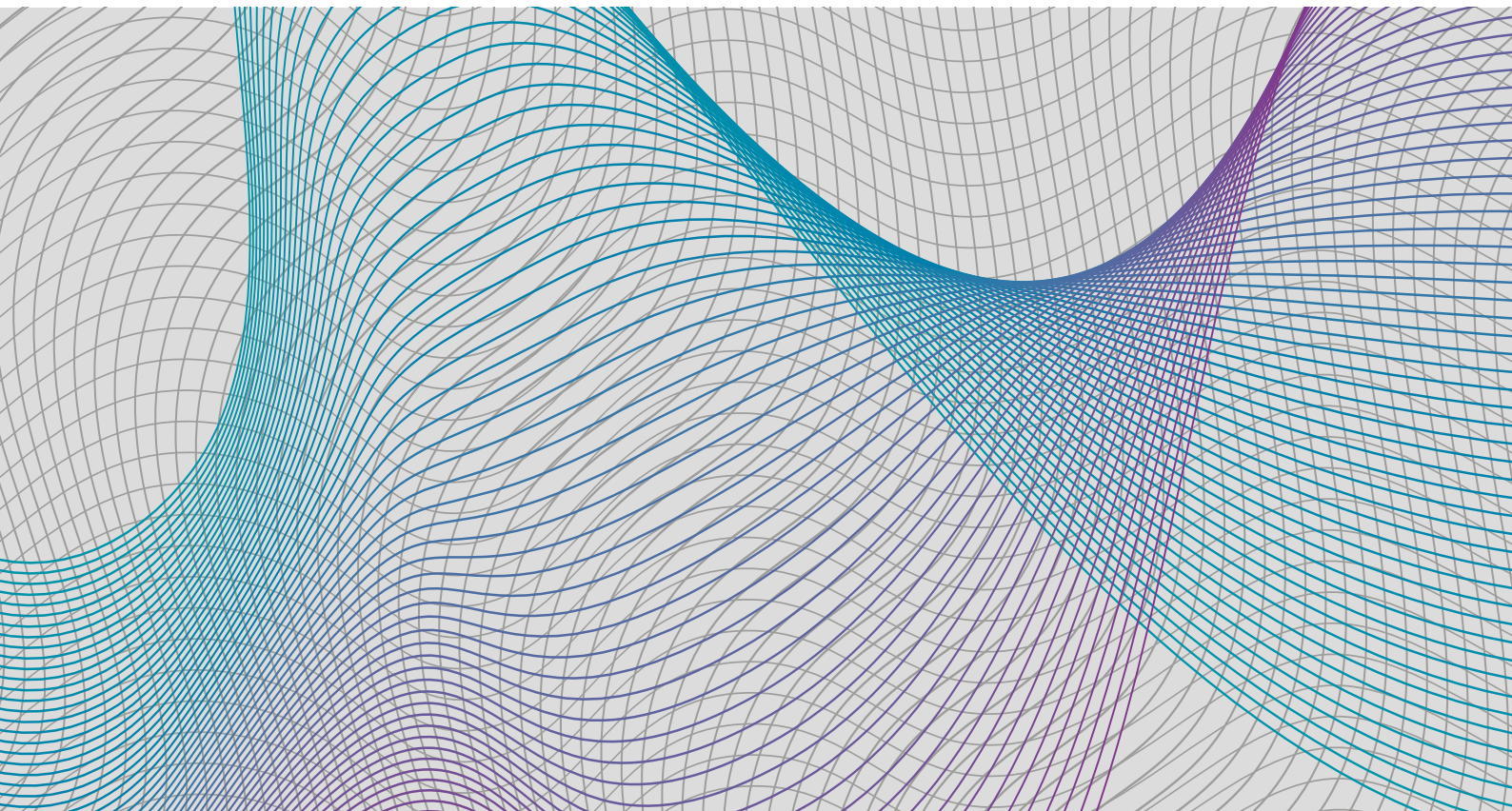




Financial Stability Review 2021



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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	Data unknown, not to be published or not meaningful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.

I Prologue

Under the Financial Stability Act (*Finanzstabilitätsgesetz*), the Bundesbank is responsible for monitoring the stability of the German financial system. It is charged 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 coronavirus 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, the distress of one or more market participants can

endanger the functioning of the entire system. This may be the case when a distressed market participant is very large or closely interlinked 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. Systemic risks can also 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 extent to which the recommendations have been implemented.

This report takes account of developments up to the cut-off date of 19 November 2021.

Overview

Stability situation in the German financial system

The coronavirus pandemic is one of the greatest challenges that society and the economy have had to face over recent decades. The financial sector is fundamental to economic development and stability. During the pandemic, it was able to perform its functions. There was neither a liquidity crunch nor a crisis of confidence. Extensive fiscal policy measures predominantly helped to shield the real economy and – indirectly – the financial system from the pandemic fallout. In this way, impending insolvencies could largely be avoided. There was no need for banks to use their capital buffers, as the feared sharp rise in losses did not materialise.

It is now essential to look to the future to ensure that the financial sector can provide sustainable financing for the forthcoming structural change and assume risks in an appropriate manner. All parties involved will need to act preventively to increase resilience to future risks.

During the coronavirus pandemic, the financial cycle expanded further, and existing vulnerabilities in the German financial system continued to mount. Enterprises, households and governments have accumulated more debt. High valuations in some market segments have the potential to trigger setbacks, and the upswing in the residential property market is continuing unabated. Moreover, the link between microeconomic and macroeconomic risks appears to have loosened during the pandemic. This underscores a development that has characterised the last 20 years and may have solidified expectations that

the financial system will sustain only limited losses in future recessions, too. The experiences of the coronavirus pandemic are thus likely to have generally increased the long-standing danger of risks being underestimated.

Hardly any losses in the German financial system

Even though real gross domestic product (GDP) fell by 5% in 2020, losses in the German financial system hardly rose in the wake of the pandemic. The resilience of the system was not put to a serious test. Government stabilisation measures were crucial to ensuring that the real economic slump did not affect the financial sector. In the initial phase of the pandemic, in spring 2020, extensive fiscal and monetary policy as well as supervisory measures prevented a liquidity crunch and a wave of insolvencies in the corporate sector.

As the pandemic continued, solvency problems hung over the corporate sector in the ensuing months, and these threatened to spill over into the financial system. In this second phase of the pandemic, government aid was a decisive factor in mitigating the impact of revenue losses in the corporate sector. In the household sector, it was above all short-time working that prevented a sharper rise in unemployment and the concurrent negative impact. As a result, there were hardly any major losses in the financial system, and banks did not need to use their capital buffers to stabilise lending.

As 2021 progressed, the economy began to recover. At the same time, the financial cycle continued to expand and vulnerabilities to build up, a develop-

ment that began some years ago. The financial cycle is fundamental to the stability of the financial system.

The financial cycle continued to expand.

It marks movements in financial variables over the medium term – lending and asset prices, for instance – which distinguishes it from the real economy’s short-term business cycle.

In the third phase, the economic challenges on the way out of the pandemic must now be mastered. Finding a good way to exit the support measures will be vital. Another key item on the agenda is economic structural change, which requires sustainable financing and appropriate risk sharing as well as a suitable approach to addressing mounting vulnerabilities. The linchpin for all this is a resilient financial system which supports economic growth, limits vulnerabilities and can deal with risk.

Potential underestimation of risks

The coronavirus pandemic has made assessing future economic risks more difficult. It appears that macroeconomic developments and microeconomic risks have become decoupled. In macroeconomic terms, the pandemic triggered an exceptionally severe

Macroeconomic and microeconomic risks appear to have become decoupled.

recession. However, in microeconomic terms, this entailed hardly any larger-scale losses. In fact, the number of corporate and household insolvencies fell. The previous two decades had already been abnormally stable, with corporate insolvencies and unemployment in practically constant decline. Even the global recession of 2008 and 2009 only briefly interrupted this trend. One reason for this was exceptional government support measures – in the coronavirus pandemic for enterprises and households, in particular, and in the global financial crisis also for banks directly.

During the pandemic, containment measures triggered revenue shortfalls on a large scale, justifying extensive fiscal support measures. However, future economic downturns could have a greater impact again at the microeconomic level and thus lead to losses, insolvencies and restructuring of enterprises. Accordingly, the implications for the financial sector would be greater.

For the stability and performance of the financial sector, it would be concerning if market participants were to assume on the basis of their experiences from the last two recessions that the link between macroeconomic and microeconomic risks will remain loose in the future. If this were the case, estimates would put credit risk too low and the ability to bear losses too high. Risk-weighted capital ratios could overstate banks’ actual resilience.

Whether and to what extent risks are actually being underestimated can often only be gauged in retrospect. However, it can be seen that risk in some market segments is currently being assessed as low. Investors do not seem to be linking higher corporate indebtedness to any immediate increase in the risk of default. Even enterprises with poor credit ratings are able to obtain relatively cheap capital market funding. In addition, financing conditions for enterprises in virtually all sectors are more favourable than the long-term average and also than before the outbreak of the pandemic. This also applies to sectors that were particularly hard hit by the pandemic or that are facing accelerated structural change.

Macro-financial environment: brisk recovery on the cards, setbacks cannot be ruled out

Uncertainty surrounding macroeconomic developments has diminished significantly over the course of the pandemic, and the German economy is expected to make a sharp recovery in the coming years. Overall, the macro-financial environment in 2021 resembles

the environment prior to the coronavirus pandemic. Financing conditions are favourable, and volatility in the financial markets is low. However, there are two major differences. The first is that the financial cycle is more advanced. The second is that Germany is just one of many advanced economies transitioning from a period of economic recovery to an upswing phase. In the current situation, a strong global increase in demand is causing shortages in the global commodities and goods markets. At the same time, difficulties encountered in fully reactivating global value chains are leading to supply bottlenecks for key intermediate goods. All this combined is currently slowing the economic recovery, ushering in a significant increase in consumer prices and causing interest rate expectations to rise in financial markets.

It is thus imperative to not lose sight of downside risk to the real economy. The Bundesbank has used a scenario analysis to examine the impact of a subdued economic recovery on the German financial system. Weaker macroeconomic growth does affect

It is imperative to not lose sight of downside risk.

the credit and securities portfolios of German financial intermediaries; however, the impact is likely to be limited. If such a scenario were to arise, no serious negative spillover effects from the financial system to the real economy are currently anticipated.

Financial cycle expanded

The current economic recovery in Germany is coinciding with an expansion of the financial cycle that has been ongoing for several years now. The build-up phase of the financial cycle is often associated with decreasing risk awareness, dynamic growth in asset prices and a rise in both lending and indebtedness. Vulnerabilities may therefore accumulate for households, enterprises and financial intermediaries. Should shocks occur, i.e. unexpected negative

developments, these vulnerabilities may impede the smooth functioning of the financial system. It is therefore important for the financial system to be sufficiently resilient so that it can remain functionally viable even in the event of negative developments. It is the task of macroprudential policy to counteract the build-up of vulnerabilities and thus prevent the financial and business cycle from amplifying each other. One major lever here is ensuring that the financial system is sufficiently resilient and has adequate capitalisation so that it can absorb macroeconomic shocks.

The economic slump triggered by the coronavirus pandemic did not interrupt the build-up of the financial cycle. Both lending and asset prices, especially residential real estate prices, continue to increase sharply. The Bundesbank's early warning indicator, which consolidates a number of individual indicators for cyclical risks and estimates the probability of a financial crisis, is continuing its upward trend.

The global macro-financial environment is driving the build-up of the financial cycle. Volatility in the international financial markets is low, and many indicators suggest that valuations are high. Financing conditions for households and enterprises are favourable. Decreasing risk awareness and a growing risk appetite among market players are typical of an expanding financial

The macro-financial environment is driving the build-up of the financial cycle.

cycle. Even prior to the pandemic, there were signs that low interest rates, favourable financing conditions and an ongoing economic boom led to an overly optimistic view of the future. Low interest rates and low volatility also create more incentives for market participants to take on greater risk in the search for yield.

Vulnerabilities continue to build up

Even before the pandemic, vulnerabilities to negative macroeconomic developments that required preventive action had built up in the German financial system. These vulnerabilities have continued to intensify as the coronavirus pandemic progresses.

First, there have been mounting vulnerabilities on the balance sheets of German banks. A rise in the percentage of loans to – relatively speaking – financially weaker enterprises in German banks' credit portfolios has been evident for a few years already. This has pushed up allocation risk. Given the favourable macro-financial environment prior to the coronavirus pandemic, the assessment of credit risk was increasingly optimistic.

The danger of credit risk being underestimated has generally increased.

Risk provisioning fell to an all-time low on the back of the upbeat economic situation and declining insolvencies, and hardly rose – even during the crisis. The danger that this may be associated with an underestimation of risk has generally increased. While the coronavirus pandemic has not led to the feared rise in insolvencies, indebtedness went up in the corporate sector, especially in those sectors that were hit particularly hard by restrictions imposed as part of efforts to combat the pandemic. As a result, these sectors are now more susceptible to future shocks. Risk is mitigated by the fact that banks' claims on particularly hard hit sectors make up only a small percentage of the banking system's credit portfolio. Furthermore, indebtedness in the German corporate sector appears moderate by international standards.

Second, vulnerabilities to negative developments in the German residential real estate market are building up further. Prices have continued to go up sharply, even during the pandemic, and are outpacing growth in households' income and in rents. Price exaggerations in the residential real estate market

have tended to increase further. Bundesbank estimates put them at between 10% and 30% in Germany in 2020. As a result, lenders may potentially overestimate the value of loan collateral. At the same time, the issuance of loans for house purchase rose dynamically: in 2020, the credit portfolio expanded by 6.5%.

The value of loan collateral may be overestimated.

Relative to GDP, loans to households for house purchase have risen appreciably since 2018. To date, risks arising from housing loans have been contained because households' debt sustainability has remained relatively stable. However, household debt relative to household income has been increasing continuously since the end of 2018. This has led to a build-up in medium-term vulnerabilities.

Financial stability would be at risk if destabilising developments were to take hold in the property market, whereby rising credit volumes and prices were to coincide with a deterioration in borrowers' debt sustainability. A pronounced lowering of lending standards would be a key sign of this. Although the available data currently provide no indication as yet of a significant loosening of lending standards for new residential real estate loans, given rising prices, an easing of lending standards could be on the cards to ensure that lending agreements can be concluded at all. Rising prices may make the associated risk appear low, as expected future price increases would decrease the loss potential from today's perspective.

Third, the German financial system is vulnerable to interest rate risk. This type of risk has built up during the extended period of low interest rates.

The German financial system is vulnerable to interest rate risk.

Interest rates could go up if inflation rates rise unexpectedly sharply or if risk premia increase. This would cause the value of marked-to-market assets to fall, resulting in losses. For banks, increases in financing costs would out-

pace interest income growth in the short term. It is predominantly small and medium-sized banks that are affected by interest rate risk; large banks make greater use of hedging transactions to compensate for interest rate risk. However, these hedging transactions only make the financial system more stable overall if counterparties can actually bear these risks.

In addition, if interest rates were to rise, the entire banking sector would be indirectly affected via heightened credit risk. Higher interest rates would increase the interest burden for enterprises in particular. These are typically financed via loans with shorter maturities.

Besides banks, insurers, pension institutions and investment funds are also vulnerable to interest rate changes. In the search for yield, they have taken on greater risk and extended the maturities of their capital investments. In an environment of low interest rates, life insurers and pension funds, in particular, are having difficulty generating sufficient returns to meet obligations arising from high guaranteed returns promised to policyholders. While a rise in interest rates generally takes pressure off insurers and improves their solvency ratio, a particularly strong rise would entail liquidity risks in the short term, as policyholders may increasingly lapse their policies and seek out more attractive investment vehicles.

And, last but not least, the German financial system is vulnerable to international developments and ensuing contagion effects. Corporate and sovereign indebtedness increased considerably across the globe during the pandemic. A slump in sales and impending liquidity bottlenecks aggravated the situation for enterprises. Public indebtedness was driven up by support measures and contemporaneous economic effects stemming from the pandemic. Given the close ties within the euro area, a rise in indebtedness in Member States is of particular relevance for the German financial system. The situ-

ation worsened particularly in those Member States that already had high debt ratios and budget deficits before the pandemic. There are still serious concerns regarding the sustainability of public debt in the euro area. Furthermore, the sovereign-bank nexus, i.e. the close financial ties between governments and banks within each Member State, has become even more entrenched during the coronavirus pandemic.

■ Macroprudential policy

What risks and vulnerabilities exist in the German financial system?

Many indicators point to a dynamic expansion of the financial cycle and an associated increase in risks to the financial system. Overall, the developments that contributed to an increase in cyclical systemic risks before the outbreak of the pandemic are continuing. These risks emanate from three main vulnerabilities: first, German banks are becoming increasingly vulnerable due to allocation risks on their balance sheets, amongst other things. Second, vulnerabilities to negative developments in the residential real estate market are continuing to build up. Third, the German financial system is vulnerable to interest rate risk. A second scenario analysis conducted by the Bundesbank shows that, as things stand, the German financial system would suffer heavy losses in the event of a severe macro-financial shock. If banks do not use their capital buffers, there could be adverse implications for the real economy in such a scenario.

In the event of a severe macro-financial shock, there may be negative repercussions for the real economy.

Should vulnerabilities continue to mount, negative macroeconomic developments are likely to have a significantly stronger impact on the financial system

and lending. It is therefore important to take preventive action now. On the one hand, the resilience of the financial system to heightened cyclical systemic risks should be increased. On the other hand, the further build-up of vulnerabilities and systemic risks should be limited. If the financial system is not sufficiently resilient, this may negatively affect economic developments; for instance, an economic downturn could be aggravated by excessive lending restrictions. In order to stabilise their capital ratios, banks may have to curtail their lending precisely when the economy is already running into difficulties. Not least to be able to sustainably fund imminent structural change and assume risks, the financial system must be sufficiently resilient going forward.

How can resilience be built up and how can vulnerabilities be limited?

The objective of the countercyclical capital buffer is to make banks more resilient to cyclical systemic risks. Banks must meet higher capital requirements when vulnerabilities increase. If the latter decline, the buffer can be reduced. In times of stress, it can be directly released, i.e. reduced to 0%. This gives the banking system wider scope to maintain its lending and thus to continue performing its macroeconomic function.

So far, the countercyclical capital buffer has been implemented along these lines in Germany. In view of rising cyclical systemic risks, it was raised from 0% to 0.25% for the first time in 2019. At the onset of the pandemic in the second quarter of 2020, it was lowered to 0% again. After the acute period of stress and in view of the economic recovery, the existing and growing vulnerabilities are now coming to the fore once again.

A key indicator used to set the countercyclical capital buffer is the development of lending relative to the real economy. This is measured using the credit-to-

GDP gap. Prior to the pandemic, loans had been experiencing very dynamic growth, which is why this indicator had already exceeded its activation threshold of 2 percentage points in the pre-crisis period. During the pandemic, credit growth remained dynamic, and the credit-to-GDP gap currently suggests a higher countercyclical capital buffer value than the 0.25% set prior to the pandemic. Steps to gradually rebuild the countercyclical capital buffer should therefore be taken in good time.

The countercyclical capital buffer should be built up again gradually and in good time.

That being said, this buffer does not explicitly take account of the dynamic developments in the residential real estate market. These must therefore be monitored closely from a macroprudential perspective. The way in which indebtedness and debt sustainability in the household sector develop and whether credit standards are loosened are crucial to the debt situation. Lenders, which are primarily banks in Germany at present, should take due account of the risks associated with residential real estate financing when granting loans and pay attention to sustainable lending standards.

Developments in the residential real estate market must be monitored closely.

Alongside the supervisory communication on sustainable lending standards, the borrower-based instruments created in 2017 could be deployed, in particular. This could counteract an excessive loosening of credit standards. Furthermore, additional macroprudential instruments that are tailored to the specific characteristics of risk build-up in the real estate market could also be utilised. For instance, sector-specific capital buffers such as the systemic risk buffer could be implemented. A lower bound could also be set for risk weights; other European countries have already opted to do so.

Macroprudential policy should be developed further

The coronavirus pandemic gives cause to reflect on and refine macroprudential policy in Europe and in Germany since the financial crisis. One key aspect here should be the effectiveness of macroprudential capital buffers. The Financial Stability Board (FSB) determined that although many countries were swift to release the countercyclical capital buffer in response to the pandemic, it was not always available or had not been built up to a sufficient level in some countries. It therefore follows that in future, it will be necessary to react more quickly to emerging risks. In the European framework, major importance is attached to the credit-to-GDP gap as a rules-based component for raising the countercyclical capital buffer. However, it has become evident that cyclical systemic risks can already build up before the credit-to-GDP gap indicates this. The discretionary component in the decision-making process should therefore be strengthened.

It is crucial that distressed banks are able to exit the market without endangering financial stability. In an evaluation of the too-big-to-fail reforms, the FSB established that, on the one hand, the new resolution regimes are having the desired effect and are deemed credible by market participants. On the other hand, however, further reforms are still needed. For example, government funds have been used in several instances to support banks in distress, contributing to doubts surrounding the functional viability of the resolution framework. In Europe, the upcoming review of the EU framework for the recovery and resolution of institutions (resolution regime) and for crisis management and deposit insurance (CMDI) now presents an opportunity to remedy any remaining weaknesses in the framework and strengthen its functional viability and credibility.

Regulatory gaps should be addressed from a financial stability perspective with regard to future risks in

the residential real estate market. In Germany, no legal basis has yet been established for income-based macroprudential instruments, which establish a relationship between debt or debt service and household income.

European minimum requirements for such instruments at the national level would be desirable. A complete toolkit would ensure that national authorities

Regulatory gaps should be addressed with regard to risks in the residential real estate market.

are able to adequately counter risks to financial stability in their respective country and at the same time reduce the contagion effects of a crisis on other countries. Owing to the national characteristics of real estate lending business, however, responsibility for the use of these instruments should remain at the national level.

Effects of climate change on the financial system: first analytical results on climate-related transition risks for Germany

The real economy and the financial system are both affected by climate change and the economic structural change associated with the transition to a climate-friendly economy. For instance, physical risks such as higher average temperatures or extreme weather may result in assets being damaged or lost. The mitigation of climate change also requires economic structural change, in the course of which some assets will likely become fully or partially stranded. The later necessary climate action is taken, the greater the transition risks associated with the changeover to a climate-friendly economy will be, and the more significant adjustments will have to be in order to meet the objectives of the Paris Agreement. However, transition risks may also occur if climate policy measures are subsequently revoked. Additionally, they may be triggered by investment in low-emission or emission-free technology that proves to be inferior to later technological developments in the market.

A new analytical framework was used to investigate how unexpected changes in global climate policy could affect the loan and securities portfolios of financial intermediaries operating in Germany. It was based on international climate scenarios devised by the Network for Greening the Financial System (NGFS) to gauge the macroeconomic repercussions of several global climate pathways. These scenarios were then incorporated into a sector model and broken down across industrial and commercial sectors on the basis of carbon intensities, allowing the effect of climate action on the real economy to be calculated. This was ultimately used as a basis for estimating the impact on the portfolios of German financial intermediaries.

Overall, the vulnerabilities of the German financial system to transition risks emanating from climate policy appear to be moderate. This is partly because

Vulnerabilities to transition risks appear moderate, but high uncertainty prevails.

the macroeconomic losses in value added seen in the climate scenarios under review are only modest – although individual sectors may be strongly affected. However, these particularly affected economic sectors account for a relatively small share of the financial intermediaries' portfolios. That share may be significant for some financial intermediaries, though, thus resulting in greater losses. That said, estimates of the German financial system's vulnerability to transition risks are subject to a high degree of uncertainty on account of complex interrelationships and the long time horizon.

When interpreting the results, it must be borne in mind that physical risks which stem from climate change itself and which may entail high real economic costs are not captured. Such risks rise particularly when climate policy measures are postponed. Furthermore, not all transition risks can be captured in the present analysis – for example, a surge in innovation activity or changes in consumer or producer behaviour. Ultimately, the complex relationships between the real economy and the financial system can only be addressed schematically in the models used.

Targeted and credible climate policy can reduce the uncertainty and risks faced by the financial system during the transition to a climate-friendly economy. If the necessary measures are taken too late, potential shocks to the financial system will be stronger. The financial sector must therefore take prompt steps to develop analytical skills for addressing climate risks, as well as building up resilience to unexpected future risks, too. Enterprises' disclosure of their carbon emissions would contribute greatly to facilitating a better assessment of risks, and should therefore be pushed forward by international standardisation bodies and legislators. Central banks should also increase the market transparency of climate-related risks – by implementing disclosure requirements for the securities they purchase and the collateral they accept, for instance.

Facilitate better assessment of risks through disclosure obligations.

Stability situation in the German financial system

Unlike the global financial crisis of 2007-08, the coronavirus pandemic has had no serious contagion effects within the German financial system. There were hardly any major losses in the financial system, which was largely attributable to government stabilisation measures. Lending was not generally restricted, and the stability of the system was maintained.

The nascent economic recovery has brought the build-up of vulnerabilities within the German financial system back into sharper focus. During the coronavirus pandemic, the expansion of the financial cycle has continued apace, with the strong growth in prices in the residential real estate market continuing unabated and lending to households increasing substantially. Lending to enterprises also remained high, and enterprises that were hit particularly hard by the pandemic became heavily indebted. The expected simultaneous upswing in the business and financial cycles in Germany brings with it the danger of an increased appetite for risk and a reduced awareness of macroeconomic risks.

The assessment of macroeconomic risks in particular has become more difficult for market participants. Indeed, macroeconomic developments appear to have become decoupled from microeconomic risks over the course of the coronavirus pandemic. The previous 20-year period was abnormally stable from a macroeconomic perspective, with business insolvencies and unemployment in practically constant decline. With a view to financial stability, however, it would be concerning if the base assumption going forward were that recessions would have hardly any effect at the microeconomic level.

Macroprudential policy should switch back from crisis management to combating systemic risks via preventive measures. At the time of writing, uncertainty is at significantly reduced levels and no further large losses are expected in the financial system in the short term. Medium-term vulnerabilities continue to build up, however, which should provoke a macroprudential policy response.

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

Macro-financial environment

Now that the economic recovery has begun to take hold, the macro-financial environment in 2021 resembles the situation prior to the outbreak of the coronavirus pandemic: lending to the domestic private non-financial sector is increasing sharply. One major factor in this regard is the buoyant demand on the part of households for housing loans. The stress in the

The environment resembles the situation prior to the pandemic.

financial system which first emerged in March 2020 was quickly banished by the comprehensive stabilisation measures ushered in via fiscal and monetary policy (see Chart 2.1.1). Since then, the financial markets have been marked by low volatility, high valuations (in some cases) and low risk premia. The unusually low interest rates are probably playing a key role here. Financing conditions in the euro area have remained decidedly favourable, just as they were before the pandemic. This environment creates strong incentives for a search for yield and may contribute to a higher appetite for risk.

Nevertheless, the current environment diverges from 2019, in which the business cycle was waning while the financial cycle was waxing, in two important ways.¹ The first is that the financial cycle is more advanced. The second is that Germany is just one of many advanced economies transitioning from a period of economic recovery to an upswing phase. In the current situation, a strong increase in demand worldwide is causing shortages in the global commodities and goods markets. At the same time, difficulties encountered in reactivating global value chains and low capacities are leading to supply bottlenecks for key intermediate goods. All this com-

bined is currently slowing the economic recovery, ushering in a significant increase in consumer prices and causing interest rate expectations to rise in the financial markets.

Economy on road to recovery

The German economy is recovering from the economic repercussions of the coronavirus pandemic. While supply bottlenecks for intermediate products have partially stalled said recovery,² the general economic outlook remains positive. Even those sectors which were affected the longest by the coronavirus pandemic and the attendant restrictions have by now begun to recover. In addition, powerful stimuli are coming from abroad.

The economic recovery could bring with it rising inflation rates and market interest rates.

The economic upturn began in many advanced economies and vital trading partners more or less simultaneously. A strong recovery in the global economy could bring with it rising inflation rates and market interest rates. Autumn 2021 saw price increases in some sectors due to higher commodity prices and supply bottlenecks.³

¹ Financial cycles are the parallel movements in financial variables within the financial system over the medium term. Key variables include the aggregate loan supply and real estate prices. The financial cycle is distinct from the business cycle, which maps briefer fluctuations in economic activity. A sharp upswing in the financial cycle can drive up financial system vulnerability and lead to a build-up of systemic risk. For further details, see the “financial cycle” entry in the Bundesbank’s glossary: <https://www.bundesbank.de/action/en/729724/bbksearch?firstLetter=F>

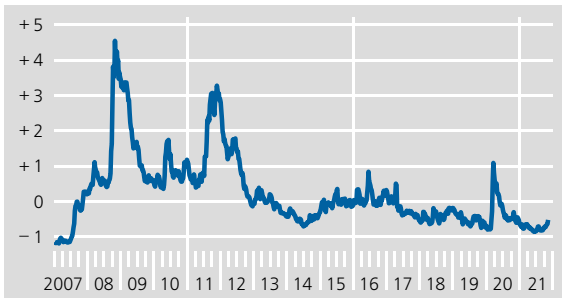
² The burden placed on the economy by supply bottlenecks may also extend well into 2022 in some sectors, such as the motor vehicle industry.

³ See Budianto, Lombardo, Mojon and Rees (2021); Deutsche Bundesbank (2020b); Deutsche Bundesbank (2020c).

Financial stress indicator*

Chart 2.1.1

Standardised weekly data



Sources: Bloomberg Finance L. P., Markit, Refinitiv and Bundesbank calculations. * The indicator is the first principal component of 11 variables included in a principal component analysis. The variables comprise various interest spreads as well as measures of liquidity and volatility in the financial market.

Deutsche Bundesbank

The environment is influenced by very expansionary fiscal and monetary policy. German fiscal policy provided comprehensive support for the corporate and household sectors, first and foremost through transfer payments and credit guarantees. This support was extended or adjusted where it appeared necessary. The monetary policy of the European Central Bank (ECB) remained accommodative and had a dampening effect on funding costs. To this end, the pandemic emergency purchase programme (PEPP) was expanded in December 2020. The programme is planned to last until the end of March 2022 at the earliest. The interest rate level was restrained by both structural and cyclical factors. The medium-term equilibrium interest rate had already declined significantly before the pandemic, for which factors including a high propensity to save, demographic developments and lower potential growth were partly responsible. These structural causes may well remain relevant after the pandemic.⁴

The economic upswing is likely to continue in the coming years.⁵ The output gap should close quickly, and aggregate capacity utilisation should reach an above-average level as early as 2022. The gradual rise in investment and the recovery in the German labour market additionally suggest that enterprises

are feeling confident and that they trust the upswing will continue.

Overall, uncertainty surrounding future macroeconomic developments has diminished significantly since the onset of the pandemic. Of course, the economy may perform differently than is expected at present. One potential scenario is another downturn and a weaker recovery than

The uncertainty surrounding macroeconomic developments diminished significantly.

anticipated. This could occur if, for example, the coronavirus pandemic necessitates renewed stringent containment measures or the supply issues remain a problem for longer than is currently assumed. Rising risk premia and a return to higher levels of uncertainty would cause financing conditions to deteriorate. Reduced intermediation capacity could lead the financial system to amplify a potential real economic shock (see the section entitled “Impact of risk scenarios on Germany’s financial system” on pp. 53 ff).

Another possible scenario is that market interest rates could rise and financing conditions could likewise deteriorate as a result. This could be triggered if inflation increases for a longer period of time or to a considerably larger degree than expected. The high current rates of inflation are largely attributable to transitory factors. Alongside catch-up effects in energy prices, which earlier saw a sharp drop, these also include increases in prices resulting from rises in the prices of other commodities as well as supply bottlenecks and tax-related factors. However, inflationary pressures could mount if the currently high rates of inflation lead to greater growth in wages or if economic agents’ inflation expectations were to rise.⁶ In addition to these cyclical factors, structural developments, such as population ageing, could lead to persistently higher rates of inflation.⁷

⁴ See European Systemic Risk Board (2021c).

⁵ See Deutsche Bundesbank (2021a).

⁶ See Budianto, Lombardo, Mojon and Rees (2021).

⁷ See Goodhart and Pradhan (2020).

High valuations in the financial markets in some cases

The favourable macroeconomic environment is reflected in the financial markets. Stock markets have now more than overcome the massive price slumps seen in March

The favourable macroeconomic environment is reflected in the financial markets.

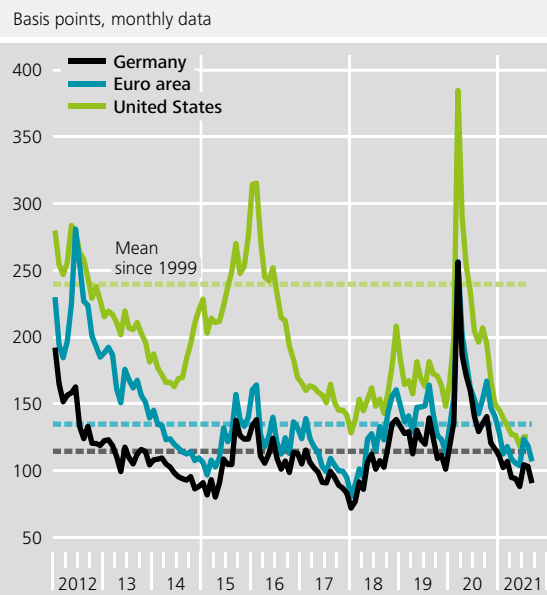
2020, and risk premia on corporate bonds are lower than they were before the pandemic in some cases

(see Chart 2.1.2). All in all, the valuations in some segments of the financial market appear to be high once again in the autumn of 2021.⁸ In this context, certain indicators suggest that valuations in the stock markets continue to be high despite a number of corrections and increased earnings expectations.⁹

A breakdown of price developments in the German DAX and the US S&P 500 share price indices shows that, up until the second quarter of 2021, greater risk propensity was the primary contributing factor to the price gains. Since the end of 2020, prices have also been influenced by the increasingly positive developments in corporate earnings. In addition, the rise in yields on government bonds, which are considered to be risk-free, had more of a dampening effect for a time (see Chart 2.1.3).¹⁰ In the markets for corporate bonds, risk premia are at historically low levels and below the values that would seem appropriate based on the fundamentals (see Chart 2.1.4).¹¹ As a result, investors could consider the acute default risks to be exceptionally low, both in comparison to the time shortly before the pandemic as well as over the long term.

The favourable global market environment may support the economic upswing, but could also contribute to the build-up of risks. On the one hand, the financing conditions are conducive to economic growth. The persistently low interest rates, positive sentiment in the international financial markets and also the low number of default events for securities are supporting

Risk premia on bonds issued by non-financial corporations* Chart 2.1.2



Sources: Banque de France, Federal Reserve and Bundesbank calculations. * Calculation according to Gilchrist and Zakrajšek (2012), Credit spreads and business cycle fluctuations, American Economic Review, Vol. 102, No 4, pp. 1692-1720. Deutsche Bundesbank

factors here. On the other hand, persistently low interest rates create incentives to search for yield. Consequently, investors may take on greater risk to generate higher yields.¹² Evidence of this is provided by, amongst other things, the increased global

Persistently low interest rates create incentives to search for yield.

⁸ See Bank of England (2021); Deutsche Bundesbank (2021d); Deutsche Bundesbank (2021b); European Central Bank (2021a); International Monetary Fund (2021a).

⁹ While not all models indicate high valuations for returns on equity and equity risk premia, it is fair value models in particular that suggest higher valuations, especially in the United States. See Deutsche Bundesbank (2021d); European Central Bank (2021c); International Monetary Fund (2021b).

