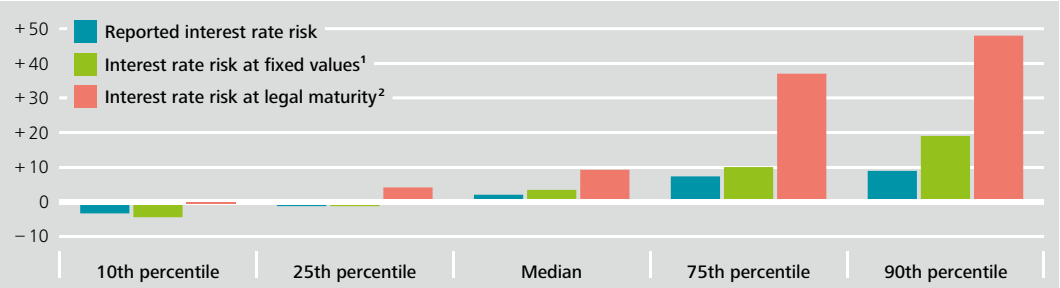
62 To calculate the Basel interest rate coefficient, banks establish the present value of their assets and liabilities and examine how it would change if the interest rate level rose abruptly by 200 basis points. This loss is expressed in relation to own funds. The Basel interest rate coefficient also includes a cut in the interest rate level by 200 basis points, with the larger loss in each of the scenarios being determinative. For most banks, the scenario with the rise in interest rates is the relevant one (see Chart 2.2.4).

Big banks may be underestimating their maturity transformation. Low Basel interest rate coefficient values are often due to the fact that a long holding period is estimated for customer deposits based on past experience. The estimated holding periods usually differ from the contractual maturities. The range of estimated values is wide for large, systemically important banks, spanning from one day to five years. The mean value for small customers' deposits is just over two years.[63] The importance of the assumed maturities to the size of the Basel interest rate coefficient can be assessed by assuming shorter maturities for holding periods. For example, if it is assumed that, for all large banks for which data are available, the maturities were consistently in line with the mean, the Basel interest rate coefficient would be 10 percentage points higher on average for one-tenth of the banks examined (see Chart 2.2.5). If the contractual holding period is assumed, this figure increases by a further 29 percentage points.

Interest rate risk* depending on various deposit maturities of German SSM banks**

Chart 2.2.5

%, as of March 2022



***** Present value loss on the banking book positions exposed to interest rate risk given an abrupt interest rate increase of 200 basis points, in relation to own funds. ****** Banks subject to the Single Supervisory Mechanism (SSM). The various deposits comprise deposits from non-banks with an undetermined maturity denominated in euro. **1** Fixed values correspond to the maturity averages of the various deposits, which are unweighted across banks. **2** Maturity of zero.

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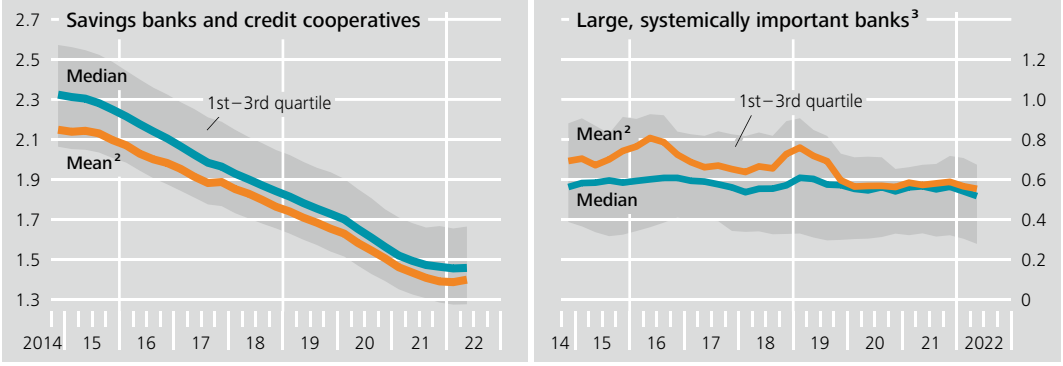
The net interest income of big banks fell markedly in the first half of 2022, while for small and medium-sized banks it showed signs of bottoming out. Big banks generally finance themselves via the market to a much greater extent than small and medium-sized banks, which may have caused a much greater increase in their interest expenditure. By contrast, small and medium-sized banks are mainly financed through customer deposits and are therefore less affected by the rise in interest rates on the cost side. For these banks, the protracted decline in the interest margin this year so far does not seem to have continued (see Chart 2.2.6). Most banks benefit from an increase in interest rates in the medium and long term. Empirically, the interest rate level and net interest income are positively correlated.[64] It is not yet clear whether current developments indicate a reversal of trends.

63 No reporting data are available for small and medium-sized banks that conduct maturity transformation to a much greater extent.
64 See Busch and Memmel (2017).

Net interest income of selected categories of banks in Germany Chart 2.2.6

As a percentage of total assets, quarterly data[1]



1 Moving average of the annualised quarterly report and the three preceding quarters. The time series are based on individual institution data. **2** Mean value weighted by total assets. **3** Includes the 14 other systemically important institutions (O-SIIs).

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In a supervisory stress test as at the reporting date at the end of 2021, the Bundesbank and BaFin examined, amongst other things, how a sharp rise in the yield curve of up to 200 basis points would affect small and medium-sized banks in the coming years.[65] In some cases, this scenario has already occurred over the course of 2022, especially in the area of short-term interest rates. As such, the institutions are expecting a significant decline in net interest income in the first year. Banks estimate that, in the event of an interest rate hike, net interest income would already be higher in the second year than in a comparable scenario of unchanged interest rates.[66] However, this scenario assumes a shock in which interest rates rise abruptly and banks do not adjust their balance sheets. In reality, interest rates often increase gradually and banks have the opportunity to react to an interest rate hike and adjust their balance sheets accordingly.

Default risk for loans to enterprises could increase significantly

A deterioration in the economic situation could lead to a significant rise in loan loss allowances. Owing to an extremely low interest rate level until recently and a long economic upswing that lasted until the coronavirus pandemic, loan loss allowances have remained at very low levels. At the end of 2021, banks' risk provisioning was not expected to grow given the favourable economic outlook. The economic outlook has deteriorated substantially since then, pushing up the risk of increased credit defaults significantly.

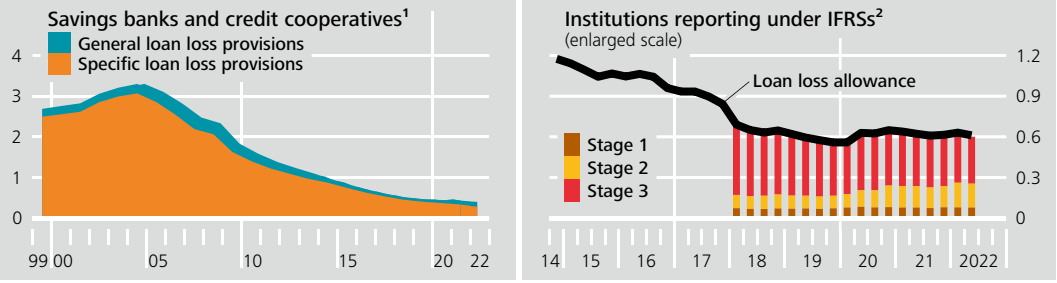
65 A total of six scenarios were examined. A severe interest rate scenario simulated a 200 basis point increase in the yield curve. For more information on this stress test, see https://www.bundesbank.de/en/press/press-releases/results-of-the-2022-lsi-stress-test-898038

66 Analyses based on balance sheet data and supervisory reports confirm this assessment.

Nevertheless, the rise in credit risk has so far not been reflected in loss allowances (see Chart 2.2.7). One reason for this may be that the impact of changes in the underlying economic conditions is often only seen in credit defaults after a time lag.

Components of risk provisioning in German institutions' lending business* Chart 2.2.7

As a percentage of gross lending



* The underlying credit definition includes book credits, certain bonds and the nominal value of contingent liabilities. Accordingly, the components of risk provisioning contain both write-downs for book claims and allowances for contingent liabilities. **1** Risk provisioning excluding reserves pursuant to Section 340f of the German Commercial Code *(Handelsgesetzbuch)*. **2** Comprises 14 institutions. The IFRS 9 loss allowance accounting standard, in force since 2018, defines three stages for the accounting treatment of exposures: performing (stage 1: all instruments upon origination or purchase), underperforming (stage 2: instruments with a significant increase in credit risk) and non-performing (stage 3: credit-impaired).

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For loans to enterprises in particular, falling income and higher interest expenditure may raise the risk of default. An economic downturn increases the risk that enterprises will no longer be able to meet their payment obligations if their earnings fall. Rising interest rates exacerbate this risk, as the interest burden grows. This elevates credit default risk. In new lending business, higher default risk is normally reflected to an appropriate degree in the risk premia for the lending rate. In the case of fixed interest loans that are already in the portfolio, however, the higher default risk does not affect risk premia.[67] This might lead to losses in banks' lending business, which may be more or less severe depending on the severity of the downturn.

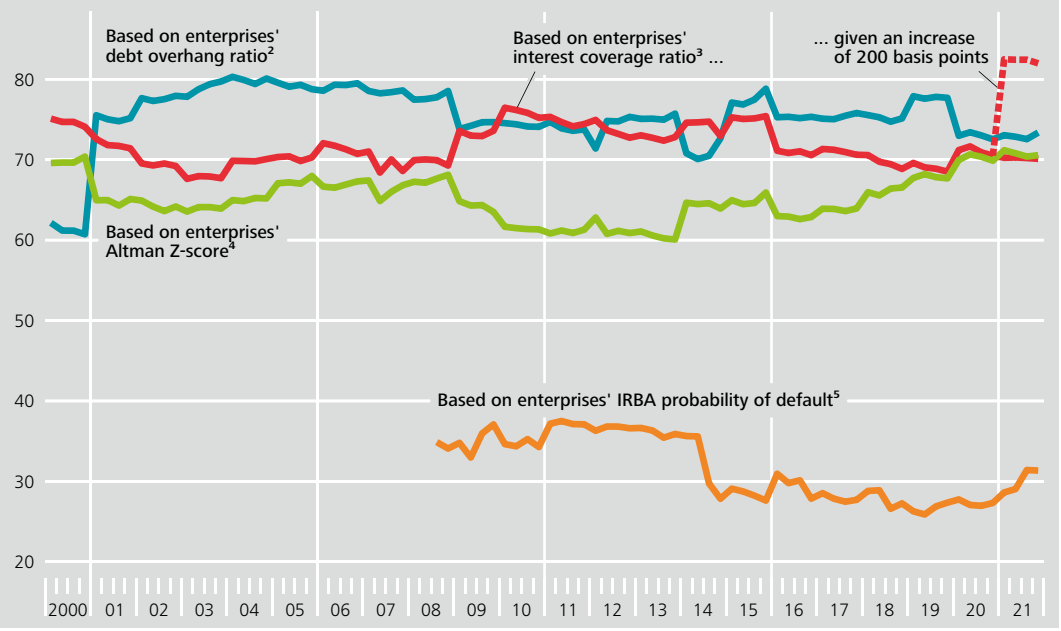
Relatively highly indebted enterprises make up a disproportionately large share of the loan portfolios. These allocation risks are reflected in enterprises' debt overhang ratio and interest coverage ratio.[68] At the end of 2021, loans to enterprises with an above average debt overhang ratio made up 73%, and those with a below average interest coverage ratio 70%, of banks' credit portfolio (see Chart 2.2.8). Allocation risks may have even increased since 2021 and may continue to rise going forward. Assuming a 200 basis point increase in lending rates from 2021 onwards, the share of loans with a below average interest coverage ratio would increase by just under 12 percentage points to 82%. Such a scenario has already materialised in part as a result of the rise in interest rates in 2022.

67 In order to prepare for an unexpected default, banks hold a proportional amount of equity against the loans.
68 The debt overhang ratio corresponds to the debt-to-EBITDA (earnings before interest, taxes, depreciation and amortisation) ratio. The interest coverage ratio is EBITDA over interest expenditure. For more on allocation risk, according to which banks' loan portfolios contain a comparatively large number of loans with above average risks. See Bednarek (2021) and Deutsche Bundesbank (2021).

Allocation risk in German banks' domestic credit portfolio

Chart 2.2.8

Loans to relatively risky non-financial corporations[1] as a percentage of total credit claims



1 Enterprises with above average risk, as measured by the median. **2** Ratio of total debt to EBITDA (earnings before interest, taxes, depreciation and amortisation). **3** Ratio of EBITDA to interest expenditure. **4** Z-score used to predict the probability of bankruptcy (generally within the next two years) based on balance sheet metrics (working capital, retained earnings, profitability and capitalisation). See Altman (1968). **5** Probabilities of default based on internal models (internal ratings-based approach or IRBA).

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Notwithstanding the large share of loans to comparatively highly leveraged enterprises, the share of enterprises with below average creditworthiness from the bank's perspective is small.[69]

Thus the share of loans with a relatively high probability of default was only 32%. The share is unlikely to have changed significantly since 2021, as the probabilities of default remained relatively stable. If the Altman Z-score is used to assess credit quality instead of the probability of default calculated by banks, the share of loans to relatively risky enterprises is much higher, at 70%.[70]

Losses could arise, in particular, on loans to energy-intensive enterprises. High energy prices can weigh considerably on enterprises that cannot pass the higher costs through to their customers. These firms may also be exposed to increased business risk in connection with the structural change caused by climate change (see the box entitled "Structural change and financial stability – challenges for macroprudential supervision" on pp. 83 ff.). Energy-intensive enterprises do not have a higher leverage ratio than other

69 Banks' credit assessment is reflected in the probability of default calculated by banks using their own internal procedures.

70 The Altman Z-score is a procedure used to assess enterprises' credit quality. It is calculated as a linear combination of weighted balance sheet metrics. See Altman (1968).

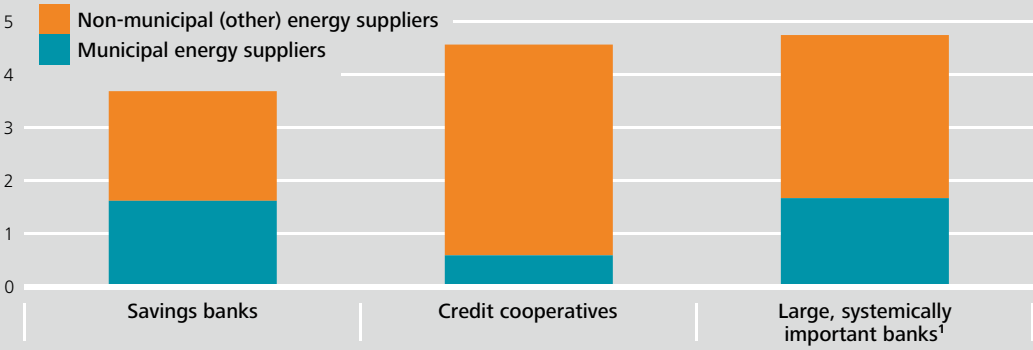
enterprises (see Chart 2.1.10 on p. 30). However, firms' debt sustainability diminishes if earnings decline over the long term. This would also entail increased credit default risks for the banking system. Taken together, these enterprises account for only around 6% of German banks' corporate loans. And yet, along the value chains, there are many indirect dependencies between German enterprises and energy price developments. It is difficult to quantify the indirect risks to banks.

Energy suppliers are a special case. Overall, German banks' credit claims on these enterprises account for only around 4.3% of loans to enterprises (see Chart 2.2.9). Credit cooperatives are comparatively heavily exposed to credit risk from private energy suppliers. Small and medium-sized banks are not more exposed to municipal energy suppliers than large banks. Credit risk appears to be fairly moderate owing to the low importance in the credit portfolio and fiscal support measures for energy suppliers.

On-balance-sheet credit claims on energy suppliers*

Chart 2.2.9

%, as of Q1 2022



* On-balance-sheet credit claims on energy suppliers in relation to the portfolio of loans to non-financial corporations. **1** Includes the 14 other systemically important institutions (O-SIIs) in Germany.

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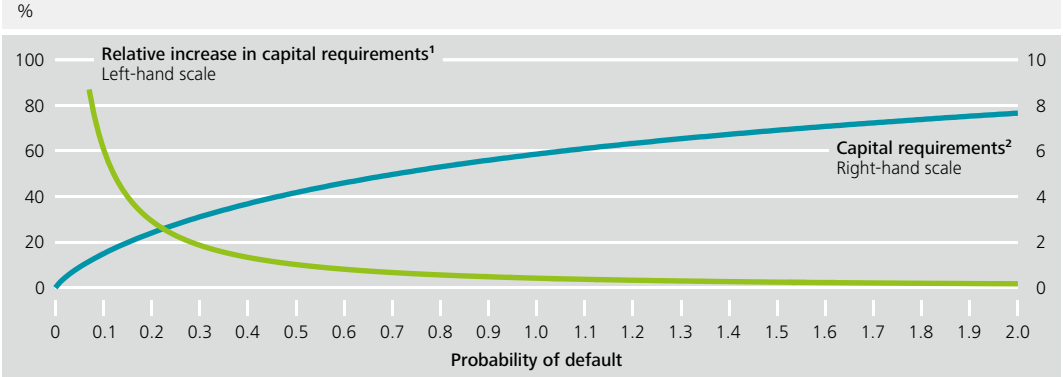
Banks could indirectly experience losses from their role in energy exchanges. Several banks are represented on European energy exchanges as clearing members. In this function, they ensure that companies in the energy sector, in particular, have access to central counterparties (CCPs) and thus to exchange trades. If a participant defaults during the life of the transaction, such a clearing bank assumes the existing payment obligations of the defaulted participant. Banks tap the deposited collateral. If it is not sufficient, they must bear the additional losses themselves. As a result of energy price developments, the collateral requirements for exchange-traded energy derivatives have risen sharply. In certain scenarios, there is a danger of market participants, especially energy companies, defaulting (see the chapter entitled "Current issues putting central clearing to the test" on pp. 115 ff.). Overall, however, the potential losses for the German banking system appear to be limited.

The probability of default on loans to enterprises calculated by banks could increase in future. In the past, large banks, in particular, credited enterprises with having very low PDs. A key driver of PDs falling up until recently is likely to have been the drop in enterprises' interest burden. At the end of 2020, enterprises' average interest expenditure amounted to around 1% of total assets. Owing to the rise in interest rates, it is now likely to be significantly higher and could rise further. In the past, an increase of 1 percentage point in the interest expenditure ratio was accompanied, on average, by an increase of just under 0.1 percentage point in the average PD on loans to enterprises as calculated by banks. This means that the PDs would currently increase by around 30%. Similarly, a poorer economic outlook is likely to drive up default risk significantly. The average PD would likewise rise by 30 percentage points if enterprises' return on equity were to fall by 5 percentage points.

Owing to increasing probabilities of default, capital requirements for loans to enterprises could go up significantly overall going forward. In particular, the large, systemically important banks which use internal models to calculate capital requirements currently have low risk weights for their loans to enterprises.[71] However, the risk weights may not correspond to the actual credit risk and may be too low.[72] A gloomier economic outlook and a higher interest burden could worsen enterprises' credit assessment, which is quantified in banks' models as the PD on corporate loans. The percentage increase in capital requirements on higher PDs could be relatively steep. This is because the current PDs are mostly low and the risk weight function is concave (see Chart 2.2.10).[73] If a loan with an average PD of 0.35% is taken as a basis, a 0.1 percentage point increase in the PD

Capital requirements as a function of the probability of default (PD)* Chart 2.2.10



Source: BIS. ***** The calculation complies with the Bank for International Settlements (BIS) standards for calculating risk-weighted assets for credit risk (CRE). In this example, a loss given default (LGD) of 45% and an effective maturity of one year are assumed. **1** Given a 0.1 percentage point increase in PD. **2** Refers to the exposure at default (EAD) on a standardised loan.

