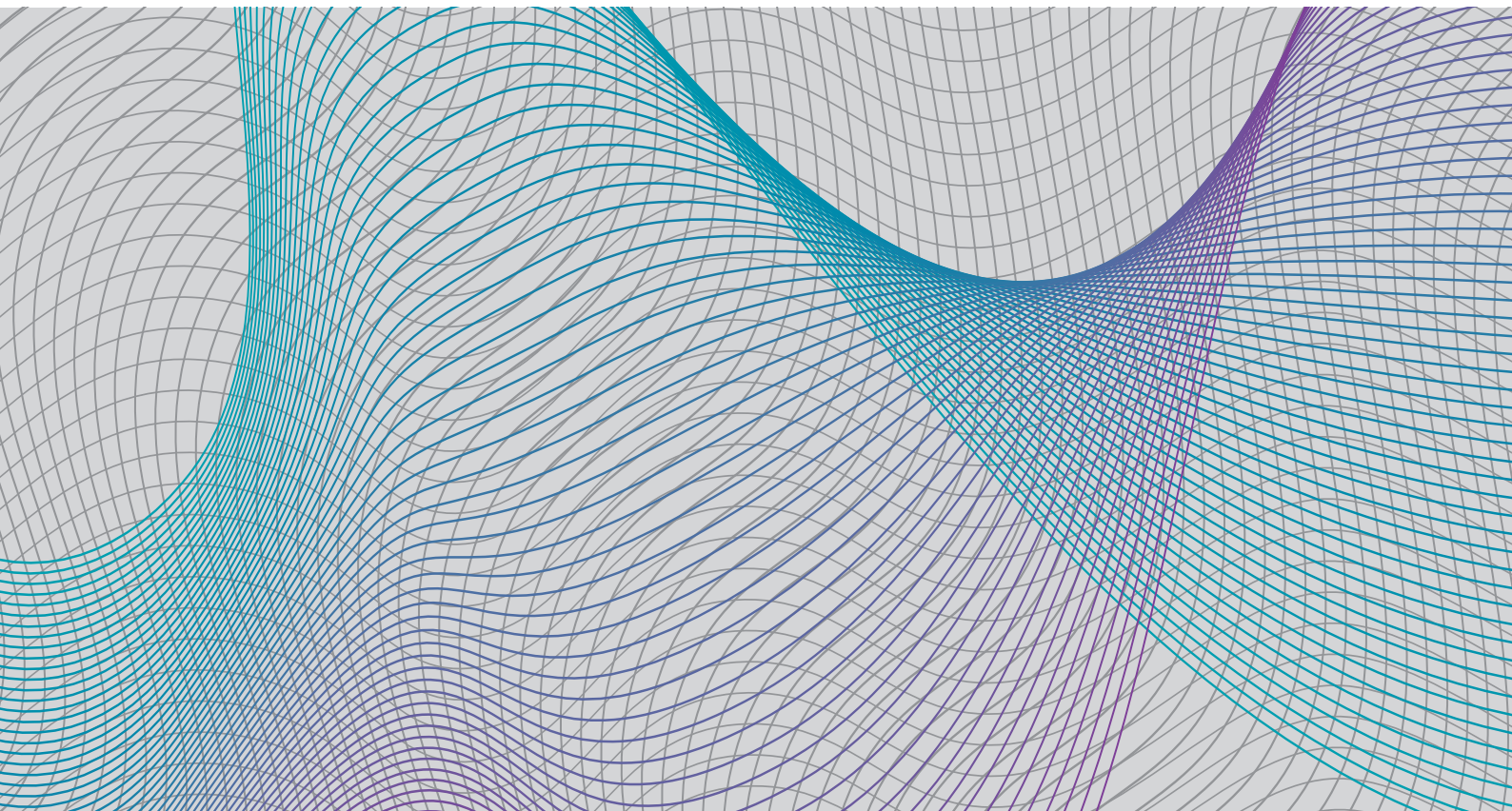




Financial Stability Review 2018



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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	Data unknown, not to be published or not meaningful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.

Introduction

Under the Act on Monitoring Financial Stability (*Gesetz zur Überwachung der Finanzstabilität*), the Bundesbank has joint responsibility for the stability of the German financial system. It has the statutory mandate to identify and assess risks to financial stability. The analyses published in its Financial Stability Review document developments that are of relevance to financial stability and highlight any risks to financial stability at an early stage. They examine the build-up of macroeconomic and financial imbalances. Such developments, which are not in line with the economic fundamentals, harbour the risk of abrupt corrections. The Bundesbank contributes its analytical findings to the work of Germany's Financial Stability Committee, which is the central body for macroprudential oversight in Germany. It gives the Committee its assessment of the general risk situation and makes proposals to it for warnings and recommendations for addressing systemic risks as well as evaluating their implementation.

The financial system coordinates savings and investment, makes it possible to hedge against risks, and facilitates payments. Its functional viability is of essential importance for the real economy. The Bundesbank understands financial stability as a state in which the financial system is able to fulfil its functions at all times. This means that a stable financial system is consistently in a position to absorb both financial and real economic shocks, especially when confronted with unforeseen events, in stress situations and in periods of structural adjustment. An adequate resilience of the financial system, that is the ability to absorb even losses from unexpected developments,

can prevent contagion and feedback effects. The financial system should neither cause nor contribute too much to a downturn in overall economic activity. Unlike microprudential supervision and regulation, which aim to ensure the stability of individual institutions, macroprudential oversight focuses on the stability of the financial system as a whole.

Risks to financial stability arise from systemic risks. Systemic risks occur, for instance, when the distress of one or more market participants jeopardises the functioning of the entire system. This may be the case when the distressed market player is very large or closely interlinked with other market players. Interconnectedness may be a channel through which unexpected adverse developments are transmitted to the financial system as whole, thus impairing its stability. Many market participants are connected to each other through a direct contractual relationship – banks, for instance, as a result of mutual claims in the interbank market. Besides this, indirect channels of contagion may exist. This may be the case, for example, if market participants conduct similar transactions and investors interpret negative developments with one market player as a signal that other market actors, too, are being adversely affected. Systemic risks thus also exist if a large number of small market participants are exposed to similar risks or risks that are closely correlated with each other.

Account has been taken of developments up to the cut-off date of 2 November 2018.

Overview

The German economy is experiencing the longest period of expansion since the country's reunification. For several years now, interest rates have been at very low levels, asset prices high and volatility in the financial markets relatively low. Moreover, economic growth is robust both at the global and the euro area level. Monetary policy normalisation is progressing in the United States, in particular.

The macroeconomic environment is thus not much different from last year when expectations of economic development were broadly confirmed. Continued robust economic development in the euro area and expectations that consumer prices will rise in the medium term are nudging interest rates upwards again. This is likely to strengthen financial stability.

However, unlike last year, risks to future economic activity are currently skewed to the downside. Geopolitical tensions have deepened; trade disputes have erupted and may escalate. It is also unclear under what circumstances the United Kingdom will leave the European Union (see the chapter entitled "The international environment" on pp. 15 ff.).

The danger that risks are being systematically underestimated, as addressed in last year's Financial Stability Review, is thus growing more acute: in a protracted spell of low interest rates coupled with favourable financing conditions and an ongoing economic boom, there is a tendency to push downside scenarios further and further out

The continued robust economic development is nudging interest rates upwards.

continued robust economic development in the euro area and expectations that consumer prices will rise in the

of mind, thus effectively failing to take into account their potential impact. If market participants are too optimistic in their expectations that past developments will continue, they may lean towards underestimating future credit risk whilst overestimating loss-absorbing capacity. Many market participants may then no longer take sufficient account of periods of crisis and downturn in their risk assessment. If a large number of market participants were to "gaze into the rear-view mirror" like this for too long and then follow each other's lead, the financial system could amplify negative macroeconomic developments.

The stability of the German financial system could then be particularly at risk if developments in the macroeconomic and financial environment prove to be much different to those expected. Such deviations would hit upon a number of vulnerabilities in the German financial system. Previous editions of the Financial Stability Review have shown that vulnerabilities have built up in a prolonged period of low interest rates and strong economic growth. These vulnerabilities include underestimating credit risk, overvaluing assets and loan collateral – for instance, for real estate – and the emergence of interest rate risk as a result of maturity transformation by financial institutions.

An unexpected, severe economic slump is likely to entail a considerable correction of asset prices, thus exposing several of the vulnerabilities cited above simultaneously. Rising losses from credit defaults and

The stability of the German financial system could be at risk if developments in the macroeconomic environment prove to be different to those expected.

heightened risk provisioning would mean falling values of assets and loan collateral. Losses would eat into banks' available capital buffers.

Whether and to what degree unfavourable macroeconomic developments are amplified by the financial system depends heavily on the financial system's

Whether unfavourable macroeconomic developments are amplified depends on the buffers in the financial system.

buffers against losses. This is due to numerous microprudential regulatory measures that have already been implemented or are to be implemented in the near future as well as to the additional capital buffers for systemically important banks.

However, the vulnerabilities cited above are not limited to individual banks; they affect the entire banking system. There is thus a risk of many banks responding to unforeseen developments at the same

Vulnerabilities are not limited to individual banks; they affect the entire banking system.

time in order to meet the capital requirements imposed on them by the supervisory authorities or the market. However, in an economic downturn with the potential associated losses, banks are barely able to build up capital internally. And, in such a scenario, raising new capital on the market would probably also only be possible with great difficulty. The only remaining option for banks would be to scale back liabilities (deleveraging) in order to stabilise capital ratios.