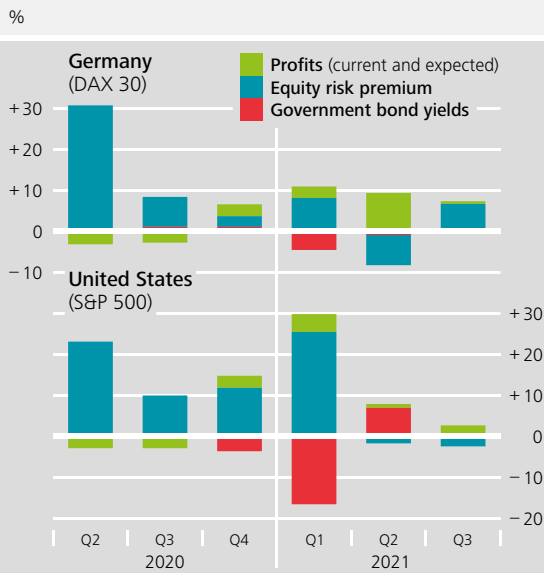
¹⁰ The determinants of price changes were estimated using a residual income model; see, for example, Claus and Thomas (2001).

¹¹ Estimation based on a fair value model. For the underlying methodology, see International Monetary Fund (2019).

¹² See Barbu, Fricke and Moench (2021); Becker and Ivashina (2015); Calomiris, Larrain, Schmukler and Williams (2019).

**Explanatory factors*
 in equity market performance**

Chart 2.1.3



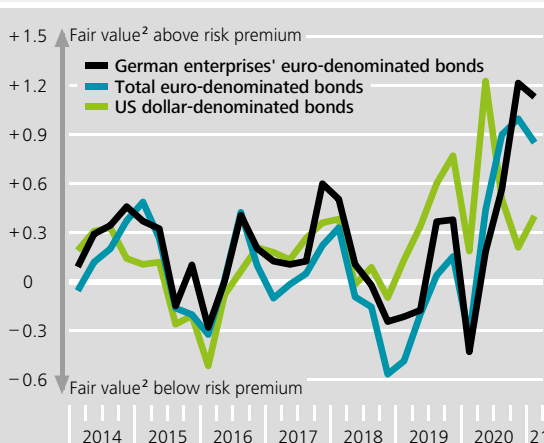
Sources: Bloomberg Finance L.P., Consensus Economics and Bundesbank calculations. * Based on the residual income valuation model. A positive contribution (e.g. falling government bond yields, falling equity risk premia or rising corporate profits) results in rising equity prices.

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**Valuation of bonds
 issued by non-financial corporations
 in the investment-grade segment**

Chart 2.1.4

Difference between risk premia in basis points per unit of risk¹



Sources: BIS, Bloomberg Finance L.P., Consensus Economics, ICE data used with ICE's permission, Refinitiv I/B/E/S and Bundesbank calculations. ¹ Difference between the risk premia in a fair value model (see International Monetary Fund (2019), Global Financial Stability Report: Technical Note on Asset Valuation Models, October 2019) and the observed risk premia from bond indices divided by the standard deviation of the risk premia since 2000. Positive values suggest fairly high valuations. ² Value justified by fundamentals.

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demand for leveraged loans, i.e. syndicated loans to particularly risky enterprises. Likewise, investors are more willing to forego investor protection clauses.¹³ The moderate level of volatility and the relatively low number of major default events may also contribute to investors underestimating risks.¹⁴

High valuations in the international financial markets in some cases create potential for setbacks. A severe macro-financial shock could place a significant burden on the securities portfolios of German financial intermediaries (see the section entitled "Impact of risk scenarios on Germany's financial system" on pp. 53 ff.). As a consequence, investors could abruptly restructure their portfolios and amplify declines in prices in the financial markets. This could restrict the financial system's capacity for intermediation.

There are multiple conceivable triggers for such a market development. For example, the pandemic could necessitate stringent containment measures once again. In addition, a real estate crisis in China could have an impact on global financial markets and thus on the German financial system (see the box entitled "Evergrande – a risk to the German financial system?" on pp. 25 f.). Sudden increases in market interest rates could also lead to falling prices.¹⁵ Particularly if inflation rates rise sharply or remain at elevated levels for longer than expected, this could contribute to an abrupt increase in interest rate expectations in the markets. Inflationary risks have grown since the beginning of the year, especially in the United States. In connection with this, interest rate expectations in the United States have risen continuously as well. Developments in the United States also influence interest rate expectations in the euro area as a result of co-movements.

¹³ See Aramonte, Lee and Stebunovs (2019); European Banking Authority (2020); Newton, Ongena, Xie and Zhao (2020); Securities Industry and Financial Markets Association (2021).

¹⁴ See Brunnermeier and Sannikov (2014); Danielsson, Valenzuela and Zer (2018); European Systemic Risk Board (2021c).

¹⁵ See, inter alia, Brandt and Wang (2003); Li, Narayan and Zheng (2010); Wright (2011).

Financial cycle continues to expand

In Germany, the economic recovery is coinciding with an expansionary phase of the financial cycle that has been ongoing for several years now. Residential real estate prices and lending to the private non-financial sector – i.e. enterprises and households – grew despite the real economic downturn (see Chart 2.1.5). This means that the coronavirus pandemic did not interrupt the upturn in the financial cycle in Germany.

Lending and residential real estate prices grew despite the real economic downturn.

estate prices and lending to the private non-financial sector – i.e. enterprises and households – grew

despite the real economic downturn (see Chart 2.1.5). This means that the coronavirus pandemic did not interrupt the upturn in the financial cycle in Germany.

The financial cycle is reflected in the developments in the Bundesbank’s early warning indicator (see Chart 2.1.6). This consolidates a number of individual indicators that provide information on the financial cycle.¹⁶ The indicator continued its upward trend, which began in 2015.

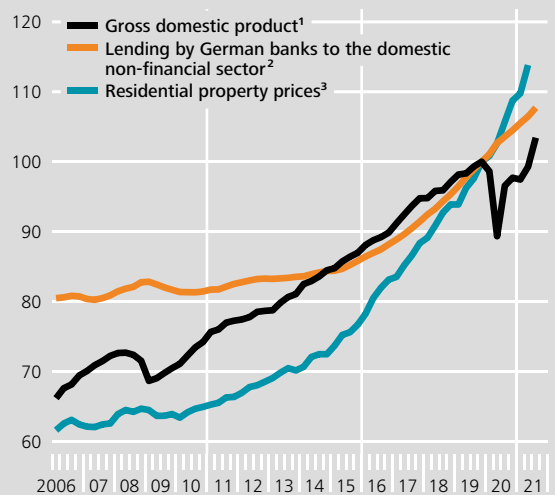
In this context, the main contributing factor was the credit-to-GDP gap, which widened further during the course of the pandemic (see Chart 2.1.7). The credit-to-GDP gap measures the extent to which loans granted in a given country are growing faster than that country’s economic output. The development of the gap is dominated by the strong fluctuations in gross domestic product (GDP) over the course of the coronavirus pandemic. In this vein, the widening of the gap in 2020 is exaggerated by the sharp downturn in GDP. Looking ahead, it is therefore likely to narrow again as the economy recovers. However, at the end of the forecast horizon in 2023, it will probably exceed the value it had reached before the recession.

With the aid of a counterfactual calculation, it is possible to estimate the role played by the extraordinarily strong fluctuations in GDP during the coronavirus pandemic with regard to the credit-to-GDP gap. Here, it is assumed that, if the downturn had not occurred, GDP would have continued to grow at a

Gross domestic product, residential property prices and lending in Germany

Chart 2.1.5

Q4 2019 = 100, nominal values



Sources: Federal Statistical Office, Bundesbank statistics and Bundesbank calculations. **1** Seasonally and calendar adjusted. **2** Seasonally adjusted. **3** Bundesbank calculations based on changing data providers (vdp Research GmbH from 2006, Federal Statistical Office from 2014).

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constant rate from the first quarter of 2020 and, in the fourth quarter of 2023, would have reached the value expected by the current Bundesbank forecast for that point in time.

The counterfactual credit-to-GDP gap may be interpreted as an estimate for the current trend of this indicator that approximates the actual credit-to-GDP gap. The counterfactual credit-to-GDP gap rises monotonically and totals around 5 percentage points towards the end of the forecast horizon.

The trend widening of the credit-to-GDP gap has persisted.

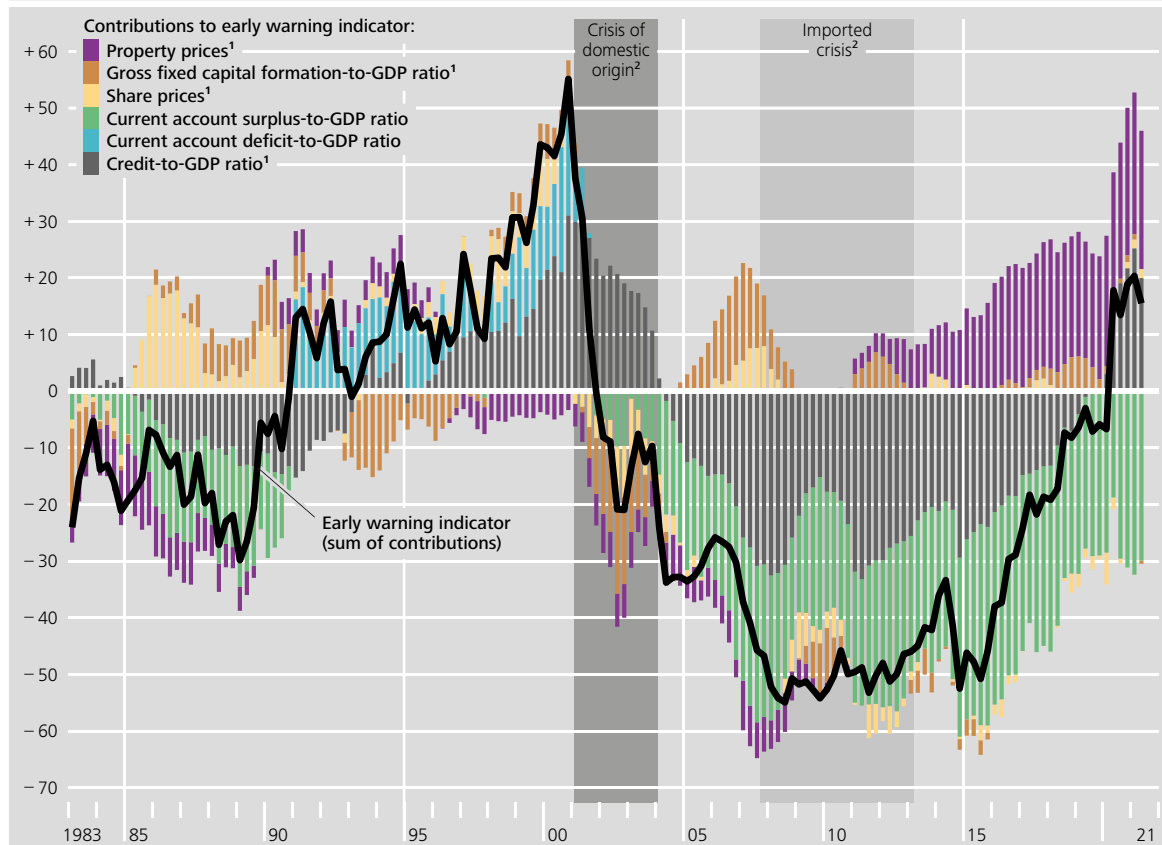
As the economy recovers, it is likely that the non-financial corporate sector will again make a similarly major contribution to private credit growth as it had

¹⁶ For details on the early warning indicator, see Deutsche Bundesbank (2018a); Beutel, List and Schweinitz (2019).

Early warning indicator for Germany*

Chart 2.1.6

Normalisation: Early warning indicator in the United States in Q1 2006 = 100



Sources: BIS, Bloomberg Finance L.P., Eurostat, ECB, IMF, OECD, Refinitiv, Bundesbank statistics and Bundesbank calculations. * The early warning indicator shows the extent to which current developments in the German financial system exhibit similarities with developments that characterised the lead-ups to past crises. A value of 100 would correspond to the level of the early warning indicator for the United States in Q1 2006. ¹ Cyclical deviation from the long-term trend, based on the Hodrick-Prescott (HP) filter. ² According to the European crises database; see M. Lo Duca et al., A New Database for Financial Crises in European Countries – ECB/ESRB EU Crises Database, ECB Occasional Paper Series 194, July 2017.

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before the coronavirus pandemic (see Chart 2.1.8). This is because rising investment activity should result in greater financing needs amongst enterprises.

Furthermore, the upswing in the residential real estate market is continuing unabated. It is therefore to be expected that lending to the private non-financial sector will continue to be driven largely by growth in residential real estate loans. Loans to

Loans to households for house purchase have been seeing particularly strong growth for an extended period of time now.

households for house purchase have been seeing particularly strong growth for an extended period of time now (see Chart 2.1.8).

At the same time, residential real estate prices are on the rise. Since as early as 2015, this price growth has made an especially large contribution to the increase in the early warning indicator (see Chart 2.1.6). They are thus highly significant for the development of cyclical risks in the German financial system.

The residential real estate market is experiencing an upswing not only in Germany, but also around the

world. In many countries, residential real estate prices continued to rise during the coronavirus pandemic.¹⁷ A major driver of this is likely to be the favourable financing conditions that can be observed in the advanced economies in particular.

Overall, there is much to suggest that, in the current environment, the financial cycle is continuing to expand and thus that medium-term vulnerabilities

Vulnerabilities are continuing to mount.

are continuing to mount. These do not pose an immediate risk to financial stability, but clearly indicate elevated risks to financial stability in the years to come. A preventive and forward-looking macroprudential policy must take this into account (see the section entitled “Implications for macroprudential policy” on pp. 68 ff.).

Decoupling of macroeconomic developments and microeconomic risks

Macroeconomic developments appear to have become decoupled from microeconomic risks over the course of the coronavirus pandemic. The pandemic triggered an exceptionally severe recession. In microeconomic terms, however, it is hardly reflected

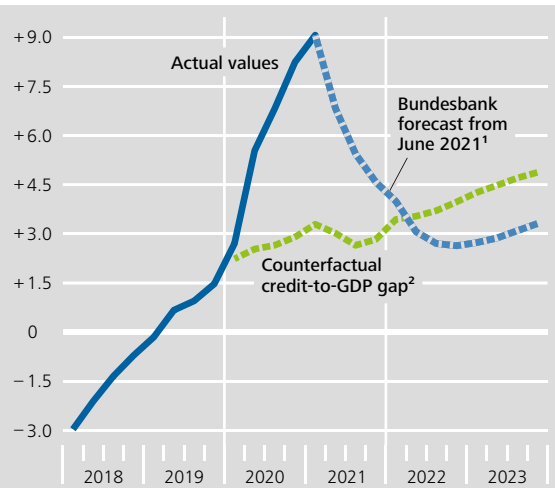
Hardly any rise in insolvencies despite severe recession.

at all in the development of key indicators. For example, the number of corporate insolvencies actually fell (see Chart 2.1.9). From a macroeconomic perspective, the previous 20-year period had already been abnormally stable. Corporate insolvencies and unemployment were in practically constant decline. Even the global recession of 2008 and 2009 only briefly interrupted this trend (see Chart 2.1.10). One reason for the negative macroeconomic developments not being entirely apparent at the microeco-

¹⁷ See International Monetary Fund (2021b).

Credit-to-GDP gap in Germany* Chart 2.1.7

Percentage points, quarterly data, as at June 2021

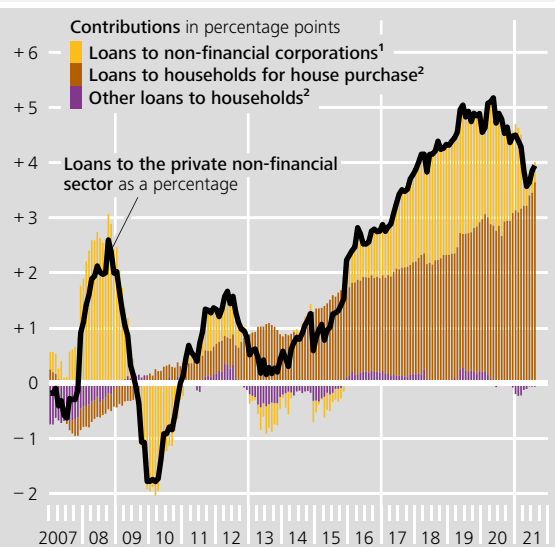


* Cyclical deviation of the credit-to-GDP ratio from its long-term trend, based on the Hodrick-Prescott filter (one-sided). Calculated according to national method. Based on loans granted by domestic monetary financial institutions (excluding central bank) to the domestic private non-financial sector. ¹ For the underlying GDP forecast, see Deutsche Bundesbank (2021), Monthly Report, June 2021. ² Theoretical credit-to-GDP gap assuming constant GDP growth between actual GDP in Q1 2020 and the value forecast by the Bundesbank for Q4 2023.

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Contributions to changes in German banks' lending to the domestic private non-financial sector* Chart 2.1.8

Year-on-year change, monthly data

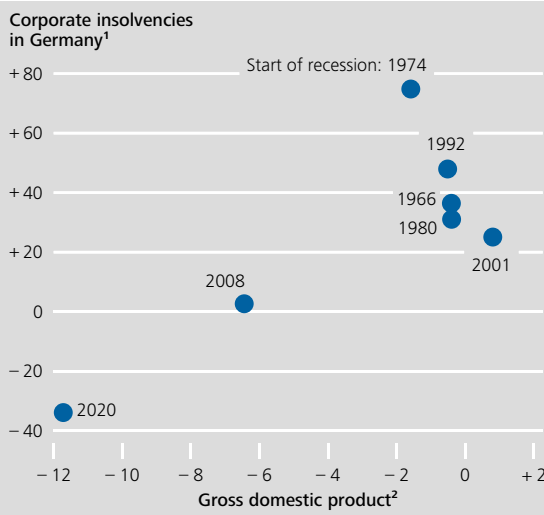


* Nominal loans and bill-based loans from domestic monetary financial institutions (excluding the central bank). ¹ Including debt securities. ² Including non-profit institutions serving households.

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German gross domestic product and corporate insolvencies during recessions* Chart 2.1.9

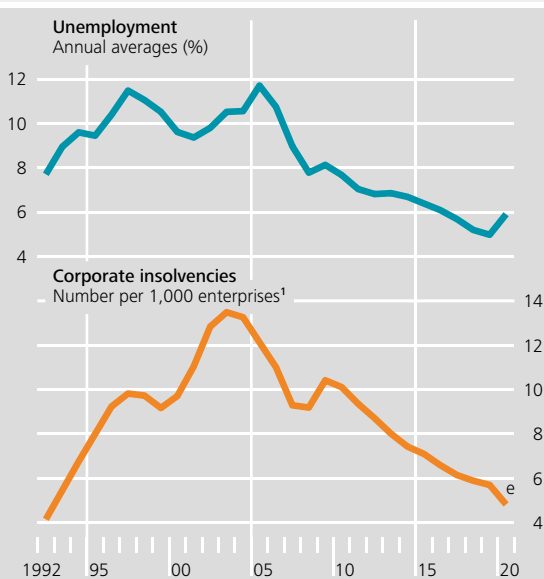
Percentage changes



Sources: Federal Statistical Office and Bundesbank calculations. * Based on recession dating by the German Council of Economic Experts; see German Council of Economic Experts, Annual Report 2017/18. **1** Change in cumulated insolvencies in the six quarters after the start of the recession compared with the six quarters before the recession. **2** Peak-to-trough change.

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Unemployment and corporate insolvencies in Germany Chart 2.1.10



Sources: Federal Employment Agency, Federal Statistical Office and Bundesbank calculations. **1** Enterprises included in the business tax statistics.

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conomic level were the extraordinary government assistance measures – for enterprises and households during the coronavirus pandemic, and additionally for banks during the global financial crisis.

Against this background, market participants may now have firmer expectations that macroeconomic and microeconomic

Market participants may anticipate only minimal losses in future crises, too.

risks are permanently decoupled from one another, and, even in the event of a macroeconomic crisis, that

hardly any individual losses should be anticipated. The experiences of the coronavirus pandemic are thus likely to have generally increased the long-standing danger of risks being underestimated (see the section entitled “Overall assessment of financial stability environment” on pp. 65 ff.).¹⁸

Situation in the German corporate sector and commercial real estate sector

Significant decline in short-term insolvency risks in corporate sector

Since 2020, the number of corporate insolvencies has progressed considerably better than forecast at the onset of the coronavirus pandemic (see Chart 2.1.11). Corpo-

rate insolvencies did not rise, but actually fell. This was also true for business deregistrations. One contrib-

Lower number of insolvencies due, in part, to comprehensive policy measures.

uting factor to this development were the extraordinary and comprehensive measures implemented by

¹⁸ For more on the danger of underestimating risks, see Deutsche Bundesbank (2019a).

Evergrande – a risk to the German financial system?

The financial difficulties of the Chinese real estate developer Evergrande attracted the attention of global financial markets at the end of September. The company is more than US\$300 billion in debt and is having difficulty meeting deadlines for payments to banks, suppliers and bondholders. Developments surrounding Evergrande have impacted several other Chinese real estate developers and could well spill over to China's entire construction and property market.¹ Financial markets generally began to view China's real estate sector more critically back in the second quarter of 2021. Investors watched closely as risk premia on US dollar-denominated bonds issued by Chinese real estate companies roughly doubled. Evergrande's acute payment difficulties led to a significant increase in risk aversion in the global financial markets at the end of September. Prices of international equity indices saw a temporary sharp drop in some cases. For instance, both the US S&P 500 and the European EURO STOXX 50 stock indices dropped by as much as roughly 3%, whilst at the same time the volatility index VIX rose at times by up to eight points, which was indicative of a strong rise in global uncertainty.

Developments surrounding Evergrande could also impact on the German financial system as contagion effects radiating from China have gained in importance around the world. This is not least an upshot of reforms to China's economic and financial system in order to internationalise and open up the country. In 2020, China contributed 18% to global GDP and accounted for 12% of global imports. Should the problems afflicting the real estate market cause Chinese growth to slump, this could exert a global impact

via the trade channel.² China's global financial linkages have risen continuously in the past few years, with its liabilities to the rest of the world amounting to US\$6.6 trillion at the end of 2020. In addition, China has also built up a substantial international investment position and is now one of the world's largest creditors. China's international investment position amounted to US\$8.7 trillion at the end of 2020.³ Indirect financial linkages can arise due to, for example, connections via third parties, such as common investors.

The direct exposure of German banks, insurers and funds to both Evergrande and other Chinese borrowers and issuers of securities are relatively small compared to their exposure to other countries. Other European banks' direct financial interlinkages seem to be modest – with the exception of UK and Swiss banks. Indirect effects could therefore result from German financial intermediaries' interconnectedness with credit institutions in those two countries. Germany could, moreover, be affected by way of a general rise in global risk aversion if the developments surrounding Evergrande, such as a disorderly insolvency, were to culminate in a systemic event and global financial stress were to rise considerably. Payment defaults by Chinese firms, for example, could lead to a repricing of the risks of US dollar-denominated bonds issued by emerging market issuers or highly leveraged US or European firms. In particular, a potential real economic slump in China could well trigger sharp losses in the international financial markets.

¹ See, inter alia, Rogoff and Yang (2021).

² See Deutsche Bundesbank (2018b).

³ Data source: IMF International Investment Position, end of 2020.

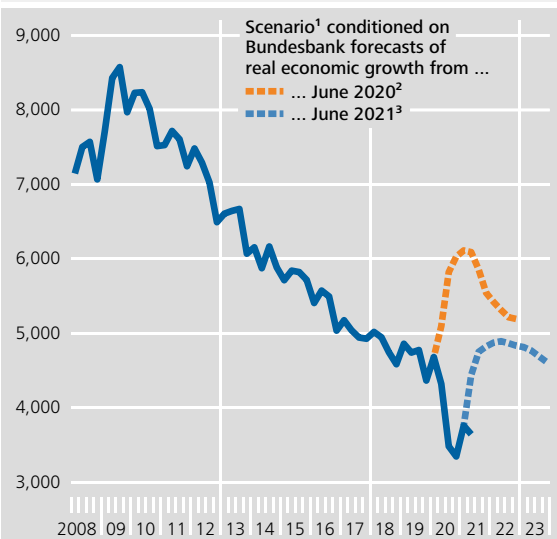
Any increase in global financial stress on the back of a real estate crisis in China would also likely have a distinct impact on the German financial system. A scenario analysis using a dynamic factor model indicates that an increase in global financial stress could lead to a decline in equity prices and a rise in equity price volatility in Germany. In addition, risk premia on German corporate bonds would widen and financing conditions would deteriorate, at times considerably. Less favourable financial market conditions could then also dampen real economic growth in Germany.⁴

⁴ See Deutsche Bundesbank (2019a).

Corporate insolvencies in Germany

Chart 2.1.11

Numbers per quarter



Sources: Federal Statistical Office and Bundesbank calculations. ¹ For the calculation of the scenarios, see Deutsche Bundesbank (2020), Financial Stability Review 2020. ² See Deutsche Bundesbank (2020), Monthly Report, June 2020. ³ See Deutsche Bundesbank (2021), Monthly Report, June 2021.
 Deutsche Bundesbank

policymakers. In particular, these included fiscal assistance measures and the temporary suspension of the obligation to file for insolvency (see Chart 2.1.12).¹⁹ The latter was enacted at the onset of the coronavirus pandemic so that illiquid enterprises would not be required to file for insolvency if they were actually solvent and had sustainable business models. The suspension of the obligation to file for insolvency was extended multiple times during the crisis, most recently until the end of April 2021; this extension was approved in order to allow for funds from government coronavirus assistance programmes to be paid out and have an impact. Alongside the fiscal measures, the solid capital and liquidity positions of German enterprises helped to ensure that the number of insolvencies did not rise.

¹⁹ For more information on the suspension of the obligation to file for insolvency, see, inter alia, Deutsche Bundesbank (2020a).

In light of the real economic upturn, no sharp rise in insolvencies is expected for the coming quarters. Conversely, risk premia on corporate securities have decreased after having risen markedly at the start of the pandemic. At present, financing conditions for virtually all sectors are more favourable than on average over the long term and than they were before the outbreak of the pandemic.

Major rating agencies also consider default risk in the corporate sector to be lower once again. However, they remain more critical than many market participants. According to projections by the rating agency S&P, until March 2022, the default rate for particularly risky bonds is set to remain virtually

Rating agencies take a more critical view of default risk than market participants.

unchanged at around 5% in Europe, and could even fall from roughly 5% to 4% in the United States.²⁰ Since the start of

2021, more German enterprises have had their ratings upgraded than downgraded. Non-investment-grade enterprises with poorer credit ratings were able to obtain relatively cheap funding via the capital market. New issuances contributed to a slight increase in the share of corporate bonds in the high-yield segment for German enterprises,²¹ with the volume of bonds in the lowest rating of the investment-grade segment even almost doubling.²²

The risk of a wave of insolvencies has noticeably diminished of late, including in the sectors hit particularly hard by the pandemic. Over the last few quarters, these sectors have relied less and less on support

²⁰ See S&P Global Ratings (2021a); S&P Global Ratings (2021b). The default rate refers to enterprises in the high-yield segment.

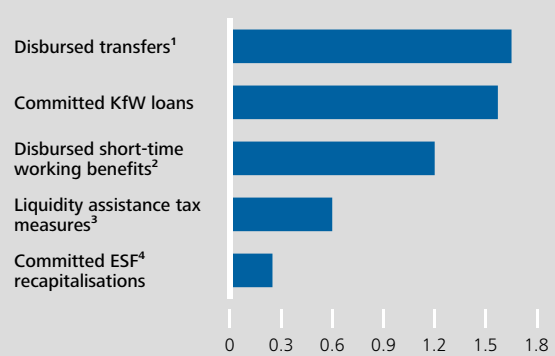
²¹ The high-yield segment comprises securities and enterprises with quality ratings below BBB- or Baa3.

²² Bonds with this quality rating are at particular risk of being downgraded into the high-yield segment. An (expected) downgrade into this segment is often associated with a surge in funding costs for the enterprises in question. See, inter alia, Deutsche Bundesbank (2020a).

Key measures to support the German corporate sector during the coronavirus pandemic*

Chart 2.1.12

As a percentage of 2019 GDP, period: Mar. 2020 to Oct. 2021



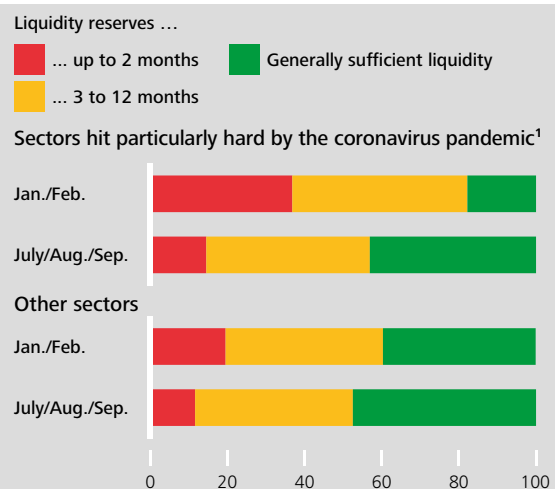
Sources: Dashboard Deutschland, Finance Agency, KfW Group, Task Force Informationen über Fiskalmaßnahmen für den Unternehmenssektor, and Bundesbank calculations. * The effects of solvency assistance tax measures (such as VAT reductions) and other automatic stabilisers are not shown here. **1** Emergency, bridging, November, December, and new start assistance. **2** Short-time working benefits to compensate for economic difficulties including reimbursed social security contributions. **3** These primarily include the extension of import VAT due dates, reimbursements of special advance VAT payments and tax deferrals. Unlike for the other measures, shown here is a cumulative estimate for 2020 and 2021 (see Deutsche Bundesbank (2021), Monthly Report, June 2021). **4** Economic Stabilisation Fund.

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German enterprises' assessments of their liquidity reserves

Chart 2.1.13

Percentage share of responses for each survey period in 2021, weighted results

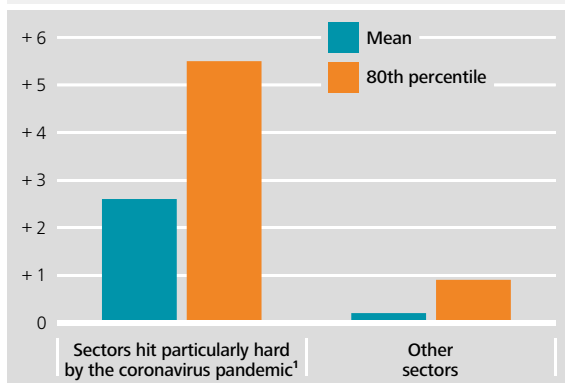


Source: Bundesbank Online Panel Firms (BOP-F). Question: "Based on the situation today and the most plausible scenario, for how long a period will your enterprise continue to have sufficient liquidity before having to discontinue or abandon its business activities?" **1** Accommodation and food service activities, retail trade, transportation and storage.

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Bank debt ratio* of German non-financial corporations** Chart 2.1.14

Change in percentage points from Dec. 2019 to Dec. 2020



Sources: AnaCredit and Bundesbank calculations; see B. Kolb, F. Mokinski and R. Unger (2021), Die Unternehmensverschuldung in Deutschland im Verlauf der Corona-Pandemie: Eine Auswertung anhand des AnaCredit-Datensatzes, Deutsche Bundesbank Technical Paper No 07/2021. * Ratio of an enterprise's outstanding nominal credit portfolio to its total assets according to the last figure reported. ** Enterprises with a bank debt ratio of between 0 and 100%. Sector classification as per the current end. 1 Retail trade, except of motor vehicles and motorcycles; passenger air transport; accommodation; food and beverage service activities; travel agency, tour operator reservation service and related activities; creative, arts and entertainment activities; sports activities and amusement and recreation activities; other personal service activities.

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measures and have become more optimistic about their future prospects. Bundesbank surveys indicate that the liquidity situation in these sectors in particular improved significantly over the summer of 2021 (see Chart 2.1.13).

Medium-term risks higher in the corporate sector

Over the medium term, however, some enterprises could face problems due to the significant rises in their debt levels during the coronavirus pandemic. Borrowing saw a particular increase

The debt levels of some enterprises have risen significantly.

amongst enterprises from sectors hit especially hard by the containment measures (see Chart 2.1.14). A substantial share of the loans issued to the corporate sector during the pandemic was probably used to

bridge short-term liquidity shortfalls rather than to invest in productivity-boosting measures that could improve debt sustainability.

Moreover, many sectors are facing the challenges of structural change. This process sped up during the coronavirus pandemic. It includes, for example, the increasing prevalence of internet shopping and working from home, as well as greater awareness of climate risk (see the chapter entitled "Climate policy and financial stability" on pp. 81 ff.). The long-term impact of this structural change could undermine the profitability of the affected enterprises.

Despite these medium-term risks, an analysis of European corporate bonds shows that their risk premia were again close to or even below the figures recorded at the end of 2019 (see Chart 2.1.2 on p. 19). This is also true for sectors in which risk premia rose particularly sharply in the second quarter of 2020 or in which debt levels have grown strongly overall since the second quarter of 2020, or that are especially affected by structural change. In this respect, investors do not appear to associate these developments with any direct default risks for enterprises from these sectors.

Commercial real estate market developments varied

The coronavirus pandemic has triggered or accelerated structural change in key segments of the commercial real estate market.²³ In future, the pandemic could, for example, lead to revenue losses for specialised hotels if people take fewer business trips and increasingly use video conferences instead. In the retail sector, the coronavirus pandemic is accelerating the use of online shopping.²⁴ This will probably

²³ See, inter alia, International Monetary Fund (2021a).

²⁴ See German Retail Federation (2021).

have a negative impact on the value of retail space in city centres and shopping centres. The value of logistics space, on the other hand, will probably continue

The commercial real estate market is affected by structural change.

to go up. The price of office buildings will likely be impacted to a particularly strong degree by the future prevalence of working from home, as developments here will influence demand.²⁵ However, hygiene measures involving physical distancing and the number of employees permitted within office premises could also lead to greater demand for space. The economic recovery could likewise have a positive impact on demand for office buildings. By contrast, uncertainty about structural change is likely to dampen demand from potential investors and tenants.

Situation in the household sector

The residential real estate market is especially important to households in Germany. First, around three-quarters of their borrowing is attributable to loans for house purchase, with residential property serving as collateral in most cases. Second, residential property accounts for over half of households' assets.²⁶ Negative developments in the residential real estate market may, therefore, have a negative impact on households and their lenders through asset losses.

The fallout from the coronavirus pandemic affected households in very different ways. Although they did not suffer any income losses on average, households with lower incomes, in particular, were more strongly affected by job losses and shortfalls in income.

Support measures prevented sharper rise in unemployment

So far, households' debt sustainability has remained robust overall. For instance, their debt-to-income ratio is still moderate from a long-term perspective. However, this ratio has risen continuously since the end of 2018. During the pandemic, households' debt in relation to their disposable income grew from just over 96% to 100% between the end of 2019 and the second quarter of 2021 (see Chart 2.1.15).²⁷

Households' debt sustainability still robust so far.

On aggregate, disposable income has risen slightly, dampening the ratio of debt to income. At the same time, because opportunities for consumption were restricted during the pandemic, savings and liquid assets in the household sector increased considerably.²⁸ Government support measures prevented a sharper overall rise in unemployment and the associated repercussions for households. At the onset of the pandemic, in particular, enterprises made extensive use of short-time working arrangements, which was able to attenuate much of the fluctuation in

²⁵ Areas that already reported rates of working from home of more than 10% in 2019 account for a share of around 19% of the services sector as a whole (excluding education). Prior to the pandemic, the economic sectors information and communication, financial and insurance activities, professional, scientific and technical activities, and other services had rates of working from home of more than 10%. See, inter alia, <https://www.destatis.de/EN/Themes/Labour/Labour-Market/Employment/LaborMarket-Covid19.html>

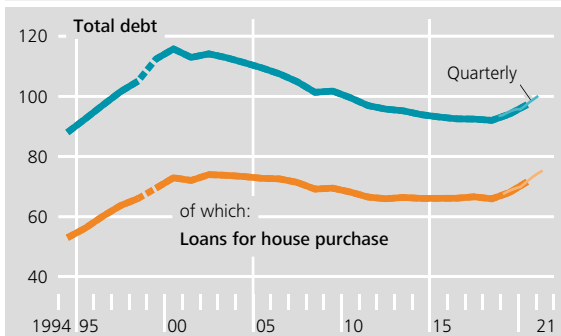
²⁶ Data based on aggregate balance sheets.