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71 The bank's capital requirements are calculated as the sum total of risk-weighted assets (RWAs). Large, systemically important banks, in particular, use internal models to calculate risk weights in lending business.
72 See inter alia Deutsche Bundesbank (2021).
73 The risk weight function assigns a specific risk weight to the PD on a loan. The capital requirement amounts to 8% of the product of risk weight and the part of the loan that is at risk of default.

increases the capital requirement for this loan by 16%. By contrast, if the PD is set to 1%, the capital requirement would increase by only 4%.[74]

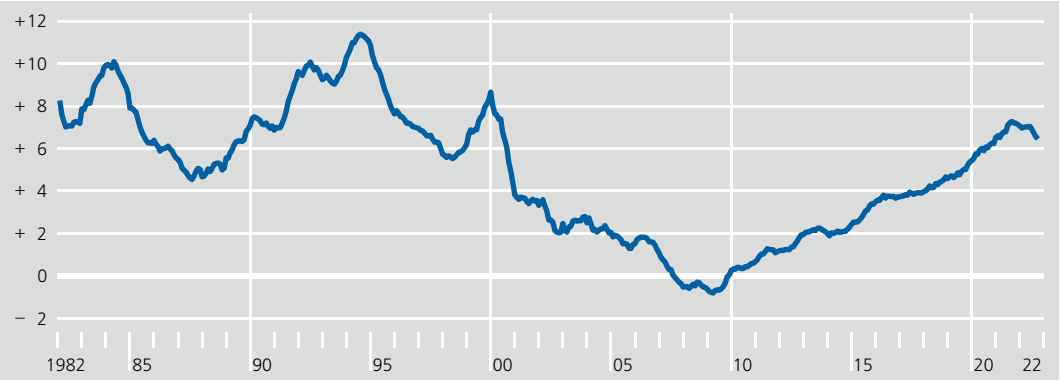
Vulnerabilities from real estate loans continue to exist

In the case of residential real estate loans, loan loss allowances could increase. Small and medium-sized banks, in particular, have significantly expanded their real estate lending in recent years (see Chart 2.2.11). Following the rise in interest rates and a potential economic downturn, credit defaults in this area could rise. The increase is likely to be gradual owing to the typically long interest rate lock-in periods. Banks' losses are also limited by the fact that loans are secured by real estate. Even a sharp slump in house prices would, taken in isolation, only lead to comparatively moderate losses. In a scenario where house prices fall by 30% and unemployment rises to 10%, banks' losses would only amount to 0.7% of the affected loan volume.[75] In a systemic view, however, further effects would occur, possibly also affecting other parts of banks' credit portfolio.

In an economic downturn, there is also a risk of higher loan loss allowances for commercial real estate loans. Commercial real estate loans account for a relatively large share (8%) of German banks' total assets. The results of surveys conducted among banks in July 2022 suggest that they are expecting higher risks associated with new commercial

German banks' lending to domestic households for house purchase* Chart 2.2.11

Year-on-year percentage change, seasonally adjusted, month-end data



***** Including non-profit institutions serving households. Up until 1991, data only for West Germany.
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74 The risk weight function is a concave function of the PD. This means that the slope of the curve decreases as the PD increases.
75 For details on the underlying model, see Barasinska et al. (2019).

Impact of the macroprudential measures

In January 2022, the Federal Financial Supervisory Authority (BaFin) announced a package of macroprudential measures aimed at strengthening the resilience of the German banking system. The measures had become necessary because high vulnerabilities had built up in the German banking system in previous years.[1] BaFin therefore announced that it would raise the countercyclical capital buffer (CCyB) to 0.75% of domestic exposures and introduce a sectoral systemic risk buffer (sSyRB) of 2% for loans secured by residential real estate located in Germany. While the CCyB is designed to ensure the banking system is resilient to cyclical vulnerabilities, the sSyRB additionally increases the resilience of lenders that are especially active in the area of residential real estate financing in Germany. Banks have until 1 February 2023 to satisfy the buffer requirements in full. Furthermore, supervisors have called on lenders to apply prudent lending standards in residential real estate financing.

The macroprudential measures aim to strengthen the resilience of the banking system by building up capital buffers for periods of stress. The capital buffers can absorb losses during periods of stress and thus counteract excessive lending constraints. While the buffers are being built up, however, the buffer requirements might, as a side effect, decrease banks' credit supply if they were to reduce their risk-weighted assets (RWAs). This would increase banks' capital ratio and thus stabilise their excess capital relative to their risk-weighted assets. Particularly banks with lower capitalisation might reduce their credit supply or issue loans with a lower risk of default. At the level of individual banks, this may certainly be a desirable side effect, as it would dampen balance sheet growth at banks with lower capitalisation. Better-capitalised banks could partly compensate for a potential decline in the supply of credit. This would then result in a redistribution of lending within the banking system without credit supply being constrained excessively overall. Macroprudential supervisors do not currently expect the macroprudential measures to substantially impair the credit supply of the banking system, as most banks already have sufficient excess capital to satisfy the buffer requirements.[2] The impact of the macroprudential measures is reviewed on a regular basis.

1 See German Financial Stability Committee (2022a).
2 See German Financial Stability Committee (2022b).

The buffer requirements preserve existing excess capital in the banking system and, in the medium term, provide banks with an incentive to build up new excess capital. In the second quarter of 2022, the banking system did not increase its capital base compared with the same quarter of the previous year. Nor was that expected, as most banks are already able to satisfy the additional buffer requirements with their existing excess capital.[3] Nonetheless, the buffer requirements strengthen the resilience of the banking system by preserving excess capital of around €23 billion, or just under 5% of the German banking system's common equity tier 1 (CET1) capital. Compared with the banking system as a whole, there was a greater increase in capital by institutions that were unable to fulfil the requirements with their existing excess capital when the macroprudential measures were announced. Nevertheless, a number of smaller banks will need to build up further capital in the coming quarters in order to satisfy the communicated buffer requirements.[4] In the medium term, all banks will probably have an incentive to build up additional capital in order to return to their desired excess capital ratio.

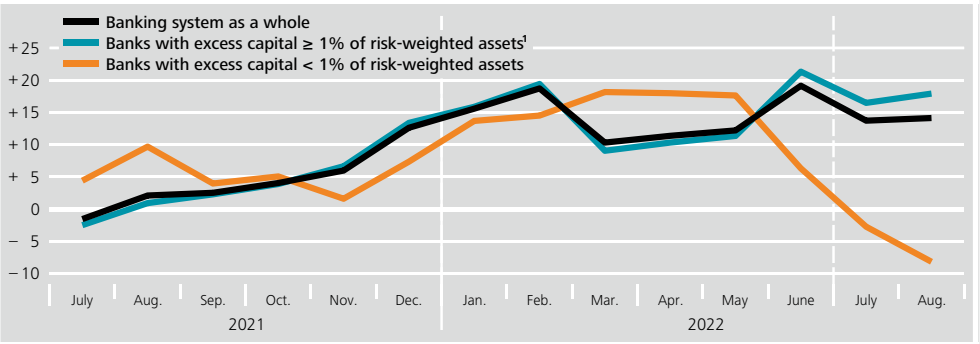
So far, there is no indication that the macroprudential measures have significantly dampened the lending of the banking system. The German banking system's new lending to non-financial corporations and households also partly experienced a significant year-on-year increase in the months following the announcement of the measures (see the chart). The risk premium on loans, i.e. the difference between the lending rate and the risk-free reference rate, has not risen.[5] Moreover, no significant changes in the structure of loan portfolios are visible in the aggregate in the first half of 2022 despite the sSyRB increasing the capital requirements for residential real estate loans, in particular.[6] Ultimately, however, causal impacts of the macroprudential measures on credit supply cannot be identified so far, as these are obscured by changes in the macro-financial environment, and lending is affected by both credit supply and credit demand factors.

To date, there are no significant differences between the new lending of banks with lower excess capital and that of better-capitalised banks. The aggregate view could mask shifts in new lending from banks with relatively low capitalisation

3 Excess capital is the share of CET1 capital that exceeds the minimum requirements and the buffer requirements.
4 These banks account for 1.4% of the total assets of the banking system.
5 The weighted, risk-free reference rate for loans with a maturity of one year or less is based on the euro interbank offered rate (EURIBOR); for loans with a maturity of more than one year, it is based on Federal bond yields.
6 See Geiger (2022).

New lending to non-financial corporations and households

Year-on-year percentage change in cumulated new lending over three months



1 Based on a representative sample. Excess capital is the share of CET1 capital that exceeds the regulatory requirements, relative to risk-weighted assets.

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to better-capitalised banks.[7] Over the first half of 2022, both groups saw a similar year-on-year increase overall in their new lending to enterprises and households, although the extent of this varied in the individual months (see the chart). While new lending by banks with lower capitalisation was lower than the previous year in July and August 2022, better-capitalised banks overcompensated for this development, which meant that the banking system as a whole significantly expanded its new lending during these months, too. The differences in new lending between banks with higher and lower capitalisation are not statistically significant after factoring other bank characteristics as well as bank and time-fixed effects into the estimation.

Since the beginning of 2022, banks have partially tightened their lending standards for residential real estate financing. Supervisors' communication regarding lending standards was intended to counter the potential build-up of risk in new lending business. The loan-to-value ratio (LTV) for newly issued residential real estate loans did in fact continue to fall (see the section entitled "Situation in the household sector" on pp. 33 ff.).[8] However, there was a significant increase in the debt service of new borrowers relative to their income. To what extent these developments are directly attributable to the macroprudential measures cannot be judged conclusively based on the available information. Nonetheless, lending standards were probably influenced to a large extent by the macro-financial environment and the situation in the housing market.

7 Here, banks are classified as having lower capitalisation if their excess capital is less than 1% relative to their risk-weighted assets. Banks with at least 1% excess capital are classified as better capitalised. Excess capital is the share of CET1 capital that exceeds the regulatory requirements.
8 Based on information from Interhyp Group.

real estate loans (see the chapter entitled "Commercial real estate and the German financial system" on pp. 97 ff.). Credit institutions are expecting to tighten their credit standards and credit terms and conditions in the coming months.

Situation in the insurance sector

At present, the risk situation in the German insurance sector is being shaped largely by the increase in interest rates, high inflation and uncertainty surrounding asset prices. Through their investments, insurers have a significant impact on the market prices of securities and the efficient allocation of financial resources. In the past, life insurers and pension funds promised households guaranteed returns. They now face the challenge of generating sufficiently high returns on their investments to achieve these guaranteed returns on a long-term basis. Rising risk-free interest rates make it easier for life insurers to generate the minimum return guaranteed in their policies in the long term.

Life insurers are exposed to interest rate risk, but vulnerability to interest rate changes is likely to have declined somewhat structurally in recent years. They will tend to benefit from rising risk-free interest rates because on-balance-sheet liabilities will fall more sharply than on-balance-sheet assets. This is because the liabilities have longer maturities than the assets. In recent years, life insurers have reduced this gap between liabilities and assets, thereby mitigating their interest rate risk. As a result, own funds in the Solvency II balance sheet are less sensitive to changes in risk-free interest rates. According to BaFin surveys, this trend is likely to continue.[76]

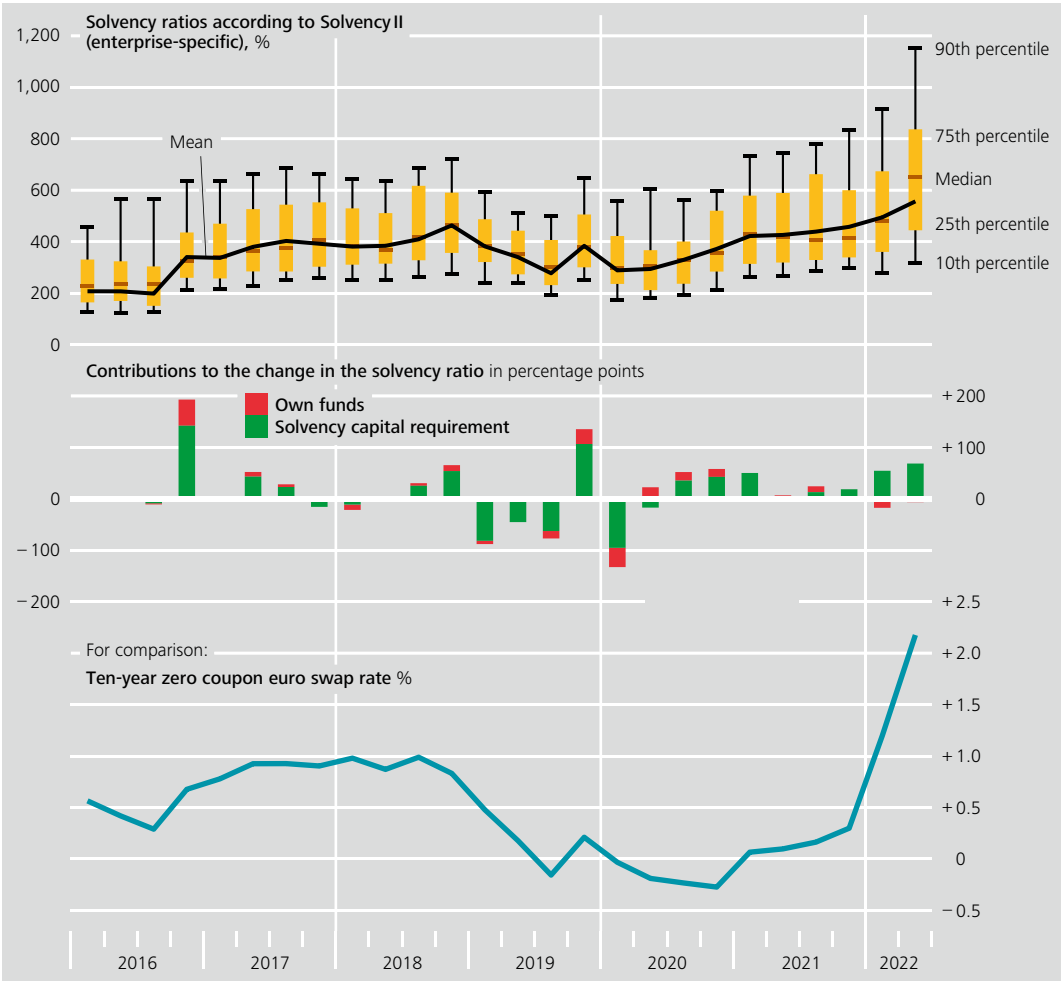
The share of corporate bonds with below average credit quality in insurers' bond portfolios has risen. This is likely to have been due to the search for yield in an environment of low interest rates, which had lasted for many years. In addition, rating downgrades have contributed to a reduction in the credit quality of insurers' asset holdings. The insurance sector has thus become more exposed to an increase in risk premia on securities in recent years.

The increase in risk premia since the end of 2021, in particular, has reduced life insurers' own funds overall. Taken in isolation, the rise in the risk-free interest rate would have led to an increase in own funds (see Chart 2.2.12), as life insurers' liabilities, owing

76 As part of its extended forecast, BaFin surveys life insurers' projections of Solvency II indicators.

Solvency ratios of German life insurers according to Solvency II* Chart 2.2.12

End-of-quarter levels



Sources: Federal Financial Supervisory Authority and Bundesbank calculations. * Shown here are the solvency ratios of the 63 life insurance corporations for which reports are available throughout.

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to their longer maturity, fall more sharply in value than their assets when interest rates go up. However, the positive effect was more than offset by the higher risk premia.

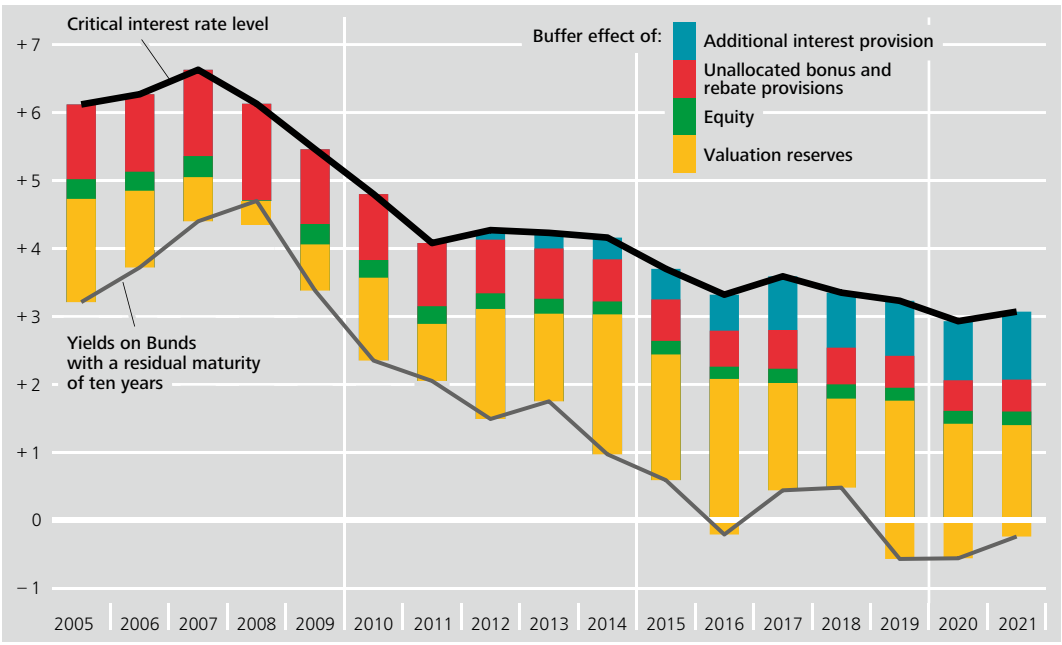
Nevertheless, the solvency ratios of life insurers have risen significantly since the beginning of 2022. The median prudential solvency ratio, i.e. the ratio of own funds to capital requirements, rose from just over 400% at the end of 2021 to nearly 670% in the first half of 2022.[77] This is the largest increase since the introduction of Solvency II in 2016. It was due primarily to a decline in own funds requirements, to which a fall in Solvency II total assets is likely to have contributed.

77 The market value-oriented approach taken by Solvency II means that permanent coverage of the requirements by own funds must equal at least 100%.

A very sharp rise in interest rates would entail liquidity risk for life insurers. That case could lead to a wave of policy lapses. According to model calculations, such a scenario could occur if yields on Bunds with a residual maturity of ten years were to exceed 3% in the short to medium term (see Chart 2.2.13).[78] The current yield on Bunds with a residual maturity of ten years is now over 2% and has thus moved closer to the critical level of 3%. The scenario of a wave of policy lapses has become more likely in this respect. However, the model does not take into account the other benefits of life insurance for policyholders, which make it less advantageous to terminate their policies, such as protection against biometric risks or tax advantages. The valuation reserves for fixed income assets in life insurers' portfolios have fallen accordingly. If the market value of German life insurers' investments were to decrease to such an extent that the surrender values were no longer fully covered by capital, it could be advantageous for policyholders to terminate their policies.[79] As a result, some life insurers might be forced to liquidate some of their unrealised losses created to some extent by the recent interest rate rises. Irrespective of this, a growing need for liquidity in the event of interest rate increases or exchange rate volatility can arise from margin calls for interest rate and foreign exchange derivatives acquired by insurers to hedge against interest rate risk and exchange rate risk. If, for

Critical interest rate level for German life insurers given an upsurge in policy lapses*

Chart 2.2.13



Sources: Federal Financial Supervisory Authority and Bundesbank calculations. * The analysis looked at the aggregate of around 70 large German life insurers, each with assets of over €500 million at book values in 2016 prices.

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78 For details on the underlying model, see Förstemann (2021).
79 For more information on lapse risk in the event of rising interest rates, see Förstemann (2021), Chang and Schmeiser (2022), Kubitza et al. (2022) and Cheng et al. (2022).

example, insurers have to sell off bonds in order to obtain liquidity, interest rates will continue to rise, all else being equal. This would trigger further margin requirements and encourage a self-reinforcing process. In the first half of 2022, such margin requirements from derivative positions led to outflows of liquidity from insurers, though no self-reinforcing processes occurred.

Geopolitical risks are weighing on the insurance sector. Although it is doing little business in Russia, Ukraine and Belarus, and there is likewise little foreign direct investment in Russia, the insurance sector could be indirectly vulnerable owing to its exposure to energy-intensive sectors. This accounts for 11% of its exposure to non-financial corporations.

The currently very high inflation rates are having a negative impact on non-life insurers and reinsurers, in particular. The impact on life insurers will be less pronounced, as their payouts were usually set in nominal terms at the time of the conclusion of the contract. Assuming that inflation risk will lead to higher long-term nominal returns, the life insurance sector could even benefit from lower valuations on the liabilities side. By contrast, the liabilities of non-life insurers and reinsurers are likely to increase, which is likely to be reflected in a reduced solvency ratio.[80]

Situation in the investment fund sector

Assets under management in the German investment fund sector have recently fallen slightly. Russia's war against Ukraine and the resulting deterioration in the macroeconomic environment have, for the time being, choked off the sector's long-term growth. However, unlike the shock triggered by the COVID-19 pandemic, where large net outflows and liquidity frictions occurred, the decline in financial assets is currently mainly due to valuation losses in the portfolios. The current macroeconomic shocks are affecting individual regions of the world, such as Europe, more than others. Against this background, the investment fund sector could benefit from the increased geographical diversification of its investments in recent years.