As a result, the banking system might excessively curb lending or reduce existing lines of credit.

The financial system could amplify an economic downturn.

It would then fall short of fulfilling its key role

in the economy (see the chapter entitled "Risks in the banking sector" on pp. 69 ff.). Deleveraging by the financial system could amplify an economic downturn.

During such a downturn, these procyclical effects could be intensified further by interest rate movements. If interest rates were to spike suddenly, this might mean losses, in particular for small and medium-sized banks. Some of these institutions have sharply expanded their maturity transformation in recent years. Other areas of the financial system, such as the insurance and investment fund sector, could also trigger a procyclical effect if they respond to sharp interest rate rises by changing their investment behaviour (see the chapter entitled "Risks for insurers, pension institutions and investment funds" on pp. 83 ff.). But if interest rates were to remain low, this would also continue to exert pressure on the entire financial system, as shown in previous editions of the Financial Stability Review.¹

Procyclical effects could be intensified by interest rate movements.

Overall, the risk situation suggests substantial cyclical risks. The aim of macroprudential supervision is to recognise dangers to financial stability at an early stage. It is precisely when the economy is in good shape that sufficient protection against unexpected developments should be built up. It is thus in every market participant's interest to be prepared for unexpected developments and ensure adequate debt sustainability. One focus of macroprudential oversight is on ensuring that capital buffers are adequate to bear cyclical risks.

When the economy is in good shape, sufficient protection against unexpected developments should be built up.

¹ See, inter alia, Deutsche Bundesbank, Financial Stability Review 2016 and Deutsche Bundesbank, Financial Stability Review 2017.

Risks to the stability of the German financial system

The robust global economic growth continued last year. The International Monetary Fund (IMF) expects growth rates to remain high. In contrast to last year, however, downside risks to the global economy have risen.

Downside risks to the global economy have risen.

On the one hand, many countries are already at a mature stage of the economic cycle; capacity utilisation in the economy has already reached the longer-term average or even exceeded it. On the other hand, in many countries, vulnerabilities have built up in the financial sector. Public and private debt are close to their all-time highs in global terms. Individual countries' scope to use fiscal measures to cushion the negative effects from a potential economic downturn may thus be limited by waning confidence in their debt sustainability.

Given this backdrop, if trade disputes were to escalate, this would have both a direct and an indirect impact on the real economy via confidence effects in the financial markets: a declining risk appetite among market participants can have a negative impact on financing conditions, possibly lowering both consumption and investment.

Negative macroeconomic developments from abroad may spill over to the German financial system, hitting upon a number of existing vulnerabilities.

Underestimating credit risk

The number of enterprises and individuals in Germany that have filed for bankruptcy has fallen thanks to the upbeat economic conditions that have been in place for many years. This fall in credit risk can be seen in

low risk provisioning by banks and reduced regulatory capital requirements. This is true, in particular, for large, systemically important institutions that use their own models for risk assessment. Lower risk assessments and reduced levels of risk provisioning have contributed to the increase in banks' capital ratios.

The fall in credit risk can be seen in low risk provisioning by banks and reduced regulatory capital requirements.

These low risk assessments have made the banking sector susceptible to a scenario in which credit risk suddenly soars – for instance, in the event of an unforeseen economic downturn coupled with higher insolvency rates. If such a scenario were to arise, the banks' capital buffers could come under pressure from losses as a result of credit defaults. In addition, rising risk weights could also push up capital requirements (see the chapter entitled "Risks in the banking sector" on pp. 69 ff.).

Overvaluing assets and loan collateral

Underestimating credit risk is closely connected with a possible overvaluation of loan collateral. It is precisely in light of the prolonged phase of low interest rates that the valuation of finan-

The valuation of financial assets is currently above average.

cial assets is currently above average. Risk premia in the international financial markets are low. If the global economy takes a turn for the worse or if political risks materialise, this could trigger a rise in risk premia in the financial markets and a clear decline in asset values.

A fall in the current high valuations of real estate, in particular, could hit the German financial system hard. Loans for house purchase account for more than half of all loans to domestic households and en-

terprises in the German banking system. The share of new loans for house purchase to households with an interest rate lock-in period of over ten years has risen from 26% at the start of 2010 to 45% of late. The growth rate in loans for house purchase to domestic households, which has been rising continuously since 2010, stood at 4.4% at last count. It is below its long-term average of 4.8%, which does not seem unusual compared to economic developments. Furthermore, household debt amounts to around 50% of gross domestic product (GDP) and has remained virtually unchanged over the past few years. At the same time, according to revised estimates, the continuing rise in residential property prices since 2010 led to an overvaluation of between 15% and 30% in German towns and cities in 2017. There are also indications that lending standards for loans for house purchase have eased slightly in 2018. All in all, the available data currently do not point to any substantial risks to financial stability arising from new housing loans.

Given the dynamic price trend and the current regional overvaluations of residential properties, there is,

The value of loan collateral may be overestimated.

however, a danger that the value of loan collateral is being overestimated. In the event of significant price corrections, the income from real estate sales may not be enough to cover the losses arising from credit defaults. A stress test shows that an economic slump and falling real estate prices would hit the real estate loan portfolio of some German banks hard (see the section entitled "Impairment of loan collateral would additionally increase pressure on banks" on pp. 61 f.).

Interest rate risk as a result of maturity transformation

Ultimately, an unexpected, sharp economic downturn would hit the financial system at the end of a

protracted period of low interest rates – unlike in previous downturns. Both an unexpected interest rate hike and a continuation of the low interest rate environment could intensify the vulnerabilities of the financial system.

If interest rates were to spike suddenly, banks' refinancing costs would go up shortly afterwards. German banks have considerably expanded their maturity transformation over the past few years; the interest rate lock-in periods for their assets significantly exceed those for their liabilities. As a result, when interest rates go up, there is likely to be a delay before interest income follows suit. There would also have to be a sufficient volume of new business to ensure that interest income improves. However, if an abrupt rise in interest rates were to coincide with a severe economic downturn, demand for loans is likely to fall, making it difficult to drum up new business. Such a hike would also entail a repricing of many balance sheet assets and would put pressure on banks as a result of increased market risk.

Moreover, the impact of abrupt interest rate rises would be heightened by the fact that several sectors of the financial system would be affected at the same time. The life insurance sector tends to have a stabilising effect as insurers do not need to respond to temporary market movements immediately thanks to the long-term nature of their business models. However, the life insurance sector is not immune to risks from an unexpectedly large interest rate hike.

The life insurance sector is not immune to risks from an unexpectedly large interest rate hike.

Unlike with banks, the value of life insurers' liabilities would fall faster than that of their assets due to the longer interest rate lock-in periods. Yet, if interest rates are much higher, policyholders have an incentive to lapse their policies and thus withdraw

funds from insurers. As the surrender values of life insurance policies are independent of the market interest rate, if interest rates were to rise sharply, these policies would probably no longer be fully backed by assets (see the chapter entitled "Risks for insurers, pension institutions and investment funds" on pp. 83 ff.).

If the economy were to take an unexpected turn for the worse, the interest rate level could also continue to hover around the zero bound. As shown in previous editions of the Financial Stability Review, persistently low interest

Persistently low interest rates would add to the further build-up of existing vulnerabilities.

rates would continue to exert pressure on the entire financial system and add to the further build-up of existing vulnerabilities. Life insurers and German institutions for occupational retirement provision would still have to face up to the challenge of funding their large stock of long-term liabilities with high guaranteed returns. Even in the past, capital investment income was often not enough to cover the expenses of setting aside the provisions required. On many occasions, they had to resort to releasing valuation reserves. Banks may extend their maturity transformation even more and thus further increase their vulnerability to a rise in interest rates.

All in all, if interest rates stay low, market participants would have an incentive to invest in riskier assets. The current extremely favourable refinancing conditions could also encourage those participants who would not increase borrowing if interest rates were higher to step up borrowing activities. High global indebtedness and the elevated valuation level in the international financial markets could go up even further.

These credit, real estate and interest rate risks can reinforce one another within the financial system since financial market players are closely connected

with each other and with the real economy. This interconnectedness allows the financial industry to fulfil its main functions:

financing the economy, ensuring that payment systems function smoothly and diversifying risk. However, this interconnectedness also harbours a risk of contagion.

Interconnectedness within the financial system harbours a risk of contagion.

Other market players may be directly affected through contractual obligations. If one contracting party incurs losses and does not have sufficient own funds to cover these losses, this will have a knock-on effect on its business partners. However, contagion can also take place via indirect channels: if market prices plummet, market participants in similar lines of business may be affected, too. In this manner, investors may lose confidence in entire market segments. Anyone active in a market will then suffer as a result.

■ Need for macroprudential action

The aim of macroprudential policy is to recognise dangers to financial stability at an early stage and to take prompt measures to keep the financial system up and running. Especially when the economy is less favourable,

financial institutions should hold sufficient capital to cover the risks they take. Moreover, adequate capitalisation is essential to ensure that banks can perform their function in the financial system smoothly, lend to the real economy, and thus ultimately help promote economic growth. Sufficient buffers against losses in economically tougher times therefore need to be built up when the economy is in good shape.