²⁷ Compared to other euro area countries, too, household debt levels in Germany appear fairly moderate. See, inter alia, <https://sdw.ecb.europa.eu/servlet/desis?node=1000004962>

²⁸ This effect was amplified by the saving ratio, which increased along with income. For a time, the saving ratio practically doubled on aggregate to more than 20% of disposable income. See Deutsche Bundesbank (2021c).

Household debt in Germany* Chart 2.1.15

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.

Deutsche Bundesbank

demand for labour. Far fewer enterprises are now making use of this option.²⁹

The negative impact of the pandemic on the labour market was limited overall, and the outlook is fairly positive. Unemployment in Germany has risen only slightly over the course of the pandemic. By interna-

The outlook for the labour market is fairly positive.

tional standards, employment has only fallen marginally. The Bundesbank's projections suggest that unemployment will decline further and employment will rise.³⁰ This assessment is supported by the labour market barometer of the Institute for Employment Research (IAB) as well as by other leading indicators for the labour market.³¹ Households in Germany also expect the labour market situation to brighten over the next twelve months.³² As a result, their income situation will probably also improve.

Upturn in residential real estate market continues

Prices in Germany's residential real estate market continued their upward trend. During the pandemic,

the persistently high demand for residential property was bolstered by positive overall developments in the income and wealth of households, amongst other things. In 2020, prices for residential real estate in Germany increased by an average of 6.7% overall, having risen by 7% in 2019 (see Chart 2.1.16). The higher prices are due, amongst other things, to the persistently scarce supply of housing in some regions and noticeably higher construction costs of late.³³ The increase in prices in Germany's seven largest cities was slightly greater, at 7.1%.³⁴ As in previous years, these price rises exceeded both average growth in house-

Price exaggerations in the residential real estate market have tended to increase.

holds' income and average growth in rents. Price exaggerations in the residential real estate market have tended to increase.³⁵ Bundesbank estimates put them at between 10% and 30% overall in Germany in 2020.³⁶ In the model calculations, supply-side constraints in the housing market would be reflected in the housing stock. A smaller stock of housing, which is included in the analysis as a supply-side explanatory factor, has an inflationary effect. However, over the past few years, on the whole, the underlying supply-side conditions have not experienced any changes that are relevant from a macro-economic perspective.

²⁹ Preliminary figures from the Federal Employment Agency show that the number of people on short-time working hours fell below one million in August 2021, compared with a maximum of around six million at the onset of the pandemic in April 2020.

³⁰ See Deutsche Bundesbank (2021c).

³¹ See <https://www.iab.de/en/daten/arbeitsmarktbarometer.aspx>

³² Data based on the Bundesbank's survey of households (Bundesbank Online Panel Households (BOP-HH)).

³³ See Deutsche Bundesbank (2020d); Deutsche Bundesbank (2021a).

³⁴ Bundesbank calculations based on data provided by bulwiengesa AG.

³⁵ See Deutsche Bundesbank (2021a).

³⁶ For more on the methodology, see Kajuth, Knetsch and Pinkwart (2016).

According to data from the Federal Statistical Office and the Association of German Pfandbrief Banks (vdp), price growth for residential property has accelerated further over the course of 2021. The upbeat labour market situation and the associated income prospects suggest that residential property prices will probably continue to climb.³⁷ While price expectations temporarily became much gloomier in the second quarter of 2020, households now once more increasingly expect residential property to become more expensive (see Chart 2.1.17).³⁸

An unexpected rise in inflation and lending rates would affect real estate prices. Higher construction costs are likely to push up the prices for new residential property. Rising lending rates, by contrast, would make housing loans more expensive for households, which could suppress demand and housing prices. However, if an inflation and interest rate scenario such as this were to be accompanied by favourable economic developments and a corresponding improvement in income prospects, demand for residential property would instead be strengthened on the whole and prices would probably continue to go up.³⁹

Over the last few years, buyers have increasingly been purchasing residential property in rural areas. By contrast, the number of transactions has tended to stagnate in towns and cities, owing, amongst other things, to the scarce supply. These trends are likely to continue. However, they will probably not

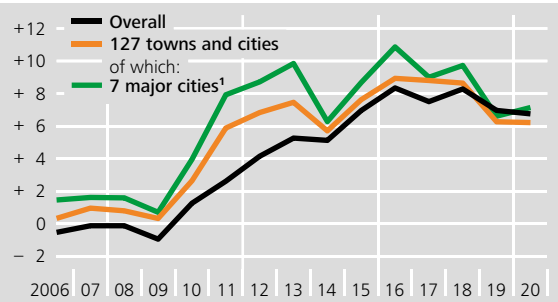
Demand for housing in towns and cities is unlikely to recede in the short term.

accelerate, despite an increase in working from home. The structurally high demand for housing in towns and cities, in particular, is not expected to recede to any significant degree over the short term. Working from home would make it possible for employees to live further away from their workplace. Results from the Bundesbank's survey of households (Bundesbank Online

Residential property prices in Germany*

Chart 2.1.16

Year-on-year percentage change



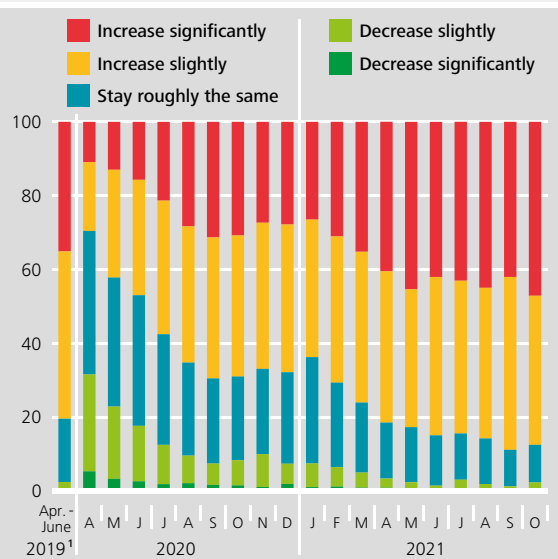
* Transaction-weighted. Bundesbank calculations based on data provided by bulwiengesa AG. ¹ Berlin, Cologne, Düsseldorf, Frankfurt am Main, Hamburg, Munich and Stuttgart.

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Households' expectations regarding property prices*

Chart 2.1.17

Percentage share of responses



Source: Bundesbank Online Panel Households (BOP-HH). * Question: "How do you think property prices in your area will develop over the next twelve months?" ¹ Average results from three panel surveys during this period.

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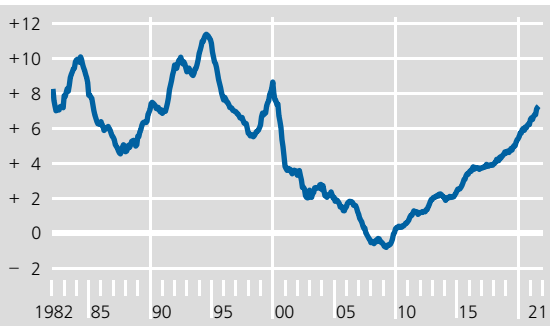
³⁷ See Deutsche Bundesbank (2020e).

³⁸ See, inter alia, <https://www.bundesbank.de/en/bundesbank/research/survey-on-consumer-expectations/real-estate-price-expectations-848340>

³⁹ See Anari and Kolari (2002).

German banks' lending to domestic households for house purchase* Chart 2.1.18

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



* Including non-profit institutions serving households. Up until 1991, data only for West Germany.
 Deutsche Bundesbank

Panel Households – BOP-HH) also show that many workers prefer working from home.⁴⁰ However, only a very small share are planning to move house for this reason.⁴¹ Moreover, these households are often considering a move within their current local area or to an area with a similar population density.

Lending continues to increase more sharply than households' income

Much like residential property prices, lending to households for house purchase also continued to rise, with the annual growth rate of the lending portfolio in the German banking sector climbing from 5.4% at the end of 2019 to 7.2% in the third quarter of 2021 (see Chart 2.1.18). The uninterrupted growth in lending during the coronavirus pandemic is also reflected in the house purchase loan-to-GDP gap, which, just like the credit-to-GDP gap, has expanded significantly. Given that prices are continuing to rise and financing terms remain favourable, the stock of residential real estate loans will probably continue to increase.

Prior to the outbreak of the coronavirus pandemic, the expansion in lending activity was accompanied by

a slight easing of lending standards. Since then, these standards have generally been tightened again somewhat. According to the qualitative results of the Eurosystem's quarterly Bank Lending Survey (BLS), the tightening of credit standards was particularly pronounced in the second quarter of 2020. The main reasons behind this, as reported in the survey, were the deteriorated outlook with regard to economic developments and borrowers' creditworthiness, as

Lending standards were tightened somewhat during the pandemic.

well as credit institutions' decreased tolerance of risk. After having remained unchanged in the first quarter of 2021, lending standards were loosened again slightly in the second quarter and tightened somewhat in the third quarter. The surveyed banks also reported that the widening of interest margins observed since 2019 – particularly for riskier loans – continued on the whole.

Alongside the qualitative information provided by the BLS, quantitative indicators relating to lending standards for new housing loans also reveal a similar picture.⁴² However, these indicators are only able to provide very general information, since the currently available data on lending standards in Germany originate from non-representative sources or are only collected on an irregular basis (see the box entitled "New collection of data on lending standards for residential real estate financing granted to house-

⁴⁰ Among the respondents to the BOP-HH survey, 14% definitely want to work from home and 20% want to work from home if their employer allows. By contrast, 48% of respondents stated that working from home was not generally possible in their line of work. These results are in line with Ifo calculations. See Alipour, Falck and Schüller (2020).

⁴¹ Fewer than 5% of households with a preference for working from home want to move. This is just 2% of all households surveyed.

⁴² In order to analyse the risks stemming from the granting of housing loans, the Bundesbank uses a number of data sources (some of which are not representative) including indicators from the private sector providers Interhyp and Europace as well as special surveys of German credit institutions carried out by BaFin and the Bundesbank. See, inter alia, Deutsche Bundesbank (2019a).

holds” on p. 34). According to the data available, the average ratio between loan volume and property value (loan-to-value (LTV) ratio) has increased since 2015 (see Chart 2.1.19). The outbreak of the coronavirus pandemic saw the LTV ratio decrease again slightly in 2020. In this context, an increase indicates an easing of lending standards, whereas a decrease points to a tightening. As the potential repercussions of housing prices grow, so, too, do the potential losses from loans with high LTV ratios – on account of price exaggerations, for example.

Households’ average debt-service-to-income ratio was in decline until 2016 and has since seen a marginal increase again. Despite higher house prices and larger lending volumes, households’ debt-service-to-income ratio had been stabilised by lower interest rates over a long period, but, in recent times, loan

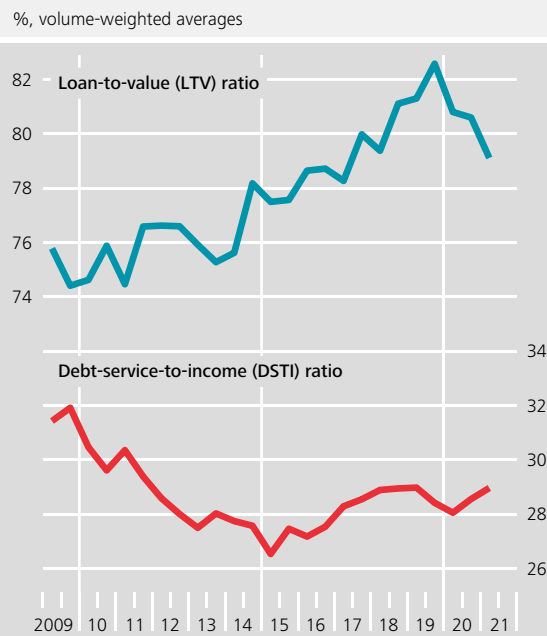
amounts have grown further, while interest rates have fallen only moderately. The worsening of the debt-service-to-income ratio was limited by the fact

Low interest rates and long loan maturities are stabilising the debt-service-to-income ratio.

that households extended the average maturity of their loans. The aggregate rise in the level of debt in the German household sector is also reflected in households’ debt-to-income ratio for new housing loans. This ratio increased from 5.5 in the first half of 2015 to 6.8 in the first half of 2021. Since the upswing in prices in the German residential real estate market is likely to continue and loans to households have been growing faster than household income for several years now, future developments in lending standards must be monitored closely.

In the short term, the risks to financial stability arising from lending to households appear to be manageable, particularly because households’ debt sustainability has remained robust so far. The fact that primarily households with higher incomes own residential property and have corresponding credit lia-

Lending standards for new loans for house purchase in Germany Chart 2.1.19



Source: Bundesbank calculations based on Interhyp Gruppe data, weighted by Socio-Economic Panel (SOEP) data.
 Deutsche Bundesbank

bilities is likely to have had a risk-mitigating effect, especially during the pandemic. These households were significantly less affected by job losses and shortfalls in income

than households with lower incomes. Furthermore, the structurally long interest rate fixation periods

Risks arising from lending to households appear manageable in the short term.

for housing loans in Germany reduce interest rate risk for households. In recent years, households have extended the interest rate fixation periods when taking out loans. The share of new loans for house purchase with an interest rate fixation period of more than five years rose by roughly 20 percentage points to more than 83% between the first quarter of 2010 and the third quarter of 2021.⁴³ In view of the long

⁴³ Most of these loans have an interest rate fixation period of more than ten years.

New collection of data on lending standards for residential real estate financing granted to households

There are currently still gaps in the data on lending standards for residential real estate financing granted to households in Germany. Robust, systematic and timely data on lending standards are important in order to better detect potential risks to financial stability at an early stage and to be able to counter these adequately. Both the German Financial Stability Committee (G-FSC) and the European Systemic Risk Board (ESRB) therefore recommended that these data gaps be closed back in 2015 and 2016.¹ The data gaps and the associated uncertainty in assessing lending standards for residential real estate loans were one reason why the ESRB issued a warning to Germany in 2019 concerning medium-term risks in the residential real estate sector.²

In order to close these data gaps, the Federal Ministry of Finance created a new legal basis for a regular data collection by issuing the Financial Stability Data Collection Regulation (*Finanzstabilitätsdatenerhebungsverordnung – FinStabDEV*) in February 2021.³ The FinStabDEV, which was issued on the basis of the Financial Stability Act (*Finanzstabilitätsgesetz*), authorises the Bundesbank to request data from commercial lenders on loans granted to natural persons to build or acquire residential real estate located in Germany. Based on the FinStabDEV, the Bundesbank issued a general administrative act on 21 September 2021, ordering reporting entities to participate in the data collection.⁴

This data collection is to ensure that the Bundesbank receives regular and standardised reports

with data on lending standards for new residential real estate loans granted to natural persons. After an implementation period of 18 months, data should be reported for the first time as at the end of the first quarter of 2023. They include, for example, the loan-to-value ratio and information on the amortisation period and borrowers' ability to service their debt. In principle, all credit institutions, insurance corporations and capital management companies which grant such loans are subject to reporting obligations. In line with the principle of proportionality, however, reporting obligations are eased for reporting entities which only grant a small number of residential real estate loans or which only have a relatively low stock of such loans. This easing of reporting requirements should not substantially diminish the information content of the data collection. In order to meet data protection requirements, the Bundesbank asks only for aggregate and anonymised data which cannot be traced back to individual borrowers.

¹ See German Financial Stability Committee (2015); European Systemic Risk Board (2016).

² See European Systemic Risk Board (2019a); European Systemic Risk Board (2019b).

³ See Financial Stability Data Collection Regulation of 28 January 2021, Federal Law Gazette I (*Bundesgesetzblatt I*), pp. 110-114.

⁴ See <https://www.bundesbank.de/en/service/reporting-systems/financial-stability> and Federal Gazette (*Bundesanzeiger*) of 29 September 2021.

interest rate fixation periods of their loans and their large financial investments in short-term interest-bearing assets, households in Germany are actually likely to benefit from an interest rate rise on average in the short term.⁴⁴

Greater cyclical vulnerabilities in the household sector

Medium-term vulnerabilities in the household sector have probably increased overall. Only a small number of credit risks materialised during the pandemic. Although households made moderate use of opportunities to defer loan repayments in the first half of 2020, these measures expired for the majority of the

Lending and residential property prices are likely to increase further.

affected loans during the course of the year without a noticeable increase in credit defaults. There was a further significant increase in banks' lending to households as well as in prices in the housing market. This trend is likely to continue. Household debt has been steadily outpacing household income since its low point in 2018. The alleviating effect of continually falling interest rates on debt service when new loans are taken out is likely to be limited in future, however. Looking ahead, there is a danger that lenders could underestimate risks arising from housing loans (see the section entitled "Vulnerabilities at banks, insurers and investment funds" on pp. 39 ff.).

■ Situation in the euro area

The short-term risks to the German financial system arising from developments in the euro area have decreased somewhat. In the initial months following the outbreak of the pandemic, there were considerable tensions in the global financial markets. These

tensions mainly affected sectors hit particularly hard by the pandemic and countries with limited fiscal leeway. This had an impact on the European non-financial corporate sector as well as European governments. Extensive fiscal and monetary policy support measures have played a major role in preventing a wave of insolvencies in the European corporate sector thus far.⁴⁵ With the recovery of the macroeconomic environment, this threat has diminished further. The risk of the situation in the euro area escalating to critical levels has thus also subsided somewhat – at least for the time being. Nevertheless, medium-term vulnerabilities have grown for enterprises and, in particular, governments.

Increase in debt during the pandemic

The levels of corporate and government debt rose in the euro area as well as around the globe during the pandemic. A slump in profits and impending liquidity bottlenecks contributed to the aggregated and consolidated corporate debt ratio in the euro area rising from 108% of GDP in March 2020 to 118% in March 2021. Enterprises' debt service ratios also increased markedly in some euro area countries (see Chart 2.1.20).⁴⁶

Corporate debt ratios in the euro area have risen.

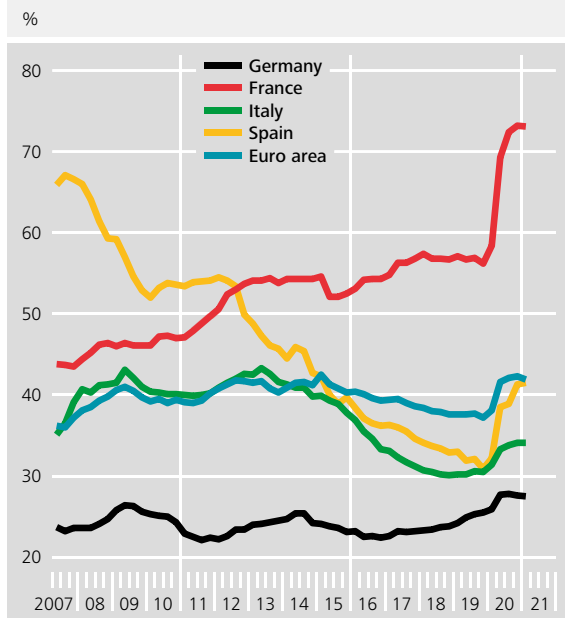
However, net corporate debt, i.e. debts minus liquid assets, increased only marginally in most countries.

⁴⁴ Calculations based on survey data from the Panel on Household Finances (PHF). See Tzamourani (2019).

⁴⁵ See, inter alia, Organisation for Economic Co-operation and Development (2021); Financial Stability Board (2021b).

⁴⁶ The debt service ratio represents interest and redemption payments as a percentage of the respective sector's income. The Bank for International Settlements records the augmented gross disposable income of the respective corporate sector under income in its statistics on the debt service ratios for the private non-financial sector. This includes gross disposable income, interest payments including financial intermediation services indirectly measured, and distributed income (dividends).

Debt service ratios* of non-financial corporations in the euro area Chart 2.1.20



Sources: BIS, ECB and Bundesbank calculations based on the BIS method. * Sum of interest and redemption payments as a percentage of sectoral income.
 Deutsche Bundesbank

It was primarily large enterprises with international focuses that made use of the favourable financing conditions to improve their liquidity positions. The risks arising from the heightened levels of debt are therefore increasingly confined to small and medium-sized enterprises from particularly hard-hit sectors.⁴⁷

Many countries in the euro area used fiscal stabilisation measures to absorb the majority of losses sustained by enterprises resulting from the coronavirus pandemic.⁴⁸ The costs of the support measures and the contemporaneous

Government debt has increased significantly in the euro area during the pandemic.

economic effects considerably drove up government debt in the euro area during the pandemic. In particular, the situation intensified in countries that already had high government debt ratios and budget

deficits before the pandemic (see Chart 2.1.21). In addition, contingent liabilities grew for many governments on account of guarantee schemes. These are largely not included in official debt ratios.

Reduction in short-term risks

At the onset of the coronavirus pandemic, there was a temporary significant increase in the yields of some countries' government bonds owing to the great uncertainty regarding the macroeconomic impact of the pandemic. This particularly affected countries that were hard hit by the economic effects of the pandemic and that already had elevated levels of debt. In addition, the redenomination risks of euro area countries derived from credit default swaps (CDSs) temporarily increased in the second quarter of 2020. Redenomination risk refers to the risk of switching to a new currency. This would be the case if, for example, a Member State were to withdraw from the monetary union and introduce its own national currency.

However, compared with the second quarter of 2020, signs of heightened stress in the euro area have subsided again markedly. Redenomination risks have diminished; in the case of Italy, they are even below the level seen in 2019. Risk premia on government bond yields have likewise dropped significantly. Governments used the favourable financing conditions to take on longer-term debt. The favourable relationship between interest rates and growth is currently providing many countries with a certain amount of fiscal leeway.⁴⁹ If this trend continues,

⁴⁷ See, inter alia, Financial Stability Board (2021b); Organisation for Economic Co-operation and Development (2021).

⁴⁸ In France, government assistance may have absorbed up to 95% of the income losses resulting from the direct shock to French enterprises; in Belgium, the share is estimated to be 85%. See European Systemic Risk Board (2021b).

⁴⁹ The interest rate-growth differential corresponds to the difference between the (nominal) average interest rate on government debt and the trend of nominal GDP growth. See Deutsche Bundesbank (2010).

the favourable interest rate-growth relationship could help reduce the risks to the sustainability of public sector debt. The economic recovery and the decrease in crisis-induced financing needs are also likely to help reduce enterprises' debt ratios and limit credit risks in future.⁵⁰

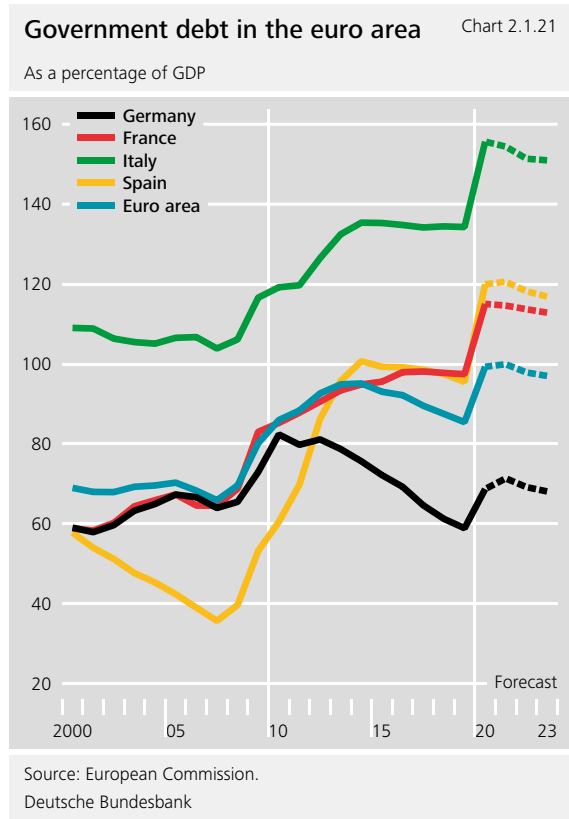
Political decisions at the European level also had a stabilising effect. For example, considerable debt-financed transfers and loans were agreed on as part of the establishment of the Next Generation EU (NGEU) fund, which aims to strengthen the economic and financial resilience of the euro area.⁵¹ Furthermore, the Euro-system reinforced its accommodative monetary policy during the pandemic by expanding its asset purchase programme. These measures, alongside the positive economic outlook, have contributed to a renewed considerable reduction in the financing costs of enterprises and governments.

Political decisions at the European level had a stabilising effect.

Euro area government budgets and enterprises remain vulnerable

In the medium term, however, there are still serious concerns regarding the sustainability of public debt. This view is shared by the European Commission. In its report on debt sustainability, the Commission finds that, in particular, countries that were highly indebted before the coronavirus pandemic face high sustainability challenges in the medium term.⁵²

In addition, the sovereign-bank nexus has become even more entrenched during the coronavirus pandemic.⁵³ In terms of financial stability, banks' large sovereign exposures were problematic even prior to the pandemic. A sharp rise in public debt could raise doubts about countries' debt sustainability. This might, in turn, call into question the credit-



worthiness of their banking systems, as a considerable percentage of government bonds is still held by the banks domiciled in each respective country. Such a sovereign-bank nexus may produce feedback effects and transfer risks from the government to banks.

The sovereign-bank nexus intensified during the pandemic.

Conversely, (implicit) government guarantees for the banking sector may lead to risks in the financial system also affecting government. Efforts to reduce the sovereign-bank nexus should remain a key priority in order to loosen the close ties between governments and banks – particularly within each individual coun-

⁵⁰ See European Central Bank (2021b).
⁵¹ See <https://ec.europa.eu/info/strategy/recovery-plan-europe>
⁵² See European Commission (2021).
⁵³ See European Systemic Risk Board (2021d). For more details on the interconnectedness between banks and sovereigns, see, inter alia, Deutsche Bundesbank (2017).

try – and to safeguard financial stability in the euro area over the long term.

The risk situation could intensify again if markets were to have fresh doubts regarding individual major

Doubts regarding willingness to consolidate could cause the risk situation to intensify again.

Member States' willingness to consolidate. Increasing risks of default for government bonds could subsequently also spill

over to financing costs in the corporate sector. Rising risk premia and associated drops in prices could lead to German financial intermediaries suffering heavy losses through their securities portfolios (see the section entitled "Impact of risk scenarios on Germany's financial system" on pp. 53 ff.).

The central banks of the Eurosystem have purchased government bonds on a large scale. Meanwhile,

there has been a build-up of private banks' deposits with the central banks, which are subject to short-term interest rate changes. On balance, this leads to a maturity transformation from longer-term government bonds to shorter-term investments. The euro area countries are thus exposed to significantly greater short-term interest rate risk via central banks' balance sheets than it would appear from the longer maturities of government bonds.⁵⁴ Government bonds' fundamentally longer maturities and coupon payments that tend to decline over the years contribute to increasing vulnerabilities to interest rate rises in the securities portfolios of all investors in government bonds.⁵⁵

⁵⁴ See Deutsche Bundesbank (2021c).

⁵⁵ See Falter, Kleemann, Strobel and Wilke (2021).

Vulnerabilities and resilience in the German financial system

Vulnerabilities at banks, insurers and investment funds

On the heels of the severe economic slump, vulnerabilities in the German private non-financial sector have continued to build up (see Table 2.2.1). In the years leading up to the outbreak of the pandemic, the favourable economic environment had generally impacted positively on the non-financial corporate sector. However, some firms' standard credit scores still failed to improve. In addition, enterprises hit particularly hard by the pandemic significantly increased their leverage. These two groups of enterprises are likely to be extremely hard-pressed to cope with a renewed economic downturn or a rise in funding

costs. Leverage has been increasing in the household sector, having for several years already been outpacing income and gross domestic product (GDP) growth. In the process, it is being strongly driven by developments in the residential real estate market, which has remained in an upswing.

Vulnerabilities amongst enterprises and households are reflected in the financial system, especially in the banking sector. The share of relatively risky borrowers, and thereby also allocation risk, in German banks' credit portfolios has increased.⁵⁶ In addition,

⁵⁶ These are enterprises whose balance sheet metrics have tended to be worse than those of other enterprises. See Deutsche Bundesbank (2018a).

Relevant vulnerabilities of German sectors

Table 2.2.1

Sector	Vulnerabilities
Real economy	
Non-financial corporations	Relatively high and rising leverage and weak earnings among non-financial corporations particularly hard hit by the pandemic; interest rate risk in parts of the corporate sector; business models potentially jeopardised by structural change
Households	Signs that recoverability of real estate collateral is being overestimated: sharp price increases and overvaluations in the residential real estate market whilst at the same time loans to households for house purchase are growing dynamically; rise in leverage from a fairly low level; initial signs of easing of credit standards
Financial intermediaries	
Banks	Incentives for increased search for yield and risk taking: e.g. high allocation risk, high maturity transformation; potential underestimation of credit risk: credit collateral could be overvalued and default risk undervalued; risk provisioning and risk weights are very low; risk of contagion in the banking system: direct via materialisation of credit risk or indirect via vulnerability to similar risks in the corporate sector
Insurers	Potential solvency risks owing to high interest rate sensitivity; incentives for increased search for yield and risk taking: e.g. default risk for asset holdings; liquidity risk: fixed surrender values harbour danger of "rush to the exits", e.g. if interest rates rise sharply or major asset value losses occur
Investment funds	Incentives for increased search for yield and risk taking: e.g. increased interest rate risk owing to long portfolio durations; danger of portfolio losses as a result of corporate sector rating downgrades

banks were increasingly optimistic about credit risk in the favourable macro-financial environment that prevailed in the years running up to the outbreak of the coronavirus pandemic, with risk provisioning falling to all-time lows and hardly rising even during the

Vulnerabilities amongst enterprises and households are reflected in the financial system.

coronavirus crisis. This has caused the attendant risk of underestimating credit risk to trend further upwards. Risks associated with loans to households could also be being understated due to the recoverability of loan collateral possibly being overstated in view of overvaluations in the residential real estate market.

In addition, interest rate risk – which rose particularly strongly during the extended period of low interest rates – has a prominent role to play in the German financial system. The longer interest rate lock-in periods in residential real estate financing have caused this vulnerability to increase in the banking sector. To be sure, interest rate lock-in periods for loans to enterprises are, on average, shorter than those for residential real estate loans, which means that the interest rate risk tends to be borne by enterprises. But if an increase in the interest burden, given rising interest rates, were to render enterprises unable to service their loans any longer, this would cause banks' credit risk to rise, thereby exposing them indirectly to interest rate risk. A marked proportion of enterprises would struggle to cope with a rise in funding costs.⁵⁷ The insurance sector and fund sector are likewise vulnerable to changes in interest rates. In an environment of low interest rates, life insurers and pension funds, in particular, are having difficulty generating sufficient returns to meet obligations arising from the, in some cases, high guaranteed returns promised to their policyholders. A rise in interest rates would therefore ease pressures over the long run and improve solvency ratios. A very strong rise in interest rates, however, would entail liquidity risks for life insurers in the short term, as

the market value of their asset holdings could drop below the value of interest rate-independent surrender values. This could incentivise policyholders to lapse their policies and seek out more attractive investment vehicles instead. In the investment fund sector, this vulnerability to changes in interest rates has increased as asset portfolio duration has gone up. Higher market interest rates go hand in hand with strong price corrections for long-dated fixed income assets and would thus lead to large losses in the fund sector.

Loss allowances in the banking sector up by less than expected

Despite the sharp economic slump during the pandemic, the banking sector was spared major losses. The government support measures for non-financial corporations and households and government-guaranteed loans issued through the KfW Group's programmes were decisive factors in this. Banks' loan loss allowances rose by less than would have been expected in such an economic slump (see Chart 2.2.1). German banks' credit claims on sectors hit especially hard, such as hotel and restaurant services and retail trade, are low, which is likely to have been a factor here, too; these loans account for only 5% or so of total exposures to the non-financial corporate sector.

During the pandemic, the banking sector was spared major losses.

With regard to savings banks and credit cooperatives, which largely prepare their financial statements according to German GAAP, the rise was driven primarily by general loss allowances, which are set aside for all foreseeable risks to loans that are not immediately at risk of default. The rise indicates that

⁵⁷ See Bednarek (2021).

savings banks and credit cooperatives have been expecting an increase in defaults on loans.⁵⁸

Large banks that prepare statements in accordance with International Financial Reporting Standards (IFRSs) have likewise increased their loss allowances. Loans must be valued in a forward-looking manner under the IFRSs. In the main, the increase in loss al-

The increase in loss allowances is largely due to higher default risk.

lowances is not because of specific credit defaults but because these banks have been assessing the risk of default as higher. As a

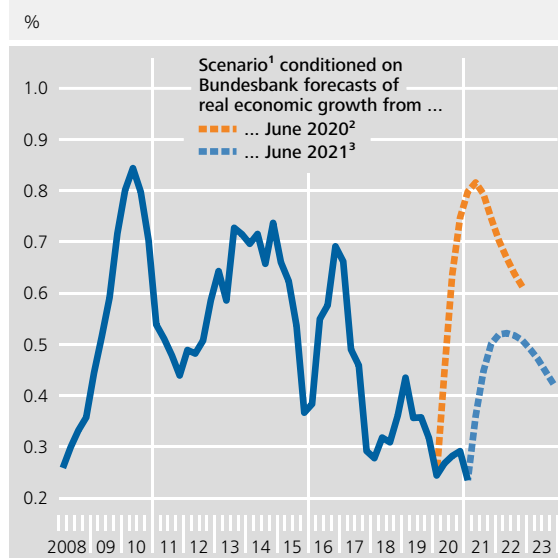
result, they have been required to recognise the expected credit losses (ECLs) of the affected loans not just for the next 12 months but for their entire lifetime.⁵⁹ Similar developments can be observed in other European countries as well.⁶⁰

Banks continue to assess credit risk as low

Although the economic slump is likely to be causing loss allowances to continue to rise with a time lag, the larger banks, at least, still regard their credit risk as being limited overall. This is indicated by the valuations produced by the internal ratings-based approaches (IRBAs) banks are using to calculate their capital requirements. Such approaches involve using models approved by supervisors to calculate the probability of loans defaulting over the next 12 months.

Based on these models, the larger banks are assuming that, although short-term default risk increased moderately during the pandemic, it remains roughly at the average level of the past few years. The mean probability of default (PD) for non-financial corporations estimated by the banks has fallen since the recession of 2008 and 2009. It hit its all-time low at the beginning of 2018 (see Chart 2.2.2). The estimated PD of relatively risky enterprises in banks'

Loss allowances* on German banks' loans to domestic non-financial corporations Chart 2.2.1



* Sum of newly recognised loss allowances (excluding collective loss allowances) in the past 12 months as a percentage of outstanding loans. **1** For the calculation of the scenarios, see Deutsche Bundesbank (2020), Financial Stability Review 2020. **2** See Deutsche Bundesbank (2020), Monthly Report, June 2020. **3** See Deutsche Bundesbank (2021), Monthly Report, June 2021.

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credit portfolio, in particular, fell strongly. Since then, it has been rising again, especially so in 2020.