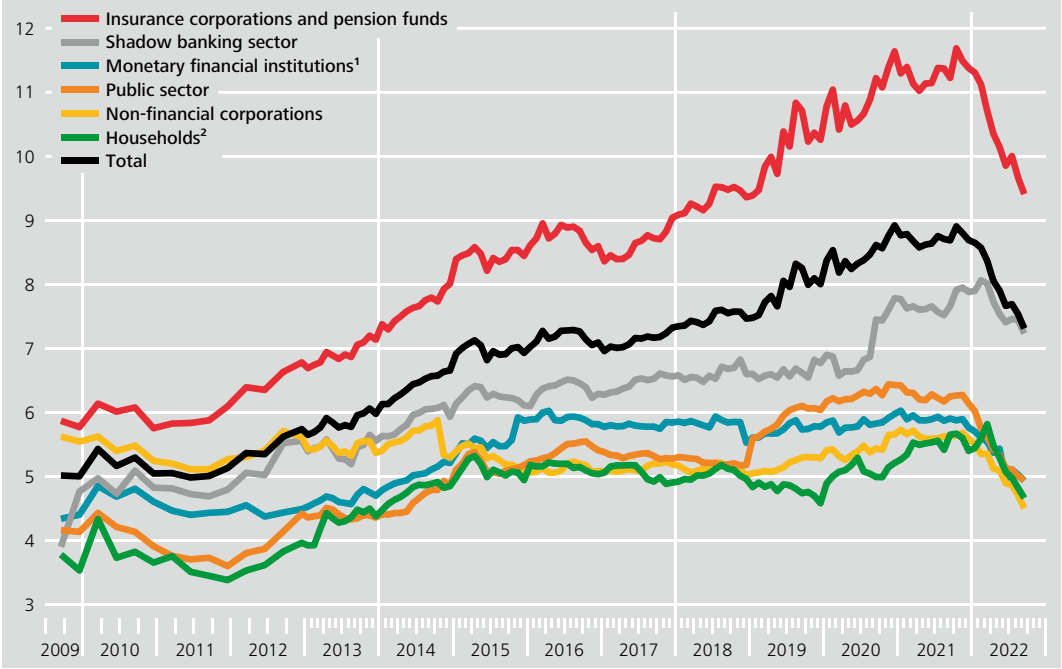
Interest rate risk is materialising in the fund sector. In the low interest rate environment of recent years, the German investment fund sector increased its maturity transformation and significantly expanded the average capital commitment period, i.e. portfolio

80 The European Insurance and Occupational Pensions Authority (EIOPA) estimates that the increase in inflation will have reduced the solvency ratio by 10 percentage points in a calculation for an exemplary insurance corporation. See European Insurance and Occupational Pensions Authority (2022), pp. 94 ff.

Portfolio duration* of German open-end investment funds by holder group

Chart 2.2.14

Weighted means in years



Sources: Centralised Securities Database (CSDB), Bundesbank statistics and Bundesbank calculations. * Mean (Macaulay) duration of the bond portfolio. **1** Excluding money market funds. **2** Including non-profit organisations serving households.

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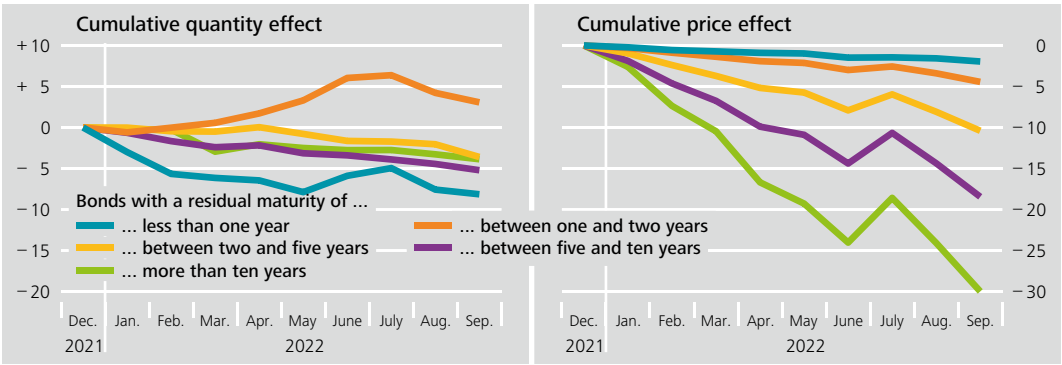
Price and quantity effects on investment funds' bond portfolio amid rising interest rates

Chart 2.2.15

%



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duration. This made German funds vulnerable to the rise in interest rates in 2022. Although, in the aftermath of the interest rate reversal, the fund sector's average portfolio duration has fallen by 15.9% since the beginning of the year (see Chart 2.2.14), this marked decline can be attributed mainly to sales as well as, in particular, to losses on long-dated bonds (see Chart 2.2.15).

The fund sector's high degree of interconnectedness can lead to contagion effects. In September 2022, insurers and pension funds held around 42% of the net fund assets in the German investment fund sector. By contrast, open-end investment funds and banks held only 14% and 9% respectively. A mere 27% were owned by households and non-financial corporations. Procyclical behaviour on the part of fund investors during a price shock can amplify the impact on financial stability if they react by withdrawing liquidity and the fund sector has to sell off securities, thus exacerbating the initial price slump.[81] Although new instruments to manage investment funds' liquidity have been introduced in order to lower the risk of large-scale withdrawals by investors and the associated liquidity risk, these have not yet been implemented across the board.

The strong intrasectoral interconnectedness of the fund sector makes it difficult to assess the consequences of possible distress. German investment funds are increasingly holding shares in each other's funds. Whilst investment fund shares accounted for only 9% of the assets held by German funds in September 2009, their share in September 2022, at 21%, already amounted to around one-fifth of the assets held by German funds. Investments by funds in other funds are making fund investments ever more similar, in particular, as funds are increasingly investing in the same vehicles.[82]

Risk scenario for the German financial system

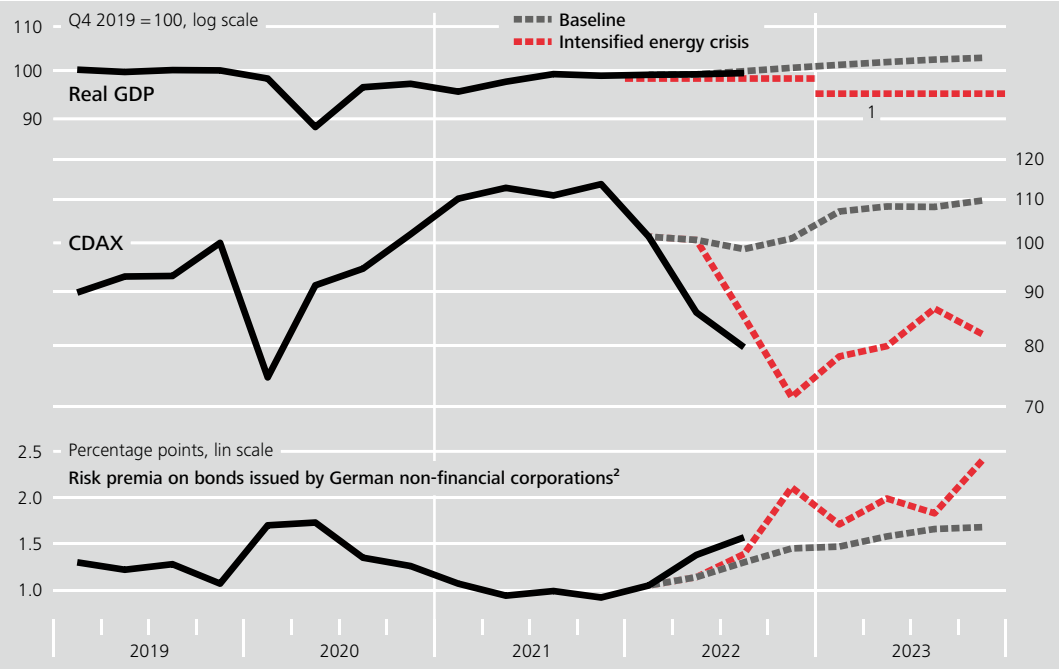
The current macro-financial environment and the economic outlook pose significant challenges for the German financial system. Over the course of the year, the uncertainty surrounding economic developments has increased, credit terms and conditions for borrowers have been tightened, and a recession has become more likely (see the section entitled "Macro-financial environment" on pp. 17 ff.). Last year, a scenario analysis by the Bundesbank showed that under unfavourable circumstances, a severe macro-financial shock could lead to heavy losses in the German financial system.[83] Germany's economy has already in the past been vulnerable to an adverse scenario in which economic activity slumps and both market interest rates and risk premia increase. These vulnerabilities, which have been building up within the German financial system for several years, comprise the potential underestimation of credit risk, the overestimation of loan collateral and substantial interest rate risk.[84] In view of these vulnerabilities, BaFin announced a package of macroprudential measures intended to strengthen the resilience

81 See Fricke and Wilke (2020) and Fricke et al. (2022).
82 Derivatives positions were not included in the analysis.
83 See Deutsche Bundesbank (2021).
84 See Deutsche Bundesbank (2018, 2019, 2020a, 2021).

of German banks against adverse macroeconomic developments in January 2022 (see the box entitled "Impact of the macroprudential measures" on pp. 58 ff.).

A scenario analysis is used to estimate how the changed macro-financial environment and a potential intensification of the energy crisis could impact on the German financial system. In concrete terms, an adverse macroeconomic scenario from the Bundesbank's June 2022 Monthly Report is examined.[85] This scenario assumes, in contrast to the baseline projection, that energy prices rise steeply and that energy exports from Russia to the EU stop completely.[86] This then leads to energy rationing and cutbacks in production. Sectoral supply chain interlinkages are taken into account when calculating losses of value added on the basis of input-output tables, and it is borne in mind that sectors would be affected by a gas supply halt to differing degrees. Furthermore, supply chain problems are exacerbated in the scenario, and growth in German exporters' sales markets falls well below the baseline level.[87] As a result, GDP plummets, particularly in 2023 (see Chart 2.2.16). In addition, the sharp real economic downturn is assumed to be accompanied by additional macro-financial stress. In line with this, the value of German shares

Selected developments in the baseline scenario and risk scenario Chart 2.2.16



Sources: Federal Statistical Office, Deutsche Börse AG, Banque de France and Bundesbank calculations. **1** Annual averages. **2** See Gilchrist and Mojon (2018).

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85 In the present scenario analysis, only the period from the second quarter of 2022 to the second quarter of 2023 is studied. The scenario actually extends to the fourth quarter of 2024.
86 The technical interest rate assumptions are based on market expectations for the three-month short-term EURIBOR and the yield on government bonds with a residual maturity of around ten years (as at mid-May 2022).
87 For a detailed description of the underlying adverse macroeconomic scenario, see Deutsche Bundesbank (2022c).

is projected to deteriorate considerably relative to the second quarter of 2022, while risk premia on German corporate bonds widen markedly.[88]

The effects of the scenario on the balance sheets of German banks, insurers and funds are studied using various analysis modules.[89] The model calculations track the effects on loan and securities portfolios in the second quarter of 2022 over the next four quarters. In the credit risk module for the banking system, the impact of increasing credit default risk on corporate and residential real estate loans is studied (see Table 2.2.2).[90] Here, it is taken into account that enterprises make recourse to credit lines, particularly when there is a steep rise in their sector's credit default rates and they have scarce liquid funds at their disposal. The market risk module approximates losses in the securities portfolios of German banks, insurers and investment funds. In addition, the banks' annual profit is modelled.[91] This is heavily influenced by interest income.[92] Above and beyond this, the analysis determines the extent to which banks would have to scale back assets such as loans or securities in order to prevent their capital ratios from falling below a certain target ratio.[93] In the investment fund sector, potential second-round effects are also analysed: if investors withdraw capital, funds may feel forced to sell off securities, resulting in a further decline in their prices.

88 The increased macro-financial stress described does not form part of the scenario in the Bundesbank's June 2022 Monthly Report. These assumptions are based on conditional forecasts from a Bayesian vector autoregressive (BVAR) model. In concrete terms, the BVAR model comprises, aside from key variables from the scenario in the aforementioned Monthly Report, a broad German stock index and a variable for the risk premia on German corporate bonds. The expected paths of the additional variables are based on conditional forecasts created under the assumption that key variables will develop as in the scenario simulations.

89 See Falter et al. (2021) and Pelzer et al. (2021). As granting loans accounts for only a small part of German insurers' and investment funds' business activities, they are almost exclusively subject to market risk. However, this risk could increase if credit risk also rises.

90 See Memmel and Roling (2021) and Barasinska et al. (2019). In the module on loans to non-financial corporations, the relationship between GDP growth and credit default rates is modelled using quantile regressions (90% quantile). These take into account the fact that the empirical relationship between the highest and lowest values of both variables may differ from the relationship between their mean values.

91 Here, net interest income is projected on the basis of interest rate developments. In addition to net interest income and the valuation result, a residual figure of the profit and loss account remains; this is expressed relative to total assets. The median of this residual value is subsequently calculated for each bank for the period from 2017 to 2021, and is then used in the scenario analysis.

92 Inflation expectations are not directly taken into account for either securities losses or net interest income; rather, they are only indirectly considered via the development of market interest rates.

93 Here, two extreme cases are considered: either the banks use their macroprudential buffers and have a target ratio just above the regulatory minimum capital requirements of Pillar I and Pillar II, or the banks do not use their buffers – just their excess capital – and attempt to achieve a target capital ratio that corresponds to the overall capital requirements (minimum capital requirements of Pillar I and Pillar II and combined buffer requirements).

Overview of modules and modelling of stress effects Table 2.2.2

Module	Credit risk for loans to non-financial corporations (losses and rise in RWAs)	Credit risk for residential real estate loans (losses and rise in RWAs)	Market risk[2]	Annual profit
Stress effects	Projection of loss ratios based on the correlation between sector-specific default rates and domestic GDP.[1] Projection of drawn credit lines based on the aggregate path according to the scenario. Sectors with higher loss ratios and lower cash to fixed costs ratios draw more credit lines in relative terms.	Projection of loss ratios based on the assumed path of the unemployment rate and the residential real estate price in the respective scenario.	Projection of losses on securities based on the assumed path of the CDAX, Bund yields and the risk premia of non-financial corporations in the respective scenario.	Projection of net interest income based on the yield curve in the respective scenario. For the sum of the remaining components of the profit and loss account, the median of the past five years is extrapolated.
Intermediaries affected	Banks	Banks	Banks, insurers, investment funds[3]	Banks
Second-round and amplification effects	For banks: deleveraging (loans, liquid assets) For investment funds: deleveraging, capital withdrawals, second-round effects on securities and investment fund share prices			

1 Modelling of the 90% quantile of default rates using quantile regression on the basis of data from 2008 to 2020. **2** Market risk includes the default risk of market-traded assets (e.g. shares, bonds). **3** Second-round effects in the German fund sector have an impact on banks and insurers that hold corresponding fund shares.

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Risk of real economic contagion effects in the event of an intensified energy crisis

In the intensified energy crisis scenario, significant losses could occur in the loan and securities portfolios of German banks. The capital reserves of the German banking system comprise excess capital and the macroprudential buffers, and amounted to 6.9% in June 2022 relative to risk-weighted assets (see Table 2.2.3).[94] In the risk scenario,

94 Excess capital is CET1 capital that banks hold on a voluntary basis over and above the capital requirements (minimum capital requirements of Pillar I and Pillar II plus buffer requirements). Only the portion of the capital reserves that can be used without breaching parallel minimum requirements from the leverage ratio is taken into account.

the ratio of capital reserves to risk-weighted assets decreases by 2.8 percentage points. The greatest losses are generated by defaults on loans to enterprises. In addition, enterprises make recourse to credit lines. However, this is only slightly responsible for the rise in risk-weighted assets. Furthermore, in the scenario, substantial losses are also incurred due to market risk. One reason for this is that rising interest rates have a negative impact on the prices of securities. As small and medium-sized banks have hardly any hidden reserves (see the section entitled "Risk situation of the German banking system" on pp. 45 ff.), these can no longer have a dampening effect, either. Losses and the rise in risk-weighted assets from residential real estate loans are, overall, relatively minor in this scenario.[95]

The higher level of interest rates results in increased net interest income at some banks over the observed one-year horizon; however, on aggregate, this is insufficient to offset additional losses. Banks that predominantly engage in deposit and lending business and are therefore greatly dependent on maturity transformation are negatively affected by a rise in the short-term interest rate over the observed one-year horizon. At banks with a more diversified business model and less of a dependence on maturity transformation, by contrast, such a rise in the interest rate tends to have a positive effect on interest income in the short term.[96]

Banks may respond to losses by reducing their holdings of relatively riskier assets such as securities and loans to non-financial corporations in order to stabilise their capital ratios. The extent to which this deleveraging occurs also depends on the extent to which banks use their buffers. Use of the buffer is defined as a bank temporarily undershooting its macroprudential buffer requirements.[97] This reduces deleveraging in response to losses, which then has a stabilising effect on lending. When banks use their buffers – i.e. aim for a target capital ratio just above the minimum requirements – they reduce their assets by 0.8%, thus increasing their capital reserves by 0.1 percentage point. If they do not use their buffers, risk-weighted assets thus fall more sharply, by 4.4%; meanwhile, capital reserves increase by 0.5 percentage point.

In the selected model framework, a substantial restriction of lending by the banking system may occur in the intensified energy crisis scenario, thus triggering con-

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95 The econometric models implemented for the projection of residential real estate prices are estimated using empirical data. In the past, residential real estate prices in Germany have barely decreased, or have actually increased, even when there has been a sharp decline in GDP.

96 Over a longer observation horizon, banks are likely to benefit from rising interest rates and record higher interest income. The pull-to-par effect, i.e. where the bond price converges to its nominal value towards its maturity date, can also be expected to generate medium-term profits in bond portfolios.

97 When banks undershoot the buffer requirements, they accept supervisory consequences such as restrictions on the distribution of bonuses or dividends. If buffers are released by the supervisory authorities – that is to say, the requirement is lowered to zero – these restrictions fall away and banks' excess capital rises immediately. For example, the countercyclical capital buffer is intended to be released in the event of adverse developments, where heavy losses are incurred or are clearly indicated, and there is a risk of excessive restrictions on lending.

Scenario analysis: effects of an intensified energy crisis

Table 2.2.3

%, as at Q2 2022

Impact on German banks and their lending		
	Effects of the intensified energy crisis scenario	
Scenario metric	with use of buffers	without use of buffers
Starting situation		
Capital reserves[1] (% of RWAs[2])	6.9	
Capital depletion		
Change in RWAs	8.6	
Change in CET1 capital (% of RWAs[2])	– 2.3	
Increase in credit risk, non-financial corporations	– 1.5	
Increase in credit risk, residential real estate	0.0	
Increase in market risk	– 1.1	
Net interest income and other income	0.3	
Capital reserves after stress (% of RWAs)	4.1	
Deleveraging		
Change in RWAs	– 0.8	– 4.4
Capital reserves after deleveraging (% of RWAs)	4.2	4.6
Reduction in lending		
Change in lending to enterprises[3]	– 1.2	– 8.8
Real economic effect		
Additional GDP effect (percentage points)[4]	–	– 4.4
GDP growth after stress	– 4.2	– 8.6

Detailed results for market risk module	
Scenario metric	Changes
Banks – first-round effect	
Banking book at market values	– 4.4
Banking book at book values	– 5.1
Banking book (% of RWAs[2])	– 1.2
Trading book (% of RWAs[2])	0.0
Insurers – first-round effect	
Securities portfolio at market values	– 7.1
Securities portfolio (% of own funds)	– 15.3
Liabilities (% of own funds)	– 7.0
Investment funds – first and second-round effects	
Securities portfolio at market values – first-round effect	– 7.2
Net asset value – first-round effect	– 6.7
Securities portfolio at market values – second-round effect	– 2.9
Net asset value – second-round effect[5]	– 2.7

1 Capital reserves: CET1 capital from macroprudential buffers and excess capital. **2** In this context, risk-weighted assets (RWAs) prior to capital depletion. **3** Relative to total loans to enterprises in the respective scenario; assumption regarding loan substitution: loans can be substituted by a different bank provided that a credit relationship with the relevant enterprise already exists and this enterprise does not belong to a particularly hard-hit sector. **4** The additional GDP effect results from a credit supply shock, which is the difference between credit supply restrictions with and without the use of buffers. The shock is converted into a GDP effect using a structural vector autoregression (SVAR) model. **5** Corresponds to the "aggregate vulnerability" metric for the fund sector, i.e. sum of second-round losses of all funds relative to the fund sector's aggregate net asset value before the shock. See Fricke and Wilke (2020) and Deutsche Bundesbank (2019).