Capitalisation is essential to ensure that banks can perform their function in the financial system smoothly.

Overall, the three main vulnerabilities of the German financial system – underestimating credit risk, overvaluing assets and the emergence of interest rate risk – suggest that there are substantial cyclical risks. The continuing economic boom and low interest rates might cause risks to be underestimated. This applies not only to the financial system, but to all sectors of the economy – households and the public sector, enterprises and financial institutions alike.

Overall, the risk situation suggests there are substantial cyclical risks.

Building up resilience against unexpected events

Especially given that the favourable macroeconomic environment could deteriorate, market participants should critically examine their risk management and work on strengthening their resilience as needed. When making decisions, they should therefore pay sufficient attention above all to scenarios that could lead to large losses. This applies especially to political risks, such as the possibility of a “hard Brexit” (see the box entitled “Brexit” on pp. 18 f.).

Market participants should pay sufficient attention to scenarios that could lead to large losses.

Market participants should check whether their financing models are sustainable even if conditions deteriorate unexpectedly. However, identifying and addressing systemic risk is first and foremost a task for macroprudential policymakers because, owing to its very nature, individual market participants are unable to take it fully into account.

Cyclical risks require preventive action

Adequate capital buffers reduce the danger that contagion in the financial system intensifies cyclical

risks. From the point of view of financial stability, it is therefore a welcome development that German banks have significantly topped up their capital in recent years. Stricter microprudential requirements and additional capital buffers, such as those for systemically important banks, have contributed to this. It is one of the main tasks of macroprudential policy to ensure that the financial system maintains sufficient buffers.

However, the existing buffers may not be enough to limit contagion effects within the financial system or negative feedback effects to the real economy. As things stand, there is a danger that credit risk, real estate risk and interest rate risk may occur at the same time, reinforce each other, and lead to herding behaviour in the financial system. As a result, action is needed from a macroprudential perspective as the German banking system could intensify an unexpected economic slump by scaling back its lending. After the financial crisis, macroprudential policy was established and equipped with suitable instruments to take preventive action against cyclical risks to financial stability. These include “soft” instruments, such as warnings and recommendations, as well as macroprudential capital buffers.²

Credit risk, real estate risk and interest rate risk may occur together and lead to herding behaviour in the financial system.

In other European countries, national macroprudential policy, too, has uncovered evidence pointing to the build-up of cyclical risks. In some cases, this evidence is mounting and has already led to macroprudential measures (see the section entitled “Some countries are addressing cyclical vulnerabilities” on pp. 50 ff.).

² See Deutsche Bundesbank, Financial Stability Review 2016, pp. 22-24.

Availability of data on the housing market needs further improvement

The real estate market plays a key role in the monitoring of risks to financial stability. To comprehensively assess the risk situation, detailed information is needed about developments in property prices, the debt levels of investors – and especially those of households – as well as lending conditions. However, when it comes to systematically capturing some of these indicators, Germany remains near the bottom of the league in Europe. As mentioned in previous editions of the Financial Stability Review, this makes it harder to appropriately monitor and potentially respond to developments in the real estate market.

The availability of data on housing loans therefore still needs to be improved. To identify systemic risk at an early stage and perform impact analyses before and after applying instruments, macroeconomic information is not enough on its own. It needs to be supplemented with disaggregated data. For housing loans, and particularly for the lending standards that apply to them, data of this kind have so far mostly been unavailable or of insufficient quality in Germany.

Disaggregated data are required to identify systemic risk from the housing market at an early stage and perform impact analyses.

I The international environment

Global economic growth is continuing and is conducive to a slow increase in the interest rate from a still low level. Monetary policy normalisation is progressing in the United States in particular, whereas in the euro area the process is still in its infancy. If the macroeconomic environment develops in line with market expectations, this should ultimately have a stabilising effect on the financial system.

However, if international trade disputes escalate or the United Kingdom leaves the European Union in a disorderly process, this could also have a substantial impact on the financial system. With regard to political events, market participants should make adequate preparations for various scenarios.

Risks in the international financial system could also materialise if interest rates see an unexpected rapid and strong increase, for example, on account of increased risk premia. An abrupt rise in interest rates could lead to refinancing difficulties and increasing credit losses, above all in those countries and sectors which have seen a significant increase in their debt levels over the past few years. In many emerging market economies, private sector debt has risen considerably. Around the world, government debts have also expanded in many quarters. A number of emerging market economies have already displayed these vulnerabilities over the course of 2018. Thus far, though, such vulnerabilities have been relatively isolated and country-specific and have resulted from weak macroeconomic fundamentals and high levels of political risk.

Interest rates could also remain low if the economic setting were to deteriorate unexpectedly, for example. Against such a backdrop, a combination of persistently low interest rates and high risk appetite could contribute to investors incurring excessive risks and a further intensification of vulnerabilities. Buffers should be created in good time against unexpected developments, and it should be established whether financing models are sustainable even in troubled times.

The German economy is vulnerable to shocks from abroad

Risk emanating from the international environment increased in the second half of 2018, compared with the beginning of the year. The trade dispute between the United States and China expanded increasingly after ever higher and more extensive tariffs were levied tit-for-tat. The exchange rates in a number of emerging market economies (EMEs) came under considerable pressure. As the date for the planned withdrawal of the United Kingdom from the European Union draws closer, the resultant uncertainty has been increasing (see the box entitled “Brexit” on pp. 18 f.). In addition, risk premia and the volatility of Italian government bonds rose once more at the end of September as the new Italian government presented the key points of its budget plan.

The robust global economic growth to date has contributed significantly to an environment in which negative shocks can be absorbed relatively well. However, vulnerability is particularly heightened in the very countries which have high levels of debt. Here, a normalisation of the interest rate level and rising risk aversion in the financial markets may be enough to have a dampening effect on real economic investments and consumption. In such a situation, the private sector players in the financial and economic system might react especially strongly to additional political risk, and even more so if multiple risks occur simultaneously. In the current environment of low macroeconomic uncertainty, unexpected developments could find many market participants unprepared, meaning that they are more strongly affected (see the box entitled “Macroeconomic uncertainty and risks to financial stability” on pp. 20 ff.).

In the current environment unexpected developments could find many market participants unprepared, meaning that they are more strongly affected.

normalisation of the interest rate level and rising risk aversion in the financial markets may be enough to have a dampening effect on real economic investments and consumption. In such a situation, the private sector players in the financial and economic system might react especially strongly to additional political risk, and even more so if multiple risks occur simultaneously. In the current environment of low macroeconomic uncertainty, unexpected developments could find many market participants unprepared, meaning that they are more strongly affected (see the box entitled “Macroeconomic uncertainty and risks to financial stability” on pp. 20 ff.).

The German financial system is highly interconnected, particularly with the euro area countries, the United Kingdom and the United States (see Table 2.1). International investments are just one channel through which cross-border interdependencies can develop. Via the real economy, the German financial system is also linked to developments in countries which receive German exports, including EMEs. Shocks from abroad can be directly or indirectly transmitted as a result of this interconnectedness. The probability of default of loans to enterprises domiciled in Germany, which are heavily geared towards export business, can also be strongly influenced by the situation of key trading partners. Additionally, changes in value chains, such as increased tariffs, may have a negative impact on Germany’s export-oriented economy. The activities of subsidiaries and branches can be important to the financial institutions themselves, as can access to international financial centres, where transactions are carried out via central counterparties or other financial services are offered.

When assessing the risk situation of a closely internationally interconnected financial system, therefore, not only domestic risks but also risks in the international environment should be taken into account.

Financial crises have often stemmed from a combination of domestic vulnerabilities and foreign shocks.

From a historical perspective, financial crises have often stemmed from a combination of domestic vulnerabilities and foreign shocks.¹ This is why it is of especial interest to open economies in particular that reforms aiming to boost

¹ Around 50 macroprudentially relevant crises have been documented for the current EU Member States in the joint financial crises database of the European Systemic Risk Board (ESRB) and the European Central Bank (ECB) published in 2017. Data were collected from 1970 to 2016 for each country individually. 13 crises were classified as “imported”, meaning that they originated abroad. A further 23 crises arose from a combination of foreign and domestic factors. See European Systemic Risk Board (2017).

the resilience of the financial system are tightly coordinated on an international level, and that a structured process is in place to assess their impact (see the box entitled “Evaluation of the G20 financial market reforms” on pp. 24 ff.).

Macroeconomic and financial environment

During the entire 2012 to 2016 period, global economic growth ranged from 3.3% to 3.6%, increasing to 3.7% in 2017.²

Economic momentum is set to continue at a practically unchanged rate over the next few years.

Economic momentum is set to continue at a practically unchanged rate over the next few years, according to

the projections of international organisations.³ This positive macroeconomic environment continues to be conducive to a slow increase in the interest rate from a low level.