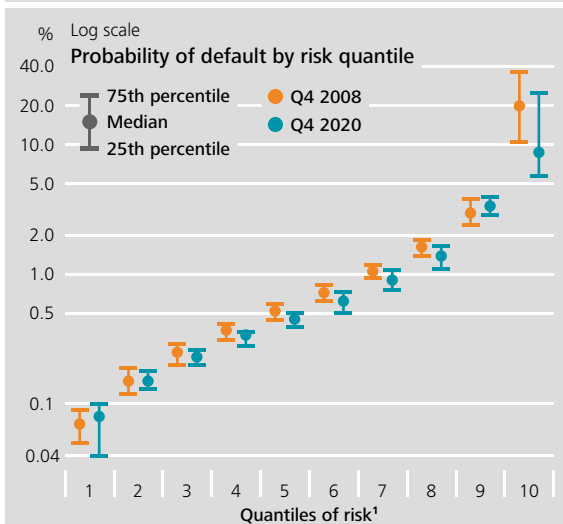
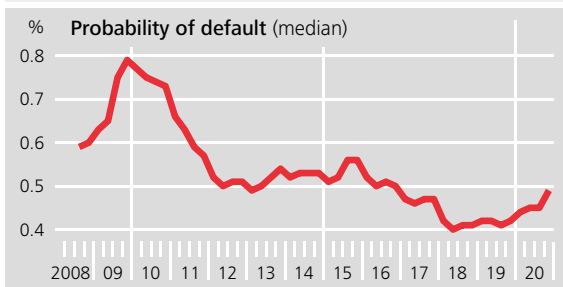
The balance sheet metrics of the relatively risky enterprises in the banks' credit portfolio, on the other hand, saw hardly any improvement between

58 General loss allowances were set aside against latent risks in the past, too. However, expected losses were determined by many institutions only on the basis of historical data. According to a new agreement by the German Institute of Public Auditors (Institut der Wirtschaftsprüfer), as from 2022 banks are required to also draw on current information and expectations when setting aside general loss allowances. The new methodology can already be applied earlier, however.

59 Loans are, as a general rule, assigned to one of three stages of impairment. Upon initial recognition, loans are assigned to Stage 1 and ECLs for the next 12 months are recognised. If the credit default risk rises significantly, the loan is moved from Stage 1 to Stage 2. The loan's lifetime ECLs now have to be recognised. All loans regarded as being credit-impaired in the usual sense are assigned to Stage 3. These are loans where the borrower's credit rating is impaired specifically owing to serious events.

60 See European Systemic Risk Board (2021a).

IRBA probability of default* of non-financial corporations in Germany Chart 2.2.2



* Probabilities of default calculated by German banks using the internal ratings-based approach (IRBA), relating to borrowers for which data from single-entity financial statements are available. **1** Measure of risk calculated per quarter and sector. The higher the quantile, the higher the risk.
 Deutsche Bundesbank

2008 and 2020.⁶¹ The capital ratio of the riskiest enterprises in the portfolio remained virtually unchanged, whereas that of other enterprises rose considerably. As regards short-term debt sustainability, the situation for relatively risky enterprises in the credit portfolio continued to deteriorate despite favourable financing conditions, with the interest coverage ratio – the ratio of earnings to interest expenditure – falling significantly over the same period.

On the whole, banks seem to regard relatively risky enterprises' creditworthiness as having improved

even though credit scores have dropped in some cases. The risk of default on real estate loans is also still being assessed as low on the basis of banks' internal models, irrespective of the economic slump (see Chart 2.2.3). This is likely to be because insolvency and default rates dropped sharply over the course of the long economic upswing in the years prior to the pandemic and were, as of late, at all-time lows.

Banks seem to regard relatively risky enterprises' creditworthiness as having improved.

Nonetheless, the models could be understating general default risk as they are probably calibrated largely on data from earlier years, which could potentially reflect exceptional circumstances. The long economic upswing that followed the global financial crisis caused insolvencies to drop to a minimum up until the outbreak of the pandemic. However, even during the recessions that came on the heels of the global financial crisis and the coronavirus pandemic, the number of enterprises and households

Default risk is potentially being understated.

in Germany filing for insolvency hardly rose or even fell. Government support measures, in particular, have made an impact here. This could create the impression that insolvencies are less closely tied to negative economic developments and that the average default risk has fallen over the long term. In future economic downturn periods or recessions, though, the relationship between credit defaults and economic activity could become stronger again, which could cause banks' credit defaults to exceed the figures expected on the basis of internal models.

⁶¹ Since non-financial corporations' balance sheet metrics are reported with a time lag of one to two years, values for 2020 are derived from extrapolations of 2018 and 2019.

Risk premia in lending rates low

A favourable assessment of default risk is also reflected in low risk premia in lending rates. These are the premia that banks demand over and above the risk-free interest rate to provide them with adequate compensation for the default risk they are exposed to.

Risk premia fell during the pandemic.

Empirical evidence shows that the risk premium rises by around 15 basis points, on average, if the PD increases by 1 percentage point (see Chart 2.2.4). During the pandemic, premia across all credit ratings, expressed as PDs, appear to have dropped: the credit default risk term structure shifted slightly downwards. Several factors may have been at play here. Government support measures such as the KfW Group's loan programmes may have meant that institutions expected lower loss given default (LGD) rates. Another reason could be that banks lowered their profit margins.

Allocation risk remains high

Whilst aggregate credit risk has come down overall in the years since the global financial crisis, lending to relatively risky enterprises has risen steadily.⁶² The resulting, comparatively high level of allocation risk increased further during the pandemic, in some cases.

Lending to relatively risky enterprises has risen.

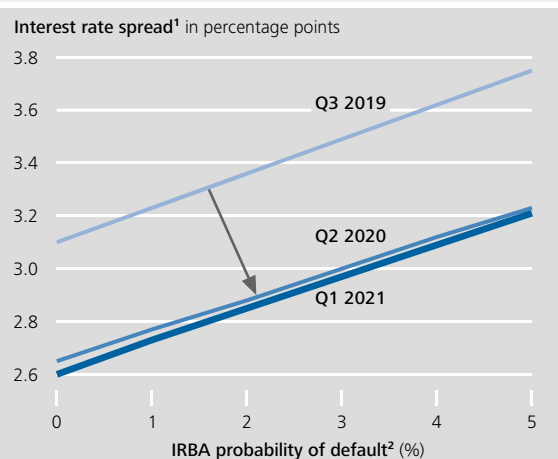
Loans to enterprises with an above average debt overhang ratio or a below average interest coverage ratio made up 82% and 69% of banks' credit portfolio respectively at the end of 2020 (see Chart 2.2.5). The high level of allocation risk can be explained to a degree by the fact that less risky enterprises made greater use of alternative forms of

IRBA probability of default* for residential and commercial real estate loans Chart 2.2.3



* Probabilities of default calculated by German banks using the internal ratings-based approach (IRBA); excluding defaulted loans. **1** Retail exposure secured by real estate (excluding small and medium-sized enterprises), which mostly comprises residential real estate loans to households. **2** Loans to domestic and foreign borrowers from the "other real estate activities" commercial real estate sector.
 Deutsche Bundesbank

Credit default risk term structure for German banks* Chart 2.2.4

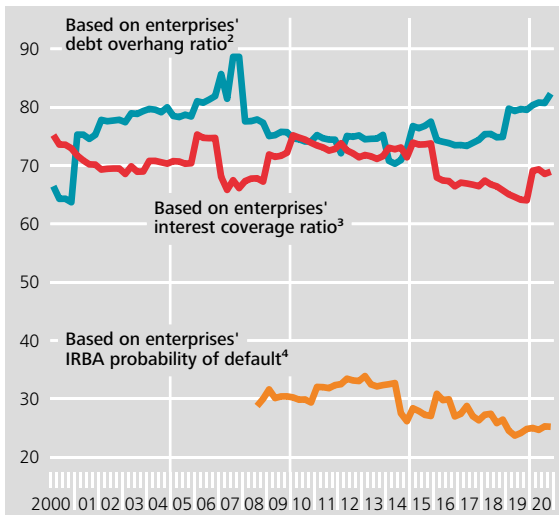


Sources: AnaCredit and Bundesbank calculations. * Estimate of a regression model saturated with fixed effects with the interest rate spread as the dependent variable. The regression model includes sectors, banks, instrument type and enterprise size as fixed effects. Where possible, only standard credit instruments (lines) with a fixed interest rate were used. **1** Difference between the credit interest rate reported in AnaCredit and the risk-free interest rate, estimated based on listed Federal securities. **2** Probabilities of default based on internal models (IRBA = internal ratings-based approach).
 Deutsche Bundesbank

⁶² See Deutsche Bundesbank (2018a); Deutsche Bundesbank (2019a); Deutsche Bundesbank (2020a).

Allocation risk in German banks' domestic credit portfolio Chart 2.2.5

Lending to relatively risky non-financial corporations¹ 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 Probabilities of default based on internal models (IRBA = internal ratings-based approach).
 Deutsche Bundesbank

financing, internal financing for instance, than of bank loans during the economic upturn that preceded the pandemic. As a result, allocation risk has mounted further, in some cases. Another factor behind the increase in allocation risk is likely that banks made a conscious decision to run greater risks before the pandemic in order to earn higher interest income. This factor could become more relevant again going forward. Another factor, for larger banks in particular, could also have been that the creditworthiness of relatively risky enterprises likewise improved during the long economic upturn, and this was reflected in banks' IRBAs. For instance, the proportion of loans to relatively risky enterprises, as measured by the median PD, makes up only around one-quarter of the credit portfolio. As it is possible that PDs are being underestimated, banks could consequently also be underestimating the percentage of riskier loans in their credit portfolio.

Vulnerabilities in banks' credit portfolio could materialise

The pandemic has demonstrated the importance of adequate risk provisioning.⁶³ Those institutions that had curtailed their transfers to risk provisions particularly sharply in the decade leading up to the pandemic raised them most strongly again in response to the pandemic (see Chart 2.2.6). Banks that had a comparatively below average capital ratio at the end of 2010 had reduced their risk provisions particularly sharply. Changes to banking regulation could have been a factor in this: following the global financial crisis and at the latest with the introduction of the initial Basel III reform package in the European Union in 2014, banks that were especially weakly capitalised had come under pressure to improve their capital ratios. This was desired from a supervisory standpoint and necessary from a financial stability perspective. Favourable economic developments and the reduction in risk provisioning that this made possible likely helped banks to improve their capital ratios.⁶⁴ Moreover, banks with low capital ratios may in some cases have utilised discretionary accounting options and raised their earnings by making smaller transfers to risk provisions. By retaining a percentage of these earnings, they are thus able to improve their capital position.⁶⁵

Heightened interest rate risk at banks

Maturity transformation means that banks are exposed to interest rate risk. Particularly when interest rates are low, there is an incentive to extend

⁶³ Risk provisions include both NPL provisioning and write-downs on accounts receivable as well as provisions for contingent liabilities.
⁶⁴ See Deutsche Bundesbank (2019a).
⁶⁵ For more on this possibility, see, inter alia, Ahmed, Takeda and Thomas (1999).

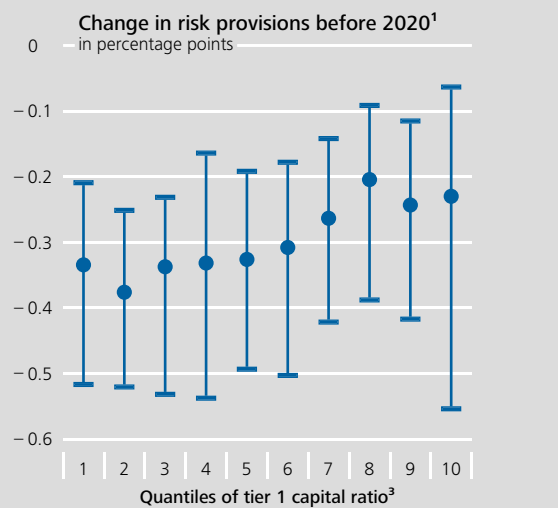
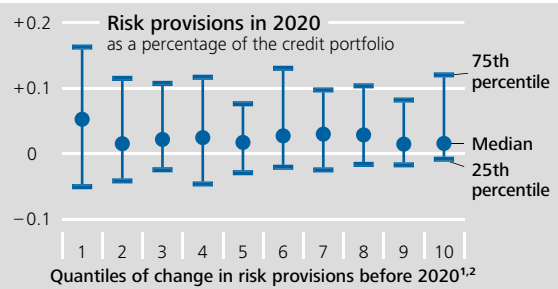
interest rate lock-in periods in lending.⁶⁶ This is especially true of savings banks and cooperative banks, which rely particularly heavily on interest business. They are also exposed to significantly higher interest rate risk than the category of large, systemically important banks (see Chart 2.2.7). Since 2016, however, these banks have seen interest rate risk come down again in trend terms. This development is

Savings bank and cooperative banks are exposed to higher interest rate risk.

more pronounced among savings banks than cooperative banks. The drop in interest rate risk is likely the result of, amongst other things, stricter regulatory rules. Banking supervisors believe that 44% of German credit institutions are exposed to heightened interest rate risk in their banking book.⁶⁷ In particular, interest rate risk can materialise if interest rates rise and interest expenditure increases faster than interest income. In the longer term, however, a rise in interest rates would probably have a positive effect on banks' net interest income, as it would boost earnings in new lending business.

Higher interest rates could, however, also impact banks indirectly through higher credit risk. They could increase enterprises' interest burden and consequently worsen their credit ratings. In this case, loan loss allowances could rise amidst otherwise unchanged conditions. Capital requirements could also go up, especially for banks that use internal models to calculate their credit risk. Where the lending rate rises by 1 percentage point, for instance, the interest coverage ratio of non-financial corporations will drop by just under 19%.⁶⁸ In such a case, allocation risk could also grow. The percentage of loans to non-financial corporations with a below median interest coverage ratio would then go up from just shy of 69% to more than 76% of loans to enterprises.⁶⁹

German banks' risk provisioning* Chart 2.2.6



* Transfers to risk provisions. **1** Difference between average transfers to risk provisions as a percentage of the credit portfolio in the years 1999 to 2010 and 2011 to 2019. **2** The higher the quantile, the smaller the drop in risk provisions. **3** Tier 1 capital as a percentage of risk-weighted assets in 2010. The higher the quantile, the higher the tier 1 capital ratio.
 Deutsche Bundesbank

66 Banks may also shorten the maturities of their liabilities. This option is limited, however, as the majority of liabilities consist of transferable deposits and other short-term deposits – particularly at small and medium-sized banks.

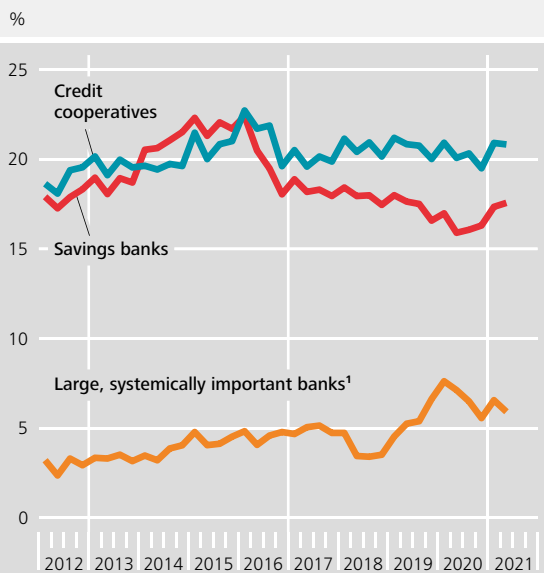
67 This view is based on an evaluation of the Basel interest rate coefficient as at 31 March 2021. The Basel interest rate coefficient is a standard measure of banks' interest rate risk. It divides the present value loss resulting from an abrupt rise in interest rates of 200 basis points across all maturities (Basel interest rate shock) by banks' regulatory own funds.

68 It is assumed here that only 25% of an interest rate increase is passed through to interest costs in the first year. This pass-through effect was estimated based on maturing new business as published in the MFI interest rate statistics.

69 The composition of the portfolio was assumed to remain unchanged.

Interest rate risk*
 in the German banking sector**

Chart 2.2.7

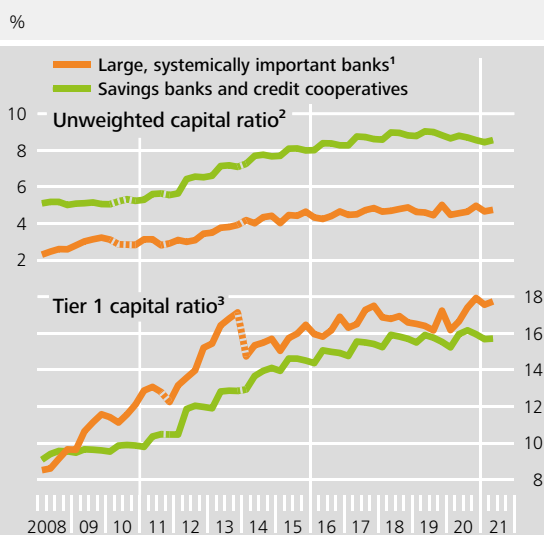


* Present value loss on the banking book positions exposed to interest rate risk for an abrupt interest rate increase (200 basis points across all maturities), based on own funds (weighted average). ** Based on the institutions' reports on the Basel interest rate coefficient. ¹ Comprises the 13 other systemically important institutions (O-SIs).

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Capitalisation of selected
 German banks*

Chart 2.2.8



* 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 13 other systemically important institutions (O-SIs). ² Tier 1 capital as a percentage of 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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Low risk assessment benefits capitalisation in the banking sector

Banks' capitalisation improved significantly following the global financial crisis. In the category of large, systemically important banks, the tier 1 capital ratio, i.e. the ratio of tier 1 capital to risk-weighted assets (RWAs), rose particularly strongly. Since 2009, this category's tier 1 capital ratio has exceeded that of savings and cooperative banks; in the second quarter of 2021, it stood at 17.7% (see Chart 2.2.8). The sharper rise among large, systemically important banks is in part because they have increasingly scaled back their exposures. Risk weights have also come down. The unweighted capital ratio, i.e. tier 1 capital in relation to total assets, is, at 4.8%, consequently only roughly half as high as the figure for savings and cooperative banks.

Banks' capitalisation improved significantly following the global financial crisis.

One factor to consider here is that the large, systemically important banks use internal models to determine risk weights. The risk weights calculated using these models are intended to reflect a particular borrower's credit risk better than the alternative standardised approach. They are significantly more volatile over time. Small and medium-sized banks, by contrast, employ the standardised approach in which risk weights are largely fixed. They change only marginally over time, meaning that capital requirements are also relatively constant.⁷⁰

At present, the German banking sector is probably able to weather losses in risk scenarios (see the section entitled "Impact of risk scenarios on Germany's

⁷⁰ In the standardised approach, risk weights for corporate loans are determined based on the rating assigned by external credit assessment institutions. Meanwhile, the majority of borrowers with small and medium-sized banks do not have such a rating. For these borrowers, a risk weight of 100% is assumed in the calculation.

financial system” on pp. 53 ff.). In its 2021 stress test, the European Banking Authority (EBA), too, attested that the German banking system is adequately capitalised.⁷¹ However, solvency is not enough on its own to ensure the proper functioning of the banking system even in the event of larger losses. In such a case, banks could respond, say, by curtailing lending in order to stabilise their tier 1 capital ratio. The banking system limiting lending exces-

Solvency is not enough on its own to ensure the proper functioning of the banking system.

sively could aggravate an economic downturn.⁷² On top of minimum capital requirements, the banking system must therefore additionally have sufficient capital reserves that it can draw on in the event of a crisis. Sufficient resilience is important as large losses can materialise more or less unexpectedly (see the box entitled “Archegos Capital Management” on p. 49). Their high degree of interconnectedness with other financial intermediaries means that large, systemically important banks, in particular, are exposed to such risks. This is one reason why these banks need to meet additional capital requirements in the form of the buffer for other systemically important institutions (O-SIIs).

Interest rate risk remains determining factor in the insurance sector

At present, the risk situation in the German insurance sector is being shaped largely by the impact of the pandemic and interest rate movements. The macro-financial environment is creating incentives for an intensified search for yield (see the section entitled “Macro-financial environment” on pp. 17 ff.). In the past, life insurers and pension funds promised households guaranteed returns. With interest rates low, they now face the challenge of generating sufficiently high returns on their investments to achieve these guaranteed returns on a long-term basis.

Against this backdrop, life insurers have invested more heavily in corporate bonds. Between the first half of 2018 and the first half of 2021, the percentage of corporate bonds rose by 0.6 percentage point to 8.5% of total assets. As a result, interconnectedness between the life insurance industry and the corporate sector has increased. At the end of the first half of 2021, approximately one-third of all corporate bonds in the portfolio of the German life insurance sector had a negative rating outlook. The percentage of corporate bonds with a rating in the lowest investment-grade segment or lower has risen significantly. It went up from 43% of the aggregate portfolio in the first six months of 2018 to 54% in the first half of 2021. Overall, the life insurance sector has likely become more vulnerable to credit risk in the corporate sector.

Life insurers have invested more heavily in corporate bonds.

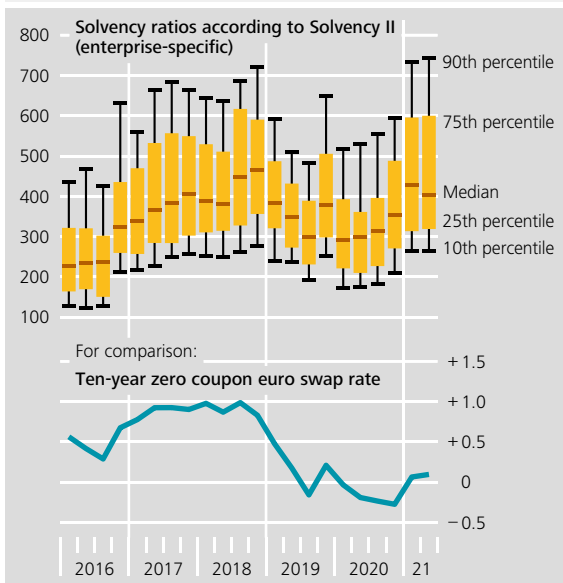
The low number of corporate insolvencies could result in credit risk also being underestimated for insurers. In Solvency II, fixed income securities’ default risk is captured in the market risk module. This risk accounts for around half of capital requirements for German life insurers’ market risk. When calculating own funds requirements based on the standard formula under Solvency II, debtors’ creditworthiness is relevant. Creditworthiness is determined by debtors’ ratings. Generally, these ratings are provided by external credit assessment institutions. If lower default rates gradually lead to better ratings, or ratings no longer adequately reflect debtors’ default risk, own funds requirements could be systematically underestimated, and risks could consequently be backed by too low a level of own funds. That could result in the resilience of the insurance sector being overestimated.

⁷¹ See, inter alia, <https://www.bundesbank.de/en/tasks/topics/joachim-wuermeling-german-banks-are-robust--873092>

⁷² See Deutsche Bundesbank (2020a).

Solvency ratios of German life insurers according to Solvency II* Chart 2.2.9

%, quarter-end data



Sources: BaFin and Bundesbank calculations. * Shown here are the solvency ratios of the 63 life insurance companies for which reports are available throughout.
 Deutsche Bundesbank

A moderate increase in the risk-free rate of interest, say as a result of higher inflation rates in the medium term, would improve the situation of life insurers as their earnings situation would benefit.⁷³ The relief provided by a moderate rise in interest rates was already reflected in life insurers' solvency ratios at the beginning of the year. Median solvency ratios rose

The situation in the life insurance sector has improved slightly.

from just over 350% as at year-end 2020 to more than 400% in the first half of 2021 (see Chart 2.2.9). This

more than offset the preceding drop in solvency ratios in 2020. As measured by this indicator, the sector's resilience has increased. The situation in the life insurance sector has consequently improved slightly, although low interest rates mean that conditions remain challenging.

However, solvency ratios do not fully reflect life insurers' economic resilience. The majority of German life insurers apply transitional measures when calculating their solvency ratios. These measures give insurers until 2032 to accumulate the own funds required by regulators or to adjust their risk profile. Their objective is to avoid the market turmoil that would ensue as a result of an abrupt switch to a mark-to-market valuation of assets and liabilities. Without these transitional measures, solvency ratios would be significantly lower. At the end of 2020, roughly a dozen life insurers would have been unable to meet own funds requirements.

The application of transitional measures significantly improves life insurers' solvency ratios.

In 2020, solvency ratios had still dropped year on year, albeit less sharply than they would have, had market developments been reflected fully. This was because the pandemic caused the low interest rate environment to become entrenched. Falling prices in the financial markets intermittently contributed to the drop in solvency ratios. Alongside the transitional measures, the regulatory solvency ratios were also supported by the volatility adjustment contained in Solvency II. This allows insurance technical provisions to be discounted at a higher rate of interest if risk premia spike in times of crisis. This is intended to prevent a temporary sharp rise in insurance technical provisions and the associated drop in the solvency ratio. The objective of the volatility adjustment is for insurers not to respond procyclically to a drop in their solvency ratios during periods of stress by selling riskier assets. At some insurers, the negative impact of the rise in risk premia on solvency ratios was actually more than compensated for by the vol-

⁷³ Insurers that apply the standard approach use the insurance supervision reporting system to report the sensitivity of their prudential solvency ratio to a parallel shift in the yield curve of currently 1 percentage point. Based on this, a large percentage of life insurers and reinsurers would benefit from rising interest rates.

Archegos Capital Management

Archegos Capital Management, a US-based family office operating similarly to a hedge fund, ran into payment difficulties at the end of March 2021.¹ Archegos had used highly leveraged derivatives to speculate on positive price developments of the underlying shares. Through use of these derivatives, Archegos was able to build up very large, concentrated exposures with little capital input and, at the same time, enter into similar transactions with securities dealers at a number of major international banks.² As the share prices fell, Archegos could no longer service its margin calls for the derivatives transactions. A number of banks were only able to sell the shares backing the derivatives at considerable price discounts. In some cases, this led to affected credit institutions suffering losses running into the billions. Since Archegos was registered as a family office in the United States, it was not subject to sufficient reporting and disclosure requirements. As a result of these events, the US Securities and Exchange Commission is looking into amending the existing regulations.

The Archegos case underscores credit institutions' responsibility for adequate risk management. For example, loans which were, in some cases, granted out of ignorance of the aggregate positions, appear to be at a high level considering the degree of insufficiently diversified equity investments. The events illustrate the potential for risks that can arise from a lack of transparency and pronounced interlinkages of non-bank financial intermediaries within the financial system. Despite the high losses suffered by some international financial institutions and the inter-

connectedness of Archegos, financial stability was not jeopardised. The Archegos case is one of a number of events in 2021 that illustrate the fact that the current market environment sets incentives for greater risk appetite.³

¹ A family office is an enterprise concerned with the bank-independent management of extensive private wealth.

² See European Systemic Risk Board (2021e).

³ These events include, amongst other things, the insolvency of Greensill Bank and the extreme price increase for shares of the video game retailer GameStop.

atility adjustment. Life insurers with sufficient capital buffers acted countercyclically in the first quarter of 2020 by investing in riskier bonds whose risk premia had risen, causing their prices to drop. Meanwhile, a far smaller percentage of life insurers that would have been unable to fulfil the own funds requirements without the transitional measures acted procyclically. This shows the immense importance of sufficient own funds for financial stability.

The rise in long-term interest rates should also be borne in mind when reviewing Solvency II.⁷⁴ One important question is what interest rates to use to calculate the insurance technical provisions. On the one hand, these interest rates should be as close to market rates as possible in order to protect consumers. On the other hand, market-oriented discount rates could potentially encourage procyclical behaviour. If life insurers' own funds are only slightly above regulatory requirements, this will tend to reinforce the procyclical effect. The European Insurance and Occupational Pensions Authority (EIOPA) has brought out two quantitative impact studies (QISs) that estimate the impact of alternative calculation methods on the sector's solvency ratios and largely form the basis for the European Commission's latest proposals. The first study is based on data as at the end of 2019 and the second draws on data as at the middle of 2020 when market interest rates were at their lowest. Owing to the lower interest rates and the associated poorer solvency ratios in the insurance sector, the second study indicates higher risks driven by more heavily market-oriented discount rates. Based on the current interest rate level, the results of the second QIS appear to be overstated, however. This would suggest that greater emphasis should be given to the first QIS, which points to comparatively lower risk from a more market-consistent valuation. From a financial stability perspective, the review of Solvency II should not result in a movement away from the principle of risk-appropriate capital requirements.

While the insurance sector is likely to benefit from a moderate increase in interest rates, a very strong rise would entail liquidity risk. This is because it could lead to a wave of policy lapses at German life insurers: 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 2.2.10). When interest rates rise, the market value of fixed income asset holdings in life insurers' portfolios falls. At the same time, life insurance customers in Germany have the option of terminating their contracts for a fixed surrender value at any time. If interest rates go up sharply, the market value of German life insurers' assets could decrease to such an extent that the surrender values would no longer be fully covered by capital. In this case it would be advantageous – under certain assumptions – for insurance policyholders to terminate their policies.⁷⁵

A very strong rise in interest rates would entail liquidity risk for the insurance sector.

Life insurers would then be forced to sell assets, thereby reinforcing a possible decline in the prices of the assets concerned and acting in a procyclical manner. In addition, they could withdraw their investments from banks and investment funds, thereby transmitting the shock to other parts of the financial system.

⁷⁴ The European Commission put forward a comprehensive package for the review of Solvency II on 22 September 2021. It centres on the legislative proposal to amend Directive 2009/138/EC (Solvency II). The implementation of the proposed directive may take until at least 2024 following national transposition.

⁷⁵ For more information on lapse risk in the event of rising interest rates, see Förstemann (2021) and Kubitzka, Grochola and Gründl (2020).

Increase in maturity and liquidity transformation at investment funds

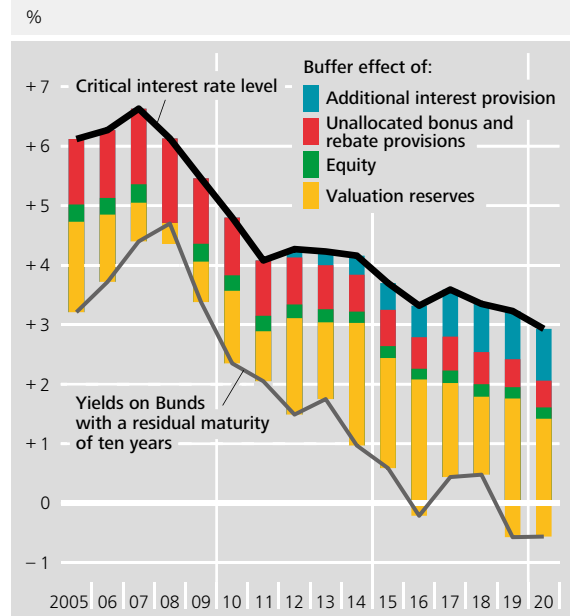
Investment funds are strongly interconnected within the financial system. This interconnectedness means that shocks can spread within the financial system and be absorbed by other financial intermediaries. In this case, being interconnected has a stabilising effect. However, shocks can also be amplified, lead to additional contagion effects and spread quickly throughout the system.⁷⁶ Funds' interconnectedness means that losses in a fund's securities portfolio may lead to losses being incurred by the fund investors. In addition, plummeting securities prices may also cause the outflow of investor funds. If funds have to sell securities as a result, the fund sector may amplify

Interconnectedness within the fund sector has increased.

price drops in financial markets.⁷⁷ Interconnectedness within the fund sector in particular has increased over

the past few years. While German funds only invested around 9% of their capital in other funds in September 2009, this proportion had risen to around 23% by August 2021. On the holder side, the fund sector continues to be especially strongly linked to the insurance sector, and this interconnectedness is increasing. Insurers are, in fact, frequently the sole investor in a fund. These single-investor funds are usually set up as specialised funds.⁷⁸ In March 2021, insurers and pension funds held around 44% of the net fund assets in the German investment fund sector; this figure had stood at 38% in September 2009.⁷⁹ Banks held 8% and other financial intermediaries held 18% of investment fund shares in Germany in August 2021. Just slightly more than one-quarter of the investment fund shares are held

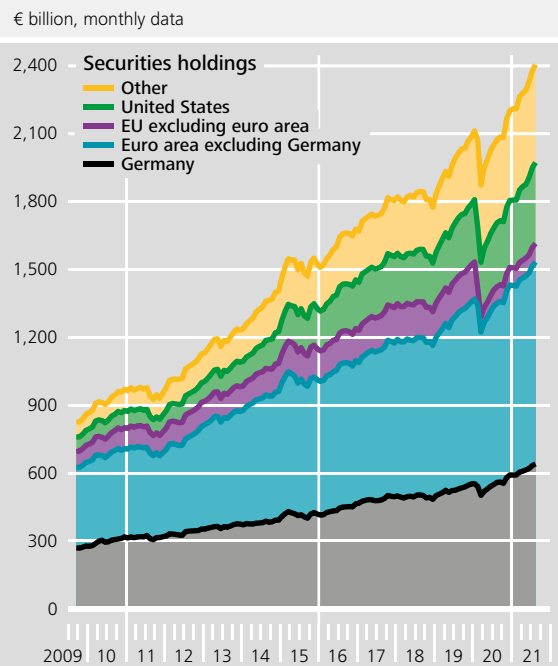
Critical interest rate level for German life insurers given an upsurge in policy lapses* Chart 2.2.10



Sources: BaFin 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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Portfolio structure of German open-end investment funds by issuer country Chart 2.2.11



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⁷⁶ See Deutsche Bundesbank (2019a).

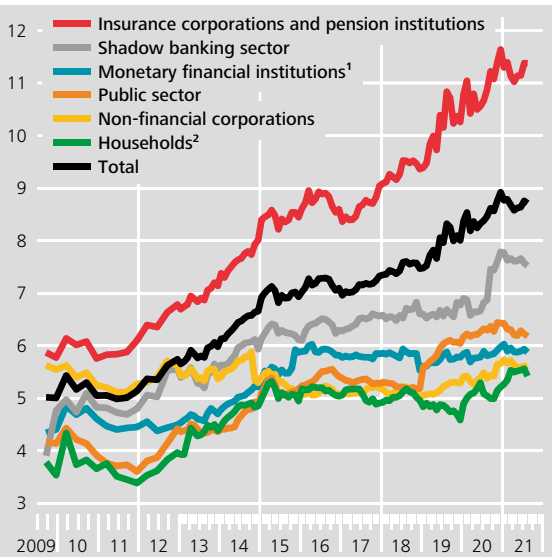
⁷⁷ See Deutsche Bundesbank (2019a); Fricke and Wilke (2020).

⁷⁸ See Deutsche Bundesbank (2018a).

⁷⁹ For a discussion of the incentives for insurers to invest through investment funds, see Deutsche Bundesbank (2018a).

Portfolio duration of German open-end investment funds by holder group* Chart 2.2.12

Weighted means in years



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

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outside the financial system, by households for instance.

The German fund sector is growing continuously and is increasingly investing outside the European Union. In June 2021, investments in German open-end investment funds amounted to 14.9% of the assets in the German financial system. Investment

German funds have become more vulnerable to shocks from abroad.

outside the European Union made up around 33% of the securities holdings of funds in August 2021 (see Chart 2.2.11). The increased international focus of investment is tending to dampen the vulnerability of German funds to shocks in Germany and the European Union, but at the same time it renders them more vulnerable to shocks in other countries. Shocks from abroad may also have an indirect impact on funds' portfolios,

such as when domestic enterprises are highly dependent on exports or international supply chains.

German investment funds were broadly successful in overcoming the shock triggered by the coronavirus pandemic. After holders withdrew capital from funds in March 2020, funds are now again receiving fairly large inflows across all segments. In addition to sustained inflows of capital, valuation effects are also boosting the stock of securities held in the portfolios of German investment funds.

In an environment of low interest rates and in the search for yield, investment funds have successively increased the risk in their portfolios over recent years: since 2009, for example, they have almost doubled the duration of their investments in particular, thereby exposing themselves to greater interest rate risk (see Chart 2.2.12).

Investment funds have exposed themselves to greater interest rate risk.

This means that their bonds and other interest-bearing securities in particular would lose more value in the event of an interest rate increase. It also means that the value of the fund shares issued would drop more sharply in such a case.

In 2020, the increase in portfolio duration was driven predominantly by funds held by insurers and investment funds. This allowed insurers to close their duration gaps as their liabilities usually have an even longer duration. In this respect, insurers are using funds to reduce their interest rate risk, which lowers their risk if interest rates continue to fall.