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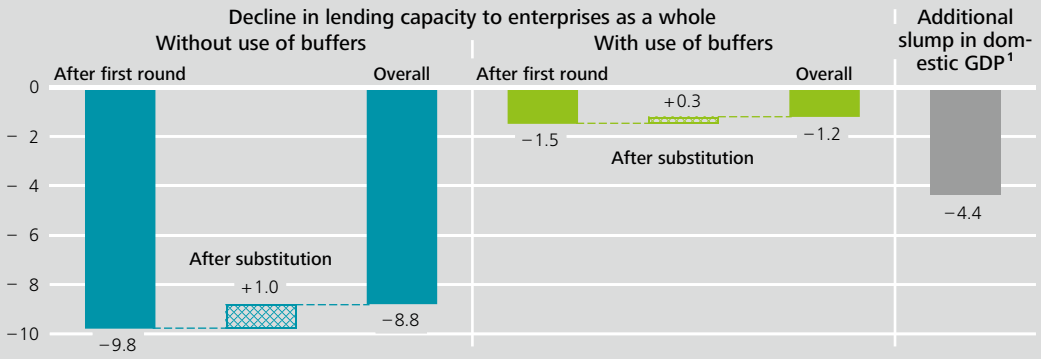
tagion effects in the real economy, particularly in the event that banks do not use their buffers. If banks do not use their buffers, their lending capacity to domestic non-financial corporations declines by 9.8% (see Chart 2.2.17). At the same time, other banks that still have scope for lending following stress effects could take on the market shares of capital-constrained banks.[98] Through credit substitution, the decline in lending capacity in the banking system could then be brought down by around 1 percentage point to 8.8%. The results show that such substitution is evenly distributed throughout the banking system and that the free lending capacity of the solvent banks is not eroded to an excessive degree. If, on the other hand, the banks use their buffers, their lending capacity to non-financial corporations only falls by 1.5%. Through substitution, the decline can be lessened by 0.3 percentage point. If the banks in the risk scenario do not use their buffers, there is a greater burden on GDP. The stress effects in the banking system and the restriction of lending capacity to domestic enterprises would decrease domestic GDP by up to an additional 4.4 percentage points in this case.[99] The results are based on extreme assumptions with regard to buffer usage – in other words, in the analysis, either all or none of the banks use their buffers to the extent that this would be necessary on account of losses. The actual restriction of lending if the scenario were to occur would likely lie somewhere between these values, and would depend on the extent to which banks were

Effects of the intensified energy crisis scenario on financial stability Chart 2.2.17

Percentage points



1 This results from the decline in lending capacity to domestic enterprises caused by not using buffers and is additional to the assumed decline in GDP in the intensified energy crisis scenario.

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98 Substitution within a credit relationship occurs when the following conditions are fulfilled: a) the borrower already had a credit relationship with the substituting bank prior to the shock; b) the borrower belongs to a sector that has not been hit excessively hard by the macro-financial shock; and c) the banks still have sufficient excess capital to substitute. Here, it is assumed that banks are not subject to any liquidity restrictions, i.e. they are able to obtain unlimited liquidity in order to refinance loans.

99 The relationship between the change in lending capacity to non-financial corporations within Germany and the change in real gross domestic product (GDP) is estimated with a structural vector autoregressive (SVAR) model. Here, the additional decline in lending capacity resulting from banks not using their buffers is modelled as a credit supply shock over eight quarters. It is assumed that deleveraging in the event of buffer usage and the resulting GDP effect are already taken into account in the respective macro-financial scenario.

willing to use their buffers.[100] This willingness is likely to decline in the event of a high degree of uncertainty, and would also be influenced by political measures – for instance, if a real economic shock was mitigated by fiscal measures, as was the case during the coronavirus pandemic.

In the scenario of an intensified energy crisis, insurers experience high securities portfolio losses. On account of Solvency II, insurers are required to book securities according to their market price. The securities affected in the risk scenario lose around 7.1% of their value, which is equivalent to 15.3% of insurers' own funds (see Table 2.2.3 on p. 71). Just under half of this is attributable to losses in equity instruments, which are held either directly or indirectly via investment funds. Reinsurers are disproportionately affected by this, as they usually tend to invest more strongly in shares. In the baseline scenario, insurers are also impacted by valuation losses on the assets side, though this primarily results from rising interest rates.

The burden on the assets side of the insurance sector is also offset by relief on the liabilities side. The higher interest rate level results in future liabilities being discounted to a greater extent, causing a depreciation of around 7% in their value relative to own funds. This means that almost one-half of valuation losses sustained in own funds on the assets side are recovered when using fair value accounting. Life insurance companies benefit most from this compensatory effect as their capital investment is less long-term than their liabilities. Non-life insurers and reinsurers, by contrast, tend to experience a positive duration gap, causing a larger decline in their solvency ratios. As the interest rate paths in the risk scenario and the baseline scenario (generated by market expectations) are assumed to be identical, the eased burden on insurers would more than offset losses in asset value in the baseline scenario, meaning that the insurance sector would profit from an interest rate rise. Overall, insurers in the intensified energy crisis scenario are barely likely to exacerbate declines in market price through sales, as they have sound capital adequacy and their investment behaviour has traditionally tended to be rather passive. Indeed, well-capitalised institutions or insurers that benefit greatly from a rise in interest rates could conceivably purchase higher-yielding shares, thereby exerting a stabilising effect.[101]

German funds record relatively moderate losses. In the scenario of an intensified energy crisis, the first-round losses in the German investment fund sector amount to 6.7% of net fund assets, or 7.2% of securities held (see Table 2.2.3 on p. 71). Valuation losses

100 Banks cannot use their buffers if, for instance, they wish to avoid supervisory consequences such as distribution restrictions or fear that doing so will be interpreted by market players as a sign that they are in financial difficulties. See German Financial Stability Committee (2021).
101 Such anticyclical investment behaviour was observed in the German insurance sector at the onset of the coronavirus pandemic in 2020. See German Financial Stability Committee (2021).

in the shares held by the funds are the main factor here. In the fund sector, losses resulting from Russia's attack on Ukraine over the past few months have been factored in. The bond portfolios of German investment funds have also depreciated significantly against the backdrop of rising interest rates (see the section entitled "Situation in the investment fund sector" on pp. 64 ff.). In the scenario, this results in mild first-round losses for the funds relative to those experienced by the banking system.

Funds could nevertheless markedly exacerbate losses from securities. Alongside these first-round losses, second-round effects arise in the fund sector through the holding of mutual fund shares and fund managers' responses. Fund managers may feel compelled to sell securities to service outflows or to maintain a leverage ratio that they have communicated to their investors. Through such sales, they contribute to a further fall in the prices of the securities sold.[102] In the risk scenario, the fund sector suffers second-round losses of 2.7% of net fund assets or 2.9% of securities assets as a result of such sales. In addition, high second-round effects can translate into higher losses for institutional investors, including German banks and insurers. At the same time, real economic effects also arise as the net wealth of private investors decreases.

Adequate resilience important for the functional viability of the financial system

The results of the scenario analysis show that excess capital and capital buffers are important to the functional viability of the banking system during periods of stress. In the depicted scenario, the solvency of the banking system is maintained, but a substantial restriction of lending may occur. Particularly in the event that banks do not use their buffers, the credit supply to the real economy could be significantly constrained. If the buffers are used, however, the banking system will then be less resilient to potential subsequent shocks until the buffers are built up again. To cope with unexpected shocks and losses, it is crucial that the banking system has an appropriately high level of resilience. Macroprudential policy should continue contributing to the maintenance of the existing level of resilience accordingly, and increase it further where appropriate (see the section entitled "Overall assessment and implications for macroprudential policy" on pp. 77 ff.).

Actual developments in the macro-financial environment to date have been less unfavourable overall than assumed in the scenario. According to the Federal Statistical Office's GDP flash estimate for the third quarter of 2022, economic growth in Ger-

102 See Fricke et al. (2022).

many was slightly positive and was therefore higher than the path assumed in the scenario. Other variables that are important for the scenario, such as the risk premia on bonds issued by German non-financial corporations, have also developed more favourably so far (see Chart 2.2.16 on p. 67). Overall, the scenario continues to depict an unfavourable path, particularly in view of the development of credit risk.

It is crucial that financial intermediaries do not underestimate macroeconomic risks and that they take appropriate precautions. The drop in GDP assumed in the risk scenario is likely to be more severe than the economic slump currently expected by market players. This engenders the danger of credit risk, in particular – which is partially disclosed in the scenario analysis – being underestimated. In view of the very dynamic and highly uncertain environment, further macroeconomic scenarios could be less favourable still than assumed in the analyses. In the event of a major shock and high losses, it may be the case that substitutability within the banking sector is restricted; for instance, if the lending capacity of other banks is exhausted. On account of low market liquidity, the fund sector, first and foremost, is likely to exacerbate potential losses even further. In the insurance sector, very strong and unexpected rises in market interest rates, above all, may lead to waves of cancellations and result in additional losses.[103]

In addition, scenarios may have a stronger effect via channels which are only approximated, or are not modelled at all, in the risk modules. Less favourable developments, such as financial stress coupled with an escalation of the energy crisis, could therefore lead to significant second-round effects in the German financial system via connections to other financial market players at both the national and international levels, for instance. Other euro area Member States are also vulnerable to a scenario in which the energy crisis intensifies and the macro-financial environment deteriorates (see the section entitled "Vulnerabilities in the euro area" on pp. 25 ff.).[104] If the analysis of the market risk module is applied to European securities holdings statistics, it can be seen that the euro area excluding Germany would be hit harder by losses compared with the German financial system. On account of the high degree of financial and economic interlinkage in the euro area, a shock affecting the euro area as a whole could thus additionally lead to significant losses for the German financial system from abroad. Furthermore, there may be a risk of losses in banks' loan portfolios from other euro area countries. These could then also have a negative impact on German banks via second-round effects on the euro area interbank market.

103 See Deutsche Bundesbank (2021).
104 The underlying scenario was part of a macroeconomic risk scenario for the euro area as a whole. It takes into account the interlinkages via euro area foreign trade. See Deutsche Bundesbank (2022c).

The magnitude of the real economic impact in adverse scenarios is additionally influenced by economic policy measures. The magnitude of the losses in the financial system depends on, not least, the extent to which recourse is made to economic policy measures in a crisis. These were not modelled in the scenario analysis. The economic impact is thus likely to be less strong in part if a real economic slump has already been mitigated by fiscal or monetary policy measures, as was the case during critical phases of the coronavirus pandemic.

OVERALL ASSESSMENT AND IMPLICATIONS FOR MACROPRUDENTIAL POLICY

The German financial system proved resilient over the course of 2022, despite acute stress in the financial markets. Rising interest rates and risk premia resulted in market corrections, and banks, insurers and investment funds suffered valuation losses on their securities holdings (see the section entitled "Vulnerabilities and resilience in the German financial system" on pp. 44 ff.). Nevertheless, the flow of credit to the real economy remained robust. The major strain on liquidity experienced by some energy companies due to collateral requirements was mitigated by the Federal Government by means of a KfW loan programme. Generally speaking, central clearing proved to be a stabilising factor in the financial system (see the chapter entitled "Current issues putting central clearing to the test" on pp. 115 ff.).

All the same, the German financial system is facing major challenges in the current macro-financial environment. In light of the steep decline in Russian energy exports to Germany, risks to the real economy are rising considerably: soaring energy prices and a possible gas shortage over the winter months could lead to a marked drop in economic activity.[105] This may cause credit losses in the financial system to increase substantially. Moreover, given the persistently high level of inflation, the probability of interest rates continuing to rise has gone up (see the section entitled "Macro-financial environment" on pp. 17 ff.). In the short term, an unexpectedly strong hike in market interest rates could lead to further valuation losses on securities and other financial assets held by banks, insurers and investment funds. In addition, credit losses in the banking system may increase if firms and households have to pay higher interest rates, for example when refinancing existing loans. At the same time, households' inflation-driven real income losses are leaving them with less financial headroom. This may cause their debt sustainability to decrease overall.

105 See Deutsche Bundesbank (2022c).

Vulnerabilities have built up in the financial system in recent years, and these harbour systemic risks. In an environment long characterised by low interest rates and an unusually long period of economic expansion, risks may have been underestimated by banks and other financial market participants.[106] In recent years, banks had expanded their lending to households and enterprises to a relatively significant extent. In particular, this concerned long-term loans with fixed interest rates, as well as loans to financially riskier companies. As a result, banks are now exposed to high credit and interest rate risk. In addition, expansionary lending has contributed to a sharp rise in household debt and asset prices over the past few years. High asset prices carry the risk of market price corrections. These can give rise to considerable losses for banks, insurers and investment funds (see the section entitled "Vulnerabilities and resilience in the German financial system" on pp. 44 ff.).

BaFin therefore adopted a package of macroprudential measures in January 2022 to strengthen the resilience of the banking system.[107] The package addresses the major cyclical vulnerabilities in the German financial system.[108] It is a continuation of the preventive macroprudential policy approach that led to the activation of the countercyclical capital buffer (CCyB) back in 2019, though the outbreak of the COVID-19 pandemic in 2020 interrupted the buffer's phase-in period.[109] In general, an increase in macroprudential capital buffers strengthens the resilience of the banking system. Banks thereby conserve more capital and have an incentive to build up new capital in the medium term. In the current situation, this is also important as banks' capitalisation has eroded slightly in recent times. Scenario analyses confirm the significance of macroprudential buffers in adverse scenarios affecting the entire financial system (see the section entitled "Risk scenario for the German financial system" on pp. 66 ff.). In order for buffers to be effective, it is crucial that they can be and actually are used in times of crisis. Besides banks' potential concerns about being stigmatised, the use of these buffers could also be restricted by rules that permit banks to recognise capital multiple times, for instance to meet buffer requirements and minimum capital requirements, such as the unweighted capital ratio.[110] As these minimum capital requirements must be strictly adhered to, a situation can arise in times of crisis in which banks cannot use their buffers in full, if at all.

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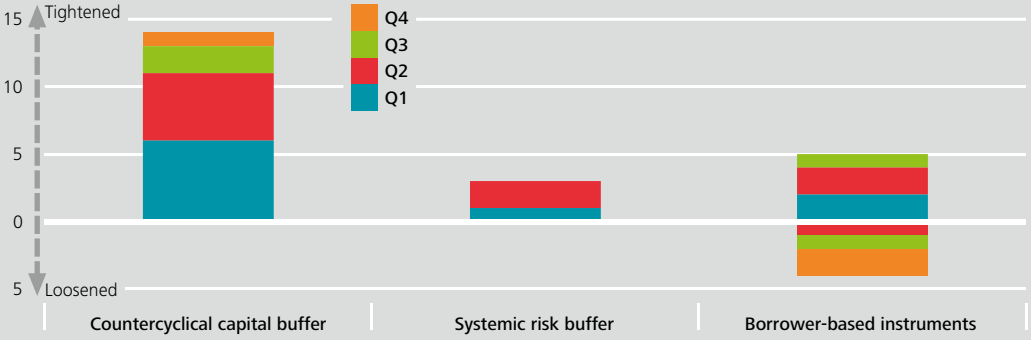
106 See Deutsche Bundesbank (2021).
107 See Federal Financial Supervisory Authority (2022). Under the package of macroprudential measures, the CCyB was raised to 0.75% of RWAs on domestic exposures and a sectoral systemic risk buffer (sSyRB) of 2% of RWAs on loans secured by residential real estate in Germany was introduced. Banks were granted a transitional period until 1 February 2023. In addition, BaFin recommended that lenders take due account of sustainable lending standards with respect to residential real estate financing.
108 See Federal Financial Supervisory Authority (2022). The IMF considers the package of measures to be appropriate but points out that further macroprudential measures would have to be taken, in particular to address the risks in the German residential real estate market; see International Monetary Fund (2022c).
109 See German Financial Stability Committee (2019, 2020).
110 See Basel Committee on Banking Supervision (2022) and European Systemic Risk Board (2021b).

Other countries in Europe have also taken or stepped up macroprudential measures this year in view of major vulnerabilities and downside risks. Since the start of the year, 14 countries have either activated the CCyB or announced their intention to raise it. Systemic risk buffers (SyRBs) were activated in three countries, in some cases on a sector-specific basis only. In addition, five countries announced the activation of borrower-based instruments and only two countries repealed existing measures (see Chart 2.3.1).[111]

Number of European countries* that have loosened or tightened their macroprudential policy since the start of 2022 Chart 2.3.1

As at 11 November 2022



Sources: ESRB and national authorities. * European Economic Area countries plus the United Kingdom.
Deutsche Bundesbank

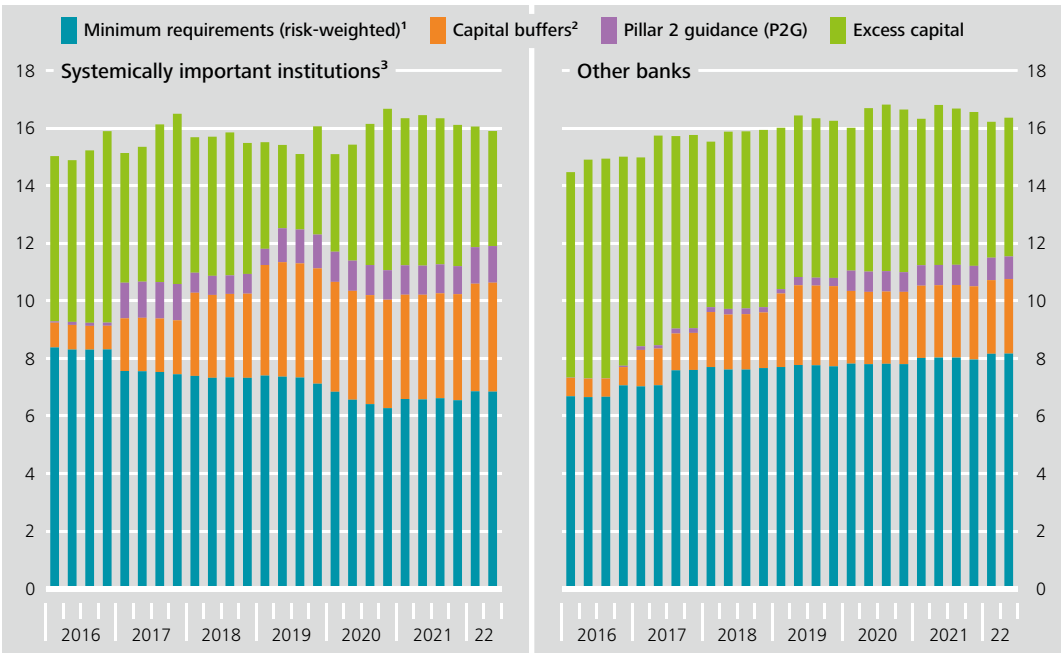
The impact of the package of macroprudential measures is regularly reviewed. Banks must comply with the increased capital buffer requirements as of 1 February 2023. They can use their excess capital for this purpose (see Chart 2.3.2). Overall, the banking system has excess capital of around €150 billion, corresponding to around 4.5% of RWAs.[112] This means that there is more than enough excess capital in the banking system to meet buffer requirements. It is, however, possible that individual institutions lack sufficient excess capital. These institutions need to restrict their lending or scale back other exposures in order to lower their capital requirements. At the individual bank level, this would be a desirable side effect as it would dampen balance sheet growth for undercapitalised banks displaying comparatively little resilience. If undercapitalised banks curtailed their lending, better-capitalised banks could use the opportunity to take market shares from these banks. This would result in a substitution of lending within the banking system without a decline in the overall supply of credit. These and other potential effects of

111 Slovenia abolished additional creditworthiness standards for exceeding the debt service-to-income (DSTI) ratio ceiling in the second quarter of 2022. In their place, however, the SyRB was introduced on 1 July 2022. In Slovakia, the requirements to be met to obtain consumer credit for the renovation of single-family homes were eased in the third quarter of 2022. The less stringent requirements are designed to enable planned energy cost savings to be factored into lending by making it possible to grant larger loans and longer-term loans. The aim of the measure is to increase the availability of financing for house renovation in Slovakia and to support the transition to a greener economy. Ireland eased the rules for two borrower-based instruments in the fourth quarter of 2022. The reason given for this was a comprehensive macroprudential framework review. According to the Central Bank of Ireland, the rule changes are unrelated to the current deterioration in the macroeconomic environment.
112 Excess capital is measured as CET1 capital less minimum and buffer requirements and less the Pillar 2 guidance.