Predominantly high utilisation of production capacity

According to International Monetary Fund (IMF) calculations, the output gap in the advanced economies has closed in the meantime. The aggregated real gross domestic product (GDP) for this group of countries is expected to expand faster than potential output both this year and next year.⁴

Accelerated growth of 2.9% is anticipated for the United States in 2018, not least on account of expansionary fiscal policy, following a rate of 2.2% in 2017.⁵ Growth in both the USA and the euro area has thus exceeded potential output. However, the growth rate in the euro area will probably decline noticeably in comparison with the previous year to 2.0%. Forecast growth rates in the euro area range

International investments of selected sectors in Germany*

Table 2.1

As a percentage of total international investments, as at end-Q2 2018^P

Debtor	Creditor		
	Monetary financial institutions (excl. central bank) ¹	Other financial corporations	Non-financial corporations and households ²
France	2.6	4.0	1.5
Italy	1.0	1.0	0.5
Netherlands	1.8	4.0	3.3
Spain	0.7	1.2	0.9
Other euro area countries	4.4	8.5	7.0
United Kingdom	5.6	2.3	2.1
United States	3.0	4.3	2.7
Total	26.0	32.5	23.9

* Total international investments according to the international investment position: €8,588 billion. This includes direct investment, portfolio investment, financial derivatives and employee stock options as well as other investment such as loans and deposits. **1** Banks (incl. building and loan associations) and money market funds, although money market funds account for less than 0.1% of total international investments. **2** Including non-profit institutions serving households.

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from 1.2% in Italy to 5.7% in Malta. In the EMEs, aggregated economic output in the current year will probably increase roughly as strongly as in the preceding year to an expected 4.7%, whilst a slight decline of 0.3 percentage point is expected for China (to 6.6%).

² See International Monetary Fund (2018a). The data here are based on aggregated national GDP data, which were combined using purchasing power parity exchange rates.

³ See, for example, International Monetary Fund (2018a).

⁴ See International Monetary Fund (2018a).

⁵ The fiscal stimulus will be considerable between 2018 and 2020, at around 1.25% of GDP in each year. See Deutsche Bundesbank (2018a), pp. 14 ff.

Brexit

Following the referendum in June 2016, the UK government announced that the United Kingdom would be leaving the European Union on 30 March 2019. Since then, both sides have been conducting negotiations to settle the withdrawal arrangements, a possible transition period and key aspects of their future relationship. The UK's economic and financial system is closely intertwined with the remaining EU Member States, which entails an inherent risk of frictions once the current legal framework ceases to apply. At the time of writing, it is still not certain whether the necessary provisions to ensure an orderly transition will come into force in time. Furthermore, it should not be assumed that all issues set to arise in future can be foreseen at this stage.

In July 2018, the European Commission advised Member States and relevant institutions to take preparatory measures and draw up contingency plans for crisis scenarios. This advice was also directed at private non-financial corporations. In an unfavourable scenario, the goods sector could run into difficulties arising from border controls and an end to the mutual recognition of product licences, for instance.

In the financial services sector, the Commission moved quickly to issue concrete warnings to market participants of the possible need to take action.¹ If the United Kingdom is merely accorded third-country status in future, any EU operating licences issued there for the following types of entities will become invalid:

- credit institutions, insurance corporations, occupational pension funds and asset management companies;

- financial market infrastructures, in particular central counterparties for the clearing of derivatives;
- external auditors, credit rating agencies and other enterprises whose activities fall within the scope of MiFID.²

Unless special exceptions are put in place, if the activities of the UK financial industry are to be continued as before in the future EU27, businesses will need to relocate – either to pre-existing or yet to be created subsidiaries, or else to legally dependent branches within the jurisdiction of the EU. These branches would generally need to complete a new licensing procedure conducted by the supervisory authorities, however. By the same token, the future EU27's financial industry will lose the access to the United Kingdom that has thus far been guaranteed by the EU passporting system. In the absence of any transitional provision or recognition of UK clearing houses, this legal situation would prove detrimental, particularly given the overriding global significance of these firms.

Up to early November 2018, financial market indicators were signalling a relatively relaxed risk situation in relation to Brexit. Given the broadly high appetite for risk that has been evident in the macro-financial environment so far, it is not in-

¹ See FISMA, https://ec.europa.eu/info/brexit/brexit-preparedness/preparedness-notices_en#fisma

² Directive 2014/65/EU of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments, OJ L 173, 12 June 2014, pp. 349-496 (MiFID II), and Regulation (EU) No 600/2014 of the European Parliament and of the Council of 15 May 2014 on markets in financial instruments, OJ L 173, 12 June 2014, pp. 84-148 (MiFIR).

conceivable that market participants' perception of the risk associated with Brexit could prompt an abrupt revaluation.

As far as Germany is concerned, supervisory information suggests that many market participants have already begun making plans and preparations for their own business operations. The resilience of systemically important institutions has been a key point of focus from an early stage. A particularly unfavourable scenario would leave financial institutions simultaneously exposed to strain from multiple angles. In addition to a shock to the real economy entailing credit defaults and impaired assets – as a result of negative confidence effects and rising risk premia, for instance – these entities would have to bear additional costs associated with relocating and reorganising their business activities. In extreme

cases, some activities might have to be discontinued altogether on account of bottlenecks, waiting times and an absence of the appropriate permits. Financial institutions should prepare for such an eventuality. They should also inform their customers and creditors about the specific risks they can foresee and how their preparations are progressing. All things considered, market participants should take precautions for the possibility of the United Kingdom leaving the EU in a disorderly process come March 2019.

In keeping with the economic conditions, consumer prices in many advanced economies and EMEs are rising.⁶ On an annual average in 2018, the US con-

In keeping with the economic conditions, consumer prices in many advanced economies and EMEs are rising slightly.

sumer price index could increase by 2.4%, whilst a rise of 1.7% is anticipated for the euro area. Inflationary effects stem from rising crude oil

prices. In addition, the unemployment rate is declining in most countries, meaning that wage inflation pressures are likely to increase.

Environment conducive to gradual rise in interest rates

The monetary policy divergence between the United States and the euro area has increased further.

The US Federal Reserve raised its policy rate in March, June and September 2018, meaning that it most recently ranged from 2.00% to 2.25%. At the same time, the Fed reduced its holdings of Treasury paper and mortgage loans by around US\$300 billion between October 2017 and October 2018. The Eurosystem implemented its decision of October 2017 and made additional bond purchases in the secondary market amounting to €30 billion per month up to September 2018. It held out the prospect that, following a reduction in monthly net purchases to €15 billion from October to December, further purchases would be made for an indefinite period of time for the sole purpose of reinvesting maturing securities. The main refinancing rate in the Eurosystem still stands at 0%, and the deposit rate is -0.4%.

⁶ See International Monetary Fund (2018a).

Macroeconomic uncertainty and risks to financial stability

The German economy is going through an extended spell of economic expansion (see the chapter entitled “Risk situation of the German financial system” on pp. 41 ff.). The upbeat state of the economy is reflected in many measures used to gauge uncertainty in the real economy and in financial markets. The low uncertainty levels suggest that there is currently a strong consensus in market participants’ forecasts and that the dispersion of their forecast errors is perceived to be minimal by historical standards (see Charts 3.2 and 3.3 on p. 43). This development has a bearing on financial stability on two counts.

First, excessive optimism about future economic developments might lead many market participants to believe that there is a case for lowering their risk provisioning or dismantling their voluntary capital buffers.¹ Also, financial market agents, enterprises and households could have an increased propensity to invest in riskier assets or projects. Both would increase sensitivity to unforeseeable shocks at the individual and the aggregate level, which can have an impact via multiple channels. On the one hand, risk-bearing assets lose more value than safe ones during adverse economic spells. On the other, market participants need to exercise greater caution when tapping into their risk buffers when times are hard. For instance, banks might cut back their lending (deleveraging) or enterprises could invest less.

Second, when low uncertainty levels coincide with a booming economy, more market participants will tend to gear their activities to similar (individual) forecasts. Thus, a large number of agents could be caught off guard if a negative

event materialises. Because they all respond in a similar way, this will generate a stronger response at the macroeconomic level. There is research which suggests that monetary policy shocks impact more strongly on the financial system and real economy in times of low uncertainty.² In addition, theoretical models and empirical studies indicate that an environment characterised by low volatility can incentivise private economic agents to take greater risks.³

The relationship between changes in expectations and subsequent macroeconomic developments is documented in the literature, which finds that more optimistic expectations lead to higher growth (in the short term) and lower risk premia on risky assets.⁴ There is also a broad body of theoretical and empirical research showing

¹ See H. Minsky, *The Financial Instability Hypothesis: An Interpretation of Keynes and an Alternative to “Standard” Theory*, Challenge, Vol. 20, No 1, pp. 20-27, 1977; and P. Bordo, N. Gennaioli and A. Shleifer, *Diagnostic Expectations and Credit Cycles*, *Journal of Finance*, forthcoming.

² For the United States, see, inter alia, S. Eickmeier, N. Metiu and E. Prieto, *Time-varying volatility, financial intermediation and monetary policy*, Deutsche Bundesbank Discussion Paper No 46/2016; K. A. Aastveit, G. J. Natvik and S. Sola, *Economic Uncertainty and the Influence of Monetary Policy*, *Journal of International Money and Finance*, Vol. 76.5, 2017; and G. Pellegrino, *Uncertainty and Monetary Policy in the US: A Journey into Non-Linear Territory*, Melbourne Institute Working Paper No 6/17. For the euro area, see G. Pellegrino, *Uncertainty and the Real Effects of Monetary Policy Shocks in the Euro Area*, *Economics Letters*, Vol. 162(C), pp. 177-181.