In the event of a downturn in the real economy or a subdued economic recovery potentially caused, for example, by strict containment measures in response to the pandemic or by longer-term supply-side restrictions, the risk of falling prices for market-traded assets would go up (see the section entitled "Impact of risk scenarios on Germany's financial system" on

pp. 53 ff.). These lower prices would immediately be reflected in investment fund portfolios. The fund share holders would also be directly affected by this and may wish to withdraw their capital. In order to lower the risk of extensive capital withdrawals by investors and the associated liquidity risk for funds, new instruments to manage investment funds' liquidity have been introduced in Germany (see the box entitled "New instruments to manage liquidity at investment funds" on pp. 55 f.).

Impact of risk scenarios on Germany's financial system

Although the current macroeconomic outlook is positive, negative developments in the economy as a whole may pose challenges to Germany's financial system (see the section entitled "Macro-financial environment" on pp. 17 ff.). A real economic setback in particular could have a negative impact. For example, the pandemic could necessitate strict containment measures again or supply problems in the industrial sector could persist. In order to estimate the risk to the stability of the German financial system, two risk scenarios are considered. The analysis is based on the current loan and securities portfolios of German banks, insurance companies and investment funds.

The first scenario assumes a subdued economic recovery. It is based on the Bundesbank's macroeconomic forecast, but deviates from it in that, amongst other things, GDP in the scenario's reference period

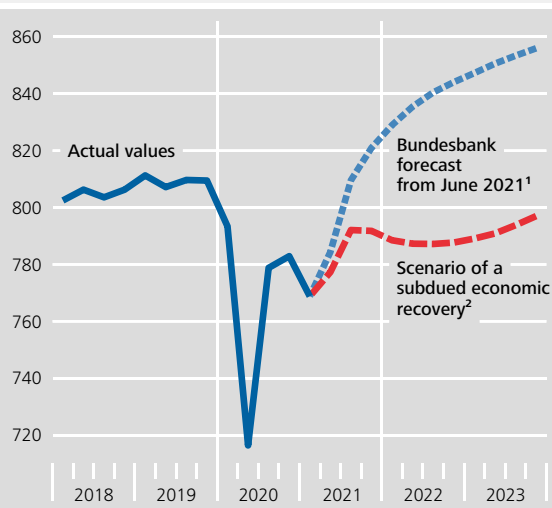
A real economic setback could pose challenges to Germany's financial system.

from June 2021 to the end of 2023 grows much more slowly than expected (see Chart 2.2.13).⁸⁰ The

output gap remains permanently open in this scenario. In addition, the macroeconomic and financial environment will also underperform the Bundesbank's macroeconomic

Forecast and risk scenario for real gross domestic product in Germany Chart 2.2.13

€ billion, chained previous-year prices, calendar and seasonally adjusted quarterly data



Sources: Federal Statistical Office and Bundesbank calculations. ¹ See Deutsche Bundesbank (2021), Monthly Report, June 2021. ² Derived from a severity function approach using the Bundesbank's forecast as the baseline; see F. Mokinski (2017), A Severity Function Approach to Scenario Selection, Deutsche Bundesbank Discussion Paper No 34/2017.

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forecast. It is assumed, in particular, that prices in the German equity market will temporarily spike down and financing conditions for non-financial corporations will deteriorate sharply. Banks' loss provisions will rise moderately. Based on this scenario, a plausible yet also much more negative development is

⁸⁰ For the risk scenario of a subdued economic recovery, a forecast density for several macroeconomic variables has been created based on a Bayesian vector autoregressive (VAR) model. The forecast density has been calibrated such that the median corresponds to the official Bundesbank forecast. Paths in the Bundesbank forecast are used for GDP and unemployment. The long-term interest rate path comes from the exogenous assumptions from the Eurosystem's Broad Macroeconomic Projection Exercise in June 2021 and corresponds to the market expectations at the time the forecasts were made. For loss provisions, CDAX, bond spreads of non-financial corporations and insolvencies, the forecast is expanded using the model. A severity function approach is employed to calculate a cyclical growth path that corresponds to an adverse economic development for the current projection. The severity of the scenario is selected such that real GDP is at the fifth percentile of the forecast density after four quarters. For information on the severity function approach, see Mokinski (2017). For the official Bundesbank forecast, see Deutsche Bundesbank (2021c).

analysed than was forecast over a period of three years.

By contrast, an unexpected, severe macro-financial shock within a year is assumed in the second risk scenario. It is not based on the macroeconomic forecast, but is guided by very negative developments that have occurred in the past.⁸¹ In this scenario, prices in the financial markets would fall sharply, and banks would have to raise loss provisions for loans to enterprises and housing loans considerably in the space of a year.

Investigation of the impact of scenarios on German banks, insurers and investment funds.

The impact of both of these risk scenarios on Germany's financial system is investigated using multiple modules for

German banks, insurers and investment funds (see Table 2.2.2 on p. 57).

For banks, it is estimated how losses and growing minimum capital requirements impact common equity tier 1 (CET1) reserves.⁸² Capital reserves include the macroprudential buffers and surplus capital.⁸³ Surplus capital is the share of CET1 capital that exceeds the minimum and buffer requirements. The results of sectoral stress tests relevant to the banking system are merged in the analysis: these stress

Even if solvency is safeguarded, shocks may be amplified by feedback effects.

tests look at stress in the corporate sector, in the real estate market and in the financial markets.⁸⁴ First, the impact on the credit

and securities portfolios of German banks is examined.⁸⁵ The analysis then 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 target ratio.⁸⁶ The extent to which assets are scaled back and the size of the reduction in lending that this involves depend large-

ly on whether banks are prepared to use existing buffers. Overall, the scenario analysis covers an important aspect of financial stability: even if the solvency of the banking system remains safeguarded, shocks may still be amplified by feedback effects on the real economy. Potential contagion effects within the banking system that could arise in the event of bank failures, for instance, were not considered.⁸⁷

As granting loans accounts for only a small part of German insurers' and investment funds' business activities, the effect examined in the case of these intermediaries is the impact on their asset holdings. They are exposed to considerable market and credit risk by virtue of their holdings of stocks, bonds and

⁸¹ To this end, the largest price drops that occurred for each asset class in the past are used. They do not necessarily need to have occurred together. For more information on how market stress assumptions are derived, see Falter, Kleemann, Strobel and Wilke (2021).

⁸² For more information on the underlying monitoring tool that the Bundesbank uses to estimate deleveraging potential in Germany's banking system, see Pelzer, Barasinska, Buchholz, Friedrich, Geiger, Hristov, Jamaldeen, Löffler, Madjarac, Roth, Silbermann and Wong (2021).

⁸³ The macroprudential capital buffers are the capital conservation buffer, the countercyclical capital buffer, the buffer for other or globally systemically important institutions and the systemic risk buffer. For more detailed information on macroprudential capital buffers, see Deutsche Bundesbank (2020a).

⁸⁴ For the risk scenario with a subdued economic recovery, the analysis assumes that the impact of the GDP growth path over three years on the loss ratios for loans to enterprises and housing loans will be immediate. This implicitly assumes that banks' balance sheets do not change over the observation period.

⁸⁵ See also Barasinska, Haenle, Koban and Schmidt (2019); Falter, Kleemann, Strobel and Wilke (2021); Memmel and Roling (2021).

⁸⁶ A distinction is made here between two extreme cases: (i) banks use their macroprudential buffers and have a target ratio just above the regulatory minimum capital requirements of Pillar I and Pillar II; (ii) banks do not use their buffers – just their surplus 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).

⁸⁷ Second-round effects in the interbank market may be included in the scenario analysis in principle. They may further reinforce the curtailment of lending; see Pelzer, Barasinska, Buchholz, Friedrich, Geiger, Hristov, Jamaldeen, Löffler, Madjarac, Roth, Silbermann and Wong (2021).

New instruments to manage liquidity at investment funds

New instruments allowing asset management companies to better manage the liquidity in the open-end investment funds they manage have been available in Germany since 28 March 2020. They increase consumer protection and are also a welcome development in terms of financial stability. These instruments help reduce liquidity risk in the fund sector. Previously, the only option had been the severely restrictive suspension of the redemption of investment fund shares if an asset management company did not have the necessary liquidity within the investment undertaking to meet all claims. In some other European countries, fund managers have had a selection of instruments at their disposal to manage their liquidity for some time now.

The amendment to the German Investment Code (*Kapitalanlagegesetzbuch*) means that funds in Germany can now also use flexible instruments for liquidity management:

Redemption notice periods

Redemption notice periods define a time-frame to ensure that investors are required to inform the asset management company in advance of their redemption demand; they apply to each individual redemption demand. The statutory maximum period is generally one month. However, the asset management company can set a time-frame within this limit in its terms of investment.

Redemption gates

As a measure that is milder than suspending the redemption of shares, asset management compa-

nies are now able to bridge liquidity bottlenecks in the event of increased redemptions by temporarily activating redemption gates. As a rule, the asset management company must announce in advance on its website that it plans to activate such a measure. The time-frame of the measure can be selected pursuant to the terms of investment. The statutory maximum period is 15 days. An upper limit is defined for the investment fund shares that can be redeemed within one day.

Swing pricing

With swing pricing, the share price is adjusted such that the costs of fund flows are allocated to those buyers and sellers of fund shares that caused the costs. In Germany, asset management companies can now choose between two forms of swing pricing. Where it is introduced as a permanent measure, full swing pricing, the modified net asset value is applied to every purchase and sale of investment fund shares where there is a net surplus of redemptions or subscriptions. An asset management company can, however, also define a threshold for net redemptions. With this partial swing pricing, the modified net asset value is applied only when the threshold is crossed.

For share purchases, the modified net asset value is formed by way of an upward technical correction of the actual net asset value, whereas for share redemptions, it results from a corresponding downward adjustment, in each case by a swing factor. This results in a settlement price that deviates from the actual net asset value and constitutes the modified net asset value. The difference between the actual net asset value

and the settlement price flows into the fund as income. This income is intended to compensate the investors remaining in the fund, as the fund loses value owing to the fund share redemptions and the resulting transaction costs.

Analyses and experiences from other countries indicate that swing pricing lowers the sensitivity of outflows to fund performance and fund income. In addition, it can also reduce the first mover advantage when redeeming investment fund shares. The findings of a consultation workshop between the international Financial Stability Board (FSB), the International Organization of Securities Commissions (IOSCO) and invited representatives of the fund industry and academia show that the fund sector gained impressive experience of swing pricing in March 2020. The prices in the financial markets contracted severely in March 2020 in response to the coronavirus pandemic. Investors withdrew substantial capital from money market funds, in particular, but also from some bond funds. In reaction to this, funds used swing pricing and higher swing factors more frequently. In practice, however, calculating a correct swing factor is not always straightforward. For example, factors that are based on normal market conditions are less suitable for use in times of stress.

A swing factor and the threshold can be calculated based on several metrics: bid-ask spreads, net broker commissions, safe custody transaction costs, taxes, exit fees, a fund's strategy, investor characteristics, the liquidity of the financial instruments, the swing pricing used by similar funds and the situation in the investment markets. In this context, fund managers emphasise that better current market price information is needed and that the quality of price data varies between countries. Moreover, they say that there

is fragmentation and inconsistency between data providers when it comes to market price information in some countries.

Surveys indicate that, even within individual jurisdictions, there are significant differences in the use of swing pricing. One reason could be that swing pricing requires a certain degree of judgement and internal know-how in order to determine the appropriate level of adjustment of the net asset value of a fund – particularly in times of stress. For swing pricing to fully achieve its intended impact, which is for all liquidity costs to be passed on to redeemers of shares, better current market price information in particular is necessary. In addition, experience gained from the use of swing pricing should be shared in order to inform fund managers and investors and avoid stigma effects.

Modules of the stress tests on German financial intermediaries					Table 2.2.2
Module	Rationale	Risks considered and intermediaries			
		Credit risk for loans to non-financial corporations	Credit risk for residential real estate loans	Market risk ¹	
Risk scenario: a subdued economic recovery over three years	Clear yet still possible deviation from the currently expected recovery path over the next three years (based on the Bundesbank forecast of June 2021) ²	Projection of loss ratios per sector based on their correlation with the assumed growth in gross domestic product.	Path of unemployment rate follows from assumed macroeconomic developments. Consistent growth is assumed for house prices.	Model forecasts for CDAX, Bund yields and risk premia of the bonds of non-financial corporations. Further assumptions are derived into consistent developments using bridge equations and estimations; the yield curve falls endogenously.	
Risk scenario: a severe macro-financial downturn within one year	Unexpected, severe macro-financial downturn (based on historical developments)	Maximum (sectors hit hard by the coronavirus pandemic) or average plus one standard deviation (other sectors) of banks' historical loss ratios between 2003 and 2020.	House prices decline by 30%; unemployment rate increases to 10%.	Market distortions are derived from the historical evolution of risk premia on bonds and share prices since January 2000. ³ The yield curve is assumed to be unchanged.	
Intermediaries affected		Banks	Banks	Banks, insurers, investment funds	
Second-round and amplification effects	For banks: curtailment of lending, sale of liquid assets For investment funds: deleveraging, capital withdrawals, second-round effects on securities and investment fund share prices				
¹ Market risk includes the credit risk of market-traded assets (e.g. shares, bonds). ² See Deutsche Bundesbank (2021), Monthly Report, June 2021. ³ 99.5th percentile for changes in the risk premia of bonds and 0.5th percentile for the relative changes in share prices.					
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securitised products.⁸⁸ For this reason, only the changes in securities portfolios are estimated for these intermediaries. In the case of insurers, the impact on their solvency is analysed in the scenarios. Looking at the fund sector, the analysis covers securities portfolio losses as well as potential amplification effects that can emanate from this sector. This is because, in times of stress, funds could be hit by large-scale redemptions and respond to this with fire sales in order to cover the liquidity outflow.⁸⁹

Subdued economic recovery manageable for German financial system

The scenario of a subdued economic recovery affects banks via their credit and securities portfolios, impacting their capital reserves and, indirectly, their lending. Loss ratios for corporate loans are calculated and applied to banks' current credit port-

folio. In this scenario, the loss ratios are dependent on the projected GDP path. They are estimated using an econometric model that includes the correlation between the change in GDP and corporate loan losses.⁹⁰ Building on this, expected losses are determined as the product of PD and LGD. In this scenario, they average 0.7%. While the loss ratio for loans to public administrations amounts to 0%, it is highest for loans to firms in the manufacturing sector (2.7%). In the scenario of a subdued economic recovery, the loss of CET1 capital equates to 1.3% of RWAs prior to capital depletion (see Table 2.2.3).

⁸⁸ Credit risk tends to manifest differently for funds and insurers than it does for banks. While credit risk at banks materialises primarily as a result of loan default events, funds and insurers are affected more by issuers of shares or bonds experiencing either a deterioration in credit quality or higher default rates resulting in falling prices. This risk is a major driver in the market risk stress test module.

⁸⁹ See Barbu, Fricke and Moench (2021); Fricke and Wilke (2020).

⁹⁰ See Memmel and Roling (2021).

Scenario analysis: effects of a subdued economic recovery over three years

Table 2.2.3

%, as at Q1 2021

Impact on German banks and their lending		
Scenario metric	Effects of the scenario	
	with use of buffers	without use of buffers
Starting situation		
Capital reserves ¹ (% of RWAs ²)	7.3	
Capital depletion		
Change in RWAs	+5.5	
Change in CET1 capital (% of RWAs ²)	-1.8	
Increase in credit risk, non-financial corporations	-1.3	
Increase in credit risk, residential real estate	-0.1	
Increase in market risk	-0.5	
Capital reserves after stress (% of RWAs)	5.2	
Deleveraging		
Change in RWAs	-0.3	-1.3
Capital reserves after deleveraging (% of RWAs)	5.2	5.3
Reduction in lending		
Change in lending to non-financial corporations ³	-0.5	-2.1
Detailed results for market risk module for banks, insurers and investment funds		
Scenario metric	Changes	
Banks – first-round effect		
Banking book at market values	-3.3	
Banking book at book values	-1.0	
Banking book (% of RWAs ²)	-0.4	
Trading book (% of RWAs ²)	-0.1	
Insurers – first-round effect		
Securities portfolio at market values	-7.9	
Securities portfolio (% of own funds)	-16.1	
Liabilities (% of own funds)	1.9	
Investment funds – first and second-round effects		
Securities portfolio at market values – first-round effect	-10.4	
Net asset value – first-round effect	-9.8	
Securities portfolio at market values – second-round effect	-2.7	
Net asset value – second-round effect ⁴	-2.5	

1 Capital reserves: CET1 capital from macroprudential buffers and surplus capital. **2** In this context, risk-weighted assets (RWAs) prior to capital depletion. **3** Relative to total loans to non-financial corporations in the respective scenario. **4** 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 D. Fricke and H. Wilke (2020), Connected Funds, Deutsche Bundesbank Discussion Paper No 48/2020 and Deutsche Bundesbank (2019), Financial Stability Review.

The relationship between macroeconomic developments and expected losses is modelled for housing loans.⁹¹ In the scenario of a subdued economic recovery, growth in house prices gradually slows and ultimately tails off. Expected losses at the end of the period amount to just over 0.1% of outstanding housing loans. This corresponds to just under 0.1% of RWAs prior to capital depletion.

For securities in banking books and for banks’ trading books, losses from market risk are calculated based on the decline in market prices.⁹² In a subdued economic recovery scenario, losses are equivalent to around 0.5% of RWAs prior to capital depletion. The losses comprise trading losses of 0.1% of RWAs and losses from write-downs of securities held by banks amounting to 0.4% of RWAs prior to capital depletion.⁹³ The calculation already accounts for the fact that declines in market prices are not reflected in banks’ balance sheets in full because write-down options are available in some cases or hidden reserves are reduced first. These options exist because securities are sometimes entered in the balance sheet at less than their market value, e.g. at amortised cost. Banks would therefore only need to recognise book value losses of 1% for the securities in their banking books despite mark-to-market losses amounting to around 3.3%.

Aggregating losses from banks’ credit and securities portfolios for the three-year scenario of a subdued economic recovery, the ratio of capital reserves to RWAs decreases by 2.1 percentage points to 5.2% (see Table 2.2.3). RWAs increase by 5.5%. The losses incurred by the banking system in this scenario are

91 See Barasinska, Haenle, Koban and Schmidt (2019).

92 See Falter, Kleemann, Strobel and Wilke (2021).

93 Unlike losses on securities held in the banking book, trading losses are not determined on a security-by-security basis. Instead, STE data on the market price sensitivity of the trading book are taken into account if available. Alternatively, a low percentile from the bank-specific distribution of historical trading loss ratios is used to approximate trading losses given the current capital requirements for market risk. See Falter, Kleemann, Strobel and Wilke (2021).

well manageable overall. Banks reduce their holdings of assets, such as corporate loans and liquid securities, only slightly. This is because only a small number of banks need to stabilise their capital ratio

Losses in muted economic recovery scenario would be manageable for banks, ...

so as to meet their capital requirements amid losses and mounting credit risk. The analysis shows that the German banking system's holdings of RWAs such as loans and securities would be reduced by only 0.3% if banks made use of both their surplus capital and their capital buffers. Should buffers not be used, RWAs would be scaled back by 1.3%.⁹⁴

As some corporate loans are not rolled over, there is a decline in the banking system's lending activities. In the scenario of a subdued economic recovery, corporate lending in the three-year window decreases by around 0.5% if use is made of buffers. If they are not used, it drops by 2.1%.⁹⁵ The banking sector hence would not heavily curb its lending. There is thus only limited potential in this scenario for the banking sector to curb overall economic growth.

Mark-to-market accounting means that the relevant balance sheets of investment funds and insurers normally respond far more rapidly and extensively than those of banks to a change in the risk situation. In

... insurance sector proves resilient, ...

the insurance sector, even a subdued economic recovery results in sizeable mark-to-market losses for a time. These amount to 7.9% of their asset holdings, or 16.1% in relation to their own funds. A slight flattening of the risk-free interest rate term structure assumed in this scenario increases insurers' liabilities. This leads to further burdens in the amount of 1.9% of own funds. The solvency ratio in the insurance sector would decrease from around 306% to roughly 285%. Relief is afforded by a regulatory adjustment factor. Pursuant to Sol-

vency II, equity risk positions are subject to more stringent requirements when prices are well above the average of the previous three years. At the same time, supervisory capital requirements are eased as soon as there is a marked drop in prices.⁹⁶ Overall, the insurance sector proves resilient in the face of a subdued economic recovery scenario.

Their business model means that investment funds are most affected by market risk. Their securities portfolios lose around 10.4% of their market value following the initial shock. This is attributable primarily to significant drops in the prices of stocks and corporate bonds. As a result of this shock, the German fund sector's net asset value (NAV), i.e. the value of all fund shares issued, falls by 9.8%. Funds can also amplify the initial shock. The strength of these second-round effects depends on the scale

... investment funds could amplify price drops.

of German funds' fire sales of securities as well as their interconnectedness and can be measured using the "aggregate vulnerability" metric.⁹⁷ This quantifies the sum of second-round losses of all German funds relative to the fund sector's aggregate NAV before the shock. In this scenario, it amounts to 2.5%. The German fund sector thus amplifies the impact of the initial shock on the aggregate NAV by around 25%, meaning that fund investors have to shoulder mark-to-market losses of 12.3% in total. The amplification effects emanate largely from a relatively small num-

⁹⁴ Buffer use can be restricted by parallel minimum requirements, such as the minimum requirement for own funds and eligible liabilities (MREL) (see the box entitled "Planned refinement of the European resolution regime" on pp. 72 ff.). Banks might also choose not to use their buffers so as to circumvent supervisory measures such as dividend restrictions.

⁹⁵ It is assumed that the decrease in lending by individual banks is compensated for by other banks. This is conditional on these other banks having ample capital reserves – i.e. supervisory buffers and voluntary surplus capital – and a pre-existing credit relationship with the affected enterprise.

⁹⁶ Potential further (temporary) easing by means of the volatility adjustment contained in Solvency II was disregarded here.

⁹⁷ See Deutsche Bundesbank (2019a); Fricke and Wilke (2020).

Scenario analysis: effects of a severe macro-financial downturn within one year

Table 2.2.4

% , as at Q1 2021

Impact on German banks and their lending		
Scenario metric	Effects of the scenario	
	with use of buffers	without use of buffers
Starting situation		
Capital reserves ¹ (% of RWAs ²)	7.3	
Capital depletion		
Change in RWAs	+11.8	
Change in CET1 capital (% of RWAs ²)	-1.7	
Increase in credit risk, non-financial corporations	-0.7	
Increase in credit risk, residential real estate	-0.2	
Increase in market risk	-0.8	
Capital reserves after stress (% of RWAs)	4.7	
Deleveraging		
Change in RWAs	-0.5	-3.7
Capital reserves after deleveraging (% of RWAs)	4.8	5.3
Reduction in lending		
Change in lending to non-financial corporations ³	-0.4	-6.0
Detailed results for market risk module for banks, insurers and investment funds		
Scenario metric	Changes	
Banks – first-round effect		
Banking book at market values	-4.9	
Banking book at book values	-1.7	
Banking book (% of RWAs ²)	-0.7	
Trading book (% of RWAs ²)	-0.1	
Insurers – first-round effect		
Securities portfolio at market values	-11.5	
Securities portfolio (% of own funds)	-23.5	
Liabilities (% of own funds)	0.0	
Investment funds – first and second-round effects		
Securities portfolio at market values – first-round effect	-11.4	
Net asset value – first-round effect	-10.7	
Securities portfolio at market values – second-round effect	-3.3	
Net asset value – second-round effect ⁴	-3.1	

¹ Capital reserves: CET1 capital from macroprudential buffers and surplus capital. ² In this context, risk-weighted assets (RWAs) prior to capital depletion. ³ Relative to total loans to non-financial corporations in the respective scenario. ⁴ 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 D. Fricke and H. Wilke (2020), Connected Funds, Deutsche Bundesbank Discussion Paper No 48/2020 and Deutsche Bundesbank (2019), Financial Stability Review.

ber of funds. In other words, close to three-quarters of amplification effects in the German fund sector are caused by just 10% of funds.

The scenario examined models a significantly negative deviation from the economic developments forecast in June for the next three years. If the economic recovery is weaker than anticipated, there is no reason to expect, based on this analysis, that lending will be severely curtailed over the observed time horizon or that the banking system will act procyclically. Countercyclical stabilisers contained in the Solvency II prudential regime will dampen the effect of relatively high mark-to-market losses on insurers’ solvency ratios. Additionally, a portion of the losses will be borne by policyholders as their profit participation shares will be reduced. A large part of the mark-to-market losses in the fund sector will be passed through not only to the wider financial system but also to households. Fund losses triggered directly by the shock are already largely taken into account in the analyses for banks and insurers. The additional second-round effects within the fund sector would lead to further losses for banks and insurers. All in all, the impact on the financial system appears moderate in this scenario. Based on the analysis, no strong, negative feedback effects would spill over from the financial system to the economy.

Heavy losses in the event of a severe macro-financial shock

The scenario of a severe macro-financial downturn within one year would result in heavy losses in the financial system. It would cause the ratio of capital reserves to RWAs in the banking system to shrink by 2.6 percentage points to 4.7% within that one year. RWAs themselves would increase by 11.8% (see Table 2.2.4).

For corporate loans, loss ratios average 1.3% across sectors but are highest for manufacturing, at 3.6%.

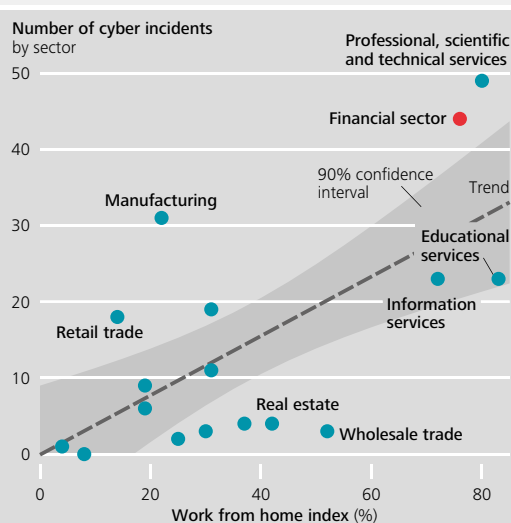
Cyber risks and the coronavirus pandemic

Cyber risks can arise from deliberate and malicious cyber attacks, but also from unintended operational service disruptions occurring in information and communication technologies. Cyber risks may jeopardise the confidentiality and integrity of data or systems and cause their availability to be restricted. Cyber incidents can pose a systemic risk to the financial system if they cause significant disruption to the functioning of the system. Due to increasing digitalisation and interconnectedness, cyber risks had been rising in the financial system even before the outbreak of the coronavirus pandemic. This trend continued during the pandemic. Potential vulnerabilities to cyber risks grew as a result of increased working from home and the associated expansion of technical infrastructures, such as more frequent use of video conferencing systems. In addition, cybercriminals took advantage of public interest in information regarding COVID-19 and the pandemic to carry out phishing and spam campaigns.¹

Irrespective of the coronavirus pandemic, cyber risks in the financial system are continuing to grow because financial market participants are increasingly using third-party services. Unlike financial intermediaries, these third-party providers are often neither regulated nor supervised. Since third-party providers are often used jointly by many financial market participants for essential tasks, this can give rise to concentration risk. Serious cyber incidents involving these third-party providers could potentially jeopardise the stability of the financial system given the interconnect-

Work from home index versus cyber incidents in the USA during the coronavirus pandemic*

March to June 2020



Source: BIS. See I. Aldasoro, J. Frost, L. Gambacorta and D. Whyte (2021), Covid-19 and Cyber Risk in the Financial Sector, BIS Bulletin No 37, January 2021. * Unlabelled points indicate other sectors (excluding the health sector).

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edness of the financial system and concentration on a small number of third-party providers.

Regulators at the national, European and global level are looking into this matter in an effort to counter cyber risks. For instance, the European Commission is planning to introduce a comprehensive regulation on operational resilience for the financial sector (Digital Operational Resilience Act – DORA), which will also include the oversight of providers of information and communication technologies.²

¹ See Aldasoro, Frost, Gambacorta and Whyte (2021).

² See <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52020PC0595&from=EN>

Corporate loan losses cause CET1 capital to decrease by around 0.7% in relation to RWAs prior to capital depletion. Assuming a sharp drop in house prices, losses on housing loans amount to 0.5% of outstanding housing loans and are significantly higher than in the scenario of a subdued economic recovery. As a result, CET1 capital decreases by 0.2% in relation to RWAs prior to capital depletion. Prices in the financial markets also fall much more sharply in the scenario of a severe macro-financial shock.⁹⁸ Losses from market risk lead to a decline in CET1 capital amounting to 0.8% of RWAs prior to capital depletion, of which 0.7% is attributable to banking books and 0.1% to trading books. Unlike in the scenario of a subdued economic recovery, it is assumed that the yield curve does not change. As a result, the mark-to-market losses for bonds are not lessened by a falling yield curve and are thus higher.

Provided banks use their buffers, lending in the banking system is not significantly curtailed in this scenario, either. If buffers are left unused, however, lending would decrease by 6% within the space of one year. This highlights the fact that utilising buffers – particularly in unexpected periods of stress – can play a key role in stabilising lending.

Lending would decrease if buffers were left unused.

Due to the higher risk premia and mark-to-market losses for fixed income securities, the scenario of a severe macro-financial shock has an especially negative impact on insurers' asset holdings, as these primarily consist of bonds. Insurers' asset holdings would lose 11.5% in value. This is equivalent to 23.5% of their own funds. The average solvency ratio for the insurance sector would consequently fall by around 40 percentage points to just over 270% of supervisory requirements. Four of the 200 insurers in the sample would fall short of the solvency capital requirement (SCR). One insurer would even fail to meet the minimum capital requirement (MCR),

with the result that this undertaking's authorisation could potentially be withdrawn and it would thus be forced to exit the market. As the business volume of this insurer is comparatively low, this is unlikely to give rise to any systemic risk.

The German fund sector would also be hit temporarily by heavy mark-to-market losses. Funds' securities holdings would shrink by 11.4% as a result of the initial shock. Their aggregate NAV would be reduced by 10.7%. The second-round effects within the fund sector, i.e. the sum of all German funds' losses due to amplification effects, would amount to 3.1% in this scenario, relative to aggregate NAV before the shock. According to the analysis, German funds would amplify the initial shock by 29% and fund investors would have to shoulder mark-to-market losses totalling 13.8% of the sector's aggregate NAV. The amplification effects are greater in this scenario as the prices of fixed income assets are now worse affected by falling prices. As these assets are less liquid than stocks, sales of securities by the fund sector come with higher markdowns attached.

Amplification effects are greater in the fund sector.

While financial system losses in the scenario of a subdued economic recovery appear moderate over the three-year period under review, a severe macro-financial shock results in heavy losses being incurred by the financial system in the space of just one year. However, the banking sector proves resilient even in a scenario of this kind and is unlikely to cut back excessively on lending – provided use is made of buffers. In the insurance sector, a few smaller insurers could be threatened

A small number of insurers could be threatened with closure.

⁹⁸ The calibration assumes short-term losses within one month, or 21 trading days.

with closure despite the countercyclical stabilisers provided by Solvency II. The fund sector suffers increased initial and second-round losses. This also brings about elevated direct amplification effects not only for other financial intermediaries but also for the private non-financial sector.

Mounting vulnerabilities necessitate sufficient resilience

At present, German financial intermediaries appear resilient to the risks presented in the scenarios. Provided available buffers are used, the German financial system is currently in a position to fulfil its functions even during periods of stress. However, if capital buffers in the banking system are not used, lending could be severely curtailed and an economic downturn could be aggravated.⁹⁹ In view of this, the solvency of the banking system is not a sufficient condition for it to perform its functions at all times.

Indicators suggest that vulnerabilities within the financial system will continue to mount. This will likely cause the scenarios examined to have a far greater impact on financial intermediaries. Additionally, further amplification effects could lead to far greater losses in the financial system. Specifi-

cally, funds could be joined by banks and insurers in responding to losses and selling risky securities as well as increasingly seeking out risk-free and liquid assets in order to improve their liquidity and stabilise their capital and solvency ratios. This could amplify price drops,¹⁰⁰ especially if banks, insurers and funds sell the same securities.

On top of this, financial intermediaries could fail, potentially giving rise to contagion effects within the financial system. Consequently, there would be a risk of downward spirals. The financial system's intermediation capacity could be restricted, causing a downturn in the real economy to be amplified. The contagion and amplification effects could be underestimated in the scenarios examined, especially during periods of acute stress. It is therefore important for the financial system to be sufficiently resilient so that it can withstand negative developments even if they are unforeseeable or difficult to predict.

Mounting vulnerabilities are likely to intensify the impact of the scenarios on the financial system.

⁹⁹ See Deutsche Bundesbank (2020a).

¹⁰⁰ See, inter alia, Adrian, Etula and Muir (2014); Brunnermeier and Pedersen (2009); Brunnermeier and Sannikov (2014); He, Kelly and Mansela (2017); He and Krishnamurthy (2013).

Overall assessment and implications for macroprudential policy

Overall assessment of financial stability environment

The short-term risks to financial stability have significantly declined over the course of 2021. At the same time, existing medium-term vulnerabilities in the financial system prior to the pandemic have continued to mount. The overall risk picture appears to indicate that an increase in the countercyclical capital buffer should be effected in a timely manner.

Decline in short-term risks in the wake of the pandemic

Short-term risks to financial stability have decreased over the course of 2021. The economic recovery has had a large role to play in this development. However, this recovery has come to something of a standstill of late on account of bottlenecks in the supply of intermediate goods. Still, the threat of a sudden economic slump has declined markedly and the probability of a strong rise in corporate sector insolvencies has decreased. In this respect, the risk of high losses in the financial system and associated systemic risks has also lessened.

Should an unexpected rise in losses occur nevertheless – following an economic slump, for example –

Severe disruptions to the functioning of the financial system do not seem very likely at present.

severe disruptions to the functioning of the financial system do not seem very likely at present. Credit risk and interest rate risk in the financial sector have increased, but are probably manageable at present. Scenario analyses indicate

that the German financial system is currently sufficiently resilient to be functionally viable even in the event of negative developments. However, a key prerequisite for this is that the available capital buffers are used to stabilise lending in the event of any losses (see the section entitled “Impact of risk scenarios on Germany’s financial system” on pp. 53 ff.).

Medium-term vulnerabilities continue to build up

In contrast to short-term risks to financial stability, medium-term vulnerabilities have built up considerably. These do not pose an immediate threat to financial stability, but clearly indicate increased risks to financial stability for the coming years. Cyclical vulnerabilities, i.e. vulnerabilities that build up over time during the financial cycle, are of particular significance here.

The financial cycle is of major importance to financial stability. It marks co-movements in financial variables over the medium term – aggregate lending and asset prices, for instance.¹⁰¹ The financial cycle is distinct from the business cycle and thus from shorter real economic fluctuations. The build-up phase of the financial cycle is often associated with decreasing risk awareness, increasing lending growth and a rise in debt. Vulnerabilities may therefore accumulate for households, enterprises and financial intermediaries. High vulnerabilities may amplify the effect of shocks, i.e. unexpected negative developments, and trigger disruptions to the functioning of the financial system. As cyclical vulnerabilities increase, the probability of

¹⁰¹ See, inter alia, Deutsche Bundesbank (2019b).

a financial crisis rises.¹⁰² Periods in which high vulnerabilities have accumulated are often followed by particularly severe recessions and financial crises.¹⁰³

The build-up of cyclical vulnerabilities in the German financial system has persisted over the past two years, and the trend widening of the credit-to-GDP gap has increased. This indicates that the financial cycle remains in an expansionary phase. This is also

The credit-to-GDP gap has been trending wider.

reflected in the continued increase in the Bundesbank's early warning indicator (see the section entitled

"Macro-financial environment" on pp. 17 ff.). Prices in the residential real estate market have also continued to rise steeply, and overvaluations have tended to increase. Lending to households climbed sharply, particularly loans for residential real estate financing. Since 2018, household debt relative to household income has been increasing continuously, albeit from a low starting value. Lending to enterprises also remained high, with enterprises that have been particularly affected by the pandemic taking on high levels of debt.