German banks' CET1 capital

Chart 2.3.2

As a percentage of risk-weighted assets



1 Sum of 4.5% + Pillar 2 requirement (P2R) + AT1/T2 gap. **2** Institutions must comply with the requirements set out in the package of macroprudential measures (0.75% CCyB and 2% sSyRB) as of February 2023. **3** Includes the 14 other systemically important institutions (O-SIIs).

Deutsche Bundesbank

the measures are reviewed by macroprudential supervisors on an ongoing basis. At present, there is no evidence to suggest that the package is substantially affecting new lending in the banking system (see the box entitled "Impact of the macroprudential measures" on pp. 58 ff.).

Macroprudential supervisors are closely monitoring how worsening conditions in the macro-financial environment are affecting existing vulnerabilities in the financial system. At present, some indicators are suggesting that cyclical vulnerabilities in the German financial system are no longer building up. However, it is unclear whether the build-up has been merely interrupted or whether a turning point has been reached. Either way, the risks to financial stability will not diminish immediately, as they have accumulated over time in loan portfolios. Vulnerabilities thus remain high. Furthermore, the past has shown that some indicators of cyclical vulnerabilities also declined several quarters before a crisis occurred (see the section entitled "Macro-financial environment" on pp. 17 ff.). If buffer requirements were to be eased in such a situation, the resilience of the financial system could be reduced if, say, banks were to pay out more profits. But it is precisely in such a situation that a high level of resilience is needed to absorb potential losses and stabilise lending. Should the interruption in the build-up of cyclical vulnerabilities currently only be of a temporary nature, even larger capital buffers might be needed in the future.

Macroprudential supervisors can adjust the capital buffers should the situation in the financial system change. The adjustment can go in both directions. If growth in lending remains dynamic and additional vulnerabilities build up in the banking system, it may be necessary to further increase macroprudential capital buffers. Conversely, if necessary, supervisors can decide at any time to release the macroprudential buffers. This may be the case, for example, when substantial losses are incurred in the financial system or when they are clearly looming on the horizon and there is a risk of the credit supply in the banking system being excessively reduced.

Given the high risks to financial stability, the ESRB is in favour of preserving or enhancing the resilience of the European financial sector.[113] In its warning to European supervisory authorities, the ESRB notes that a number of severe risks to financial stability currently exist. These may materialise simultaneously, thereby interacting with each other and mutually amplifying their impact. This has made the prospect of severe disruptions with substantial losses in the financial system more likely. The ESRB has therefore called on supervisory authorities to take measures to preserve the resilience of the financial system, one of which is maintaining existing capital buffers. A targeted increase in the capital buffers could further strengthen resilience, taking into account country-specific developments. Other macroprudential measures should be taken, if necessary. Risks to financial stability emanating from non-banks, such as insurers and investment funds, should be addressed where appropriate. The ESRB's warning was welcomed by both the German Financial Stability Committee and the ECB Governing Council.[114]

To broaden the scope of macroprudential policy options, its toolkit should be expanded to include income-based instruments. As things currently stand, BaFin is not authorised to impose caps on income-based lending standards in the area of residential real estate financing (see the section entitled "Situation in the household sector" on pp. 33 ff.). Such instruments allow supervisors to target potential risks to financial stability emanating from high household debt. The ESRB and the IMF therefore recommend establishing a legal basis for income-based instruments in a timely manner to ensure macroprudential supervisors' efficiency and ability to act.[115]

In the current situation, the onus is not only on supervisors but also on financial market participants. Over the past two decades, the German financial system has been spared large-scale losses even during severe economic downturns, such as during the COVID-19 pandemic. Indirectly, this was not least due to fiscal and monetary policy measures. Financial market participants should be aware that, despite the long period of low

113 See European Systemic Risk Board (2022b).
114 See German Financial Stability Committee (2022c) and European Central Bank (2022b).
115 See European Systemic Risk Board (2021a) and International Monetary Fund (2022c).

and declining losses in the financial system, losses stemming from credit defaults could rise substantially in the future in view of risks being tilted considerably to the downside. All actors should therefore scrutinise their risk management, for example by gauging the impact of adverse scenarios on their business models and, if need be, taking necessary measures at an early stage to mitigate risks.

Given the high degree of uncertainty, all actors should assess risks adequately and reflect them on their balance sheets in a transparent manner. This means, in particular, that banks should revalue their exposures at an early stage if losses are likely to materialise. In addition to prudent risk provisioning, banks should exercise caution when distributing profits. It is important that financial intermediaries and other financial market participants help preserve and further enhance the financial system's level of resilience – because only a resilient financial system can perform its functions even during periods of stress.

In addition, operational risks should be properly addressed. The smooth functioning of payment systems and a steady cash supply are major cornerstones of economic activity. The risk of operational disruptions, for instance due to cyberattacks in connection with geopolitical tensions, has risen sharply. Appropriate precautionary measures are needed to increase operational resilience.

Macroprudential policy will continue to face challenges in the medium term, in part due to structural change in the real economy. The current energy crisis has highlighted the challenges for the financial system given the structural transformation of the real economy (see the box entitled "Structural change and financial stability – challenges for macroprudential supervision" on pp. 83 ff.). Only a resilient financial system can fulfil its functions even when enterprises increasingly exit the market as a result of structural change and cause losses in the financial system (see the section entitled "Situation in the corporate sector" on pp. 27 ff.). Firms entering the market, in particular, depend on a functioning financial system to be able to take advantage of the opportunities associated with structural change and to finance growth. Moreover, macroprudential policy needs to help ensure that financial stability is not jeopardised if a bank or another financial intermediary runs into difficulties. This requires mechanisms for the effective and efficient resolution of financial institutions.

Both things can contribute to enhancing financial stability. However, the result may be a balancing act between the desired objective of structural change towards an emissions-free economy and the risk-oriented regulation of the financial system. Risk-oriented regulation should not be adjusted in such a way that sustainable investment, say, is generally given preferential regulatory treatment. One example of this is the proposal by the European Commission to give preferential treatment to the green investment

Structural change and financial stability – challenges for macroprudential supervision

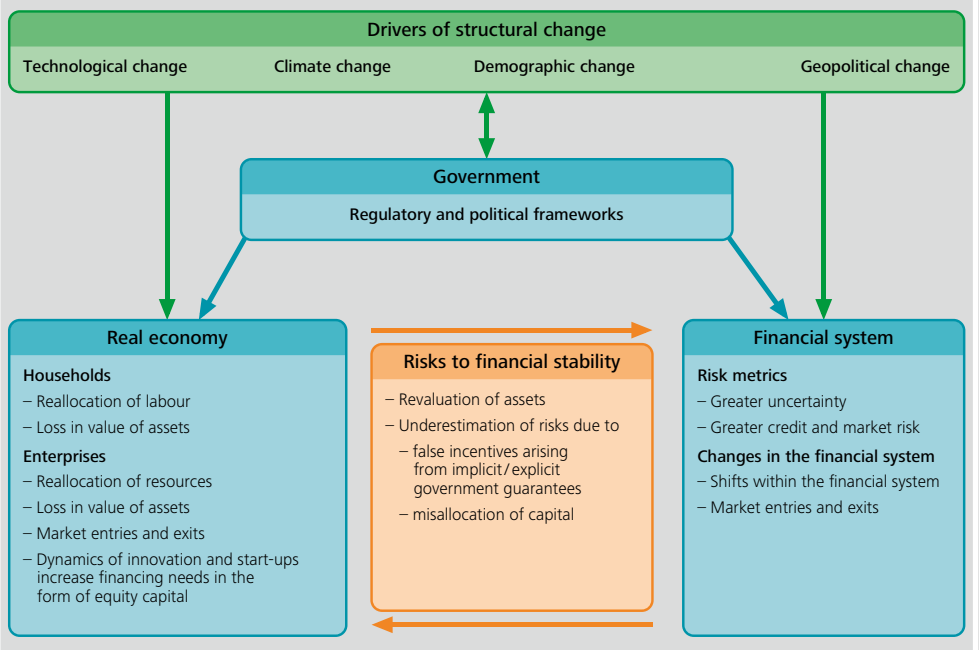
A stable financial system is able to fulfil its functions at all times – even during periods of stress and real economic upheaval. A stable financial system is resilient, which means that it also cushions losses from unexpected developments and reduces contagion and feedback effects. Macroprudential supervision has thus far focused primarily on the financial system's functioning during periods of stress. However, we are currently in a period of upheaval in which structural change in the real economy and the financial sector is accelerating. Russia's attack on Ukraine and the associated rise in energy prices are substantial contributors to this development. Structural change implies shifts in the relative contributions of individual sectors or factors of production to economic output. It is a prerequisite for safeguarding the welfare of society and increasing the economy's growth potential.[1]

A functioning financial system is a key prerequisite for structural change, as it promotes and supports the necessary transformation processes in the real economy. It finances innovations, supports competition and helps to distribute and hedge risks. Structural change can be associated with abrupt transformations in the real economy, potentially leading to disruptions in the financial system. This is why the possible implications of structural change for financial stability have become a matter of key concern for macroprudential oversight (see the chart).

Structural change is driven by various developments. At present, the main drivers include climate change and climate action, demographic change, technological change, for instance due to digitalisation, as well as geopolitical changes and their implications, such as shifts in global trade relations (see the chart).[2] As one example, large parts of the existing capital stock are tied up in carbon-intensive industries and production techniques. This capital stock may become redundant in the wake of structural change and the transition toward climate neutrality. There is thus a considerable need for investment – to ensure that the capital stock is still replaced but in a way that is compatible with this transition, and also for innovation and new technologies. Such ventures are associated with high economic risks and uncertainties.

1 See German Council of Economic Experts (2021).
2 See Buch (2022) and Lane (2021).

Structural change and financial stability



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Structural change, not least to tackle climate change, requires innovation and implies a reallocation of resources between economic sectors. The necessary real economic adjustments unfold with a varying degree of intensity and speed. In general, they are gradual and do not lead to sudden or unforeseen changes. However, such long-term adjustments can also cause disruptions in the financial system if they lead to abrupt shifts in expectations and repricing of risks and assets.[3] The risk of abrupt adjustments may be higher in periods where structural change accelerates unexpectedly, as for example in the wake of developments in the gas market triggered by Russia's attack on Ukraine.

Substantial real economic adjustment processes entail a higher need for investment and thus a greater need for equity or debt financing. In Germany's bank-based financial system, debt finance is a major financing source for investments.[4] Financing structures for start-up and growth finance for small, innovative enterprises, which tend to rely more heavily on equity financing, are not as well established as in other economic regions. Policy initiatives such as the capital mar-

3 See Monga and Lin (2019) and Stiglitz (2019).
4 See Allen and Gale (1995).

kets union may trigger marked changes in enterprises' funding structure over the medium term.[5]

Reallocation processes may be accompanied by an increase in insolvencies in sectors that are particularly exposed to structural change. Insolvencies are likely to rise in shrinking sectors. But insolvencies could also be relatively high in very dynamic sectors characterised by innovation and growth. These adjustments are perceived asymmetrically, for while the sectors and enterprises that are in decline as well as the potential balance sheet losses are known, the enterprises that are yet to be established and their financing needs are not.

Government action shapes the conditions for structural change

Government action affects the interaction between the real economy and the financial sector. It influences the way shocks are transmitted as well as who eventually carries the risks associated with structural change. This regulatory framework includes insolvency and labour law, financial market regulation, the design of other regulatory frameworks – for example in the field of science or competition policy – and fiscal policy, particularly the standard tax and transfer system and contingency measures if risks materialise. The specific design of this framework is adapted to changes in the environment via policy coordination processes at the international and national levels.

However, government measures can also come with undesirable side effects and can lead to corrections that cause sudden developments. For example, the longer it takes for the necessary climate policy measures to be taken, the greater the transition risks associated with the transition to a climate-neutral economy. This is because the later any measures are taken, the larger the adjustments need to be in order to achieve the climate goals. For one thing, this tends to increase the risk that market participants will be surprised by the measures or their effects. Transition risks could also arise if measures already taken are unexpectedly reversed.[6] In this way, government measures can thus mitigate the impact of structural change but they can also amplify its potentially disruptive effects.

5 See German Council of Economic Experts (2018).
6 See Deutsche Bundesbank (2021).

The impact of structural change is not confined to the real economy or to traditional risk categories such as market or credit risk. Technological change also leads to changes in conditions of competition in the financial system. Existing business models could come under pressure and be supplemented or replaced by new ones. In this process, risks to financial stability could emerge.[7]

The financial sector can be a catalyst

From a financial stability perspective, structural change primarily affects the aforementioned risk categories. Some drivers of structural change can have a direct impact on these risk categories. For example, physical risks from climate change such as higher average temperatures or extreme weather may lead to greater damage and thereby losses to asset values in the future. If anticipated, they may already trigger repricing today.[8] At the same time, the need to reallocate real economic resources creates new sources of risk:

First, risks could be systematically underestimated and risk concentrations could emerge that contribute to the build-up of financial stability risks. Market participants could misjudge the timing and magnitude of the adjustment processes. If a real contraction in certain sectors is reflected on financial institutions' balance sheets only with a time lag, hidden risks may accumulate. These can subsequently lead to losses and, in a worst case scenario, impair the financial system's ability to finance the transition.

This may happen, for example, if enterprises without a sustainable business model are kept afloat. Government measures could, for instance, support enterprises whose business models are unsustainable in the long term. If banks only slowly reduce non-performing loans to such enterprises and extend their existing credit lines, they too can contribute to corporate zombification.[9] This would ultimately lead to a misallocation of credit and capital in the economy as a whole; weaker firms would exit the market more slowly, thereby slowing down structural change.

7 See Buch (2018).
8 See Deutsche Bundesbank (2021).
9 See Andrews and Petroulakis (2019) and Banerjee and Hofmann (2018).

Second, government frameworks or measures can produce distorted incentives. One of the objectives of government interventions in the context of structural change may be, for example, to promote private financing and innovation. If, however, owing to implicit or explicit guarantees for enterprises or financial institutions, actors expect public sector support when risks arise, they may misprice the associated risks.[10] The result would be an incentive for the market participants in question to take on excessive risk. In principle, anyone taking entrepreneurial risks should also be able to bear them. If the government nevertheless makes implicit or explicit guarantees for business activity, it is important to monitor the debt sustainability of public finances as well.

At a given level of minimum capital requirements, a financial system with a larger capital base can provide more funding to meet the increased demand for debt financing in times of structural change. This is because financing of innovation and productivity growth requires a functioning and resilient financial system. Financial institutions may be less capable of financing structural change if the potential losses that arise in the process jeopardise their capital base.[11] The strength of this relationship and the extent to which, for example, a banking-dominated financial sector is able to finance transformation and innovation are determined by a number of other factors besides capitalisation. These include, inter alia, the degree of risk aversion and the existence of incentives to take risks.[12]

Macroprudential policy and supervision have important tasks to perform

The task of macroprudential supervision is to understand how the financial system contributes to structural change and how it is itself affected by the developments driving structural change. This requires a comprehensive understanding of structural change and, amongst other things, of how government influences it. That also includes measures that go beyond financial regulation such as competition policy measures, the design of insolvency law, and fiscal support measures and incentives. Fiscal measures, in particular, have played an important role in

10 For an overview of the impact of implicit guarantees using the too-big-to-fail problem as an example, see Buch et al. (2021) and Financial Stability Board (2020).
11 See Schivardi et al. (2022).
12 Many studies focus on the role of the financial sector in facilitating investment in innovation. To date, however, few studies have investigated the relationship between the resilience of the financial sector, on the one hand, and transformation processes or economic growth, on the other. See Coricelli and Wörgötter (2012), Elert et al. (2019), Hall and Lerner (2010) and Klein and Turk-Ariss (2022).

safeguarding financial stability in previous periods of stress, for example during the coronavirus pandemic. Going forward, it is therefore important not to lose sight of the implications of fiscal policy measures for financial stability. This requires effective monitoring of both fiscal measures and corporate debt. Overall, from a financial stability perspective it is important to design economic policy measures such that they do not distort incentives, maintain the steering effect of price signals and thus do not delay important adjustment processes. Moreover, they must not put debt sustainability of public finances at risk.

Long-term structural changes are inherently difficult to predict and model. For example, in view of potential deglobalisation or fragmentation, analyses should focus on changes in international interconnectedness. On the one hand, fragmentation could make the financial system more vulnerable and increase contagion risks. On the other hand, fragmentation aimed at reducing exposures to jurisdictions perceived to be risky could make the financial system less vulnerable. This could be the case, for example, where western advanced economies change supply chains such that they import a larger share of their intermediate inputs from economies that are political partners. One prerequisite for a better understanding of such implications is analysis of the link between international trade integration and financial integration.

When analysing risks to financial stability, it is important to understand how structural change that is slow or delayed – but also unexpectedly rapid – can affect the financial system. The analytical focus here is on the questions of where, how and to what extent risks potentially arise in these processes and of who bears these risks. In the context of structural change in the financial system, it is also necessary to closely monitor the risks arising from a shift in financing activity to the non-bank financial sector.

The task of macroprudential policy is to strengthen the resilience of the financial system, including during and for periods of structural change and high uncertainty. For if insolvencies increase in the course of the transformation process, credit risk will also mount. As a key element of macroprudential policy, capital buffers, in particular, strengthen banks' resilience.

Structural change also implies transformation processes in the financial system. To finance innovation in the context of structural change, there may be a

greater need for equity financing, for example in the form of venture capital.[13] At the same time, digitalisation, in particular, is an important driver of structural change in the financial system. Conditions of competition change as a result. Existing business models may become unsustainable and be changed or replaced by new ones, leading to shifts between the various parts of the financial system as well.[14] Risks to financial stability can arise if core functions of the financial system shift to less regulated intermediaries.

Another key matter for macroprudential policy is to better manage bank failure. In this regard, structural change in the financial system also means, not least, implementing an effective and efficient resolution of financial institutions with unsustainable business models. The core elements are banks' recovery and resolution plans. Here, microprudential supervisors play an important role. Resolution processes must be feasible and credible. They must prevent individual ailing banks, as far as possible, from putting the stability of the financial system as a whole at risk in order to avert the need for fiscal stabilisation. This is the only way to avoid market distortions and inefficiencies. In addition, the associated fiscal burden may also trigger concerns about the sustainability of public debt or place an excessive strain on public finances.

13 See Shafie et al. (2021).
14 See Buch (2018).

needed to finance the insurance sector's transition to sustainability.[116] The focus should be on the risks associated with investment. These can be either high or low when it comes to "green" investment. Where there are no substantial differences between this investment type's risk profile and that of other investment types, the preferential treatment of sustainable investment could lead to misguided incentives that could pose risks to financial stability further down the line.

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COMMERCIAL REAL ESTATE AND THE GERMAN FINANCIAL SYSTEM

Commercial real estate plays a central role in the financial system as collateral for banks' loans to firms and as an investment. Prices of commercial real estate react relatively strongly to cyclical developments. The commercial real estate market is also important from a macroeconomic perspective. It is therefore unsurprising that adverse developments in commercial real estate markets have amplified financial crises in the past.

The German commercial real estate market does, however, have some features that could reduce risk. The indebtedness of commercial real estate firms has remained constant in recent years. On average, commercial real estate loans in German banks' portfolios are relatively well collateralised. Historical relationships provide evidence that commercial property prices in Germany react more slowly to deteriorating financing conditions than is the case in other countries. The valuation of commercial real estate is in line with estimates based on long-term trends. Experience gained in earlier crises prompted regulators, back in 2013, to address risks arising from runs on real estate funds.

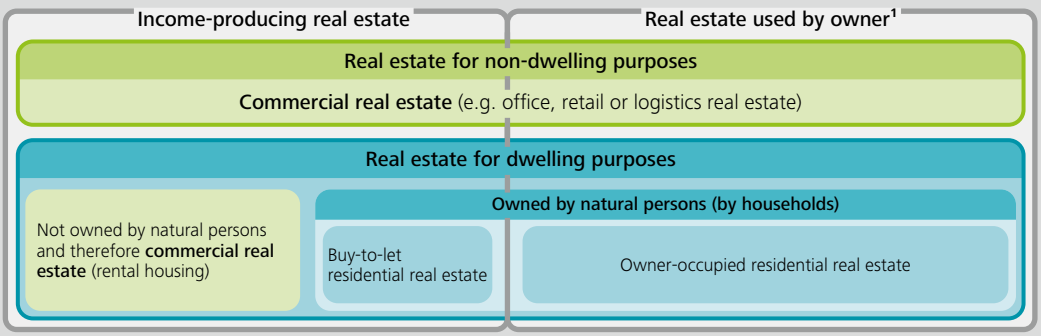
For a systemic perspective, the analysis should include not only the German commercial real estate market, but also commercial real estate and investors abroad. For one thing, a significant share of German commercial real estate loans have a connection to other countries and, for another, foreign

players are heavily involved in the German commercial real estate market as direct investors. International commercial real estate markets tend to develop along similar paths and are influenced, in part, by the same global factors. Shocks in the commercial real estate market could therefore have a greater impact on the economy and financial system than a purely historical and national perspective would suggest.