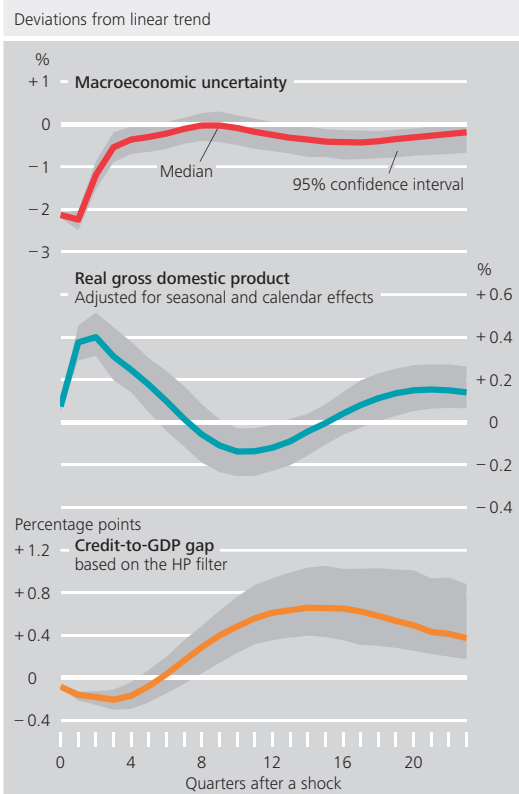
³ See J. Danielsson, M. Valenzuela and I. Zer, *Learning from History: Volatility and Financial Crises*, *Review of Financial Studies*, forthcoming; and S. Bhattacharya, C. Goodhart, D. Tsomocos and A. Vardoulakis, *A Reconsideration of Minsky’s Financial Instability Hypothesis*, *Journal of Money, Credit and Banking*, Vol. 47, pp. 931-973, 2015.

⁴ See A. Popescu and F. Smets, *Uncertainty, Risk-taking, and the Business Cycle in Germany*, *CESifo Economic Studies*, Vol. 56, No 4, pp. 596-626, 2010; and P. Beaudry and F. Portier, *News-Driven Business Cycles: Insights and Challenges*, *Journal of Economic Literature*, Vol. 52, No 4, pp. 993-1074, 2014.

that changes in macroeconomic or firm-specific uncertainty impact directly on the real economy.⁵ A new empirical panel study for 60 countries (based on a period of more than 200 years) concludes that deviations in financial market volatility from its long-term trend significantly raise the likelihood of a crisis in the future. The panel study also observes that below average volatility is far better at predicting crises than above average volatility.⁶

What is particularly relevant from a financial stability perspective is the path followed by variables identified in the literature as being indicators of crises. This box will therefore proceed with an empirical analysis of how a decline in uncertainty in the real economy and among financial institutions in Germany, in particular, impacts on

Impulse responses to an uncertainty shock in Germany



Sources: Bank for International Settlements (BIS), European Commission, Eurostat, Ifo Institute for Economic Research in Munich (based on C. Grimme and M. Stöckli, Measuring Macroeconomic Uncertainty in Germany, CESifo Forum 19, pp. 46-50, March 2018) and Bundesbank calculations.

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⁵ See N. Bloom, The Impact of Uncertainty Shocks, *Econometrica*, Vol. 77, pp. 623-685, 2009; R. Bachmann, S. Elstner and E. R. Sims, Uncertainty and Economic Activity: Evidence from Business Survey Data, *American Economic Journal: Macroeconomics*, Vol. 5, No 2, pp. 217-249, 2013; C. L. Ilut and M. Schneider, Ambiguous Business Cycles, *American Economic Review*, Vol. 104, No 8, pp. 2368-2399, 2014; D. Caldara, C. Fuentes-Albero, S. Gilchrist and E. Zakrajsek, The Macroeconomic Impact of Financial and Uncertainty Shocks, *European Economic Review*, Vol. 88, pp. 185-207, 2016; and Deutsche Bundesbank, Monthly Report, October 2018, pp. 49 ff.

⁶ See J. Danielsson, M. Valenzuela and I. Zer, Learning from History: Volatility and Financial Crises, *Review of Financial Studies*, forthcoming.

⁷ A structural vector autoregressive (SVAR) model is used with three endogenous variables ordered as follows: (i) uncertainty measure, (ii) real GDP and (iii) credit-to-GDP gap. The estimated reduced form residuals of the model are transformed into orthogonal shocks using a Cholesky factorisation of their covariance matrix. The impulse responses shown are those to the Cholesky shock in the equation for the measure of uncertainty. The SVAR was specified with four lags and estimated over the Q1 2000-Q3 2017 period.

⁸ See C. Grimme and M. Stöckli, Measuring Macroeconomic Uncertainty in Germany, *CESifo Forum*, Vol. 19, pp. 46-50, March 2018.

the real business cycle and the credit-to-GDP gap.⁷ A distinctly positive gap is interpreted as indicating an increased susceptibility to financial crises. Uncertainty is measured using an indicator which condenses information from more than 100 macroeconomic time series.⁸ This analysis reveals that an unexpected decline in uncertainty leads, with a small lag, to an upturn in the real economy and a positive widening of the credit-to-GDP gap. Real gross domestic product exceeds its long-term trend by as much as 0.4% for a period of six quarters (see the above chart). The response shown by the credit-to-GDP gap is also

significant and persistent,⁹ climbing to its highest value around three to four years after the shock. It can be concluded, then, that unexpectedly low macroeconomic uncertainty increases the likelihood of turmoil in the financial system.

The results are robust and do not change if other uncertainty indicators are used. These include the Ifo Institute's uncertainty indicator for the corporate sector, which captures the cross-sectional dispersion in the forecast errors of the firms included in the Ifo survey, and the VDAX, which reflects implied stock market volatility. The results are equally robust if other filtering methods (Hamilton filter with a forecast horizon of 8 or 18 quarters) are used to determine the credit-to-GDP gap.¹⁰ Lastly, the evidence is corroborated if the likelihood of crisis is used in the econometric model instead of the cred-

it-to-GDP gap. The likelihood of crisis was calculated using the Bundesbank's early warning model. When this measure is used, an unexpected decline in macroeconomic uncertainty is followed, with a lag of around four years, by a significant increase in the likelihood of crisis.¹¹

⁹ The most common method used to determine the credit-to-GDP gap is the Hodrick-Prescott filter (HP filter) with a smoothing parameter of 400,000. The gap thus constructed is used as the third variable. See N. Tente, I. Stein, L. Silbermann and T. Deckers, The countercyclical capital buffer in Germany, Deutsche Bundesbank, November 2015.

¹⁰ See J. Hamilton, Why You Should Never Use the Hodrick-Prescott Filter, Review of Economics and Statistics, forthcoming.

¹¹ For more information on the early warning indicator, see the box entitled "Early warning models: a historical perspective on the risk of a financial crisis" on pp. 47 ff.; and Deutsche Bundesbank, Financial Stability Review 2017, pp. 45 ff.

The US Federal Reserve's forward guidance has indicated an intention to hike interest rates further. At present, the members of the Federal Open Market Committee (FOMC) anticipate a median policy rate of almost 3.4% at the end of 2020. The interest rate path derived from market prices currently suggests that market participants are assuming the interest rate increase will be a little lower. This path will reach its peak in 2020 at around 2.8%. Even over a two-year period, market participants are expecting short-term deposit rates of close to 0% for the euro area.

The yield spread between US ten-year government bonds and corresponding Bunds widened (see Chart 2.1), but interest rates could converge once more on account of interna-

The macroeconomic environment is still conducive to a slow increase in the interest rate.

tional interest rate linkages. A further rise in the risk-

free interest rate in the United States could thus exercise upward pressure on interest rates in Europe, even if short-term monetary policy interest rates do not change in the euro area.⁷ However, continued robust economic development in the euro area and expectations that consumer prices will rise in the medium term are again helping interest rates to creep upwards.

The macroeconomic environment is thus not substantially different from last year. However, downside risks to economic developments have increased. Geopolitical tensions have intensified, trade disputes have broken out and are threatening to escalate, and the circumstances under which the United Kingdom will leave the EU are unclear.

⁷ See M. Ehrmann and M. Fratzscher (2005).

Framework of multilateral trade under stress

Growing protectionism represents one of the main threats to the favourable macroeconomic development still expected going forward. The trade dispute between the United States and China has expanded to ever more product classes and is threatening to escalate further. However, other economic areas are also being affected by the protectionist measures implemented by the US Administration. The majority of the countries affected have responded by raising tariffs on goods imported from the United States. Avoiding new trade barriers for cars is the subject of current talks between the EU and the USA.

If an escalated trade dispute were to trigger or exacerbate an economic downturn, this would also have consequences for the financial system. The latest stress test conducted by the European Banking Authority (EBA) sheds more light on the vulnerability of the European banking sector to demand shocks from abroad.⁸ Financial services have not been directly affected by trade disputes to date.