Above and beyond that, the risk of contagion effects emanating from the euro area, chiefly originating from higher levels of government debt, mounted during the pandemic. The latter rose substantially on account of extensive fiscal measures and lower tax revenue during the pandemic. The situation escalated primarily in those countries which had already had high debt ratios and deficits prior to the pandemic. Thus there are still serious concerns regarding the sustainability of public debt in the euro area. Compounding this is the fact that the sovereign-bank nexus became even more entrenched during the coronavirus pandemic (see the section entitled "Situation in the euro area" on pp. 35 ff.).

The build-up of cyclical vulnerabilities in the German financial system is likely to continue into the future

and may pick up speed. The Bundesbank's lending forecasts indicate persisting high growth rates, particularly for residential real estate loans. In addition, the upswing in the residential real estate market will probably carry on, with further strong price rises.

The build-up of cyclical vulnerabilities is likely to continue.

Overall, the current macro-financial environment provides all the prerequisites for this.

Potential underestimation of risks

A synchronous upturn in the business and financial cycles, such as is currently observable in Germany, harbours the threat of increased investor risk appetite and diminished awareness of future macroeconomic risks. Low interest rates and the positive growth outlook are encouraging the search for yield and thus an increased risk appetite. Low volatility in the financial markets, high valuations in some market segments and favourable financing conditions are incentivising increased risk taking. In an economic environment such as this, coupled simultaneously with high confidence levels and low risk awareness, market participants might tend to underestimate risks.¹⁰⁴ Even prior to the pandemic, there were concerns that the extraordinarily long economic upswing, the protracted period of low interest rates and the favourable financing conditions would result in an overly positive future outlook.¹⁰⁵

¹⁰² See, inter alia, Alessi, Antunes, Babecký, Baltussen, Behn, Bonfim, Bush, Detken, Frost, Guimaraes, Havranek, Joy, Kauko, Mateju, Monteiro, Neudorfer, Peltonen, Rusnak, Rodrigues, Schudel, Sigmund, Stremmel, Smidkova, van Tilburg, Vasicek and Zigrainova (2015); Sufi and Taylor (2021) and the literature they reference.

¹⁰³ See, inter alia, Kaminsky and Reinhart (1999); Schularick and Taylor (2012); Gourinchas and Obstfeld (2012); Claessens, Kose and Terrones (2009); Mian, Sufi and Verner (2017).

¹⁰⁴ See, inter alia, Deutsche Bundesbank (2018a).

¹⁰⁵ See Deutsche Bundesbank (2018a); Deutsche Bundesbank (2019a).

It has become more difficult for market participants to assess macroeconomic risks. The experiences of the coronavirus pandemic have solidified a development that has characterised the last 20 years: macroeconomic developments and microeconomic risks appear to have become decoupled (see the section entitled “Macro-financial environment” on pp. 17 ff.). Exceptional government support measures (for enterprises and households during the coronavirus pandemic and also for banks during the global financial crisis) are one reason for this. There is a risk that market participants will come to view support measures of this kind as the norm. However, the shock triggered by the coronavirus pandemic was not only exceptionally strong, but the measures taken to contain it also affected the otherwise broadly healthy German corporate sector. In this highly unusual situation, it made sense from an economic policy perspective to help enterprises and households alike through the crisis with extensive government support measures.

Macroeconomic developments and microeconomic risks appear to have become decoupled.

During the pandemic, containment measures also contributed to revenue losses, which additionally justified the exhaustive fiscal support measures. However, future downturns could have a greater impact again at the microeconomic level and lead to losses, insolvencies and corporate restructuring.

Risks could be systematically understated.

The implications for the financial sector would be that much greater. From a macroeconomic perspective, it would be concerning if market participants were to assume on the basis of their unique experiences from the last two recessions that the decoupling of macroeconomic developments and microeconomic risks will be permanent. The actual risks could then be systematically understated.

Whether risks are actually being underestimated and the extent to which this is the case can often only be assessed in hindsight. However, it can be seen that risks in some market segments are being assessed as remarkably low. Investors do not seem to be linking increased debt in some segments of the corporate sector to any immediate risk of default. Even enterprises with poorer credit ratings are able to obtain relatively cheap funding via the capital market. In addition, financing conditions for enterprises in virtually all sectors are more favourable than the long-term average and also more favourable than they were before the outbreak of the pandemic. This also applies to sectors that were particularly hard hit by the pandemic or that are facing accelerated structural change.

In the favourable macro-financial environment of the past few years, banks have continuously downgraded their credit risk (see the section entitled “Vulnerabilities at banks, insurers and investment funds” on pp. 39 ff.). Levels of risk provisioning fell to a new historical low prior to the pandemic and rose less strongly during the pandemic than originally anticipated. For banks that calculate their capital requirements using internal models, the probability of default of the relatively risky enterprises in their credit portfolios has fallen sharply. While this reflects the declining insolvency figures, key balance sheet metrics of these enterprises have barely seen any improvement. The impact of the long economic upswing and extensive government assistance during previous recessions can be seen here. From a microeconomic perspective, therefore, credit assessments initially only reflect the decline in insolvencies. From a macroprudential perspective, however, a credit assessment based implicitly on the assumption of future support measures seems problematic. When looking at the overall risk situation or capital adequacy, therefore, it is necessary to incorporate additional factors that cannot be captured from the perspective of the individual banks. This is the task of macroprudential policy.

Implications for macroprudential policy

Vulnerabilities in the banking system should be addressed early on in order to safeguard its stability in the medium and long term. To this end, the macroprudential authorities have at their disposal the option of imposing macroprudential capital buffers, first and foremost. Following the global financial crisis, these were introduced as part of the initial

Vulnerabilities in the banking sector should be addressed.

Basel III banking regulation reform package and its implementation in the EU with the Capital Requirements

Directive (CRD) and the Capital Requirements Regulation (CRR). The macroprudential capital buffers comprise the capital conservation buffer, the countercyclical capital buffer, the capital buffer for global systemically important institutions (G-SIIs) and for other systemically important institutions (O-SIIs), as well as – in Europe – the systemic risk buffer (see Chart 2.3.1). Banks can use these buffers as a temporary measure to stabilise their lending in times of stress. For as long as they fall short of buffer requirements, banks may only distribute profits to a limited degree and have to draw up a capital conservation plan.

Cyclical systemic risks such as those that are building up in the German financial system at present are predominantly addressed by means of the countercyclical capital buffer, which focuses on risks emanating from excessive domestic lending. It can be lowered by supervisory authorities in times of stress in order to stabilise lending. In Germany, the Federal Financial Supervisory Authority (BaFin) halted the build-up of the countercyclical capital buffer at the beginning of the pandemic. It reduced the requirement for this buffer to 0% to support the banking sector in its efforts to stabilise lending.

Until the revised CRD V came into force in 2020, the systemic risk buffer could only be used to increase resilience to long-term structural risk. Since then, it has also been possible to deploy the buffer in order to counteract cyclical risk. However, a prerequisite is that these risks have not already been adequately addressed by means of the countercyclical capital buffer. In contrast to the latter, the systemic risk buffer can also be applied to individual sectoral risk exposures, such as real estate-secured loans, or to individual banks or categories of bank. It can be activated without a 12-month preliminary phase, unlike the countercyclical capital buffer. To prevent a build-up of risk in the real estate sector specifically, a lower bound could also be set for risk weights. Other EU countries are already utilising this option.

Indicators suggest a gradual increase in the countercyclical capital buffer

To ensure that the countercyclical capital buffer can support lending in periods of stress, it must be built up early on. Several indicators which signal the build-up of cyclical systemic risks at an early stage are used to set the level of the buffer. The credit-to-GDP gap is an important indicator used by supervisors to set the level of the countercyclical capital buffer.¹⁰⁶ It shows how much faster domestic loans are increasing than a country's economic output. A high credit-to-GDP gap points to excessive lending, which could give rise to threats to financial stability.

The credit-to-GDP gap has continued to grow dynamically during the pandemic. It currently stands significantly above pre-pandemic levels and, once the fluctuations triggered by GDP subsidence, is likely to amount to more than 3 percentage points (see

¹⁰⁶ For more information on calculating the credit-to-GDP gap, see Basel Committee on Banking Supervision (2010); Deutsche Bundesbank (2019a); European Systemic Risk Board (2014); Tente, Stein, Silbermann and Deckers (2015).

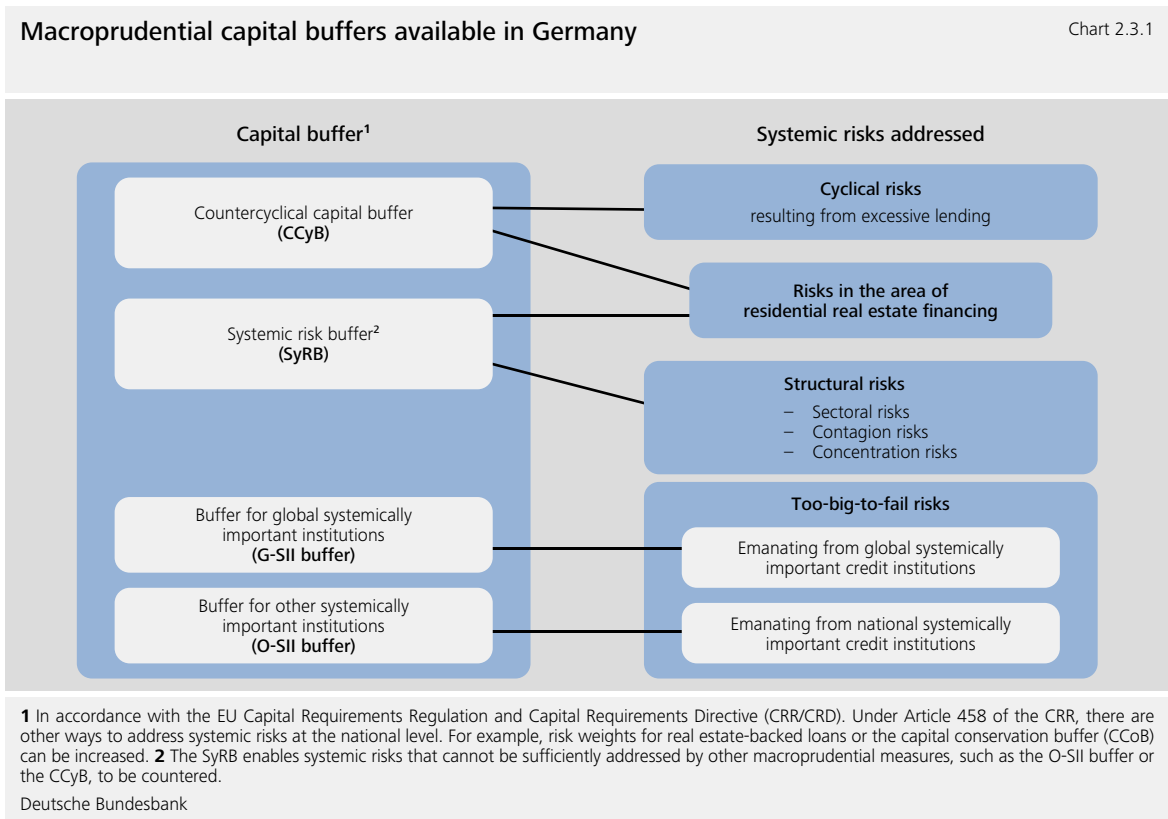


Chart 2.1.7 on p. 23). Activation of the countercyclical capital buffer is warranted from a value of 2 percentage points and up (see Chart 2.3.2). Should the macro-financial environment, contrary to expectations, deteriorate sharply, the buffer can be released again at any time. Macroprudential supervisors in other European countries have already responded to the increased cyclical systemic risks in the financial system by activating the countercyclical capital buffer or announcing its activation (see Chart 2.3.3).

Closely monitor developments in the residential real estate market

Price increases in the residential real estate market, in conjunction with elevated lending growth, are contributing to the build-up of cyclical vulnerabilities in the German financial system. Experience in other countries has shown that risks to financial stability are

especially likely to build up in the residential real estate market if excessive price and lending growth is accompanied by an erosion of lending standards.¹⁰⁷ For Germany, the available data currently provide no indication of an excessive loosening of lending standards for new residential real estate loans (see the section entitled “Greater cyclical vulnerabilities in the household sector” on p. 35). Moreover, household leverage is still relatively moderate despite strong lending growth. To counter a threat to financial stability, BaFin can impose restrictions on credit institutions concerning the granting of residential real estate loans.¹⁰⁸ Looking

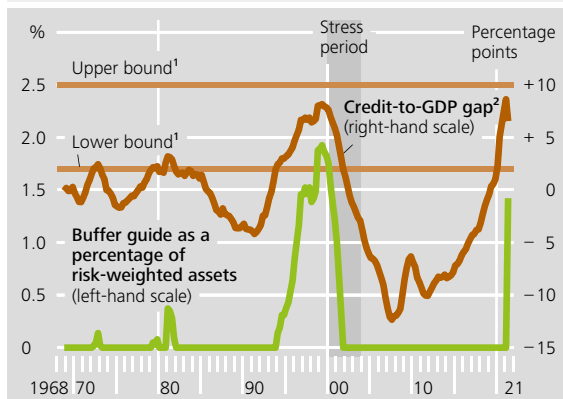
Lending standards were not loosened excessively.

¹⁰⁷ See, inter alia, Dell’Ariccia, Igan and Laeven (2012); Demyanyk and van Hemert (2011); Jordà, Schularick and Taylor (2015).
¹⁰⁸ See Section 48u of the German Banking Act (*Kreditwesengesetz*).

Guide for the countercyclical capital buffer in Germany*

Chart 2.3.2

Quarterly data



* Calculated according to national method. **1** If the credit-to-GDP gap (G) is less than or equal to (greater than) 2 percentage points (10 percentage points), the buffer guide (BG) is 0% (2.5%); if the gap is between these lower and upper bounds, the buffer guide in quarter t is calculated according to the following formula: $BG(t) = 0.3125 \times G(t) - 0.625$. If the year-on-year growth of price-adjusted GDP is negative, the previous period's BG applies. If the credit-to-GDP gap exceeds 10 percentage points, a CCyB rate that is higher than 2.5% can also be set. **2** Cyclical deviation of the credit-to-GDP ratio from its long-term trend. Based on loans granted by domestic monetary financial institutions (excluding central bank) to the domestic private non-financial sector.

Deutsche Bundesbank

at all of the indicators, the prerequisites for activating such borrower-based macroprudential instruments currently are not yet being met. However, the upswing in residential real estate prices is likely to continue. In addition, loans have been growing faster than household income for several years already, which has led to a continuous increase in the debt ratio since 2018. From a macroprudential perspective, then, there must be close monitoring of how debt and debt sustainability in the household sector develop and whether lending standards are loosened. Lenders should take due account of the risks associated with residential real estate financing when granting loans and heed sustainable lending standards. The price and credit dynamics in the residential real estate market could otherwise lead to an easing of lending standards and result in risks to financial stability. In addition to strengthening resilience by building up capital buffers, the use of bor-

rower-based macroprudential instruments could then be called for.

New data will mean an improvement from 2023 onwards in the basis for making decisions on the deployment of borrower-based macroprudential instruments (see the box entitled "New collection of data on lending standards for residential real estate financing granted to households" on p. 34). Income-based instruments have not yet been created in Germany, despite being recommended by the German Financial Stability Committee in 2015.¹⁰⁹

These instruments are a potential upper bound for the debt service ratio and the debt-to-income ratio.

Income-based instruments have not yet been created in Germany.

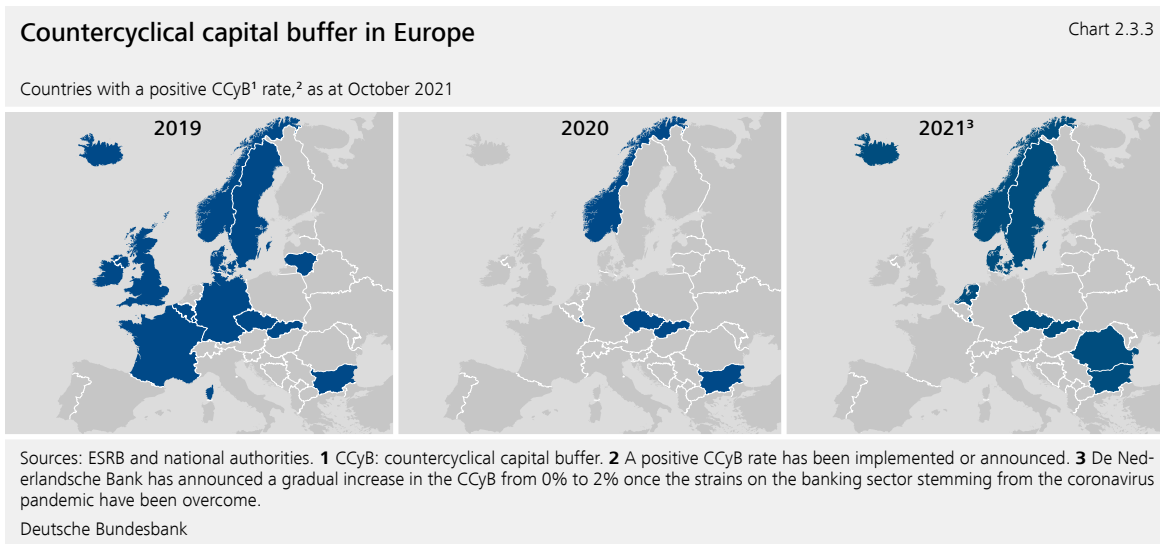
They create a link to household income. As income is a significant factor in households' debt sustainability, making such instruments available could considerably enhance the effectiveness and efficiency of macroprudential measures. From the Bundesbank's perspective, creating income-based instruments in Germany is still warranted. The European Systemic Risk Board (ESRB), too, emphasised this as a key recommended action for Germany in a warning issued in 2019.¹¹⁰

Using experience to refine and advance macroprudential policy

The outbreak of the coronavirus pandemic interrupted a policy cycle that had begun following the global financial crisis. The pandemic gives cause to look back at the experience gained in recent years and to use these insights to refine and advance macroprudential policy. One key aspect here should be the effectiveness of macroprudential capital buffers.

¹⁰⁹ See German Financial Stability Committee (2015).

¹¹⁰ See European Systemic Risk Board (2019b).



The countercyclical capital buffer should be built up in times of increasing cyclical vulnerabilities, such as when lending rises unusually strongly over a longer period. If the vulnerabilities decrease, it can be lowered and even directly released, i.e. reduced to 0%, in times of crisis. It is, however, crucial that buffers are built up early on. The international Financial Stability Board (FSB) notes that, although many countries were swift to release the countercyclical capital buffer in response to the pandemic, it was not

Consider strengthening the discretionary component in the decision-making process on activating the countercyclical capital buffer.

always available or built up to a sufficient level.¹¹¹ This could be the reason why macroprudential authorities in some European countries instead lowered structural buffers, such as the buffer for O-SIIs or the systemic risk buffer. However, this is not consistent with the intended purpose of these buffers.¹¹² It should therefore be examined whether the European legal framework is impeding a timely build-up of the countercyclical capital buffer. The decision-making process on activating the buffer currently attaches major importance to the credit-to-GDP gap. However, it has become evident that cyclical systemic risks can

already build up before the credit-to-GDP gap indicates a need for action. It should therefore be reviewed whether the discretionary – i.e. non-rules-based – component in the decision-making process needs to be strengthened and the legal framework adapted.

The extent to which capital buffers can actually be used in periods of crisis should also be examined. The current rules permit banks to recognise capital multiple times, for instance to meet buffer requirements and minimum capital requirements, such as the unweighted capital ratio. As this leverage ratio must be strictly adhered to, in crises a situation can arise in which banks cannot or can only partially use their buffers. A lowering of buffer requirements by supervisors would thus be completely or partially ineffective.

In particular, when reviewing the macroprudential framework, potential risks emanating from the residential real estate sector should become more of a focus. For instance, borrower-based instruments for the private financing of residential real estate

¹¹¹ See Financial Stability Board (2021c).

¹¹² See European Systemic Risk Board (2021d).

Planned refinement of the European resolution regime

The review of the EU framework for the recovery and resolution of institutions (resolution regime) and for crisis management and deposit insurance (CMDI) is currently planned. The resolution regime represents significant progress compared with the situation prior to the global financial crisis of 2007-08. At that time, creditors of large banks often assumed that the banks would be rescued using taxpayers' money should they become distressed. Creditors expected such bail-outs, which would safeguard them from major losses, as failures of large banks could endanger the financial system and the real economy. On account of this "too-big-to-fail" (TBTF) problem, creditors' expectations of rescue were fulfilled in most cases during the global financial crisis. Large banks also benefited from more favourable refinancing conditions on account of implicit government guarantees. These were often not consistent with the banks' risk profiles and were relatively favourable compared with those of smaller banks.

In order to solve the TBTF problem, standards for establishing resolution regimes were developed under the aegis of the international Financial Stability Board (FSB). First, these are intended to ensure that large institutions, too, are able to exit the market in the event of distress without placing financial stability in jeopardy. Second, they are intended to rule out, as far as possible, the use of taxpayers' money to support banks.

The FSB examined the functional viability of the newly established resolution regimes in its evaluation of the TBTF reforms.¹ This revealed that in the EU, too, government funds have been used in several instances since 2016 to support banks

in distress. The FSB noted that this could call the credibility of the resolution regime into question and thus impair its functioning.

The lessons learned from the FSB's evaluation are therefore also relevant for the review of the EU's CMDI framework. The European Commission held a public consultation in the spring of 2021 and has announced a corresponding legislative proposal for the beginning of 2022. The objective of the review is to remedy weaknesses in the framework and thereby reduce the TBTF problem.

One core problem of the resolution regime is that it contains structural disincentives to avoid resolution procedures in favour of national insolvency proceedings. In the event of bank distress, a public interest assessment (PIA) compares the outcome of a resolution procedure with that of a national insolvency procedure. Based on this assessment, a decision is made regarding which procedure could better achieve the resolution objectives. Scope for discretion exists in the PIA, which, in recent years, has led to resolutions being avoided and institutions being liquidated in national proceedings. The existing scope for discretion therefore proves problematic when it comes to the use of taxpayers' money as part of national insolvency proceedings on account of current State aid rules. This means that the minimum burden sharing requirements for creditors are lower than in a resolution procedure.² This scenario can lead to creditors incurring fewer losses in insolvency proceedings than would be

¹ See Financial Stability Board (2021a).

² The State aid rules are based on the European Commission's Banking Communication from 2013.

the case in a resolution procedure. Creditors thus also have less of an incentive to differentiate between sound banks and banks with a higher insolvency risk. Therefore, the market could ultimately forfeit its disciplinary role in part. To address this problem, the following three amendments should be implemented, in particular.

First, the PIA should be structured in a consistent and predictable manner. As public interest is assessed using undefined legal terms, there is no legal certainty with regard to the outcome of the assessment. Therefore, a PIA can lead to differing outcomes depending on the responsible authority and the respective national insolvency law. For this reason, the relevant undefined legal terms should be fleshed out in the legal texts and the existing scope for discretion in the PIA should thus be reduced.

Second, banking insolvency law should be largely harmonised. The assessment of whether resolution or insolvency is better suited to an institution in terms of upholding the resolution objectives can vary for each Member State owing to differences in their national insolvency regulations. Harmonised banking insolvency law could create greater legal certainty and better predictability for investors.

Third, the burden sharing requirements as part of a bail-in before taxpayers' money can be used must be better aligned between the resolution regime and State aid rules. In this context, the European Commission's State aid rules for the event that taxpayers' money is used as part of an insolvency should be based on the provisions of the resolution regime with regard to the minimum bail-in amount when the Single Resolution Fund (SRF) is used. The existing requirements for accessing the SRF should remain in place.

According to these, in the event of a bail-in, shareholders and creditors should be required to absorb losses of at least 8% of total liabilities including own funds of an institution.

The resolution regime must also be effective in the event of system-wide banking crises. Thus, cooperation between resolution authorities and macroprudential authorities should be stepped up. This relates, in particular, to cooperation in the development of crisis scenarios for resolution planning. In addition, uniform criteria should be used to regularly check whether the SRF's financial resources available for performing resolutions would also be sufficient in periods of stress, such as the simultaneous resolution of several institutions.

To ensure that resolution can be carried out, contagion effects in the financial system must be contained. Banks hold liabilities of other banks which can be bailed in during resolution to absorb losses (minimum requirement for own funds and eligible liabilities, or MREL). On account of these MREL liabilities, there is a danger of contagion risks within the banking system. In Germany, investments in MREL liabilities are highly concentrated – particularly in the savings banks and the cooperative sector. Savings banks and cooperative banks hold, in addition to their share of equity as owners of their central institutions, a major portion of the MREL liabilities issued by their central institutions. This is partly because interlinkages within their sectors can be counted with a risk weight of 0% when calculating capital requirements. To reduce possible contagion risks in the event of a bail-in, alongside own funds, subordinated intra-sectoral liabilities as well as, where applicable, further MREL liabilities should be exempt from this preferential regulatory treatment.

Moreover, the interaction between different regulatory requirements should be observed. Particularly in times of crisis, institutions should have the option of using their buffers, i.e. breaching their supervisory buffer requirements. This would enable the institutions to maintain lending to the real economy, even if they have suffered heavy losses. Under current legislation, it is permitted to count capital towards buffer requirements and non-risk-based MREL requirements at the same time. The MREL requirement is a minimum requirement that always has to be met. This could lead to a situation where capital buffers cannot be used in full to absorb losses in times of crisis without minimum requirements being breached at the same time. In such an instance, the bank in question would, by necessity, have to make adjustments, which, inter alia, would entail a reduction in assets in order to satisfy the min-

imum requirements once again. Ultimately, this could mean the intended function of the buffers – to stabilise lending – is impaired. From a macroprudential perspective, the simultaneous counting of capital towards both capital buffers and the non-risk-based MREL requirement should therefore be reconsidered.

have not yet been included in European legal bases. However, such instruments are legally enshrined in many EU Member States and have already been activated in some countries. To ensure the availability of the instruments in all countries, a European policy specifying which instruments should be available at a minimum at the national level would be desirable. A complete toolkit would ensure that the relevant national authorities are able to adequately counter risks to financial stability stemming from the financing of residential real estate in their respective country, and at the same time reduce the potential contagion effects of a crisis on other countries. Owing to the national specificities of real estate financing business, responsibility for their use should remain at the national level. Moreover, this approach could acknowledge existing national legal bases. In this way, distributional effects associated with the activation of these instruments could also be better taken into account.

This year, the European Commission launched a review of the macroprudential framework for the banking sector, holding a public consultation to this effect. It intends to submit a legislative proposal based on this by the end of 2022. This framework also forms the basis for macroprudential policy for the banking sector in Germany under European law. The upcoming review thus provides an opportunity to address the above-mentioned points. In addition, the crisis management framework in the EU should be refined and advanced (see the box entitled “Planned refinement of the European resolution regime” on pp. 72 ff.)

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Climate policy and financial stability

The economy as a whole and the financial system are both affected by climate change and the transition to a climate-friendly economy. As a result, some assets are likely to lose value. The later necessary climate action is taken and the higher the uncertainty surrounding the future pathway of climate policy, the greater the transition risks associated with the changeover to a climate-friendly economy will be.

A new analytical framework was used to investigate how transition risks stemming from climate policy could affect portfolios in the German financial system. It was based on climate scenarios devised by the Network for Greening the Financial System (NGFS) to gauge the macroeconomic repercussions of several global climate policy pathways. These scenarios are incorporated into a sector model that takes account of differences in the carbon intensity of industrial and commercial sectors, allowing the effects on financial institutions' portfolios to be estimated. All in all, these effects appear to be moderate. This is partly because the losses in macroeconomic value added in the scenarios are relatively small. However, financial assets that react strongly to climate policy measures may make up a large share of some financial intermediaries' portfolios. One relevant factor for the banking sector, which is a major component of the German financial system, is that a high proportion of its loans have relatively short remaining terms to maturity, and are consequently less strongly affected by the observed longer-term risks.

When interpreting these results, it is important to bear in mind that the analytical framework does not capture physical risks that stem from climate change itself and may entail high real economic costs. These will rise, in particular, if climate action is delayed. In addition, the framework does not take account of all transition risks. Another factor to consider is that the relationships between the real economy and the financial system, as well as dynamic adjustments due to innovation and non-linearities, can only be represented schematically in the models. The results are also subject to a high degree of uncertainty.

Effects of climate change on the financial system

Climate change is a key issue faced by societies across the globe. The frequency and extent of extreme weather events are increasing perceptibly. The economic risks directly linked to climate change and the associated rise in temperatures are already relevant today. These risks can unfold over long periods of time, such as the long-term rise in the sea level, or materialise abruptly when floods destroy homes and factories or droughts wipe out entire harvests. Climate-related risks are likely to rise sharply in the future. In addition, in the next decade or two it will probably become increasingly difficult to mitigate climate change, as changes in the climate are very slow and global warming is already partly in process.¹ Within their mandates and statutory tasks – safeguarding price stability and monitoring financial stability – central banks have an important role to play in ensuring the success of climate policy.²

Climate risks relevant for the financial system

From an economic standpoint, climate change is caused by global externalities. Greenhouse gases emitted locally lead to harms at a global level for which the emitters or consumers of the relevant goods and services do not, or do not adequately, pay the costs. This market failure justifies government action to make the costs of these harms visible in the markets. To achieve this, either the costs of the harms can be transferred to those who cause them, or these same parties can pay to prevent the harmful activities from occurring. The aim in both cases is to limit greenhouse gas emissions to an emissions budget which, given the technological and political possibilities, society considers desirable. This can be achieved using economically efficient government instruments such as emissions-based taxes and emissions trading systems. As climate change has global

effects, climate policy should be internationally coordinated and binding.

The consequences of climate change will be felt by the financial system. The Intergovernmental Panel on Climate Change (IPCC) states that average temperatures are rising globally and extreme weather events will hence become both more frequent and more intense.³ The average temperature may even rise suddenly and more rapidly than in the past, thus having a greater negative impact on the economy than hitherto.⁴ In particular, extreme weather events can act as shocks to the real economy. They can feed through to the financial system directly or indirectly and endanger financial stability via unexpected losses in asset values. Should there be no major slowing of climate change, it might ultimately only be possible to mitigate harms resulting from extreme weather events through adaptation to the consequences of climate change.⁵

The consequences of climate change will be felt by the financial system.

Relevance of physical and transition risks

A functioning financial system can support the pathway marked out for the macroeconomic structural

¹ See Intergovernmental Panel on Climate Change (2021); International Monetary Fund (2020); Intergovernmental Panel on Climate Change (2018); Dietz, Bowen, Dixon and Gradwell (2016).

² See Buch and Weigert (2021).

³ Climate change is increasing the frequency of extreme weather events (e.g. rainfall and droughts). Statistically speaking, this raises the probability that, in future, more extreme realisations of a random variable (e.g. the average daily temperature) will be observable than expected to date. Climate change can be mitigated by appropriate climate policies, climate-friendly innovation and changes in production and consumption behaviour.

⁴ This is due to non-linear processes in connection with global warming. Events that are difficult to predict can cause abrupt changes. These are known as “tipping points”. In addition, events can be mutually influential and reinforcing. See Intergovernmental Panel on Climate Change (2021).

⁵ See Federal Government (2020) for information on adaptation measures in Germany.

shift to a climate-neutral economy. Consequently, the first step that needs to be taken is to identify the possible vulnerabilities in the financial system that could materialise as a result of climate-related risks. Climate-related risks in the financial system can be broken down into physical and transition risks.⁶ While physical risks are caused or increased by climate change, transition risks are primarily associated with climate action and the transition to a low-emissions economy. Both types of risk affect not only the real economy but also the financial system. Physical risks such as extreme weather events can reduce the value of financial assets. However, financial assets can also lose value as a result of transition risks, e.g. due to an unexpected change of tack in climate policy. This analysis only indirectly considers the potential vulnerabilities from the physical consequences of climate change because, in the near future, physical risks are likely to be smaller than transition risks in Germany.⁷ By contrast, transition risks will already have a direct impact over the next few years, and the focus is therefore on them.

Climate change and climate policy have repercussions via the traditional financial risk categories, e.g. market, credit, reputational and legal risk. The

Climate change and climate policy have repercussions via the traditional financial risk categories.

effects of both climate change and climate policy vary across regions, yet they often follow a common global trend. If risk

management does not take sufficient account of climate-related risks and climate policy, there is a danger of them being systematically underestimated. This can give rise to risk concentrations that ultimately contribute to the build-up of systemic risk in the financial system and thus pose a threat to financial stability. In the end, assets can suffer abrupt value losses because of new information about future climate protection measures.

Focus on transition risks

Analysing the effects of transition risks on financial stability requires a long observation horizon which must also be specific to the sector and financial instrument. The legally enshrined pathway towards climate neutrality in Germany spans a period of several decades.⁸ It is therefore necessary to select a longer observation horizon than for the usual financial stability analyses.⁹ However, the observed financial assets normally have comparatively short maturities. For example, the average remaining term to maturity of assets in Germany is five to ten years (see Table 3.1 on p. 94). Nonetheless, climate change and climate policy have an impact on emissions-intensive firms, e.g. via rising costs. The expected long-term effects of climate and structural change on future profits are already influencing today's valuations of firms and assets. These influence the real economy first, before feeding through to financial intermediaries' balance sheets via financial and financing instruments. This is how long-term developments in climate change and climate policy can already have a bearing on financial stability today. Adjustments take place immediately because market expectations about future developments in climate change and climate policy are priced into the valuations of non-financial corporations and the assets they issue. Loans, however, which make up the majority of banks' assets in Germany, are affected far less because probabilities of default are likely to rise only slightly and only increase substantially in response to very large losses in the real economy.

⁶ Transition risks can, for example, be risks arising from the political process, technological change and changes in preferences.

⁷ Physical risks in the form of productivity effects caused by a gradual temperature rise were also analysed as macroeconomic scenarios. In the NGFS scenarios, however, they only have a stronger impact on economic developments in Germany from 2040 onwards. Estimates put this year's exceptionally large storm damage in Germany at around 1.1% of GDP. From a macroprudential point of view, physical risks are therefore likely to have only comparatively small effects on the financial system for the time being.

⁸ See Federal Climate Protection Act (*Bundes-Klimaschutzgesetz*).

⁹ The observation period is usually three to five years.

In much the same way, bonds are also exposed to smaller losses than stocks and participating interests. In Germany, stocks make up a mere 3% of banks' assets but around one-quarter of the balance sheets of insurers and investment funds.

Climate-related risks can potentially give rise to unexpected disruptions that are very different to the shocks normally explored in financial stability analyses. This analysis attempts to take account of that fact. Possible shocks stemming from climate-related risks often act via several of the following dimensions: (i) duration, as they can take effect across several decades, (ii) breadth, as the shocks can unfold at

Future developments in climate change and policy are highly uncertain.

a global level, (iii) depth, as entire value chains can be affected, (iv) asymmetry, as certain sectors may be affected disproportionately, and (v) speed, as contagion effects can rapidly spread shocks to other financial markets. Transition risks in particular take effect along the breadth and depth dimensions because they are caused by changes in climate policy and adjustments in the real economy. Thus, global climate action can act as a common macro factor. For example, a rise in global carbon prices may constitute a shock affecting large swathes of the real economy and financial system. Uncertainty is another important factor. Given the great uncertainty about future developments in climate change and climate policy, the effects of transition risks are analysed in several different scenarios (see the box entitled "Uncertainty versus risk in the context of climate-related risks" on p. 101).