Importance of commercial real estate for financial stability

The commercial real estate market reacts more strongly to cyclical developments than the residential real estate market. Commercial real estate is held with the aim, amongst others, of generating capital gains and regular rental income.[1] Expected returns therefore play a greater role in the decision to buy than is the case with residential real estate. Income-producing real estate also includes rental housing, i.e. real estate that enterprises let out for dwelling purposes (see Chart 3.1).[2] In an economic downturn, the rental income expected from commercial real estate will change, and consequently its value will, too. The commercial real estate market is therefore more sensitive globally to the state of the economy than the residential real estate market.[3]

Classification of real estate from a financial stability perspective Chart 3.1



Source: European Systemic Risk Board (2019a). **1** For real estate for non-dwelling purposes, the exact definition is: "property held by owners for the purpose of conducting their business, purpose or activity". Social housing is also counted as commercial real estate, but cannot be clearly classified in this schematic overview. The size of the boxes is not indicative of their relevance.

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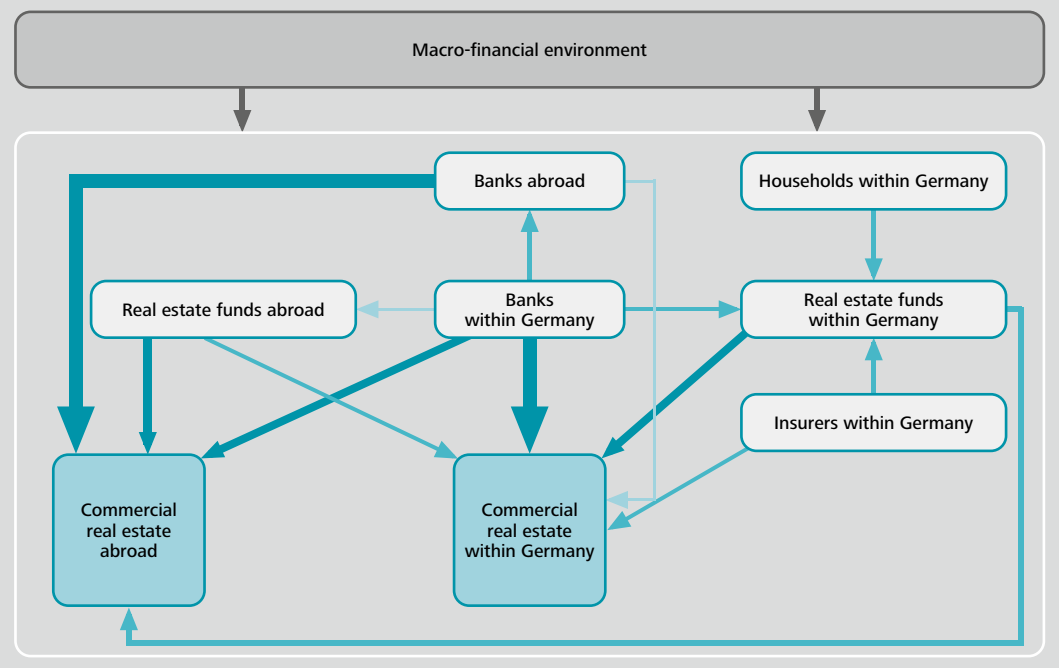
Abrupt changes in the economic environment can impact the financial system through multiple channels and amplify developments. The construction and purchase of commercial real estate is financed by banks, real estate funds and insurers through loans and direct investment (see Chart 3.2). Large real estate enterprises can also tap the capital market for funding by issuing bonds and equities. Commercial real estate plays an important role in the financial system, both as collateral for loans to enterprises and as an investment for real estate funds. Long-term assets are thus financed using debt with

1 A breakdown of the total floor space of urban commercial real estate, which excludes the logistics segment, yields a share of around 49% for the rental housing segment, a share of around 39% for the office segment and a share of 12% for the retail segment. See Knetsch (2021). Calculations are based on data from the 2011 census. A breakdown of the commercial real estate transaction volume by primary use type, which is not comparable to the previous breakdown, suggests that the logistics segment is of a similar size to the retail segment. See Jones Lang LaSalle (2022).
2 See European Systemic Risk Board (2019a). The legal documents on which the use of macroprudential instruments is based (CRR/CRD, Section 48u of the German Banking Act, or *Kreditwesengesetz*) employ a different definition of residential real estate, which is based solely on the purpose for which it is used and which includes "rental housing".
3 See Bank for International Settlements (2020).

Interconnectedness with commercial real estate markets

Chart 3.2



Note: The thickness of the arrows shows the relevance of the ties within the commercial real estate market within Germany. This relevance is based on both quantitative and qualitative assessments.

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potentially shorter maturities or through fund shares which can potentially be redeemed at shorter notice. Unlike market-traded securities such as equities and bonds, the liquidity of commercial real estate is low and the underlying information asymmetry is significant, something which materialises particularly in the event of a loss of confidence. For example, borrowers have more insight into construction projects than lenders. Furthermore, unlike with residential real estate, borrowers in the commercial real estate sector also have little incentive to service loans if they experience financial difficulties.[4] At the same time, both commercial real estate firms and investors such as real estate funds may be leveraged. All the characteristics – debt, maturity and liquidity transformation, illiquid assets and moral hazard – have the potential to amplify the impact of a negative shock in the commercial property market on the financial sector. A negative shock may, say, not only reduce the value of collateral, it may also limit the ability to sell commercial real estate at an adequate price. At the same time, highly leveraged commercial real estate firms might fail to service loans, which in turn increases the pressure to sell the commercial property used as collateral. In addition, indebted investors may be forced to sell other assets in order to generate liquidity. This is particularly the case where the redemption notice periods for fund shares in real estate funds are short (see the section entitled "Risks arising from runs on real estate funds already addressed by regulators" on pp. 105 f.). This

4 See European Systemic Risk Board (2015, 2019b).

could result in negative price spirals with adverse effects on the balance sheets and income of stakeholders in the commercial real estate market.

Financial intermediaries would also be affected indirectly if, for example, negative macroeconomic developments caused a decline in construction activity in the commercial real estate market. Depending on the strength of the shock, this could additionally impair economic growth and thus cause credit default rates to rise across sectors. The interconnectedness of financial intermediaries with each other and through cross-border loans and investments in commercial real estate may amplify the transmission channels.

The commercial real estate market has, to date, rarely been the sole trigger of financial crises, but has often amplified their impact. The banking crisis in Sweden in the early 1990s was largely caused by revaluations in the commercial property market.[5] In other crises, commercial real estate loans may not have been the trigger, but they did contribute significantly to the losses suffered by banks – examples being Spain, Ireland and the United States during the Global Financial Crisis of 2007-08.[6] The non-performing loans ratio has usually been higher for commercial real estate than for residential real estate, as there is a greater incentive for strategic credit defaults on commercial real estate loans.[7]

Characteristics of the German commercial real estate market

The commercial real estate market is important for the real economy. Measured by its share of gross domestic product (GDP) in Germany, the economic importance of the commercial real estate sector has risen from around 13% in 2010 to almost 15% in 2019.[8] This share is roughly in line with the international average.[9]

Prices in the German commercial real estate market fluctuate procyclically with economic developments. In Germany, cyclical troughs in commercial property prices coincide, in particular, with recessionary periods (see Chart 3.3). There is, moreover, a high

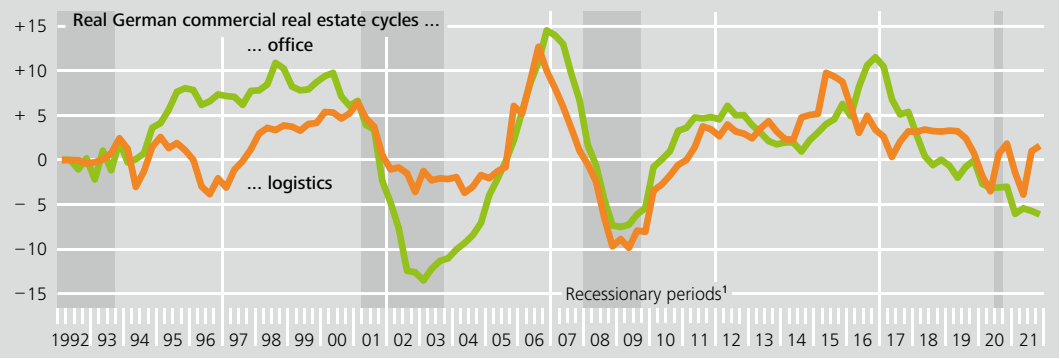
5 See Englund (1999).
6 See Levitin and Wachter (2013).
7 See European Systemic Risk Board (2015, 2019b).
8 See International Monetary Fund (2021). Estimates of the size of the commercial real estate sector are based on MSCI data on the value of professionally managed real estate investments.
9 When calculating this average, the city states were excluded from the underlying International Monetary Fund dataset.

degree of co-movement between the cycles in the two market segments office and logistics.[10]

German commercial real estate price cycles*

Chart 3.3

Deviation from trend (%)



Source: Jones Lang LaSalle. * Extracted using the one-sided HP filter (λ = 1,600). **1** Recessions in Germany as defined by the German Council of Economic Experts.

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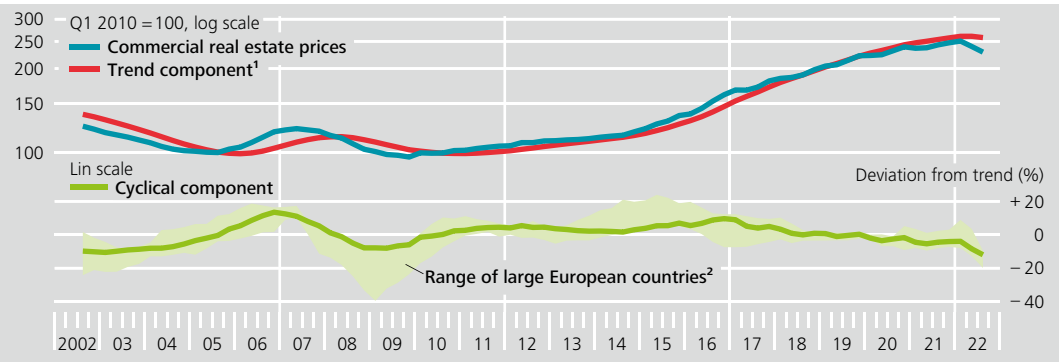
For the most part, commercial property prices in Germany rose in the years leading up to the COVID-19 pandemic, as they did in other European countries. If commercial property prices are broken down into a long-term trend and a cyclical component, it becomes clear that developments in Germany in recent years do not go beyond the long-

Breakdown of commercial real estate prices in Germany

Chart 3.4

Adjusted for inflation



Sources: Jones Lang LaSalle, OECD and Bundesbank calculations. **1** Long-term trend based on one-sided HP filter (λ = 1,600). **2** France, Germany, Italy, Spain and United Kingdom.

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term trend (see Chart 3.4).[11] The cyclical component lies within the range seen in other large European countries. In Germany, commercial property prices have in recent years

10 For reasons of consistency, price data in the charts are based on data provided by real estate service provider JLL. Nationally and internationally comparable data are available only for the logistics and office segments.

11 For the overall commercial real estate index, the office and logistics segments are weighted at 74% and 26%, respectively, based on transaction volume. See Jones Lang LaSalle (2022). No meaningful data are available for the retail segment in recent quarters. The rental housing segment was not included in the European comparison as no appropriate time series are available for this segment. Nominal prices were adjusted for inflation using the consumer price index.

outpaced other indicators of economic growth, such as GDP, private consumption, employment or office rents.[12] However, increased working from home, the energy crisis and the economic downturn could have a negative impact on the trend in the long term.

Banks dominate commercial real estate financing in Germany

In Germany, bank loans are the most important form of commercial real estate financing. Commercial real estate loans represent around 7% of domestic banks' total assets. In Germany, commercial property loans account for around one-third of bank loans issued to non-financial corporations. This is more than in the other large euro area countries, where the percentage stands at around 20% to 25%.[13] Bank loans also play a greater role in Germany than they do in the United States. This also applies to Pfandbriefe, where the loans are used as cover funds. By contrast, less use is made of commercial mortgage-backed securities (CMBSs) and non-bank loans to finance commercial real estate.[14] Loans to finance domestic commercial real estate are broadly anchored in the banking system. Foreign business is predominantly the preserve of large banks.

The upturn in the commercial real estate market in recent years has been accompanied by an expansion in lending. Lending in the commercial real estate sector has grown continuously since 2015. In the course of the COVID-19 pandemic, credit growth declined for a time. While lending to foreign borrowers was temporarily curtailed, growth in lending to domestic borrowers remained elevated.[15]

Risk characteristics of loans paint mixed picture

The leverage ratio of German commercial real estate enterprises is stable. In relation to total assets, their debt levels remained broadly unchanged between 2002 and 2020. Analyses of AnaCredit credit data show that the relative indebtedness of German commercial real estate enterprises with banks has increased slightly over the past three years. Compared with other euro area countries, however, it is still in the lower range. Yet large

12 The underlying evaluation is based on an analysis by the European Central Bank. See European Central Bank (2011).
13 See International Monetary Fund (2021). This share varies by dataset and the definition used.
14 See International Monetary Fund (2021).
15 For more information on developments in lending and other indicators of developments in the commercial real estate market, see, in particular, https://www.bundesbank.de/en/statistics/sets-of-indicators/system-of-indicators-for-the-german-commercial-property-market

real estate firms, in particular, can also use instruments such as bonds to raise debt. These are not captured in AnaCredit. The leverage ratio of German real estate enterprises that are public limited companies has declined since the Global Financial Crisis. By European standards, however, it is fairly high.

The share of commercial real estate loans with a high loan-to-value (LTV) ratio is small by the standards of the real estate sector. For example, the share of commercial real estate loans with an LTV greater than 100% is lower than for residential real estate loans.[16] These LTVs are, however, not fully comparable, as their level is strongly dependent on whether banks count collateral at market value or at the more conservative mortgage lending value.[17] In addition, banks take different types of collateral into account when calculating LTVs, making it more difficult to compare LTVs as reported by banks.[18]

Survey results point to a tightening of lending standards. The responses given to a number of ad hoc questions included in the July 2022 Bank Lending Survey (BLS) suggest that German banks expect higher risks when granting new commercial real estate loans. This can be attributed, amongst other things, to the Russian war of aggression against Ukraine and the reversal of interest rates. Banks indicated that they were expecting to tighten credit standards slightly and to tighten credit terms and conditions somewhat in the following six months. This would reduce vulnerability in new lending (see the section entitled "Risks in the German commercial real estate market" on pp. 110 f.).

Non-recourse and bullet loans increase banks' vulnerabilities; however, the percentage of loans with these risk characteristics appears to be relatively constant over time. In around one-third of commercial real estate loans issued, the lending bank has recourse only to the posted collateral in the event of a borrower experiencing payment difficulties. Borrowers' investors are not obliged to inject any further funds for these loans. Repayment of these loans is therefore highly dependent on the underlying value of the property and the cash flows that borrowers generate from the properties. In addition, in around half of the loan portfolio, principal and interest payments are due only at the end of the loan term.[19] This is a relatively large proportion by international standards. However, the share of loans with these risk characteristics in the total commercial real estate loan portfolio and in new lending appears to be relatively constant over time. The fact

16 The comparison of residential and commercial real estate within Germany is based on a Bundesbank analysis that is confined to institutions reporting collateral on a market value basis.
17 According to Section 3 of the Regulation on calculating the mortgage lending value *(Beleihungswertermittlungsverordnung)*, the mortgage lending value is the value of the property after adjustment for short-term, e.g. cyclical, fluctuations. The market value represents the ceiling for the mortgage lending value.
18 This makes it difficult to compare data within the same dataset and, above all, between datasets such as AnaCredit and Financial Reporting (FINREP), as the problem is further exacerbated here by different reporting rules.
19 This analysis refers only to loans for which the repayment structure is known. The repayment structure is unknown for around one-third of the portfolio.

that only a small proportion of commercial real estate loans are granted without loan collateral limits the risk involved.

In Germany, only a comparatively small percentage of commercial real estate loans are floating rate loans. As floating rate loans make up only around one-third of the commercial real estate loan portfolio in Germany, interest rate risk lies predominantly with the lender. Banks typically use derivatives to hedge some of the interest rate risk.[20] Around one-tenth of fixed interest loans have a residual maturity of less than two years. In an environment of rising interest rates, the borrowers in question therefore risk having to roll over their loans at expensive rates.

Low risk weights at banks using internal ratings may indicate that risks are being underestimated. For almost one-third of the total volume of commercial real estate loans, banks calculate the risk weights used to determine capital requirements based on internal models (internal ratings-based approach, or IRBA). The weighted median of the maximum risk weights applied is significantly lower than the risk weights used by institutions applying the credit risk standardised approach (CRSA). During the pandemic, the median IRBA risk weights temporarily spiked slightly higher.

Potential risks in connection with the effects of the COVID-19 pandemic have not yet materialised. However, possible signs of a deterioration in credit quality were evident in a clear increase in loans for which a significant rise in credit risk was observed.[21] Over the past two years, their share in loans backed by commercial real estate has swollen from 12% to 22%.[22] Although these loans are not categorised as non-performing, banks have increased their risk provisions for them.

Risks arising from runs on real estate funds already addressed by regulators

Real estate funds have grown significantly in importance in recent years. The German real estate fund sector is the largest in Europe in terms of assets under management.[23] Since 2010, German open-end real estate funds' net fund assets have doubled to 8% relative to GDP.[24] This is mainly due to the strong growth seen in open-end special-

20 See Hoffmann et al. (2019).
21 This describes developments in stage 2 loans, i.e. loans that are not yet non-performing but for which an increase in credit risk has been observed. Non-performing loans are not taken into account.
22 These data are available only from banks reporting in accordance with International Financial Reporting Standards (IFRSs).
23 See European Securities and Markets Authority (2022).
24 Both retail and specialised funds are included here.

ised real estate funds, which are investment vehicles reserved for institutional investors. As at the end of the third quarter of 2022, German open-end specialised real estate funds were holding around €170 billion in net fund assets under management. The main shareholders are German insurers and pension funds, which each hold around 30% of fund shares, and domestic banks with around 18%. Direct purchases of land and real estate in Germany still make up the bulk of investment activity of specialised real estate funds, even if indirect forms of investment via equity investments and loans to real estate companies now account for just under 30% of commercial real estate investment. Retail real estate funds, through which households invest mainly in the commercial real estate market, are more focused on the commercial real estate market abroad.

Regulatory requirements limit risks arising from liquidity and maturity transformation. Real estate assets are illiquid, and real estate funds are only able to free up the liquidity needed to meet an upturn in redemption requests by shareholders with a time lag, because they first need to sell off fund assets. Liquidity risk exists, in particular, when investors expecting devaluations all wish to sell their real estate fund shares at the same time and their redemption requests have to be met out of the funds' limited stock of liquid assets. In the case of German open-end retail real estate funds, this issue has been addressed through the introduction of long minimum holding and redemption notice periods. Evidence of the effectiveness of these regulatory requirements can be found in the data on net fund inflows and outflows during the COVID-19 pandemic in March 2020, with retail real estate funds launched after the new fund regulation went into effect in July 2013 registering significantly higher net fund inflows than those set up before that date. Only the bottom tenth percentile in the distribution of net fund inflows saw new and old funds register fund outflows in net terms. However, these were significantly smaller at new funds, being less than 0.1% of their pre-crisis net fund assets, than they were at old funds, which recorded outflows of around 1% of their pre-crisis net fund assets.[25] This suggests that regulators have sharply reduced the risk of a downward spiral of mutually reinforcing sales by scaling back the incentives for excessive net fund withdrawals. These rules do not necessarily apply to specialised real estate funds. However, these vehicles are often held only by individual – or very small groups of – investors. Having a small number of investors limits the risk of strategic withdrawals and thus also the risk of a negative spiral brought about by net fund withdrawals. Another factor is that demand for investments in real estate funds remained high during the COVID-19 pandemic.

25 Even after expiry of the 12-month redemption notice period in February 2021, there were no increased outflows from new funds.