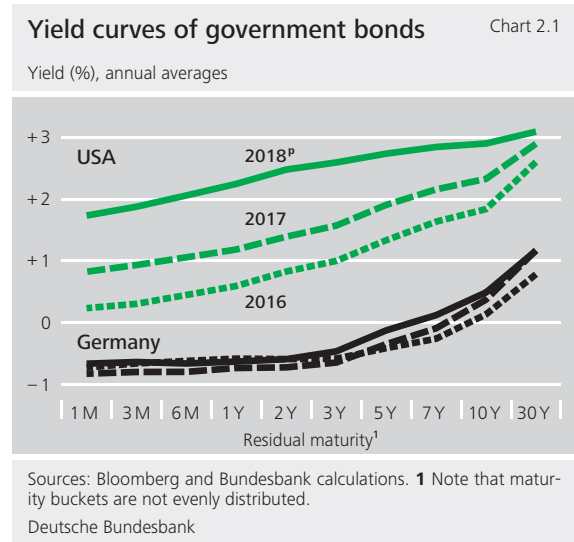
The German economy is closely involved in European

The German economy is closely involved in global value chains and thus vulnerable to protectionist developments.

and global value chains. This makes it vulnerable to protectionist developments. A significant escalation of trade disputes therefore has the potential to dampen growth in Germany considerably.

Potential disruption of value chains and increase in foreign exchange risk

Internationally traded products such as refined oil, computers and vehicles have a high import density. The value chain of these products in its entirety often



incorporates a large number of countries.⁹ Cross-border value chains have continued to grow increasingly important to the German economy over the past 20 years. This trend has been fostered by lower tariffs and decreased transportation and communications costs, as well as agreements on investment protection, rules on competition and the protection of intellectual property rights. Deeper integration within European economic and monetary union has also provided substantial impetus.

Protectionist measures would change and in particular shorten global value chains.¹⁰ It is difficult to gauge the macroeconomic impacts of adjusted value chains reliably, partly because the changes to the production processes are dependent on a multitude of different factors. This is particularly true of sectors in which production is shaped by a high degree of cross-border value chains.

⁸ See <https://www.eba.europa.eu/risk-analysis-and-data/eu-wide-stress-testing/2018>.

⁹ See M. P. Timmer, B. Los, R. Stehrer and G. J. de Vries (2016).

¹⁰ Model-based analyses show that measures to increase trade costs would reduce the scope of value chains and the degree of their specialisation. For examples of these models, see R. Johnson and G. Noguera (2017); P. Antràs and A. de Gortari (2017); and E. Lee and K. Yi (2018).

Evaluation of the G20 financial market reforms

The global financial crisis prompted the world's 20 most important advanced and emerging market economies (G20) to undertake an overhaul of international financial market regulation. The reforms are intended to make the global financial system and economy more resilient to crises whilst also enabling sustainable, robust growth and promoting open product and financial markets.

The far-reaching reform agenda has already been implemented in many areas. The time has now come, therefore, to review whether the regulatory objectives have been achieved, whether any side effects have emerged, and whether the right balance has been struck for society between the costs of regulation and the benefits associated with more stable financial markets. Looking at costs and benefits to society as a whole is intrinsic to this kind of analysis. Individual financial institutions often perceive regulation as a negative since it entails having to spend more on compliance or because increased financing costs make certain business models more expensive. For society, it is ultimately a positive if it takes pressure off the taxpayer and the financial sector bears the costs of crises itself.

Coordinating the preparation and implementation of the G20 reform agenda has been the task of the Financial Stability Board (FSB). The FSB's next step is to review the impact of the reforms. Comprehensive evaluation projects involving sophisticated analysis rely on a shared understanding of goals and consensus in relation to methodology and organisational matters. As a means of agreeing internationally accepted guidelines for these aspects, the FSB

developed a framework for post-implementation evaluation during Germany's presidency of the G20 in 2017.¹

Since then, two evaluation projects have already been undertaken on the basis of this framework, with interim results published for consultation in summer 2018.² The final results will be ready for when the G20 heads of state or government convene for their summit in Buenos Aires at the end of November.

The first project is investigating to what extent the G20 reforms provide incentives to centrally clear over-the-counter (OTC) derivatives. During the financial crisis, transactions cleared through central counterparties (CCPs) were less severely impacted by market disruption than bilaterally cleared transactions. The increased use of CCPs should also reduce systemic risk.³

The results of the consultation report show that there has been a strong increase in central clearing since the implementation of the reforms. This development is not purely the product of new clearing obligations for standardised derivatives, however. As there are also now higher regulatory capital and collateral requirements in place for bilaterally cleared transactions, bilateral clearing should generally become more costly than

¹ See Deutsche Bundesbank, Financial Stability Review 2017, pp. 14 f.

² See Financial Stability Board, Evaluation of the Effects of Financial Regulatory Reforms on Infrastructure Finance: Consultative Document, July 2018 and Financial Stability Board, Incentives to Centrally Clear Over-the-Counter (OTC) Derivatives, August 2018.

³ See Deutsche Bundesbank, Financial Stability Review 2016, pp. 79 ff.

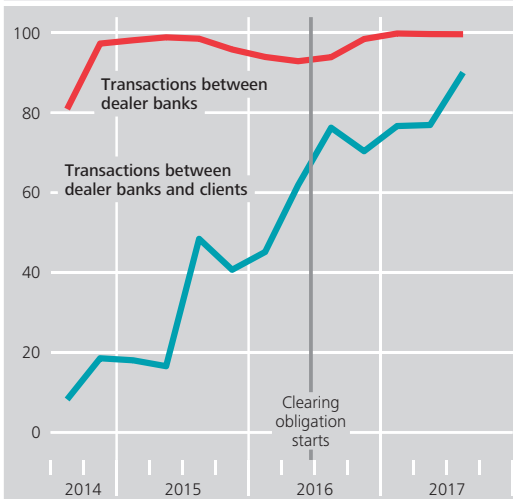
central clearing. This means that, particularly for larger market participants and those that are active on the derivatives markets, cost advantages create incentives to use CCPs for derivatives clearing. For smaller market participants, though, central clearing may remain unprofitable owing – in part – to higher fixed costs. The Bundesbank’s contribution to the report included analyses examining the transaction costs of euro-denominated interest rate swaps by German dealer banks. It found that central clearing is becoming a more attractive option in relative terms due to increasing cost advantages. This was a factor driving the growth in the proportion of transactions between dealer banks and clients cleared through CCPs coinciding with the progressive implementation of the reforms. For dealer banks, meanwhile, economies of scale meant that there were already benefits to be had in central clearing even before the reforms came into play (see the adjacent chart).

However, qualitative surveys show that some providers see certain regulatory provisions, like the leverage ratio, as an impediment to offering clearing services. There is therefore concern among some market players that the high degree of concentration in terms of clearing providers means that supply could be severely limited in the event of individual major providers of clearing services withdrawing from the market.⁴ The analyses showed, however, that economic factors not related to regulation play a central role when it comes to deciding whether to offer clearing services, such as the CCP’s business model or banks’ internal risk capital allocation.

On the demand side, too, other factors aside from regulation play into whether transactions are cleared bilaterally or centrally. For example, according to surveys, a higher degree of market

Central clearing of German dealer banks’ interest rate swaps*

As a percentage of total transaction volume for each counterparty type



Sources: DTCC and Bundesbank calculations. * New business in euro-denominated OTC interest rate swaps (fixed against six-month EURIBOR) reported by German dealer banks for the period under review (Q3 2014 to Q3 2017).

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liquidity for certain contracts plays an important role for some market participants.

The extent to which regulatory and non-regulatory factors interact and affect the incentives to clear centrally is an area requiring further investigation. The Bundesbank is therefore of the opinion that it is too early to derive any robust conclusion as to the need for regulatory changes from the results currently available.

The FSB’s second evaluation project is looking into the impact of the G20 financial regulatory reforms on the financial system’s function of financing the real economy. The work centres on

⁴ Looking forward, market participants cited a possible loss of access to UK clearing houses as a regulatory barrier (see the box entitled “Brexit” on pp. 18 f.).

two areas: first, the effect of relevant reforms on infrastructure financing provided by the financial sector and, second, the role of financial market regulation in terms of financing for small and medium-sized enterprises (SMEs). The evaluation concerned with infrastructure finance is nearing completion, while the inquiry on SME financing is scheduled to run until mid-2019.

The analyses on infrastructure finance focus on the impact of G20 financial market reforms which have already largely been implemented. The Basel III capital and liquidity requirements along with the OTC derivatives reform have been pinpointed as relevant here. The interim results contained in the consultation report published in July 2018 indicate that the reforms under review have so far been less influential for investment and financing decisions in the field of infrastructure than other factors. The analyses to date do not point to any significant effect attributable to the assessed reforms when it comes to the volume and costs of infrastructure finance. There were also indications that the reforms have contributed to shorter average maturities of infrastructure loans granted by global systemically important banks. This effect is not necessarily unintended, given that reducing maturity mismatches in credit institutions' balance sheets was one of the aims of the reforms.

Infrastructure financing remains heavily bank-based, but the share of market-based finance is growing, particularly in advanced economies. The G20 financial regulatory reforms have been identified as one of several possible drivers behind this development. Such a shift may exert stabilising effects on infrastructure financing if it leads to a greater diversity of funding sources.

The evaluation of the G20 financial market reforms is a large-scale overarching project that does not end with the projects outlined here. Work on the effects of the regulation of systemically important banks is set to begin at the start of 2019. The purpose of these reforms was to ensure that financial distress at large institutions can be dealt with without recourse to taxpayers' money. Systemically important banks should no longer be "too big to fail"; they should be resolved in an orderly fashion and able to exit the market without jeopardising financial stability. The key reform components meant to ensure this include higher loss-absorbing capacity, more intense supervision and the creation of resolution regimes.