However, the actual vulnerabilities could be greater. First, transition risks might coincide with physical risks, especially if climate action proves insufficient. This is the focus of the analyses for Europe performed by the European Central Bank (ECB).¹⁰ Second, via links with the international financial system, climate action and related transition risks in other

countries could have repercussions for the German financial system. Moreover, transition risks could interact with other risks. They could also coincide with further stressors unrelated to the climate which have macroeconomic effects and are not included in the analysis.

Analytical framework for investigating vulnerabilities in the financial system

The impact of transition risks is usually analysed using climate scenarios which simulate climate action, for example in the form of a carbon price trajectory. In order to be able to gauge the financial system's potential vulnerabilities, such scenarios need to cover all of the relevant dimensions through which climate-related shocks can act. The scenarios are based on plausible and coordinated developments in climate change and climate policy that may ensue from possible changes in climate, economic and societal conditions. Owing to the complexity of the interplay involved and the significant degree of uncertainty that this entails, it is not possible to make any forecasts. Instead, a number of plausible pathways that future developments might take are constructed in climate scenarios.

The second vintage of international climate scenarios developed by the NGFS form the starting point for assessing the vulnerabilities in Germany's financial system. The NGFS climate scenarios were devised by an international consortium of climate researchers

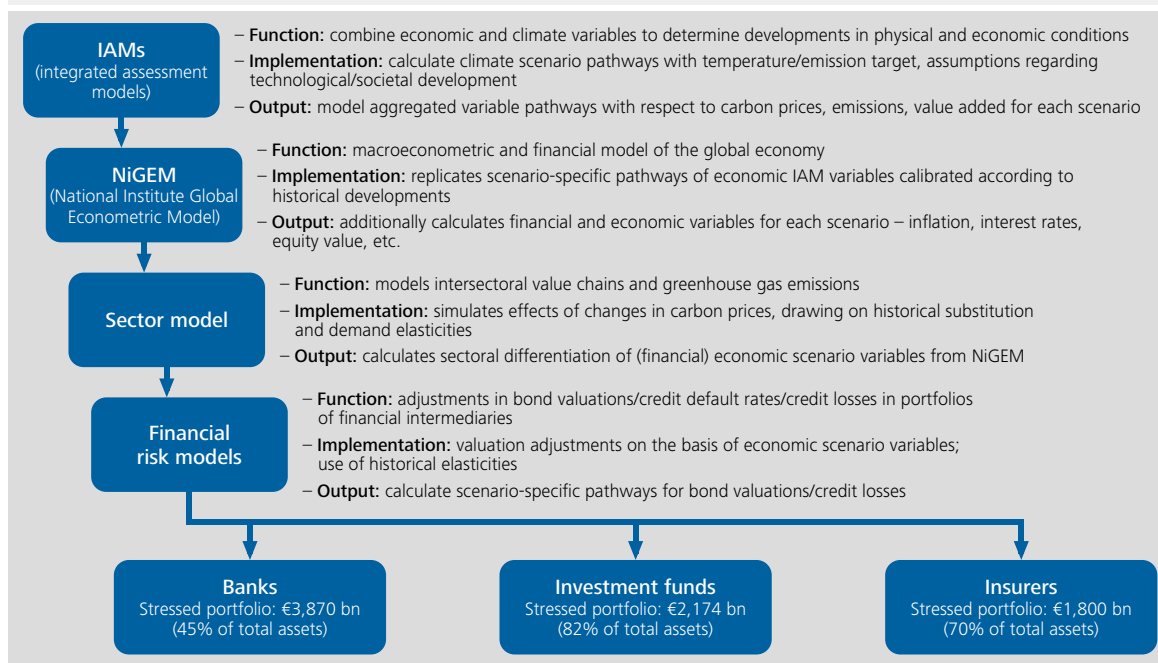
Climate scenarios are a basis for estimating economic repercussions.

and are in line with those of the IPCC. Central banks and other stakeholders in the financial sector supported the work on analysing and addressing cli-

¹⁰ See European Central Bank (2021a).

Model chain: effects of climate scenarios on the financial system

Chart 3.1



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mate-related risks (see the boxes entitled “Climate-related data for financial stability: what has been achieved so far and where are the gaps?” on pp. 103f. and “Set of scenarios for analysing climate-related risks – development and selection” on pp. 86f.). Climate scenarios are a basis for estimating the economic repercussions of abrupt, unexpected and uncertain changes in global climate policy.

A series of models is used to project the effects of climate scenarios on the real economy and financial system (see Chart 3.1). Integrated climate models, macroeconomic and financial econometric models, real economy sector models, and market and credit risk models are included in the chain to capture all the relevant transmission channels.¹¹ The integrated climate models calculate physical and economic climate scenarios where certain limits for global greenhouse gas emissions are met with the goal of optimising costs or welfare.

A number of assumptions are made, including as regards technological progress, consumer and producer behaviour and the general socioeconomic setting.¹² Model outputs include variables such as gross domestic product (GDP) levels and carbon emissions and prices. The downstream models take the outputs from the integrated assessment model (IAM) as given and then introduce differentiations. For example, the multi-country macroeconomic financial model, the National Institute Global Econometric Model (NiGEM), supplements the IAM outputs by adding changes in national value added,

¹¹ For a detailed, technical presentation of the model chain, see Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021); Frankovic (2021).

¹² Given the highly simplified manner in which the real economy and financial system have been modelled, it is assumed that a more realistic presentation would not materially influence the results.

Set of scenarios for analysing climate-related risks – development and selection

The Network for Greening the Financial System (NGFS) has played a pioneering role when it comes to combining integrated assessment models (IAMs) with macroeconomic and financial econometric models, in particular. One of the goals the NGFS set for itself was to devise a shared and comparable analytical framework for global climate risks for central banks and financial institutions to use. This framework is intended to aid in the analysis of hidden or unknown risks to the real economy and financial sector as well as potential vulnerabilities in the financial system. Using this work as a basis, the analytical results are fed into Bundesbank models and the impact of climate-related risks in financial intermediaries' portfolios is estimated.

A consortium of global leaders in climate research commissioned by the NGFS has designed multiple climate scenarios based on scientific findings.¹ The choice of scenarios is guided by the current debate amongst academics and society at large. A significant event in this context was the UN's 2015 Climate Change Conference in Paris (United Nations Framework Convention on Climate Change, 21st Conference of the Parties (COP 21)), at which a global framework for efforts to combat climate change was established. It includes implementing measures to permanently limit global warming to (well) below 2°C compared with pre-industrial levels, and efforts to limit it to below 1.5°C.

Based on the Paris climate goals, similar scenarios were already used in the special report of the Intergovernmental Panel on Climate Change (IPCC) on the impacts of global warming of

1.5°C.² Members of the consortium commissioned by the NGFS are also involved in drawing up the IPCC's Sixth Assessment Report (AR6). This is scheduled to be published in full by the end of 2022.³ Future greenhouse gas emissions hinge on a multitude of economic, technological, social and political developments which cannot be forecast, so climate researchers employ various assumptions about future developments, on the basis of which they derive multiple scenarios of possible emission pathways for carbon dioxide and other greenhouse gases. These scenarios form the basis for projections of future climate change. Shared Socioeconomic Pathways (SSPs) model alternative pathways, including for the areas of population and human development, economy and lifestyle, policy and institutions, technology, environment, and natural resources.

These SSPs cover a range of scenarios which the IPCC regards as plausible in principle, including some pathways that are rather implausible from today's perspective. However, the members of the NGFS and the group of climate modellers agreed to confine the analysis of the financial system's vulnerabilities to climate-related risks, in the first stage, to the "Middle of the Road" Shared Socioeconomic Pathway (SSP2), which

¹ They include the Potsdam Institute for Climate Impact Research (PIK), the International Institute for Applied Systems Analysis (IIASA), the University of Maryland (UMD), Climate Analytics (CA) and the Eidgenössische Technische Hochschule in Zurich (ETH Zurich).

² See Intergovernmental Panel on Climate Change (2018).

³ See Intergovernmental Panel on Climate Change (2021). The most relevant section in connection with the NGFS scenarios is the contribution of Working Group III on mitigating climate change, which will be published in the second quarter of 2022.

envisions a continuation of current developments in population, gross domestic product (GDP), urbanisation and technological progress.⁴

In the IPCC scenarios, multiple assumptions are varied simultaneously using IAMs: the socioeconomic drivers using the SSPs, policy design, technological change and preference responses. Scenarios then depict internally consistent possible future developments under the given assumptions. Uncertainty is measured by comparing pairs of reference scenarios; their probability of occurrence is uncertain and they therefore cannot be used to quantify risk. Ultimately, scenarios can only be used to make projections, but forecasts which would permit assessments of the likelihood of individual scenarios are not possible.

The IPCC's IAM-based scenarios also provided guidance for the European Commission's Green Deal. The common climate policy and, in particular, the Effort-Sharing Regulation at the European level serve to channel these objectives and the underlying climate scenarios into German legislation and climate policy. Germany's Federal Constitutional Court recently confirmed that compliance with the climate goals under the Paris Agreement, which the EU has adopted, is necessary to protect future generations.

In July 2021, the NGFS published its second vintage of scenarios.⁵ These were derived from the IPCC scenarios and cover a broad range of future carbon emission pathways. The NGFS's "Below 2°C" scenario roughly lines up with Germany's new climate policy objectives. However, because the scenarios are defined at the global level, Germany's emissions are only apportioned according to a key.⁶ They do not constitute explicit national restrictions in climate models and thus

are not geared to actual national policy objectives.⁷ Instead, the carbon price in the scenarios is actually derived only indirectly from the negotiated EU emission budgets and market participants' behaviour. In principle, the scenarios are consistent with the German and European climate objectives as well as the goals of the Paris Agreement.

⁴ See Intergovernmental Panel on Climate Change (2018).

⁵ See <https://www.ngfs.net/ngfs-scenarios-portal/explore>

⁶ The climate models generally divide the world into between 11 and 32 regions.

⁷ The national breakdown is basically guided by a variety of variables such as energy consumption, GDP, population, and historical real reductions. Fitting the NGFS model results exactly to Germany or even to individual sectors therefore cannot easily be done and will in all probability deviate from German sector-specific policy objectives (carbon reduction). General objectives such as reducing national carbon emissions by 2045-50 are depicted in individual scenarios, but narrow objectives such as the exact timing of the phase-out of coal power or the transition to e-mobility in Germany are not explicitly derived (in the climate models or the macroeconomic simulation model).

equity values and government bond prices.¹³ These changes are then fed into a sector model and broken down by carbon intensity across industrial and commercial sectors. This allows us to calculate the repricing of financial instruments in these sectors and the downstream value adjustments in financial intermediaries' portfolios. These adjustments in value depend on the general economic environment and greenhouse gas-specific drags on the real economy. This model chain is a way of applying the climate scenarios to the financial system and investigating their impact on financial intermediaries' assets. The subsequent analyses adopt both the consistently selected assumptions of the IAM model (MESSAGE), which observes developments into the year 2100, as well as the additional downstream assumptions made in NiGEM.¹⁴ Based on this approach, the real economic repercussions of transition risks result from consistent climate scenarios and are simply enriched with other relevant variables and disaggregated in greater detail by the models applied downstream. In our analysis of the effects on the financial system, the observation period is kept to ten years, however. This is mainly because agents' balance sheet and portfolio adjustments are not taken into account and the average maturities of loans and securities in financial intermediaries' portfolios are roughly five to ten years.¹⁵

Some aspects that could impact significantly on the outputs are omitted from the model chain. One is that innovations that create the technology of the future occur in a fast-moving environment given the necessary funding they need to get them market-ready. This is a process that would have a positive effect in the transition to a climate-friendly economy. Another is that physical risks are not observed. These will grow in significance over time, both in direct terms and indirectly through international supply chains. Third, for large parts of financial intermediaries' portfolios, the maturities of

Physical risks are not observed.

securities are far shorter than the time it will take to transition to a green economy. The direct losses caused by financial system shocks are smaller for shorter remaining terms to maturity and are broken down by remaining term to maturity in the present analysis. Intermediaries could, however, increase the weighting of lower-risk securities in their portfolios. Dynamic adjustments of this kind are likewise omitted from this analysis.

Each module in the model chain is subject to uncertainty in terms of how the modelled dynamics are incorporated and what statistical methods were used to estimate them. Model uncertainty increases with each additional model in the chain since a model's output builds on the results and imprecisions inherent in the one preceding it. This is why the analysis can only deliver results on the potential magnitude of the impact on the financial sector and the relative extent to which the German financial system might be affected across the scenarios observed.

Exposing vulnerabilities by comparing scenarios

Climate policy can trigger abrupt adjustments in the real economy and financial system.¹⁶ Sudden shifts in the global climate policy stance are simulated in the analysis by drawing comparisons between different climate scenarios. Although multiple assump-

¹³ Responses modelled only in downstream models but not in upstream ones therefore cannot be included. For example, the IAMs disregard adaptation responses to unforeseen shocks or an altered risk situation in financial markets. The present analysis therefore assumes that responses in downstream models leave the IAM scenario unchanged. In this way, it looks at first-round effects. See Edenhofer, Lessmann and Tahri (2021); Kalkuhl, Stecke and Edenhofer (2020).

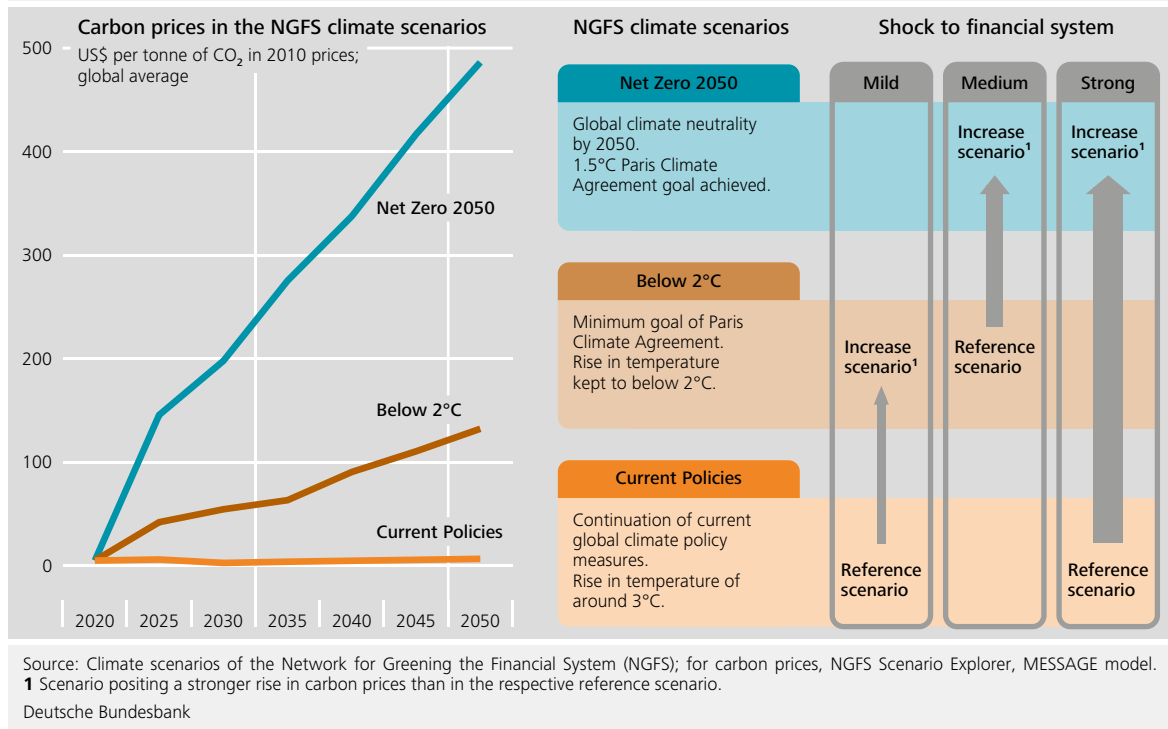
¹⁴ See <https://www.ngfs.net/ngfs-scenarios-portal/explore> for a description of the IAM MESSAGE model.

¹⁵ For a detailed description of the methodological challenges and constraints, see Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021); Frankovic (2021).

¹⁶ For a detailed presentation of further aspects of modelling climate risks in the financial system, see Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021).

NGFS climate scenarios and potential shocks to the financial system

Chart 3.2



tions need to be made to define these scenarios, just a single characteristic – the average global carbon price – is used to differentiate them hereinafter, because this is often the main focus in the public debate and can be seen as a proxy for the intensity of policymakers’ efforts to mitigate climate change.¹⁷ The analysis only examines climate scenarios which, from a current perspective, may involve significant changes in policy direction but do not go beyond the realms of plausible socioeconomic developments.¹⁸

In order to identify the financial system’s vulnerabilities in each case to unexpected changes in climate policy, the model results from two different climate scenarios are compared with one another. Pairing different scenarios provides insights into how sen-

sitive balance sheets are to unexpected changes in international climate policy. What losses that kind of climate policy shock causes in the value of assets in the financial system give an idea of the sort of corridor the possible vulnerabilities in the financial system are likely to fall within.

¹⁷ The carbon price differs across regions both in reality and in the scenarios. We nonetheless call it the global average for the sake of simplicity. Given that core instruments are in place at the European level, such as the EU Emissions Trading System (ETS), the analysis presented here does not break down carbon prices any further than the regional level.

¹⁸ The scenarios are based on scenarios which the Intergovernmental Panel on Climate Change (IPCC) considers possible. Of the scenarios described as shared socioeconomic pathways (SSPs), only SSP5 has been excluded. That scenario is of a more climate-hostile nature, but technological and economic developments that are already in motion have made it a controversial topic in the scientific community. Generally speaking, though, global socioeconomic developments of a more climate-hostile or more climate-friendly nature are also conceivable. See Intergovernmental Panel on Climate Change (2021).

The NGFS climate scenarios are each described in terms of a pathway taken by the future carbon price (see Chart 3.2). The two climate scenarios paired in each case to calculate a shock to the financial system are referred to hereinafter as the reference scenario and the increase scenario. The starting point for each analysis is the respective reference scenario, which is assumed to be based on market expectations as regards future climate, economic and policy developments as well as, in particular, the associated carbon price. The global carbon price currently stands at just under US\$2 per tonne of carbon dioxide equivalent.¹⁹

Changes in climate policy can trigger major losses in asset values.

Based on the climate action measures already enshrined in law, the carbon price is projected to increase only slightly. However, the minimum goals of the Paris Agreement include reducing global warming to well below 2°C and thus call for a higher carbon price.²⁰ The reference scenario is selected from among the NGFS climate scenarios that posit a flatter carbon price pathway (see Chart 3.2). This reference scenario is then paired with an alternative (increase) scenario for the climate that assumes a stronger rise in the carbon price in future than the corresponding reference scenario. The middle NGFS climate scenario performs a dual role in this exercise: depending on the market expectations assumed in the model, it can be either a reference scenario or an increase scenario. Different combinations of reference and increase scenarios are feasible as a way of modelling multiple possibilities in terms of unexpected policy shifts. The price pathways for the reference and increase scenarios paired in each case are assumed to reflect the expectations of market participants and the future stressors within the given scenario.²¹ A change in climate policy thus impacts directly on asset prices.²² Bonds or stocks of firms with carbon-intensive operations, in particular, could suffer major losses in value in the event of an unexpected shift in policy to a climate-neutral economy,

leaving them as stranded assets. The present analysis assumes that the policy change occurs in 2021 and that all future adjustments are known.²³

Both the reference and increase scenarios entail losses in the financial system. To estimate the vulnerabilities to the shock triggered by the change in policy stance, the losses incurred in each scenario are compared with each other. The heavier the losses from the change in policy, the greater the shock to the financial system and the more vulnerable the system will be (see Chart 3.2). The “Current Policies” scenario assumes that no climate policy intervention occurs beyond the global climate policy measures already implemented. The “Below 2°C” scenario assumes

¹⁹ See World Bank (2021).

²⁰ As they currently stand, the policies pledged by the parties to the Paris Agreement will see global temperatures rise by around 2.5°C by 2100. This NGFS scenario has been dubbed “Nationally Determined Contributions”. See <https://www.ngfs.net/ngfs-scenarios-portal/explore>. Future political objectives and policy action are subject to great uncertainty, which is amplified further by heterogeneous expectations among market participants about how these developments will unfold.

²¹ Three of the NGFS scenarios have not been included in our analysis: “Divergent Net Zero”, “Delayed Transition” and “Nationally Determined Contributions”. The “Divergent Net Zero” scenario assumes divergent carbon pricing across sectors. For Germany in particular, this scenario impacts less on general macroeconomic variables such as GDP and losses in asset values than the “Net Zero 2050” scenario. The “Delayed Transition” scenario assumes a delay in the introduction of climate policy measures, which then need to be all the more stringent to make up for their later implementation. The main effects in this scenario materialise after 2030, which is not fully compatible with the constraints of the analysis carried out here (e.g. static balance sheets of financial intermediaries). The “Nationally Determined Contributions” scenario rests on the climate policy objectives of all countries worldwide. Looking specifically at Germany, the country’s reduction objectives as communicated in 2020 in the context of the Paris Agreement and the European Green Deal mean that this particular scenario largely matches the NGFS’s “Below 2°C” scenario and – for Germany – exhibits only marginal differences from it. All three scenarios were omitted from the analysis of financial stability risks in Germany for the reasons explained. See <https://www.ngfs.net/ngfs-scenarios-portal/explore> for details on the scenarios.

²² A change in consumption behaviour might also mean that the basket of goods – which is assumed to be constant here – needs to be changed. The moderate effects on inflation, which remains below 1% per year across all the model-based scenarios, suggest only moderate changes in the basket of goods.

²³ This assumes the data at the current end and an immediate, credible shock. Such a development is not currently to be expected.

the rise in global temperatures will be limited to well below 2°C, as envisaged in the Paris Agreement objectives. The “Net Zero 2050” scenario simulates the most ambitious climate action, with global climate neutrality assumed to be achieved by 2050. This is necessary if global warming is to be limited to 1.5°C. While the total costs stemming from climate change and climate policy can be reduced by decisive climate action, the shock to the financial system based solely on the transition risks will be all the greater the more sharply policymakers change tack. In the long run, reducing physical risks will deliver greater benefits (see the section entitled “Similar results in international studies” on pp. 99 ff.).

To gain the most comprehensive picture possible of the vulnerabilities to transition risks, the analysis also investigates a particularly strong shift in climate policy. The “Current Policies” scenario serves as the reference scenario in this case, and for the purposes of this analysis it is assumed that this scenario is currently expected by

Focus is on a particularly strong climate policy shift.

financial markets. This reference scenario is then compared with the “Net Zero 2050” scenario. Shifting from the “Current Policies” scenario to the “Net Zero 2050” scenario would trigger a comparatively strong shock to the financial system (see Chart 3.2). Pairing these two scenarios thus depicts the largest possible hike in carbon prices out of the scenarios considered here and hence estimates the maximum level of vulnerabilities to transition risks within the confines of the socioeconomic assumptions of the scenario.

Factoring uncertainty into the analysis

As uncertainty plays an important role in the analysis of transition risks, its potential impact is also estimated. Both the reference scenario and the increase scenario are subject to uncertainty – uncertainty

about which scenario will materialise, for example, and what the expectations of market participants are with regard to the selected reference scenario. To factor this uncertainty into the analysis, we leave the increase scenario unchanged and select a different reference scenario that already assumes more ambitious climate action. This new combination of reference and increase scenarios models a medium shock to the financial system. As a last step, we estimate the effect of uncertainty by comparing the potential losses in asset values from a medium and a strong shock to the financial system.²⁴

Vulnerability of the German financial system to a change in climate policy

The real economic effects of changes in climate policy can be broken down into aggregate level effects and sectoral structural effects. The unexpected change from the “Current Policies” reference scenario to the “Net Zero 2050” increase scenario has effects first of all on Germany’s real economy. These effects are calculated

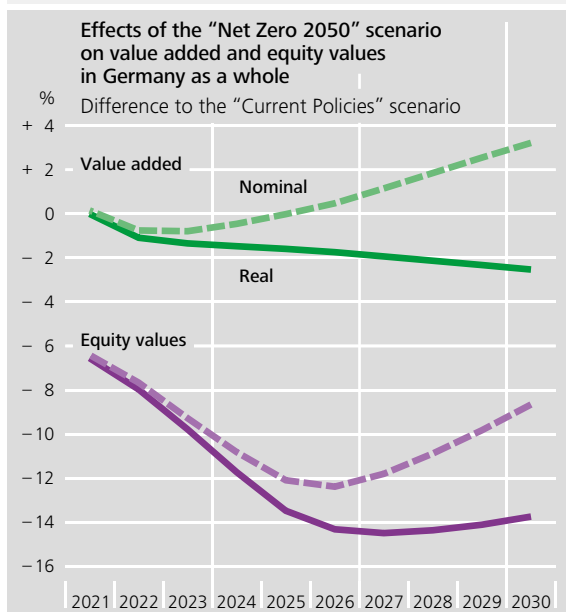
Aggregate value added particularly affected by rise in carbon prices.

with NiGEM on the basis of the NGFS scenarios previously modelled in the IAMs. Of the information thus gathered on price and interest rate effects, aggregate value added and equity values are of particular analytical interest. These two variables are affected more than others by the unexpected change in policy and in particular by the rise in the price of carbon.

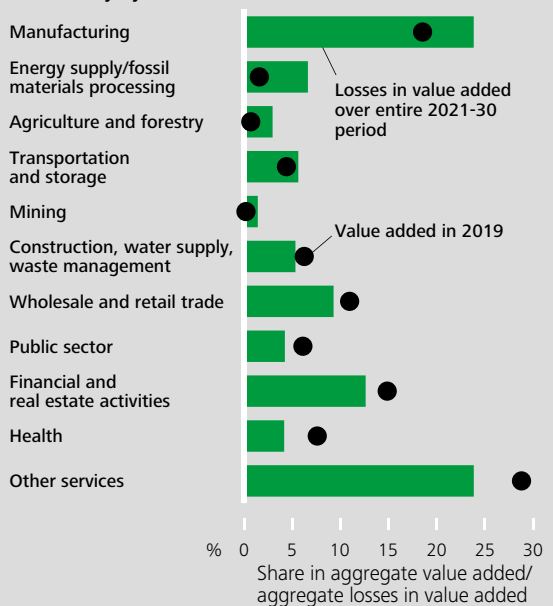
While gross value added shows only a moderate response in the increase scenario as of 2022 compared with the reference scenario, falling by roughly

²⁴ For information on scenario selection, see Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021).

Losses in value added from a rise in carbon prices* Chart 3.3



Losses in value added vs. value added of firms in Germany by sector¹



Sources: Federal Statistical Office, World Input-Output Database, I. Frankovic (2021), The Impact of Carbon Pricing in a Multi-Region Production Network Model and an Application to Climate Scenarios, Deutsche Bundesbank Discussion Paper, forthcoming and Bundesbank calculations. * Potential losses in value added from an increase in carbon prices from the "Current Policies" scenario to the "Net Zero 2050" scenario. For the increase in prices and the scenario assumptions, see Chart 3.2. ¹ Sectors arranged by the size of the difference between the share in the losses of value added and the share in value added.
 Deutsche Bundesbank

2% in real terms, equity values experience a real decline of around 14 percentage points relative to the reference scenario (see Chart 3.3).²⁵ In nominal terms, equity values are projected to decline by somewhat more than 12 percentage points up to the mid-2020s when compared with the scenario without the additional increase in the price of carbon. They do, however, recover some ground by 2030, by which point they are only a little short of 9 percentage points lower than in the reference scenario. Nominal gross value added, meanwhile, declines initially before bouncing back by 2030 to somewhat over 3% compared to the reference scenario. This higher nominal outcome in the "Net Zero 2050" scenario is attributable to the slightly higher price level, which by 2030 is about 5% higher than in the reference scenario. The national level effects have only a limited impact on the downstream financial system. In particular, the annual changes in gross value added and equity values are low after the initial decline. These start off at somewhat over 1 and 6 percentage points before coming to roughly 0.25 and just under 2 percentage points. The adjustments are relatively sharp at the start of the period under consideration due to immediate asset repricing in anticipation of future corrections.

The national losses in terms of both gross value added and equity values are distributed unevenly in arithmetical terms across the sectors of the real economy. In particular, a number of emissions-intensive sectors make a disproportionately large contribution, relative to their value added, to the loss in aggregate value added (see Chart 3.3). These sectors include, amongst others, agriculture, forestry, energy supply and the fossil fuel industry. The public

²⁵ The real economic effects in the climate scenarios depend on assumptions concerning the fiscal use of tax revenues. While the analyses presented here assume that taxes will be cut, public subsidies could, for example, be increased instead. The assumption that taxes will be cut tends to increase burdens in comparison to public subsidies. The level of the relative effects is discussed in Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021).

sector, the health sector and the remaining services sectors, by contrast, are less affected by losses relative to their value added share.

Intermediaries vulnerable via loan and securities portfolios

The effects of the climate scenarios and, in particular, of the associated rise in the price of carbon on the financial system are measured using the losses accruing in the portfolios of German financial intermediaries. The analysis looks not only at the sector in which the issuers of the affected assets operate, but also the nature of the asset, i.e. bonds, loans and

The effects depend on share of transition-sensitive sectors in the portfolios.

stocks. Most of the balance sheets of financial intermediaries are covered by this analysis (see Chart 3.1 on p. 85).²⁶ These bal-

ance sheets are broken down into financing and financial instruments, loans and government bonds, bonds issued by non-financial corporations (non-financial bonds), bonds issued by financial corporations (financial bonds), stocks and participating interests, and investment fund shares (see Table 3.1). The real economic effects of shocks stemming from transition risks are moderate, but impact more heavily on transition-sensitive sectors of the real economy.²⁷ As for the effects on the financial system, these depend, first, on the size of the share of transition-sensitive sectors in financial intermediaries' portfolios. The smaller the share, the lower the vulnerabilities. Second, the effects hinge on the remaining terms to maturity of the financing and financial instruments in those portfolios, as risk premia tend to be higher for longer remaining terms to maturity.

The remaining terms to maturity of banks' holdings of loans and bonds are relatively short. By contrast, securities such as stocks, participating interests and investment fund shares potentially have infinite

terms. While securities of transition-sensitive sectors account for a relatively large share of these instruments, the small portfolio share of 3% in each case means that banks on the whole are nevertheless not very vulnerable to transition risks.

German funds hold the highest portfolio share of stocks, participating interests and investment fund shares, at around 48%. In addition, they hold non-financial bonds with an average remaining term of 10.5 years. The remaining term to maturity in the portfolios of insurers is somewhat longer than in the portfolios of funds. In the case of non-financial bonds, transition-sensitive sectors are significantly underrepresented in the portfolios of both funds and insurers. These sectors are likewise significantly underrepresented in insurers' holdings of stocks, participating interests and investment fund shares, but tend to be overrepresented in funds' holdings of the same asset classes.

All in all, banks' portfolios are less affected by the real economic effects of transition risks than those of funds and insurers.

This is mainly due to the relatively short remaining terms to

Banks less affected than funds or insurers.

maturity and the low shares of financial and financing instruments from transition-sensitive sectors.

²⁶ For a detailed account of descriptive statistics on financial intermediaries and of the literature on previously conducted analyses, see Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021). The dataset is more comprehensive than in many other analyses, particularly in terms of its coverage of financial intermediaries and financial instruments.

²⁷ Transition sensitivity denotes how strongly a sector's value added responds to a rise in the price of carbon and is calculated using the sectoral ratios of losses in value added to aggregate value added. It thus encompasses the overall impact on value added resulting from the emission intensity of the sector itself, the emission intensity of the inputs, and, via demand effects, the emission intensity of downstream sectors. The one-third of sectors whose value added reacts most to a rise in the price of carbon are considered to be transition-sensitive. We measure the shares of financing and financial instruments issued by transition-sensitive sectors held in intermediaries' portfolio. These shares are then compared with the share of aggregate value added attributable to the transition-sensitive sectors.

Portfolios of German financial intermediaries in the scenario analyses

Table 3.1

As at Q4 2020

Loan portfolios			
Metric	Banks		
Total in € billion	4,789		
Loan portfolios included in the scenario analyses (stressed portfolio), in € billion	2,452		
of which: Percentage share of loans issued to transition-sensitive sectors	19		
Ratio of share of loans issued to transition-sensitive sectors to the share in value added of these sectors	67		
Stressed portfolio as a percentage share of total loan portfolios	51		
Remaining term to maturity of loans in the stressed portfolio, in years	5 to 7		
Securities portfolios			
Metric	Banks	Funds	Insurers ¹
Total in € billion	1,474	2,206	1,853
Securities portfolios included in the scenario analyses (stressed portfolio), in € billion	1,418	2,027	1,800
Stressed portfolio as a percentage share of the securities portfolios of the respective financial sector	96	92	97
Remaining term to maturity of non-financial bonds in the stressed portfolio, in years	6	11	13
Stressed portfolio by asset class, percentage shares			
Government bonds	28	19	30
Non-financial bonds	3	12	9
of which: Share attributable to transition-sensitive sectors	45	15	8
Ratio of share attributable to transition-sensitive sectors to the share in value added of these sectors	150	53	27
Financial bonds	52	22	31
Stocks and participating interests	3	23	26
of which: Share attributable to transition-sensitive sectors	33	36	9
Ratio of share attributable to transition-sensitive sectors to the share in value added of these sectors	117	126	32
Investment fund shares	14	25	4

¹ Unit-linked products are not taken into account in the analysis because policyholders typically bear the investment risk with such products. Insurers' holdings of German investment fund shares are assigned to the asset class of the securities held by the funds. The fund shares category itself only includes the portion for which this is not possible (e.g. foreign investment fund shares).

Insurers are somewhat more vulnerable due to the comparatively long remaining terms to maturity in their bond portfolio. Funds, by contrast, are exposed most to potential losses from transition risks on account of their portfolios' high shares of stocks, participating interests and investments in other funds.

Transition risks can also lead to losses via investments in residential real estate.²⁸ Owing to gaps in the data on the financing structure of residential real estate, this asset category cannot be included in the analysis (see the box entitled "Climate-related risk and potential losses in value of residential real estate" on pp. 95 f.). This means the potential losses from transition risks could be generally higher, as all categories of intermediaries under consideration have exposure to loans to households for house purchase or investments in the residential real estate sector.

German financial system moderately vulnerable to transition risks

An unexpected change from the "Current Policies" reference scenario to the "Net Zero 2050" increase scenario would leave German financial intermediaries moderately vulnerable to transition risks via their securities portfolios, with a large proportion of the losses accruing in the asset classes stocks and participating interests. The fall in profits suffered by firms from the real economy as a result of climate-related risks negatively impacts their enterprise values and thus takes an immediate toll on their stocks and participating interests. Bonds are exposed to less severe losses than stocks, however. This is especially true of government bonds, as their value is driven primarily

²⁸ These make up a roughly 15% share of the portfolio held by German banks and a smaller share of the portfolios held by the fund and insurance sectors. Commercial real estate is included in the analysis of the banking sector's potential vulnerabilities as it is possible to assign individual loans in this segment.

Climate-related risk and potential losses in value of residential real estate

Residential real estate plays a major role in the analysis of climate-related risks to financial stability. The International Renewable Energy Agency (IRENA), for example, identifies residential real estate as the sector facing the greatest risk of stranded assets, i.e. of assets losing value as a result of transition risk.¹ This is especially true of western Europe and Germany. Since buildings are used over long periods, stranded assets can hardly be avoided in the residential real estate sector. In addition, residential real estate serves as collateral for the majority of loans to households. A loss in value could thus increase credit risk for lenders.²

Physical risk stemming from climate change is also likely to have a bearing on residential real estate in particular, especially when the properties are situated in regions with a higher probability of experiencing extreme weather conditions. Among lenders, this contributes to rising expected losses from physical damage, and also from falling prices. To analyse physical risk for the housing loan portfolio, the exact location of properties as well as information on which loans are secured by which properties are required. These items of information are not currently available in combination, which is why the impact of physical risk has not been analysed.