All transmission channels relevant

Risks can spill over from the commercial real estate market to the financial system via all transmission channels. The debt channel is limited in terms of its importance because it is – with the exception of real estate enterprises organised as public limited companies – relatively small and constant over time, along with the fact that open-end real estate funds are subject to borrowing limits. Risks associated with maturity and liquidity transformation are kept in check in the real estate fund sector by way of long minimum holding and redemption notice periods. By contrast, cross-border loans by German banks and direct investment by foreign actors play a relatively major role in the German commercial real estate sector by international standards. Furthermore, owing to the critical importance of German bank loans for the commercial real estate market, it can be assumed that bank loan maturity transformation, the illiquidity of commercial real estate used as collateral and moral hazard issues for borrowers are the most relevant transmission channels in the German commercial real estate market. The quantitative significance of the real economy channel is roughly in line with the international average.

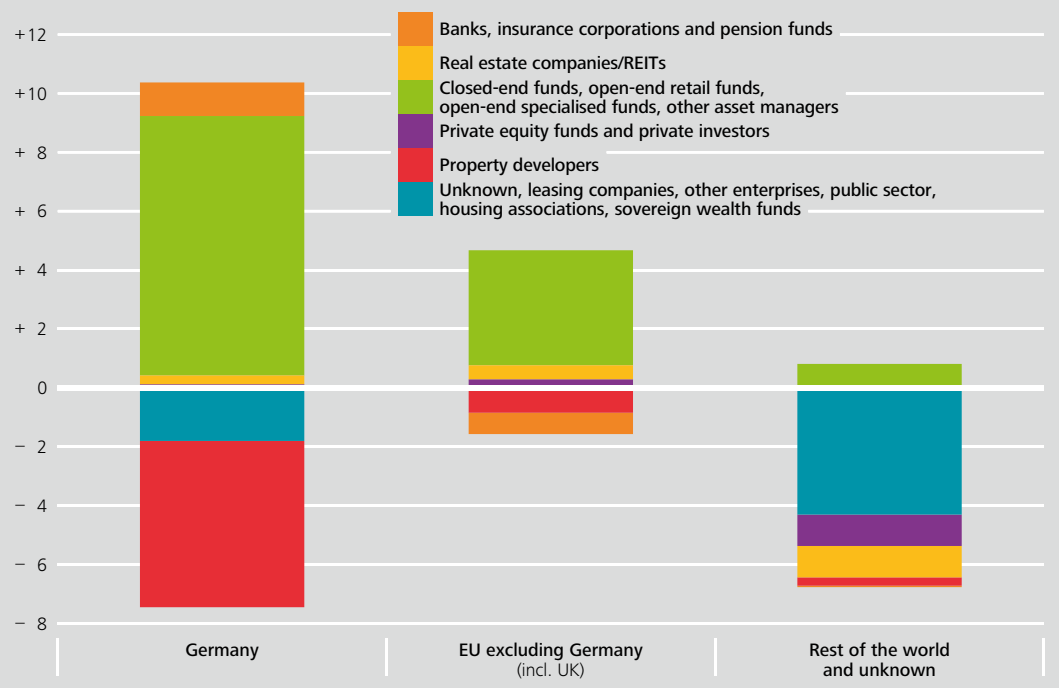
National and international interconnectedness

German banks and real estate funds are heavily involved in the foreign commercial real estate market through loans and investments. Around one-quarter of German banks' commercial real estate loan portfolio has been issued to borrowers abroad. Just under two-thirds of this volume is also secured with foreign real estate. Open-end retail real estate funds used primarily by households to invest in the commercial real estate market diversify their investments to a degree by financing foreign – mostly European – commercial real estate. As households are less interconnected with other financial market actors, this limits the risk of contagion within the financial system during periods of stress. The households are, however, directly exposed to portfolio losses at home and abroad.

International players such as investment funds are heavily involved in the German commercial real estate market through direct purchases. Foreign investors account for a large share of commercial real estate, above all in logistics, retail and office proper-

Net purchases of German commercial real estate by investor origin* Chart 3.5

€ billion, average for the years 2017 to 2021



Sources: Savills and Bundesbank calculations. * Excluding purchases or sales of rentable residential real estate.
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ties. Foreign funds, in particular, are active buyers, with net purchases in the years 2017 to 2021 averaging over 50% of the net purchases of German funds (see Chart 3.5).[26]

Credit relationships between banks and real estate funds, and the volume of foreign banks' lending related to the German commercial real estate market are comparatively minor. Loans to domestic open-end real estate funds amount to only 5% of the total volume of German banks' commercial real estate loans. In addition, banks also hold shares in domestic open-end real estate funds, though these investments are smaller than their loan exposures to funds, accounting for around 0.3% of the total assets of German banks. The stock of loans issued by German banks to foreign real estate funds is likewise very low.[27] Similarly, foreign banks have only a very small portfolio of loans related directly to the German commercial real estate market. Their loan exposures to German real estate funds are negligible.

26 Data source: Savills.
27 This analysis omits loans issued by German players to non-European real estate funds and loans granted by German non-banks to foreign real estate funds.

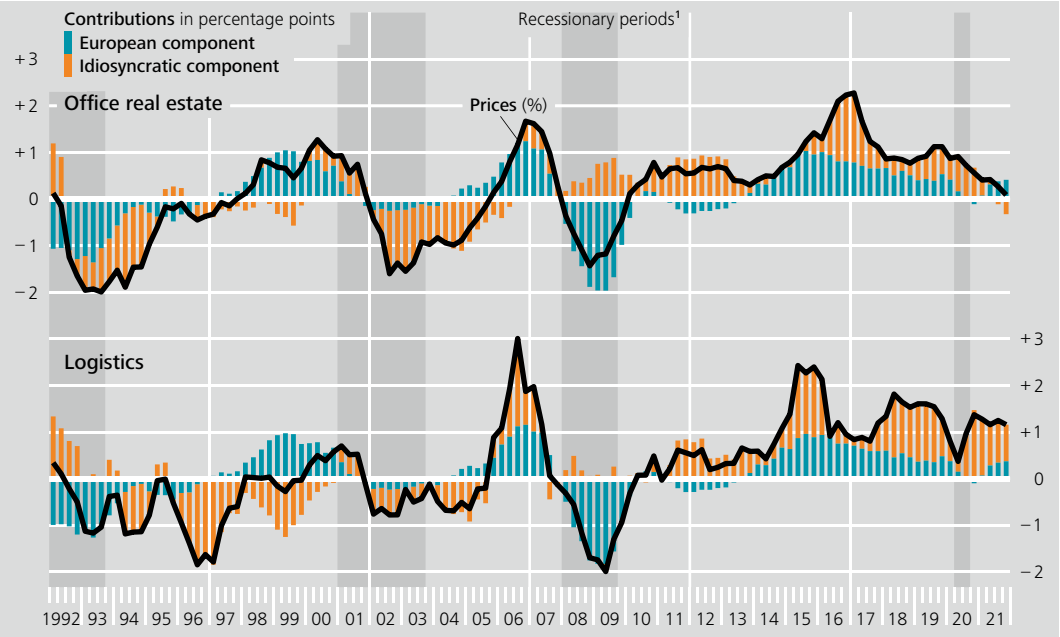
Global factors influence the value of commercial real estate in Germany

Commercial property prices in Germany are exposed to international factors owing to their dependence on the global interest rate level and foreign players' involvement in the purchase and sale of German commercial real estate. Given sufficiently large capital flows, international buyers can be regarded as marginal buyers whose willingness to pay has an outsized impact on the price level.[28] International investors base their purchase decisions on the price level of alternative investment opportunities. In addition to comparable investments such as foreign commercial real estate, the price of lower-risk assets such as government bonds is also an important factor in purchase decisions. The price of such assets, in turn, is particularly dependent on the global interest rate level (see the section entitled "Risks in the German commercial real estate market" on pp. 110 f.).

Prices in the German commercial real estate market move broadly in line with commercial property prices in other European countries. The influence of a European cycle on German price developments can be differentiated from purely domestic developments

Breakdown of German commercial real estate prices into a European and an idiosyncratic component Chart 3.6

Quarter-on-quarter change, normalised



Sources: Jones Lang LaSalle, OECD and Bundesbank calculations. **1** Recessions in Germany as defined by the German Council of Economic Experts.

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28 See Bank for International Settlements (2020).

using a principal component analysis.[29] On average, European determinants explain around 60% of fluctuations in German office and logistics real estate prices.[30] One notable episode during which European factors exerted a particularly strong influence was the Global Financial Crisis (see Chart 3.6).

Risks in the German commercial real estate market

Direct effects from the Russian war of aggression are mainly to be expected on loans used to finance properties under development. Increased commodity prices are weighing on the construction sector, and building material shortages can lead to considerable delays in construction activity. This could render ongoing projects economically unviable. If these are not completed, banks could be particularly affected, as three-quarters of loans related to properties under development are bullet or non-recourse loans.[31] Furthermore, a gas supply freeze would drive up the risk of a recession, which would in turn increase default risk in the portfolio of commercial real estate loans. However, the shares of non-performing loans and of loans subject to forbearance measures in the total stock of loans secured by commercial real estate have both so far stagnated at a low level, coming to 2.1% and 4.1%, respectively, in the second quarter of 2022.

Commercial property prices in Germany react somewhat more slowly to an increase in funding costs than they do in other European countries. Risk premia on bonds in Europe have already risen significantly in 2022 and could increase further owing to the negative economic outlook and the high degree of uncertainty, which would lead to an additional tightening of financial conditions (see the section entitled "Macro-financial environment" on pp. 17 ff.). An unexpected increase in credit risk premia is used in model calculations as a measure for a financial shock in the European non-financial corporate sector.[32] The average effect of such a financial shock on commercial property prices is estimated based on historical relationships in the years 1999 to 2019. Real GDP, consumer

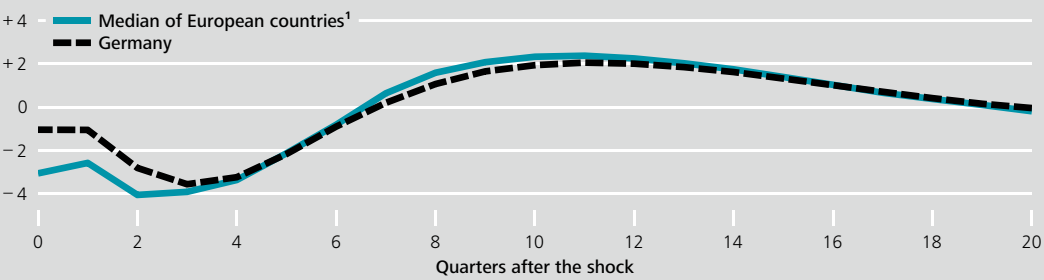
29 The simple average of country-specific filtered cycles can be used as a proxy for a European cycle.
30 Owing to data quality problems – especially from 2017 onwards – international analyses of retail property prices are only possible to a limited extent. On the basis of the available data, the degree of co-movement between retail property prices and price developments in other European countries is found to be significantly smaller.
31 Loans funding properties under development account for around 8% of the total portfolio of commercial real estate loans.
32 The interest rate spread of European corporate bonds over German Bunds serves as a proxy for credit risk premia. The model is a factor-augmented vector autoregressive model. Data for the period following the COVID-19 shock at the beginning of 2020 were excluded. At present, a consensus has yet to emerge on how to deal with the COVID-19 shock within the framework of the method used. See Bernanke et al. (2005), Krippner (2013) and Lenza and Primiceri (2022).

prices and interest rates for the euro area are also used in this model as inputs.[33] In the model, a financial shock in the form of a one percentage point increase in credit risk premia leads to a decline in the growth rate of European commercial property prices by up to 3½ percentage points (see Chart 3.7). The sensitivity of prices in Germany is somewhat lower initially than it is in other European countries.

Response of commercial real estate prices to a tightening of financing conditions for enterprises*

Chart 3.7

Percentage points



Sources: Banque de France, Federal Reserve Bank of St. Louis, Jones Lang LaSalle, Leo Krippner (www.ljkmfa.com), OECD and Bundesbank calculations. * Financing conditions approximated by the spreads of euro area corporate bonds over German government bonds. The analysis is based on a factor-augmented vector autoregressive model. The weighting of office and logistics real estate is based on the transaction volume breakdown by primary use type for 2021. **1** Belgium, France, Germany, Ireland, Italy, Netherlands, Spain, United Kingdom.

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Potential macroprudential courses of action

Macroprudential instruments can be used to limit risks emanating from the commercial real estate market. A distinction is made here between capital-based and borrower-based instruments. Where capital-based instruments are used, the build-up of additional capital buffers strengthens resilience to credit defaults. The deployment of borrower-based instruments counteracts the build-up of credit risk when new loans are granted.

Capital-based macroprudential instruments were activated in Germany at the beginning of 2022. The package of macroprudential measures aims to strengthen the resilience of the German financial system in the face of a build-up of cyclical and structural risks (see the box entitled "Impact of the macroprudential measures" on pp. 58 ff.). Risks emanating from the commercial real estate market are addressed by the countercyclical

33 Shocks are identified in the model on the basis of recursive zero restrictions (Cholesky decomposition). It is assumed that exogenous changes in credit risk premia for enterprises will feed through into commercial real estate markets without a lag. The assumption is that potential effects on the real economy, consumer prices or interest rates would be expected only with a delay.

capital buffer (CCyB) as a subset of the aggregate risks. In addition, the sectoral systemic risk buffer (sSyRB) set for the residential real estate sector also covers risks arising from loans for rented residential real estate which, from a financial stability perspective, is assigned to the rental housing market segment because it is used commercially to generate profit and thus counts as commercial real estate. The imposed sSyRB is therefore estimated to cover one-sixth of the total portfolio of commercial real estate loans. There is no evidence as yet that the package of measures has led to an excessive decline in new lending for rental housing properties compared with other commercial real estate lending. An sSyRB that would cover risks arising from the financing of other commercial real estate has not yet been imposed.

The borrower-based instruments available for residential real estate financing can be imposed in the rental housing market segment as well; experience with the deployment of such instruments for traditional commercial real estate, both in Europe and globally, has been limited thus far. Unlike existing capital-based measures, borrower-based instruments have a direct impact on new lending only. This means that their use can dampen the build-up of risks to financial stability. These instruments do not, however, contribute directly to risk mitigation in the commercial real estate loan portfolio. Borrower-based instruments may include, in particular, minimum requirements for lending standards such as the LTV, the debt service coverage ratio (DSCR) or the interest coverage ratio (ICR). Since 2017, the Federal Financial Supervisory Authority (BaFin) has been legally authorised to impose LTV ceilings and amortisation requirements in the area of residential real estate financing. It can deploy these macroprudential instruments to curb the granting of new loans for the construction or purchase of residential real estate located in Germany and thus also address risks emanating from the rental housing market segment.[34] The measures may be taken where and to the extent necessary to counteract a disruption in the functioning of the domestic financial system or a threat to domestic financial stability. Borrower-based instruments are not yet available in Germany for other segments of the commercial real estate market, such as office, retail and logistics real estate. Heterogeneity, international interconnectedness and market complexity are thorny issues to consider in the debate surrounding possible borrower-based instruments for the commercial real estate market.[35]

34 See Section 48u of the Banking Act, Section 5(8a) of the Investment Code *(Kapitalanlagegesetzbuch)* and Section 308b of the Insurance Supervision Act *(Versicherungsaufsichtsgesetz)*.
35 See European Systemic Risk Board (2022), p. 38. The European Systemic Risk Board (ESRB) has set up a working group to take a more in-depth look at borrower-based instruments for commercial real estate loans at the conceptual level. The first results are expected in mid-2023.

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CURRENT ISSUES PUTTING CENTRAL CLEARING TO THE TEST

Central counterparty clearing, with its multiple lines of defence, mitigates contagion risk within the financial system. By and large, this approach has worked as it should and helped preserve financial stability. During bouts of exceptional market volatility, though, abrupt spikes in margin requirements can have destabilising effects on market participants.

After market prices for energy products like gas and power ballooned in 2022 in the wake of Russia's war of aggression against Ukraine, some firms operating in the energy sector encountered liquidity problems. These issues were caused not only by higher purchase prices but also by significant market volatility that prompted central counterparties (CCPs) to strongly increase the margin requirements for firms hedging their transactions in the derivatives market. In the end, government-guaranteed lending programmes were rolled out to ease the liquidity bottlenecks.

CCP regulations are already designed to smooth cyclical effects of this kind. They are set up in such a way as to prevent margin requirements from declining too far when markets are calm so that they do not have to be increased as much during stress episodes. Studies indicate that the existing regulatory approach grants CCPs too much freedom for determining how they design the models used to compute margin requirements. For this reason, it is gratifying to note the discussions currently under way at the European level to improve the regulations in this respect. Regulatory measures are flanked by global studies into the scope for enhancing the transparency

and accessibility of risk models, and in particular their sensitivity to market volatility. Such measures will have a limited impact, however, as they cannot fully offset the fallout from extreme price spikes. Indeed, actual events can be more severe than the adverse scenarios used to calibrate risk models.

Stabilising role of central counterparties

Surprise events and developments in recent years – the COVID-19 outbreak plus ballooning energy prices in the wake of Russia's war of aggression – have put the central clearing of financial instruments and commodity derivatives to the test. Central counterparties (CCPs) have done what they are designed to do during both stress episodes, and they have shown that they can act as stabilisers in the financial system by minimising counterparty risk and boosting market transparency. Unlike in the 2007-08 Global Financial Crisis, there were no general losses of confidence in the financial system, which meant that trading was able to continue without interruption in the market segments affected by the stress episodes. This facilitated price discovery in derivatives markets, which is essential for market participants' risk management. CCPs have thus been instrumental in ensuring that the financial system was able to perform its important allocation function even during periods of stress.

CCPs act as systemic risk managers and mitigate contagion risk in the financial system. If central clearing did not exist, the failure of a significant market participant could quickly spill over to other market participants, forcing them to write off their defaulted exposures and, in turn, laying them, too, open to the risk of financial distress or even insolvency. In addition, they may have no option but to replace the trades transacted with the insolvent market participant, possibly at worse terms and conditions. At the same time, there is a danger of that failed market participant's collateral being sold in uncoordinated fire sales in the market, potentially amplifying negative price spirals.[1] To minimise these risks, CCPs interpose themselves between counterparties to financial transactions traded, with the original buyer and seller thus becoming members of central clearing. CCPs promise their clearing members that the financial transaction entered into will be settled and cleared. If a member defaults, the CCP assumes that member's obligations and has to bear any associated losses.[2] This mechanism means that CCPs take on direct default risks from trading partners and – provided risk management systems function properly – are able to mitigate contagion effects and boost the confidence of participants in a functioning market.[3] Contagion effects caused by losses of confidence, which can arise due to a lack of transparency, materialised during the Global Financial Crisis, when trading in some bilateral market segments came to a standstill.

CCPs operate multi-level systems of safeguards (default waterfalls) to hedge against the risk of clearing member defaults. Central clearing via CCPs is an option for many financial transactions, including equity, bond and repo trades as well as for derivatives,

1 See Brunnermeier and Pedersen (2009).
2 See Deutsche Bundesbank (2016), pp. 79 ff.
3 See Affinito and Piazza (2021).

whose generally long lives make them more complex in terms of risk management. If a clearing member defaults and the collateral it has posted with the CCP is insufficient to cover the loss resulting from its failure, the CCP has to use its own financial resources to absorb some of the remaining losses. This "skin in the game", as it is known, incentivises CCPs financially to ensure that their risk management systems are appropriate and thus to preserve their own financial soundness. In addition, all clearing members are required to pay contributions into a default fund which is used to cover any losses that go beyond the collateral posted by defaulted clearing members and the CCPs' own skin in the game. This arrangement gives all the stakeholders incentives to ensure that CCPs operate functioning risk management systems.[4]

CCPs' risk management is built around netting and initial margins. These initial margins are collateral that clearing members post with the CCP in the form of cash or securities, with their amounts being calculated according to risk exposures and marked to market. CCPs compute margins using statistical methods such as value-at-risk models to estimate the risk of losses from (portfolios of) derivatives in multiple scenarios. Risk is measured primarily on the basis of how strongly the market prices of traded products have fluctuated in the past, with market developments in the recent past usually featuring more prominently than more distant ones. In addition, CCPs operate by netting offsetting transactions – that is, they assess the entire portfolio of transactions that a member is clearing through them to determine the net risk arising from all that member's transactions. This way, CCPs can also account for correlations across products and categories of financial instruments as well as concentration risks when they calibrate their margin requirements. CCPs increase the margin requirements when price volatility rises. Without such initial margin calls, they would run the risk of having insufficient collateral, if the market environment changes and a member defaults, to cover losses resulting from that member's positions being unwound. The regulatory regime governing CCPs in the European Union (EU) sets out provisions aimed at preventing margin requirements from declining too far during periods of market calm.[5] The rules do, however, grant the CCPs some discretion in terms of calibration, and thus in how they design the procyclical – that is, self-amplifying – properties of risk models.