Automotive sector only moderately affected to date

The German automotive sector is heavily involved in international value chains and would thus potentially be particularly affected by trade-restricting measures. In June, the US Administration started a process to introduce tariffs for cars amounting to 20%, which could also apply to imports from the European Union. Although such measures have not been implemented thus far, a tariff increase nonetheless remains a viable policy option for the US Administration. A recent study concludes that an import tariff of 25% on cars alone would reduce German GDP by €5 billion or 0.16%.¹¹

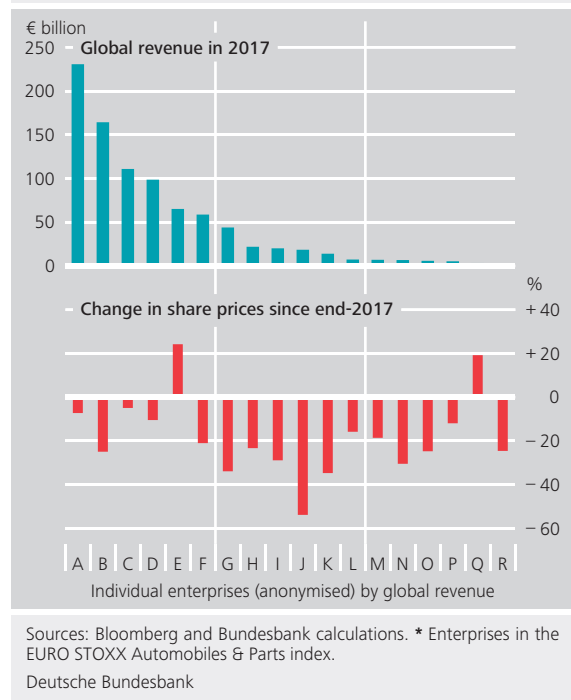
To date, the risk of an exacerbated trade dispute has made only a moderately negative impact on share prices and credit risk premia of enterprises in the automotive industry. However, the sector is currently being adversely affected by other factors. For the most part, the performance of share prices in the relevant European sector index has been weak, but not indicative of a crisis, since the start of the year (see Chart 2.2).

The US market accounts for between 15% and 30% of the global revenue of many of the enterprises in this index. The risk premia derived from credit default swaps (CDS) widened for the three largest German car manufacturers. Even at their peak, though, these premia did not reach a level that signalled an acute risk of default.¹²

Although an import tariff would reduce the profits of automotive corporations overall, it probably would not pose a threat to their solvency. However, it could potentially be more difficult for suppliers to cushion the blow from a shock resulting from

An import tariff would reduce the profits of automotive corporations, but probably would not pose a threat to their solvency.

Figures on euro area automotive sector enterprises* Chart 2.2



higher trade barriers than for larger manufacturers with sites in different countries.

Potentially substantial implications for the real economy

Alongside the immediate impacts on the value chains of individual sectors, macroeconomic effects and possible countermeasures must be considered.

A hypothetical scenario will therefore be examined below in which the United States levies an import duty of 20% on all products and its trading partners adopt symmetrical countermeasures. Model calculations by the Bundesbank suggest that such

¹¹ See G. Felbermayr (2018).
¹² Information on premia is based on CDS with a five-year maturity. Source: Bloomberg.

Foreign trade of countries with significant trade links to the USA and Germany*

Chart 2.3

2017 goods exports as a percentage of the exporting country's GDP



Sources: IMF and Bundesbank calculations. * Countries listed in descending order (except Germany) by relevance of potential US trade effects on Germany, simply measured as the product of the two export metrics. The chart shows the most relevant of the countries that had a GDP of more than US\$100 billion in 2017.

Deutsche Bundesbank

an event would result in a marked decline in GDP in many countries.¹³ Aside from the United States, those economies whose exports to the USA make up a high percentage of their own GDP would tend to be most affected by this scenario (see Chart 2.3).

With regard to the German economy, very diverse impacts can be identified depending on the model used. In calculations using the NiGEM macroeconomic model, moderately negative real GDP deviations of 1.4% compared with the tariff-free scenario occur after three years.¹⁴ Indeed, in a dynamic sto-

chastic general equilibrium model which only observes the interaction between Germany, the euro area and the United States, the GDP losses after three years amount to 4.7%.

Essentially, enterprises which export their goods to the United States would be directly affected by new tariffs. They would be confronted with higher costs, and as long as they attempted to pass these on to consumers, they would experience reduced demand. Against this backdrop, a deterioration in the credit quality of these enterprises could also be expected. Furthermore, the dampening effect on global growth would be reflected in reduced demand for other goods. Investment activity could also decline significantly.

Reduced demand and a fall in investment activity could also weigh on global growth.

Foreign exchange risk in global production networks

Foreign exchange risk presents a further challenge. Such risk arises when production is financed in a different currency to that of the earnings from the sales of these goods. Enterprises have various options for dealing with such risk. Three risk mitigation strategies implemented to differing degrees within the automotive industry, for instance, can be identified:¹⁵ (1) through financial instruments such as foreign currency debt and currency deriv-

¹³ See Deutsche Bundesbank (2017a), p. 77 ff., Scenario II b of the New Keynesian DSGE model and Scenario 2c of the NiGEM simulation.

¹⁴ NiGEM is the global economic model of the National Institute of Economic and Social Research (NIESR). It depicts most of the OECD countries as well as important emerging economies separately. The different countries are linked to each other via foreign trade as well as the interest rate-exchange rate nexus. The model has New Keynesian features as well as forward-looking elements on the financial and labour markets.

¹⁵ See S. Bartram, G.W. Brown and B. Minton (2010).

ative contracts, (2) through flexible adjustments to sales prices, whereby higher costs are passed on to customers, and (3) avoiding risk by relocating production to key sales countries or purchasing intermediate inputs in the currency in which the end products are to be sold (natural hedging). The remaining foreign exchange risk is then borne by the owners of the enterprise.

A comprehensive adjustment of international production structures to consistently increased trade barriers would change, inter alia, the financing structure of enterprises and the management of foreign exchange risk. Enterprises might be especially vulnerable to unbalanced payment flows on the revenue and expenditure sides during the adjustment process. An extreme scenario in which German enterprises are no longer able to pay their outstanding liabilities, however, does not appear particularly likely at present.

Possible confidence effects as well as changes in behaviour and policy

The scale of the potential repercussions for economic growth of an intensified trade conflict can ultimately only be roughly estimated. Generally speaking, the negative effects would be milder if enterprises were able to dodge the blow of higher tariffs by adjusting their business and production strategies. In some areas, it may also be possible to replace intermediate and finished products made more expensive by tariffs with similar products from other regions.

The impact of the trade conflict could be stronger if it is accompanied by increased risk aversion on the financial markets. This would be reflected not only in financial conditions, but also in growing restraint concerning investment and consumer spending decisions. There is also the risk of trade disputes escalating further if tariffs were to be raised repeatedly tit-for-tat.

Global macroeconomic and financial imbalances

In the past, systemic misalignments in the financial system often went hand in hand with an unusual increase in debt within an economy. A high level of debt increases the likelihood of the effects of macroeconomic shocks being amplified, tensions materialising at the same time and the diversification of risk tending to become less effective.

No all-clear signal for euro area debt

The Stability and Growth Pact and supplementary rules are in place to prevent Member States building up unsustainable levels of public sector debt. However, these rules do not govern private debt. This is why, in the wake of the global financial crisis, macroprudential policy was given an institutional basis to address developments in private debt as well. With a particular view to cross-border effects of debt crises, this framework stipulates not only national responsibility but also powers to monitor and intervene throughout the euro area. The central banks and competent supervisory authorities of the euro area liaise closely to regularly assess the risks stemming from dynamic developments in credit and asset prices as well as the suitability and adequacy of the available macroprudential instruments.¹⁶

Debt levels across the euro area Member States reveal a mixed picture. At the end of 2017, public sector debt exceeded 90% of GDP in seven countries, which is well above the 60% limit set by the Maastricht Treaty. Forecasts for three large countries –

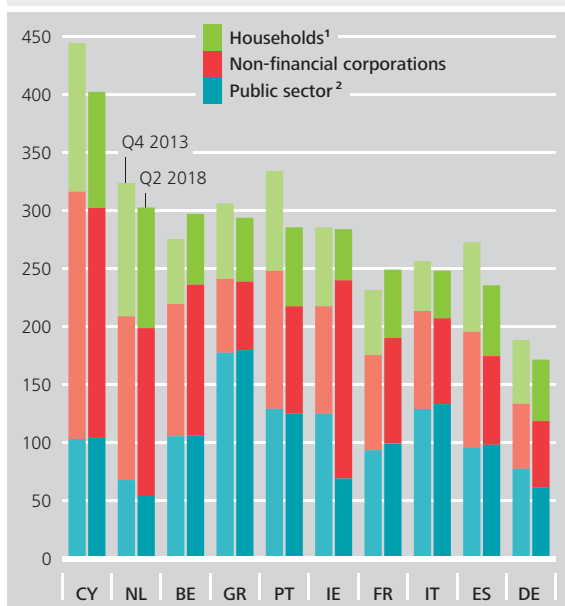
Debt levels across the euro area Member States reveal a mixed picture.