Transition risk can affect residential real estate via multiple transmission channels. For example, increases in the carbon price raise the future costs of energy and thus of heating for properties which run on fossil fuels. Furthermore, in the absence of additional investment in energy efficiency, housing which is less energy efficient can decline in value.³

To estimate the possible losses in value of residential real estate in scenarios relating to the carbon price, the present value of the additional energy costs incurred relative to the highest efficiency class is calculated for each of the real estate energy efficiency classes.⁴ The difference in these present values equates to the share in total additional costs for energy which will have to be paid in the future on top of a currently expected carbon price pathway. The “Current Policies” scenario of the Network for Greening the Financial System (NGFS) serves as the reference scenario. In this scenario, no carbon tax is charged. The difference in the present value of energy costs is then viewed in relation to the current prices of energy efficient properties as, for these properties, the rise in energy prices is likely to lead to merely small cost increases. Ultimately, the differences in present value can be interpreted as an outcome of differing expectations about future energy prices, which are already reflected in property prices today. Price discounts constitute a proxy for differences in energy and renovation costs, as buyers weigh up higher energy costs over the expected useful life against immediate renovation costs. In a second step, the calculated

¹ See International Renewable Energy Agency (2017).

² Credit institutions hold a share of just under 94% of loans for house purchase in the household sector; a share of roughly 6% is attributable to insurers. A drop in residential real estate prices would affect owners and hence their lenders as well.

³ The Federal Government’s Climate Action Plan 2050 aims to increase the energy efficiency of residential buildings; see Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (2016).

⁴ See ter Stege and Vogel (2021).

loss in value is aggregated using the observed shares of energy efficiency classes for Germany.

The calculations show that in the case of significantly increasing energy price expectations among market participants, for example in the NGFS's "Net Zero 2050" scenario, higher energy prices mean the value of the building stock could be as much as 13% lower on aggregate than if there were no energy price appreciation. The higher loss given default rates this produces are likely to be manageable for German banks. Stress tests that are not focused on climate change, for example, show that the German banking system could cope with losses even if prices in the residential real estate market come down by significantly more.⁵ Transition risk in the residential real estate market thus appears to give rise to only moderate risks to financial stability.

This estimation of the impact of transition risk on the residential real estate market is subject to restrictions, however. First, energy prices experienced only low nominal price volatility in the 2010s and barely changed on average.⁶ This makes it difficult to statistically estimate the impact of (expected) energy costs on housing prices.⁷ Second, the pool of data on the energy efficiency of the housing stock currently contains gaps. In particular, data on lending terms and conditions and energy efficiency for residential real estate are not available in a shared, centralised location. The losses incurred when a loan defaults therefore cannot be estimated. For the same reason, it is not possible to gauge whether lenders are already considering the risks stemming from lower energy efficiency when they grant loans.⁸ Third, possible downstream effects are not captured. These may include the increase in costs due to a higher number of renovations in more rapid transformation scenarios, for

instance, or the adjustment of lending terms and conditions. Fourth, possible incentives to invest in building renovations, which could stem from higher carbon prices for example, are not considered. Renovations would increase the efficiency of the housing stock, thus mitigating the impact of higher energy costs on price depreciation.

⁵ See Barasinska, Haenle, Koban and Schmidt (2019).

⁶ See Schütze, Stede and Wietschel (2020).

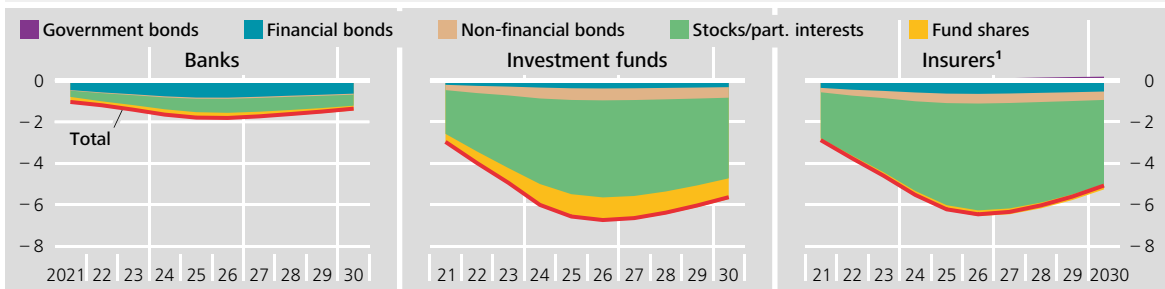
⁷ In Germany, the valuation haircut for inefficient residential properties seems to have risen only weakly in recent years; see, for example, Taruttis and Weber (2020).

⁸ See Federal Financial Supervisory Authority (2019).

Vulnerabilities of German financial intermediaries to climate-related transition risks: market risk by asset class in a scenario of a strong shock to the financial system*

Chart 3.4

Cumulated changes in value as a percentage of the stressed securities portfolios



Sources: Bundesbank statistics and Bundesbank calculations based on the scenarios of the Network for Greening the Financial System (NGFS). * Potential effects of scenario-dependent market price changes in the “Net Zero 2050” increase scenario compared to the “Current Policies” reference scenario. For the scenario assumptions, see Chart 3.2. ¹ Insurers’ holdings of German investment fund shares are assigned to the asset class of the securities held by the funds. The fund shares category itself only includes the portion for which this is not possible (e.g. foreign investment fund shares).

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by the level of government debt and similar structural factors.

Banks seem to be the least vulnerable to transition risks in their securities portfolios (see Chart 3.4),²⁹ which stand to lose a maximum of 2% in value.³⁰ By contrast, investment funds and insurers are more vulnerable, with the value of their securities portfolios falling by a maximum of 7% and 6%, respectively. For

Banks seem to be the least vulnerable.

all intermediaries, the maximum loss materialises in the mid-2020s. Around half of the maximum loss arises immediately after the information on the carbon price shock becomes known at the start of the analysis period, as the intermediaries anticipate the future losses by immediately repricing their assets. The losses suffered each year after that stem from structural adjustments in the real economy. Because the increase scenario projects a stronger transition to carbon-neutral production as of the mid-2020s than the reference scenario, financial assets will see their values rise again. Overall, the shock triggered by the change in policy stance initially leads to losses in intermediaries’ portfolios, but these are not very high over the entire period of the analysis. That said, it does take relatively long for intermediaries to

overcome the heaviest burdens from the transition to a low-carbon real economy and reduce the losses again.

German financial intermediaries are vulnerable through their holdings of stocks in particular. Although stocks account for only 3% of the securities portfolio of German banks, they are responsible for just under half of the initial loss. Financial bonds also contribute to the losses, as they comprise 52% of banks’ securities portfolio. In the case of funds, losses affect stock investments in particular, contributing around 4.7 percentage points to the maximum relative loss in value of German funds up to 2026. The prices of corporate bonds and bank bonds held in the fund sector’s portfolios decline rather mod-

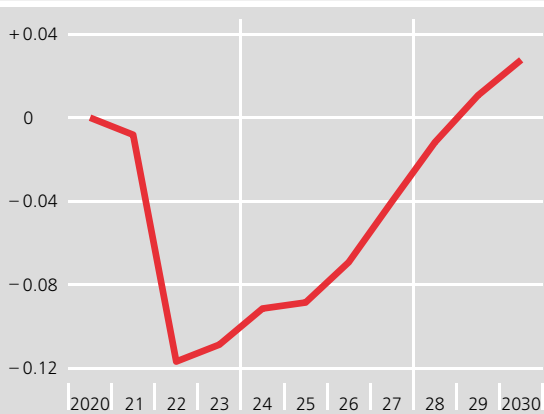
²⁹ In principle, these are potential vulnerabilities and losses, but in the following we refer to them merely as vulnerabilities or losses in order to improve readability. While the analyses are based on a horizon up to 2050, the results are only presented and interpreted up to 2030. For a presentation of the results up to 2040, see Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021).

³⁰ The analysis is based on nominal values, modelling the aggregated portfolio losses in a given year of all financial intermediaries in each sector. Real carbon prices calculated with the IAMs were converted into nominal values in NiGEM for the purposes of this analysis. Losses are shown in relation to the aggregate total assets of the given financial sector in the scenario.

Vulnerability of German banks to climate-related transition risks: credit risk in a scenario of a strong shock to the financial system*

Chart 3.5

Cumulated effects as a percentage of the stressed loan portfolios



Sources: Bundesbank statistics and Bundesbank calculations based on the scenarios of the Network for Greening the Financial System (NGFS). * Potential effects of scenario-dependent default rates in the “Net Zero 2050” increase scenario compared to the “Current Policies” reference scenario. Negative values represent a more negative outcome (e.g. higher losses) compared to the reference scenario, while positive values represent a more positive outcome (e.g. lower losses). For the scenario assumptions, see Chart 3.2.

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erately in the increase scenario compared to the reference scenario. German insurers are exposed to similar vulnerabilities as German funds, their potential losses up to the mid-2020s amounting to around 6% of their overall portfolio. In comparison to the reference scenario, insurers are vulnerable via stocks and participating interests especially.

Potential losses from bank loans are low, as German banks have only very minor exposures to the particularly transition-sensitive sectors. These exposures account for only around 1.7% of the loan portfolio of German banks under consideration. At around 2.4%, only credit cooperatives have somewhat higher exposures to the five sectors affected most by transition risks. Furthermore, loans are usually backed by collateral that will cover some of the losses in the event of default.³¹ A further reason for the low credit losses is the predominantly long-term nature of changes to real economic activity in the

transition to a low-carbon economy. This is a gradual adaptation process, so the credit default rate will rise only moderately as well. The scenario analyses indicate that German banks are only marginally vulnerable to transition risks in the loan portfolios under consideration (see Chart 3.5), with losses coming to a mere 0.1% of the loan book covered by our analysis. These losses materialise primarily in the first half of the 2020s, i.e. somewhat earlier than in banks’ securities portfolio. Losses in the German banking sector’s loan and securities portfolios differ in terms of both how they evolve and their amounts, because the increase in the probabilities of loans defaulting as a result of declining value added and asset values turns out to be smaller and also because losses are not fully realised on the balance sheet beyond the mid-2020s.³²

German financial intermediaries vulnerable through stocks in particular.

Impacts concentrated in some cases

Individual intermediaries may be significantly more vulnerable than the financial system on average. Based on the distribution of losses within financial sectors, we estimate whether vulnerabilities are heavily concentrated at individual financial interme-

³¹ Physical risks may lead to a decrease in the value of the collateral in future. As physical risks in Germany are only set to rise significantly as of 2040, they were not included in the analysis.

³² Empirical estimates indicate that a 1% decrease in value added or the stock price leads to a rise in the probability of default of 4 basis points and 9 basis points, respectively. By contrast, in the case of equity instruments and bonds issued by the financial and non-financial sectors, the modelling of changes in market prices as a means of estimating market risk is based solely on the stock price pathways mapped out in the climate scenarios. Stock prices are more sensitive than value added, which makes them potentially more vulnerable to market risk. Furthermore, the vulnerabilities to market risk outlined here disregard the fact that these may not necessarily fully translate into losses that reduce the banks’ equity capital. See Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021).

diaries.³³ The greater the difference between the losses of less vulnerable intermediaries and those of more vulnerable intermediaries, the higher the concentration. The less vulnerable and more vulnerable intermediaries within a given sector are identified based on the loss distribution. The banking, fund and insurance sectors are considered separately from one another. In each case, the potential losses at the 5th percentile show the minimum expected losses for the 5% of financial intermediaries that are most vulnerable within that sector. Equally, the potential losses at the 95th percentile show the maximum expected losses for the 5% of financial intermediaries that are least vulnerable for each sector. The more disparate these percentiles, the greater the concentration of vulnerabilities within the sector. The difference in losses between the 95th and 5th percentiles is referred to below as the loss differential between the least and most vulnerable financial intermediaries. The loss differential roughly states the loss amount of the most affected intermediaries, since the least affected intermediaries suffer hardly any losses at all.

Vulnerabilities are concentrated most in the fund sector, where the loss differential peaks in 2026 at 25 percentage points. In the insurance sector, the maximum loss differential is 14 percentage points.

Vulnerabilities are concentrated most in the fund sector.

By contrast, individual banks appear to face relatively similar levels of vulnerability to transition risks in their securities portfolios, with the maximum loss differential between the less vulnerable and more vulnerable banks coming to around 3.1 percentage points in the period under analysis.

In the German banking sector, losses from credit claims are only moderately concentrated at individual institutions. The picture for loan portfolios is therefore much the same as it is for securities portfolios. The maximum loss differential between the

less vulnerable and more vulnerable institutions is roughly twice the weighted mean, at 0.2 percentage point. Systemically important financial institutions are less affected by transition risks in their loan portfolios, as they issue a smaller share of their loans to transition-sensitive sectors.

Similar results in international studies

International studies arrive at similar estimates of the magnitude of potential vulnerabilities in the financial system.³⁴ Studies for other countries which investigate a similar issue put the respective local banking sector's vulnerability to transition risks at between 1% and 3% of the securities portfolio.³⁵ Those banking sectors, too, are judged to be less vulnerable, comparatively speaking, with regard to credit claims. For the insurance sector, studies identify vulnerability of between 6% and 11% of the respective securities portfolio. The few comparable studies for the fund sector arrive at much the same results in qualitative terms. While international studies produce very similar results, their analytical frameworks differ substantially in some cases. For example, they select different methods, scenario assumptions, analytical horizons or levels of geographical, sectoral and intrasectoral coverage. The results do, however, seem robust to these differing assumptions.

Results seem robust to differing assumptions.

³³ For a detailed presentation of the results, see Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021).

³⁴ For a more detailed discussion, see Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021).

³⁵ These include, for example, France, the United Kingdom and the Netherlands as well as pan-European analyses. See Etzel, Falter, Frankovic, Gross, Kablau, Lauscher, Ohls, Schober, Strobel and Wilke (2021).

Comparison of Bundesbank and European Central Bank climate risk analyses

Table 3.2

Analytical components	Bundesbank	ECB
Analytical focus	Vulnerabilities of German financial sector (banks, insurers, investment funds)	Vulnerabilities of euro area banks
Risks considered	Transition risks	Transition and physical risks
Time horizon	2030 (losses over 2021-30 period)	2050 (losses in 2050)
Scenarios considered	NGFS Phase II - No transition: "Current Policies" - Orderly transition: "Below 2°C" and "Net Zero 2050" - Disorderly transition: not considered	NGFS Phase I - No transition: "Current Policies" - Orderly transition: 1.5°C - Disorderly transition: 2°C (delayed implementation of climate action measures)
Level of analysis of real economic effects	Sector-specific	Firm-specific
Analysis of country-sector interactions and adaptation of sectoral value chains	Yes	No
Outcome/conclusion	- Moderate losses from transition - "Net Zero 2050" scenario leads to highest losses up to 2030 among scenarios considered	- Transition reduces overall costs of climate change and climate policy - "Current Policies" scenario leads to high losses in 2050
Drivers of outcome	At aggregate level, low losses in value added, low portfolio share of transition-sensitive economic sectors and limited remaining terms to maturity	High physical losses in 2050 in "Current Policies" scenario, mainly in southern Europe

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That said, the results can vary widely when the focus of the analysis shifts.³⁶ This is the case with the ECB's economy-wide climate stress test for the euro area banking system, for instance (see Table 3.2).³⁷ This stress test employs a broadly similar model methodology, but considers a horizon extending to 2050.³⁸ Furthermore, the ECB's analysis focuses on physical risk, as this is the predominant form of risk at the point when the results are analysed (2050). The impact of transition risk, which was considered up to 2030 in the analysis for the German financial system, has already shifted into the background by 2050. Moreover, the ECB analysis does not depict the full transition pathway of losses for the banking system, but simply the end point in 2050. The "Current Policies" scenario gives rise to losses from market risk that are roughly 35% higher in 2050 than in 2020. In the case of credit risk, losses increase by around 8% over the same period. The "Net Zero 2050" scenario is the one with significantly lower

losses in the ECB's analysis. In the present Bundesbank analysis for the German financial system, however, this scenario leads to potential losses compared with the "Current Policies" scenario. The differences in the impact of the scenarios can be explained by the differing focuses of the two analyses. While the investigation for the German financial system does not consider the impact of physical risk owing to the relatively short horizon up to 2030, in the ECB analysis physical risk is a significant driver of losses. These losses are incurred in southern European countries,

³⁶ For an overview of the scenario analyses on climate-related risk conducted, in progress, or planned by supervisory authorities and central banks worldwide, see Network for Greening the Financial System (2021b).

³⁷ See European Central Bank (2021a).

³⁸ The ECB's approach is also based on the NGFS scenarios overlaying a macroeconomic and financial econometric model. In geographical terms, the sample analysed is EU-wide and more differentiated across real economic firm-level data, but also smaller in terms of coverage of the financial system. The analysis is confined to the banking sector and looks at 1,600 euro area banks.

Uncertainty versus risk in the context of climate-related risks

Risk is spoken of when it is known which future events might occur and with what probability. Risk is therefore a calculable variable. In the case of uncertainty, on the other hand, no information is available on the probabilities of events occurring, and it may not even be known which events might occur. Uncertainty is therefore not calculable.¹

The analysis of climate-related risks in the financial system is dependent on the results of scientific models that examine climate change and its effects. These models are subject to considerable uncertainty. For example, the rise in the average global temperature for a given quantity of greenhouse gas emissions, i.e. climate sensitivity, cannot be precisely determined, not least due to climate tipping elements. Tipping elements take on a new state once a tipping point of a climate effect has been reached, and this new state remains in place even if the climate effect subsequently falls back below the tipping point. Knock-on effects can then occur abruptly, such as the release of greenhouse gases from the Siberian permafrost, or steadily, as with the melting of the polar ice caps. Furthermore, the effects of climate change on humankind and the economy are uncertain, as are the possibilities to mitigate these through climate change adaptation.

Mapping transition paths to a climate-neutral economy is also subject to considerable uncertainty. Not only are the drivers of the transition uncertain, but so is their effectiveness in reducing emissions. Political uncertainty means, for example, that the scale, timing and continuity of climate protection measures cannot be precisely gauged. Their effectiveness depends on the availability of low-carbon technologies and the behaviour and preferences of economic agents. Therefore, technological innovations and changes in consumer behaviour are addi-

tional factors in the transition to a climate-neutral economy which, alongside climate policy, are not possible to forecast.

The uncertainty surrounding the mapping of both climate change and the transition factors is reflected in the formulation, specification and parameterisation of models that attempt to capture these dynamics. Climate scenarios are therefore always based on degrees of abstraction, assumptions about key drivers of a model's mechanics, and parameters that have to be chosen along these dimensions of uncertainty. Climate scenarios may, then, describe internally consistent narratives for plausible future developments in the climate and the economy, but the probabilities of these scenarios occurring are unknown due to the aforementioned uncertainties and the assumptions which have to be made as a result.

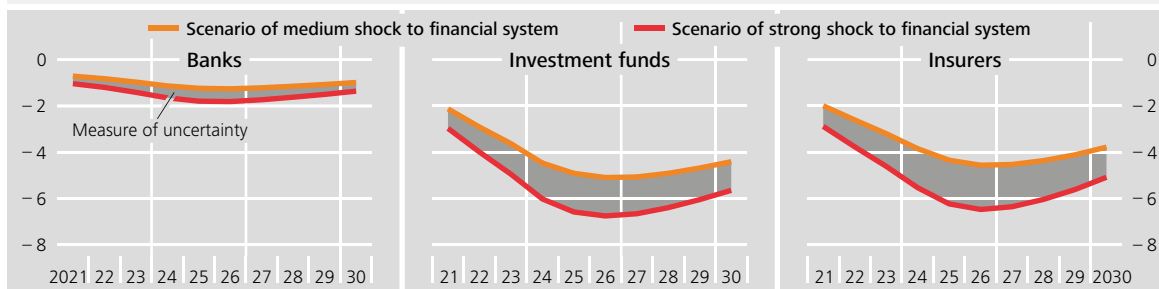
Scenario analyses on climate-related risks already entail a great deal of uncertainty concerning the choice of the increase scenario and the reference scenario. In making this choice it is necessary to adopt numerous assumptions and perform projections spanning several decades. Owing to shorter observation horizons, it is often possible to make forecasts in traditional stress tests by extrapolating current developments into the future, at least for the baseline scenario. To actually quantify risks it would also be necessary to determine the probabilities of all the possible scenarios as part of a forecast based on historical data. As stress scenarios usually represent structural breaks, this is typically not possible even in traditional stress tests, making a certain degree of uncertainty unavoidable.

¹ See Knight (1921).

Uncertainty about the reference scenario with regard to German financial intermediaries' vulnerabilities to climate-related transition risks: market risk*

Chart 3.6

Cumulated changes in value as a percentage of the stressed securities portfolios



Sources: Bundesbank statistics and Bundesbank calculations based on the scenarios of the Network for Greening the Financial System (NGFS). * The measure of uncertainty about the choice of reference scenario in Chart 3.4 is the difference between the outcomes calculated for the "Current Policies" reference scenario used to model a strong shock to the financial system and for the "Below 2°C" reference scenario (medium shock to the financial system). For the scenario assumptions, see Chart 3.2.

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in particular. In the ECB's analysis, firms in the real economy are also very constrained in their responses, and it is assumed that financial institutions generally do not adjust their portfolios.

Impact of uncertainty is relevant

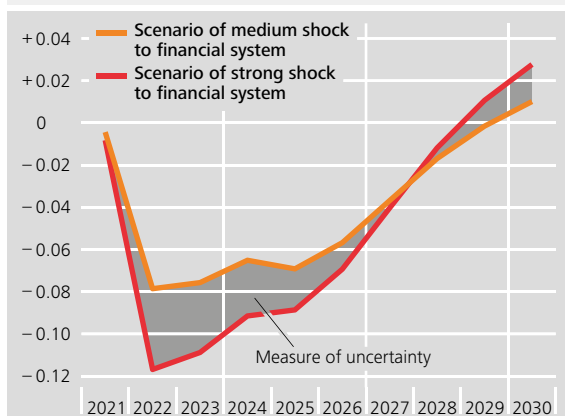
There is uncertainty surrounding the choice of reference scenario (see the box entitled "Uncertainty versus risk in the context of climate-related risks" on p. 101). Due to the complexity of developments in the climate and the economy, it is unclear how probable specific climate scenarios may be. The main determinant of the transition risks considered in the analyses is the measures formulated by policymakers. Future shocks may be greater or smaller depending on how credibly policymakers set a given climate action goal. Thus, even gauging the current expectations of market participants, i.e. choosing the reference scenario, is fraught with great uncertainty.³⁹ To judge which reference scenario is plausible, information on whether and to what extent future losses are already being factored into asset valuations would be needed. Similarly, structural adjustments made in anticipation

Great uncertainty about market participants' current expectations.

Uncertainty about the reference scenario with regard to German banks' vulnerabilities to climate-related transition risks: credit risk*

Chart 3.7

Cumulated effects as a percentage of the stressed loan portfolios



Sources: Bundesbank statistics and Bundesbank calculations based on the scenarios of the Network for Greening the Financial System (NGFS). * The measure of uncertainty about the choice of reference scenario in Chart 3.5 is the difference between the outcomes calculated for the "Current Policies" reference scenario used to model a strong shock to the financial system and for the "Below 2°C" reference scenario (medium shock to the financial system). For the scenario assumptions, see Chart 3.2.

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³⁹ This is similarly true of the increase scenario, too. At this point, though, the increase scenario should remain unchanged, as it can reveal the greatest potential vulnerabilities to financial stability among the SSP2 scenarios.

Climate-related data for financial stability: what has been achieved so far and where are the gaps?

Central banks and supervisors worldwide face major challenges with regard to the risks stemming from climate change and climate policy. Climate-related risks do not sit within the conventional analytical framework; they have so far barely been included in the accounting of non-financial corporations; and the availability of relevant data is limited. The analytical challenges and limited availability of data as well as the lack of consistency between data sources constitute significant impediments to adequate risk assessment. Central banks therefore need to improve their analytical instruments and data infrastructures accordingly.¹ The past years have already brought some important advances in this regard. One example is the creation of an analytical framework for assessing the impact of climate-related risks on the financial system.

Progress has also been made in terms of the data. The Financial Stability Board (FSB) is playing a particularly instrumental role in broadening the data pool on climate-related risks. In 2021, it identified data requirements for climate-focused analyses as well as specifying where further action is needed.² Numerous initiatives are also being pursued at the G20 level to close data gaps.³ Plans include assisting providers of sustainability data, such as ratings agencies for environmental, social and governance (ESG) standards, in improving data quality.⁴ To hone climate-related risk analysis further, improvements are also needed in the use, exchange and linking of the data already available within the scope afforded by legislation. This is why, parallel to the FSB's efforts, the Network for Greening the Financial System (NGFS) is currently considering ways to

pool and better exchange data.⁵ The objective of all these efforts is to develop suitable indicators for physical and transition risks.⁶

At the same time, the introduction of internationally comparable disclosure standards for climate-related risks is crucial. Mandatory reporting on greenhouse gas emissions should form a core component of that, and a uniform reporting standard – ideally global in scope – should be established. Globally speaking, a large number of financial enterprises still have little awareness of the extent to which they finance greenhouse gas emissions.⁷ A mandatory reporting system of the kind mentioned above could pave the way for a deeper harmonisation of disclosure requirements, making an important contribution to transparency. It could enable financial markets to channel funds into more climate-friendly investments in a concerted manner. This is why international coordination efforts geared towards global transparency and common disclosure standards are to be welcomed.⁸ A basic standard for sustainability reporting is in preparation, building

¹ See Deutsche Bundesbank (2019); Buch and Weigert (2021).

² See Financial Stability Board (2021b).

³ A possible new G20 Data Gaps Initiative could also address climate data in future, see G20 Finance Ministers and Central Bank Governors (2021). The G20 TechSprint 2021 is also tackling the issue of data availability and data sharing, see <https://www.techsprint2021.it/>

⁴ The focus is initially on climate topics; the plan is to broaden this to embrace further sustainability topics as time goes on.

⁵ See Network for Greening the Financial System (2021a).

⁶ See European Central Bank (2021b); European Central Bank and European Systemic Risk Board (2021); European Systemic Risk Board (2020).

⁷ See Task Force on Climate-related Financial Disclosures (2020).

⁸ See Financial Stability Board (2021a).

on the framework developed by the Task Force on Climate-related Financial Disclosures (TCFD).⁹ An International Sustainability Standards Board (ISSB) is being established under the aegis of the International Financial Reporting Standards (IFRS) Foundation for this purpose and will draw up international standards for sustainability disclosures by enterprises.¹⁰ To ensure symmetry with European standards, it would make sense for the IFRS Foundation and the European Financial Reporting Advisory Group (EFRAG) to coordinate their efforts.¹¹ Central banks too should increase the market transparency of climate-related risks – by implementing disclosure requirements for the securities they purchase and the collateral they accept, for instance. The central banks of the G7 member states will also discuss options for implementing the TCFD recommendations in their own disclosures. As the holder of the

G7 presidency in 2022, Germany will be able to make a positive impact on the implementation of disclosure measures.

⁹ See Task Force on Climate-related Financial Disclosures (2017).

¹⁰ See <https://www.ifrs.org/projects/work-plan/sustainability-reporting/>

¹¹ EFRAG is tasked with devising concrete standards for the European Commission's proposed Corporate Sustainability Reporting Directive (CSRD), which are then to be adopted as delegated acts.

of changes in climate policy would have to be known.⁴⁰

The scale of the uncertainty surrounding the choice of reference scenario can be illustrated at least by way of example, however. The choice of reference scenario is especially important as it forms the starting point for determining vulnerability. To illustrate the uncertainty surrounding the impact of the choice of reference scenario, the reference scenario used to model a strong shock to the financial system ("Current Policies") is replaced by a scenario underpinned by more ambitious climate action goals ("Below 2°C"). Leaving the increase scenario ("Net Zero 2050") unchanged, this reduces the shock to the financial system as the reference scenario already factors in the pursuit of more ambitious climate goals. Given this medium shock to the financial system, the additional transition risks and potentially ensuing losses are accordingly smaller (see Chart 3.2 on

p. 89). The difference between the two loss curves given a strong and a medium shock to the financial system serves as the measure of uncertainty.

There may be considerable differences in the impact of the two scenarios. The computed vulnerabilities of the financial system to transition risks in securities portfolios are much smaller when a reference scenario is used that already entails more ambitious climate goals. Estimated vulnerability decreases by around 25% to 33% in the financial system as a whole (see Chart 3.6). The analysis of transition risks in the German banking sector's loan portfolio produces similar results (see Chart 3.7). In this case, the reduction amounts to around 40% of the

⁴⁰ This uncertainty exists because the scenarios are designed for a global setting and take into account the reciprocal assessments of all market participants. In this context, an estimation for German market participants would constitute no more than an approximation.

previously calculated vulnerabilities. However, the uncertainty illustrated using this approach can only serve as an example owing to the lack of information about the probability of future developments. Furthermore, other scenario parameters can influence uncertainty. The actual vulnerability of the financial system could therefore be either greater or smaller.

Policy can reduce uncertainty

Policy can significantly help reduce the uncertainty surrounding the transition to a climate-neutral economy. Uncertainty about the transition pathway can be minimised for market participants by pursuing a reliable national and international climate policy with clear and credible targets, for example relating to the reduction of greenhouse gas emissions. By the same token, disclosure requirements and standardised climate indicators for firms, e.g. regarding their current and foreseeable carbon emissions, can help participants in the financial system to better gauge

Risk assessment can be improved through disclosure requirements.

the actual level of climate-related risk and thus the challenges facing individual firms in connection with the transition to a climate-neutral economy (see the box entitled “Climate-related data for financial stability: what has been achieved so far and where are the gaps?” on pp. 103 f.). This would allow transition risks to be incorporated into price formation in financial markets and risk premia to adjust accordingly. Provided policymakers set credible climate objectives, the risk premia for climate-friendly investments may fall compared with other investments. At the same time, this is likely to help keep the financial system’s vulnerabilities to transition risks at a moderate level.

Even so, the financial sector should prepare itself to cope with potentially larger shocks. In principle, sce-

narios could arise in which policymakers take measures to combat climate change unexpectedly late in the day and these measures are much stronger than assumed in this analysis.⁴¹ In this case, the transition to a low-carbon economy would have to occur within an even shorter space of time. More extreme increase scenarios could then materialise, meaning that the shock to the financial system would be greater. This could ultimately lead to higher losses.⁴² This makes it all the more important, then, for intermediaries and financial market agents to consider transition risks in their risk management and to be sufficiently resilient.

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⁴¹ The NGFS’s “Delayed Transition” scenario is one example of this. In this scenario, policymakers do not implement more stringent climate measures until 2030.

⁴² Given the analytical constraints outlined here, such as the assumption of static balance sheets of financial intermediaries, the impact of such scenarios was not examined.

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Glossary

AR6	Sixth Assessment Report
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
CCyB	Countercyclical capital buffer
CDS	Credit default swap
CET1	Common equity tier 1
CMDI	Crisis management and deposit insurance framework
CRD	Capital Requirements Directive
CRR	Capital Requirements Regulation
CSRD	Corporate Sustainability Reporting Directive
DORA	Digital Operational Resilience Act
EBA	European Banking Authority
ECB	European Central Bank
EFRAG	European Financial Reporting Advisory Group
EIOPA	European Insurance and Occupational Pensions Authority
ESG standards	Environmental, social and governance standards
ESRB	European Systemic Risk Board
EU	European Union
FinStabDEV	Financial Stability Data Collection Regulation (<i>Finanzstabilitätsdatenerhebungsverordnung</i>)
FSB	Financial Stability Board
GDP	Gross domestic product
G-FSC	German Financial Stability Committee
G-SIIs	Global systemically important institutions
HGB	German Commercial Code (<i>Handelsgesetzbuch</i>)
IAB	Institute for Employment Research
IAM	Integrated assessment model
IFRSs	International Financial Reporting Standards
IMF	International Monetary Fund
IOSCO	International Organization of Securities Commissions
IPCC	Intergovernmental Panel on Climate Change
IRBA	Internal ratings-based approach
IRENA	International Renewable Energy Agency
ISSB	International Sustainability Standards Board
KAGB	German Investment Code (<i>Kapitalanlagegesetzbuch</i>)

KfW	Kreditanstalt für Wiederaufbau
LTV	Loan-to-value ratio
MCR	Minimum capital requirement
MREL	Minimum requirement for own funds and eligible liabilities
NGEU	Next Generation EU
NGFS	Network for Greening the Financial System
NiGEM	National Institute Global Econometric Model
OECD	Organisation for Economic Co-operation and Development
O-SIIs	Other systemically important institutions
PEPP	Pandemic emergency purchase programme
PHF	Panel on Household Finances
PIA	Public interest assessment
RWAs	Risk-weighted assets
SCR	Solvency Capital Requirement
SRF	Single Resolution Fund
SSM	Single Supervisory Mechanism
SSP	Shared Socioeconomic Pathway
TBTF	Too-big-to-fail
TCFD	Task Force on Climate-related Financial Disclosures
VAR model	Vector autoregressive model
vdp	Association of German Pfandbrief Banks

Bundesbank publications concerning financial stability

This overview lists selected recent Bundesbank publications on the subject of financial stability. The Financial Stability Review and the Monthly Report are available in both German and English, while discussion papers are usually published in English. The publications are provided in electronic format on our website (under Publications); printed copies can also be ordered or subscribed to free of charge via the Bundesbank's order portal.

Background information on selected models and procedures is provided in the associated technical papers.

A selection of data and charts from the Financial Stability Review may be found on our website (under Tasks > Financial and monetary system > Financial Stability Review). In addition, large volumes of continuously updated data are available for various Bundesbank statistics (under Statistics, in particular in the time series databases).

■ Financial Stability Reviews

Financial stability reviews for the period 2005 to 2020; usually published once a year in November.

■ Technical papers

13/2021	Sensitivitätsanalyse klimabezogener Transitionsrisiken des deutschen Finanzsektors	Dominik Schober, Tobias Etzel, Alexander Falter, Ivan Frankovic, Christian Gross, Anke Kablau, Pierre Lauscher, Jana Ohls, Lena Strobel, Hannes Wilke
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12/2021	Deleveraging-Potenzial im deutschen Bankensystem und Auswirkungen auf die Finanzstabilität	Manuel Pelzer, Nataliya Barasinska, Manuel Buchholz, Sören Friedrich, Sebastian Geiger, Nikolay Hristov, Axel Löffler, Marcel Madjarac, Markus Roth, Leonid Silbermann, Lui-Hsian Wong
11/2021	Stress testing market risk for German financial intermediaries	Alexander Falter, Michael Kleemann, Lena Strobel, Hannes Wilke
10/2021	Analysis of (stressed) allocation risk in the aggregate credit portfolio of domestic banks	Peter Bednarek
09/2021	German residential real estate valuation under NGFS climate scenarios	Lucas ter Steege, Edgar Vogel
08/2021	Risiken im Unternehmenskreditgeschäft inländischer Banken	Christoph Memmel, Christoph Roling
07/2021	Die Unternehmensverschuldung in Deutschland im Verlauf der Corona-Pandemie: eine Auswertung anhand des AnaCredit-Datensatzes	Benedikt Kolb, Frieder Mokinski, Robert Unger

■ Articles from the Monthly Report

September 2021	The performance of German credit institutions in 2020
August 2021	Monetary policy and banking business
July 2021	Digital risks in the banking sector
July 2021	Macroprudential policy and growth-at-risk
June 2021	Government finances: Central bank bond purchases increase sensitivity to interest rate changes
June 2021	Outlook for the German economy for 2021 to 2023
May 2021	Monetary policy and banking business
April 2021	Assessments and expectations of firms in the pandemic: findings from the Bundesbank Online Panel Firms
March 2021	A new European prudential framework for investment firms
February 2021	Monetary policy and banking business
December 2020	Risk Reduction Act – the national implementation of the European banking package
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