Ongoing offsetting payments (variation margins) prevent the build-up of substantial unrealised losses over the life of contracts. Market prices of cleared products generally fluctuate, so to prevent substantial liabilities from building up in clearing members' longer-running positions as a result of market developments, changes in the value of these positions are balanced across members at the end of each trading day by means of vari-

4 See Binder and Saguato (2021) and Rehlon (2013).
5 See Regulation (EU) No 648/2012 of the European Parliament and of the Council of 4 July 2012 on OTC derivatives, central counterparties and trade repositories.

ation margins. Clearing members whose positions have lost value as a result of changes in prices pay that loss to the CCP as a variation margin. These payments always have to be made in cash because the CCPs then route them to the members whose positions have made profits. Since one clearing member's losses will always match the other's profits, the sum of variation margin payments made and received always adds up to zero across clearing members. One exception to this arrangement are intraday variation margins, which CCPs will call in the event of strong market movements, as these are often only paid out on the next trading day to the members with a profit position. While variation margins thus balance liabilities from past price movements, initial margins collected by a CCP cover the market risk to which the CCP is exposed between the time of a clearing member's possible default and the full closeout of the positions cleared for that member.

Liquidity requirements in central clearing

CCPs call highly liquid collateral from clearing members for both initial and variation margins, so CCP users need to plan their prospective liquidity needs. For market participants, clearing transactions through a CCP means that they no longer have to worry about the solvency of their counterparties. Centrally cleared portfolios can, however, give rise to significant short-term liquidity needs if a CCP increases its margin requirements because of abrupt changes in prices. These liquidity requirements are due to two factors. First, there is the immediate loss effect, in the form of the variation margins for positions that lose value as a result of current price developments. Second, there is the adjustment of initial margins, because if the clearing members or their customers are unwilling or unable to give up on their trading positions, they must immediately meet the CCP's increased margin requirements. This can cause those clearing members or their customers to experience liquidity bottlenecks.

Rising CCP margin requirements are a major challenge primarily for market participants whose ability to fall back on highly liquid resources is limited. Users of central clearing have different degrees of exposure to the risk of liquidity bottlenecks because of their individual characteristics and business models. Banks are able to access money markets and central bank loans as sources of funding, which can help them respond to short-term liquidity demands. Non-banks such as funds or insurers, by contrast, may find it more difficult to meet CCPs' margin requirements because, as the customers of clearing members, they are connected to CCPs indirectly. Furthermore, they are unable to obtain liquidity from central banks. Non-banks lacking sufficient liquidity buffers have to go to the repo market or sell assets to generate liquidity. Both of these possible avenues have their draw-

backs, however. Repo markets accept only high-quality securities as collateral, and sales of assets can be associated with losses in value. In a worst-case scenario, asset sales will also set in motion or amplify adverse developments in the prices of the assets sold. Non-financial corporations, such as firms from the energy sector, have only a limited stock of liquid assets, which leaves them particularly exposed to the risk of liquidity bottlenecks. They are often reliant on short-term bank credit financing in order to be in a position to meet increasing margin requirements. While the European banking system has sufficient liquidity to provide loans of that kind, risk considerations or the time consumed by decision-making processes may lead to bottlenecks in short-term lending during spells of market stress.

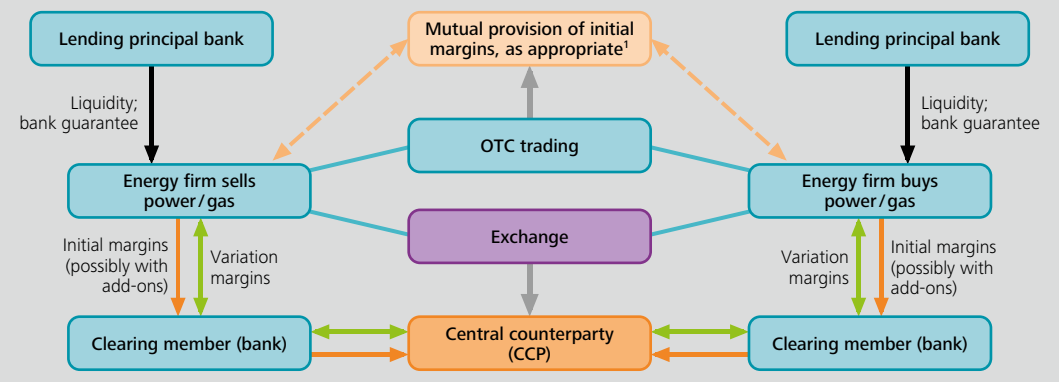
Energy price shock pushed up margin requirements for enterprises

Gas and power prices were already climbing to new highs in the autumn of 2021, and the surges gained traction after Russia commenced its war of aggression against Ukraine. Prices in European energy and commodity markets were already rising sharply in the fourth quarter of 2021. Gas prices increased on the back of multiple factors including unfavourable weather conditions for renewable energy generation and Russia's looming war against Ukraine, while power prices followed similar patterns because gas is a key input in electric power generation. The outbreak of war in February 2022 and its implications for the European gas supply sent prices sharply higher yet again in 2022, and they have been hovering at a significantly elevated level amid considerable fluctuation ever since (see Chart 2.1.8 on p. 28).

Contracts in the energy sector for the physical supply of gas or power are mainly traded bilaterally over the counter. Long-term delivery contracts for input factors for power production, such as gas, are mostly transacted by energy companies in over-the-counter (OTC) trading. Similar arrangements are used for the sale of final products, such as the delivery of power. In regulatory terms, these bilateral delivery contracts are not classified as OTC derivatives even though, economically speaking, they constitute a derivative with physical delivery. In the case of OTC derivatives settled in cash at the end of their lives, many non-financial corporations benefit, furthermore, from a regulatory exemption from collateralisation requirements in bilateral clearing. Thus, these transactions are collateralised only if the counterparties voluntarily agree to do so (see Chart 4.1). In times of crisis, then, non-financial corporations may be surprised when their counterparties suddenly demand protection against counterparty risk. Exact figures on the amount of col-

Energy market clearing: trade and payment flows

Chart 4.1



1 Increase of collateralisation in times of crisis.

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lateral in bilateral energy derivatives clearing are not available. Transparency in this field should be increased as a matter of urgency.[6]

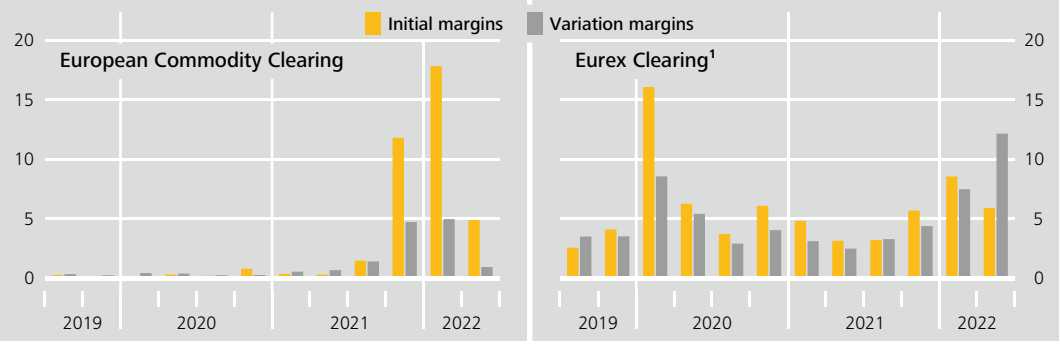
Some energy sector trading is conducted on-exchange. In addition to contracts for same-day or next-day physical delivery, derivatives for later delivery dates are also traded on exchanges. In the case of power, derivatives related to the delivery of base load power one year ahead typically account for the bulk of the trading volume in Germany. Through the use of derivatives, market participants are able to hedge against fluctuations in prices. This way, energy producers gain planning security because they can sell their future output at a set future date, whilst energy purchasers use forward contracts to secure their future power needs. All market participants use exchanges for short-term energy trading. Exchange prices are crucial for how prices evolve in the energy market because prices in OTC trading are aligned with those quoted on exchanges. All exchange-traded energy products are centrally cleared by CCPs.

The strong surge in power and gas prices in the wake of Russia's war of aggression against Ukraine has put CCPs, clearing members and their customers to the test. Energy markets in Europe are integrated across borders, as evidenced by a broad circle of participants from the EU, Switzerland and the United Kingdom of the energy exchanges and CCPs. European market participants in energy markets use three CCPs in particular: European Commodity Clearing AG (ECC) in Leipzig, ICE Clear Europe Ltd in London, and Nasdaq OMX Clearing AB in Stockholm. These CCPs perform central clearing for exchange-traded derivatives related to power, gas and emissions allowances, amongst other transactions. All three CCPs responded to the extreme price increases and elevated price volatility in the energy market by raising the initial margin requirements for their clearing mem-

6 See European Securities and Markets Authority (2022b).

Margin calls of selected central counterparties Chart 4.2

€ billion, maximum aggregate daily value in each quarter



Sources: European Commodity Clearing and Eurex Clearing. Published in accordance with CPMI-IOSCO Public quantitative disclosure standards for central counterparties. **1** Eurex Clearing data on initial margin calls also include intraday variation margin calls. End-of-day margin calls have been included under initial margin calls only since Q3 2021.

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bers. At the same time, the strong price swings also led to higher variation margins. As a result of falling prices and receding market volatility, the volume of initial margins declined again just as quickly, however.

High liquidity needs for clearing energy derivatives led to liquidity bottlenecks among firms from the energy sector. Data from ECC, for example, highlight the sharp increase in margin requirements that had to be met by firms from the energy sector especially (see Chart 4.2). Whilst, in previous years, ECC's maximum aggregate daily initial margin call for its clearing members in a given quarter amounted to a figure only in the low hundreds of millions of euro, it reached more than €10 billion in the fourth quarter of 2021 and more than €17 billion in the first quarter of 2022. Similarly, the maximum aggregate daily value for variation margin calls in a given quarter grew from an amount in the mid hundreds of millions of euro to around €5 billion. Clearing members passed these margin requirements on to their customers, in some cases with supplementary add-ons.[7] As a result, these customers, which are comprised largely of non-financial corporations from the energy sector, were confronted with simultaneous liquidity calls from clearing members to cover initial and variation margins and, in some cases, supplementary add-ons. Customers active with other CCPs had to meet the liquidity requirements of multiple CCPs at the same time. Furthermore, some customers faced additional margin requirements from counterparties in OTC trading.[8] If energy producers do not have sufficient liquidity to meet margin requirements, they might scale back their activities in the derivatives market. This reduction in supply may cause energy prices in the derivatives market to rise further.

7 The business relationship between clearing members and customers has not been at the focus of regulatory efforts thus far, so these add-ons are not subject to any restrictions. See European Federation of Energy Traders (2022).
8 See German Association of Local Public Utilities e. V. (2022).

In order to finance the temporary liquidity needs arising from increased margin requirements from CCPs and thus to safeguard the energy supply, some European governments implemented extensive fiscal measures. In Germany, the Federal Government established a credit programme via the KfW Group totalling €100 billion and guaranteed by central government.[9] This financing instrument is only available to German energy firms and cannot be used to meet margin requirements in OTC trading. As a further measure, market participants called for the range of eligible collateral for central clearing to be extended, for example to include uncollateralised bank guarantees, amongst other things. On 21 October 2022, the European Commission granted a one-year exception to allow this extension.[10] Bank guarantees can only be used by non-financial corporations that are themselves clearing members of a CCP. They are not suitable for covering the liquidity needs arising from variation margins as these must be provided in cash in order for CCPs to be able to pass them on. When making amendments to regulation, the resulting transfer of risk from the real economy to the financial system must fundamentally be taken into account. From the perspective of financial stability, it is vital that regulatory changes do not impair the risk management function of CCPs.

Coronavirus shock increased margin requirements in the financial sector

Unlike in the case of the energy price shock, the financial sector, in particular, had to bear sharply rising margin requirements during the COVID-19 pandemic. As a result of the coronavirus shock, liquidity risk arising from margin requirements emerged within the financial sector in the spring of 2020. In order to meet liquidity requirements, many financial intermediaries sold off assets, thus triggering a self-reinforcing cycle in financial markets. Previously, the prices of many financial assets had fallen sharply in light of the adverse effects of the coronavirus pandemic and the measures taken to contain it, and volatility in financial markets reached record levels. This development particularly affected the markets for equities, credit derivatives, and interest rate derivatives, which are mostly cleared through CCPs.[11] The significant price changes led to high intraday variation margin calls. In addition, the sharply increased volatility resulted in high initial margin calls.[12] This meant that many clearing members' liquid funds were strained by high payments for variation and initial margins at the same time. For example, in the first quar-

9 See Federal Ministry of Finance (2022).
10 See European Association of CCP Clearing Houses (2022).
11 See European Central Bank (2020b), p. 101, Chart A.
12 See European Central Bank (2020b). The CCPs' model sensitivity to heightened market volatility was the main driver of increased initial margin calls. By contrast, the size and diversification of clearing members' trading positions played only a subordinate role.

ter of 2020, the CCP Eurex Clearing AG called around €16 billion of additional initial margins on one day, up from amounts in the low single-digit billions of euro in the two preceding quarters (see Chart 4.2 on p. 122). The maximum aggregate variation margin call had more than doubled to around €8.5 billion during the same period.

CCPs' rising margin requirements particularly affected the Dutch insurance sector, which responded by selling off money market fund shares. Insurers and pension funds have large holdings of derivatives in order to hedge against interest rate changes and exchange rate fluctuations. At the end of February and beginning of March 2020, these positions made strong valuation gains as the euro appreciated against the US dollar and, at the same time, long-term interest rates decreased. Insurers and pension funds invested some of the profits – in the form of variation margin inflows – in money market funds. From mid-March 2020, this trend reversed and derivatives positions experienced a sharp decline in value. This led to corresponding variation margin calls from the CCPs, which in turn had to be serviced by the insurers and pension funds.[13] They sold off their money market fund shares in order to obtain the liquidity needed for the variation margins.[14]

Money market funds sold off securities – in some cases at significant discounts. In order to pay out the redeemed money market fund shares, money market funds sold off short-dated bonds, thereby further reducing the prices of these securities and eroding their market liquidity. This, in turn, pushed up CCPs' margin requirements. Confidence in the solvency of money market funds was ultimately lost to a degree,[15] which caused other market participants to sell off money market fund shares.[16] In the end, the sharply increased margin requirements contributed to a self-reinforcing fall in the prices of securities. These procyclical price dynamics were halted by the decisive intervention of multiple central banks, amongst other factors. By announcing the pandemic emergency purchase programme (PEPP) and the associated large-scale purchases of securities – notably including commercial paper from firms – the Eurosystem helped restore market liquidity and the prices of securities to stabilise.[17]

A similar development was observed in the UK gilt market at the beginning of October 2022. The significantly higher interest rate level in 2022 and the debt-financed budget plans of the government led by Prime Minister Liz Truss brought about an increase in risk premia and thus in interest rates in the UK gilt market. This subsequently led to a considerable loss in the value of interest rate derivatives and the corresponding variation margin

13 See European Central Bank (2020b), p. 101, Chart A.
14 See European Central Bank (2020b), p. 102, Chart B.
15 In particular, low-volatility net asset value and variable net asset value money market funds came under pressure. By contrast, the more stringently regulated constant net asset value money market funds were able to generate additional deposits.
16 A similar spiral was also triggered by margin payments via investment funds. See European Central Bank (2020a), pp. 122 ff.
17 See European Systemic Risk Board (2020).

calls of CCPs. This particularly affected UK pension funds, which often try to hedge their long-term liabilities with interest rate derivatives. In order to generate liquidity to meet CCPs' margin requirements, these pension funds sold off UK gilts. This triggered a self-reinforcing fall in the prices of these securities, which could only be halted by a purchase scheme introduced at short notice by the Bank of England.[18]

Regulation of margin requirements

An important element of CCP regulation is the prevention of excessive declines in initial margins during periods of calm. Under EU rules, European CCPs are expected to take measures to prevent potential procyclical effects in their risk management practices, provided that this does not impair their soundness and financial security.[19] For this reason, they are required to calibrate their models for calculating initial margins using one of three options in order to limit procyclicality: CCPs may either (i) apply a buffer of at least 25% to the calculated initial margins, (ii) factor stress phases into the calibration of initial margin calls with a weight of at least 25%, or (iii) use a historical look-back period of at least ten years for the calibration. However, both during the period of stress in the wake of the COVID-19 pandemic and during the energy price shock, it became apparent that these regulations were only able to counteract the procyclicality of initial margin requirements to a limited extent. With regard to the market participants affected by high margin requirements, rapid changes in initial margins by CCPs are ambivalent: although the rapid decline during calmer market phases leads to a release of liquidity, this could also cause requirements to rise sharply again in future.

From a financial stability perspective, it should be investigated how liquidity bottlenecks in bilateral and central clearing can be better prevented in future. In addition to improving supervisory transparency regarding existing collateralisation requirements in bilateral clearing, expanding the number of enterprises subject to collateral obligations would also be conceivable. If the sharp rises in margin requirements for central clearing have been caused by excessive declines in margin requirements during calm market phases, it may be necessary to introduce more concrete rules which would reduce CCPs' freedom when it comes to designing their risk models. At present, an international review is being conducted on how regulation could be further improved.[20] Thus far, there has

18 See Bank of England (2022).
19 For information on the risks arising from competition between CCPs and from the procyclicality of collateralisation requirements, see Deutsche Bundesbank (2016), pp. 85 ff.
20 See Basel Committee on Banking Supervision, Committee on Payments and Market Infrastructures and Board of the International Organization of Securities Commissions (2022).

been no global consensus on the extent to which procyclical behaviour in the models for calculating margin requirements would be acceptable from a regulatory perspective. International coordination of regulation would be welcome, as CCPs in the major economic areas are partly in competition with one another and uniform rules would avoid competitive disadvantages. The European Securities and Markets Authority (ESMA) is working at the European level to improve the three existing options that limit procyclicality.[21] Furthermore, it should be examined whether it would be appropriate to impose regulatory provisions on the add-ons that clearing members may include when passing on CCPs' margin requirements to their customers. This could reduce liquidity needs and procyclicality in this peripheral area of central clearing.

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GLOSSARY

BaFin	Federal Financial Supervisory Authority
BIS	Bank for International Settlements
BLS	Bank Lending Survey
BOP-F	Bundesbank Online Panel – Firms
BOP-HH	Bundesbank Online Panel – Households
BVAR	Bayesian vector autoregressive model
CCPs	Central counterparties
CCyB	Countercyclical capital buffer
CET1	Common equity tier 1
CMBSs	Commercial mortgage-backed securities
CRD	Capital Requirements Directive
CRR	Capital Requirements Regulation
CRSA	Credit risk standardised approach
DSCR	Debt service coverage ratio
DSTI	Debt-service-to-income ratio
DTI	Debt-to-income ratio
EBA	European Banking Authority
EBITDA	Earnings before interest, taxes, depreciation and amortisation
ECB	European Central Bank
ECC	European Commodity Clearing AG
EEA	European Economic Area
EIOPA	European Insurance and Occupational Pensions Authority
ESMA	European Securities and Markets Authority
ESRB	European Systemic Risk Board
EU	European Union
FINREP	Financial reporting
FSB	Financial Stability Board
GDP	Gross domestic product
G-FSC	German Financial Stability Committee
G-SIIs	Global systemically important institutions
ICR	Interest coverage ratio
IFRSs	International Financial Reporting Standards

IMF	International Monetary Fund
IRBA	Internal ratings-based approach
KfW	Kreditanstalt für Wiederaufbau
LCR	Liquidity coverage ratio
LSTI	Loan-service-to-income ratio
LTV	Loan-to-value ratio
OECD	Organisation for Economic Co-operation and Development
O-SIIs	Other systemically important institutions
OTC derivatives	Over-the-counter derivatives
PEPP	Pandemic emergency purchase programme
RWAs	Risk-weighted assets
SCR	Solvency Capital Requirement
SRF	Single Resolution Fund
SSM	Single Supervisory Mechanism
sSyRB	Sectoral systemic risk buffer
SVAR	Structural vector autoregressive model
TPI	Transmission Protection Instrument
vdp	Association of German Pfandbrief Banks

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