¹⁶ For an overview of current countercyclical capital buffer rates by country, see Table 3.1 on p. 53.

Debt of selected euro area countries in figures

Chart 2.4

As a percentage of GDP



Sources: Eurostat and ECB. **1** Including non-profit institutions serving households. **2** As defined in the Maastricht Treaty.

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Spain, France and Italy – project annual budget deficits of more than 1.7% of GDP from 2019 up until 2023.¹⁷

The current very low interest rates and the favourable economic setting could be used more rigorously to prepare government budgets to cope with future challenges. Lower debt levels provide the scope needed to ward off any shocks by fiscal means. If debt levels remain high, however, this scope is limited, as confidence in sustainable fiscal policy would dissipate all the more quickly in the face of crisis situations.

Concerns about future budgetary developments in Italy notably led to risk premia for Italian government bonds rising over the course of the year to their highest level since 2013. The government's GDP growth forecast for 2019, which was lifted to 1.5%, did not allay the doubts of many investors. Comments from

the coalition ranks indicating the option of a parallel currency added to the uncertainty. An index for Italian bank equities posted losses of around 30% between the end of April and early November 2018. This was probably partly down to deteriorating market sentiment possibly making it harder to rid bank balance sheets of the still high stocks of non-performing loans.

While foreign creditors reduced their share in Italy's total government debt from 33.4% in April 2018 to 30.8% in July, the Italian financial sector topped up its share from 45.2% to 47.8% over the same period.¹⁸ In the short term, this helped to stabilise government bond yields in the summer months.

However, in the long run, the nexus between the government and domestic banks gives rise to the undesirable mechanics of uncertainty about the valuation of government bonds spilling over to the financial system. This problem is not unique to Italy. Due to the preferential regulatory treatment given to sovereign bonds, there is also no requirement to hold a risk-appropriate amount of capital against exposures to a government in the European Union countries.¹⁹

There are also risks attached to the debt of non-financial corporations and households (see Chart 2.4). Although private debt declined in the countries where it had been especially high prior to the financial crisis, such as Ireland, Spain

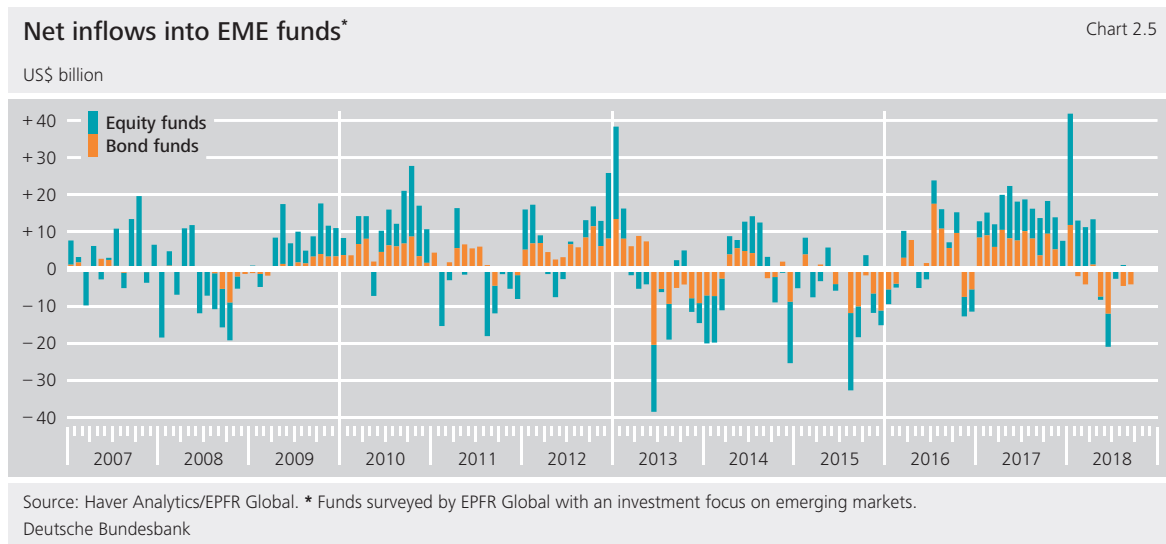
There are also risks attached to the debt of non-financial corporations and households.

and Cyprus, it has continued to rise for the past five years in Belgium and France, as has total debt. In the euro area as a whole, too, aggregate debt remains high. On a positive note, none of the larger and

¹⁷ See International Monetary Fund (2018a).

¹⁸ Source: Banca d'Italia, whose share rose from 16.3% in April 2018 to 16.8% in August 2018.

¹⁹ See Deutsche Bundesbank (2017b), pp. 31 f. and International Monetary Fund (2018b).



more highly indebted euro area countries are presently running a pronounced current account deficit, reducing their vulnerability to a change in refinancing terms.

Differing vulnerabilities of major EMEs

In the EMEs, economic growth since the global financial crisis has been accompanied by a sharp rise in debt. The particular combination of heavy reliance on regularly raising funding on the capital markets, macroeconomic imbalances and political conflict is creating a critical situation for a number of countries. Rising interest rates across the globe and a stronger US dollar could also markedly dampen credit financing as a driver of the economic growth seen thus far in the EMEs.

Inflows into equity and bond funds with an investment focus on EMEs serve as a readily available indicator of cyclical changes in financial conditions (see Chart 2.5). After substantial net inflows in 2017, both fund types saw net outflows from spring 2018. These outflows were explained partly by global events and partly by country-specific developments. Rising interest rates in the United

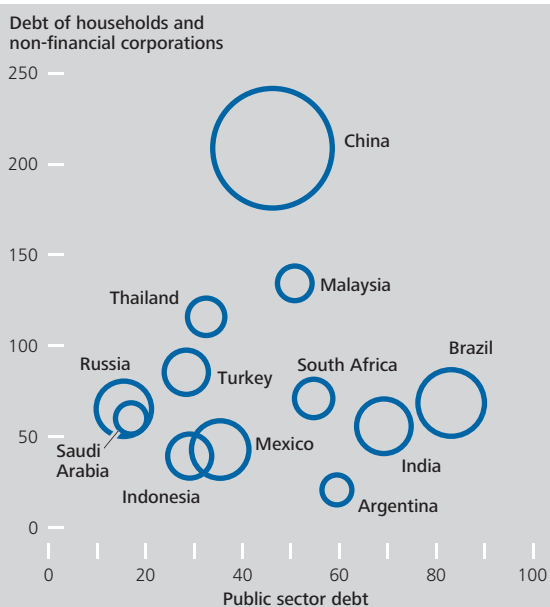
States and greater risk aversion, to some extent caused by an escalation of the trade conflict, are likely to have contributed to a reduction in capital flows to these countries.²⁰ A longer historical comparison puts the recent fluctuations into perspective. Since 2013 there have been multiple periods in which there were abrupt outflows from funds. The picture is much the same for the risk premia of many EME bonds; although these did indeed rise over the course of the year, they remained below the levels reached in early 2016.

Within the group of major EMEs, there are considerable differences in the nature and scale of macro-financial imbalances. Between 2008 and 2017, public sector debt rose particularly markedly in South Africa (+27 percentage points of GDP), Brazil (+22 percentage points) and China (+20 percentage points). At the end of 2017, the highest government debt ratios were those of Brazil (83% of GDP) and India (69%) (see Chart 2.6). Both of these countries have particularly high budget deficits, including this year (see Chart 2.7).

²⁰ For information on the influence of US interest rates, see, for example, M. Uribe and V. Z. Yue (2006) and V. Bruno and H. S. Shin (2015).

Debt for selected EMEs in figures* Chart 2.6

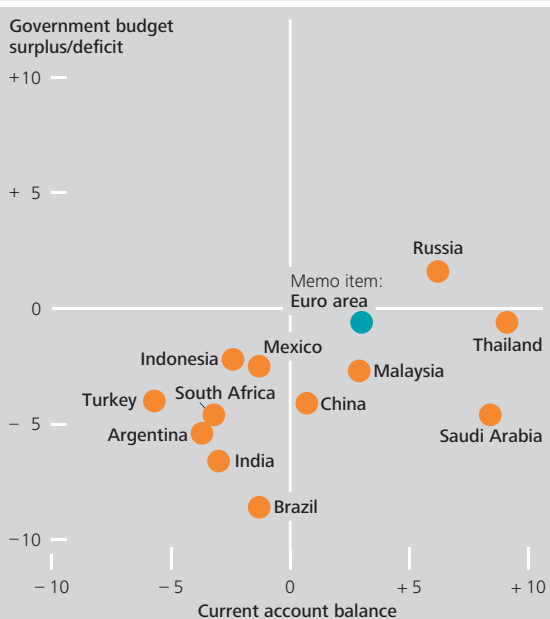
As a percentage of GDP, as at 31 December 2017



Sources: BIS credit statistics and IMF international investment position statistics. * The size of the circle indicates gross liabilities in the international investment position (absolute, e.g. China: approx. US\$5 trillion).
 Deutsche Bundesbank

Budget balances and current account balances of selected EMEs Chart 2.7

As a percentage of GDP; forecasts for 2018



Source: IMF, World Economic Outlook, October 2018.
 Deutsche Bundesbank

Private debt has also been rising continually over the past ten years in the EMEs, where the aggregate is 129% of GDP.²¹ This growth in fact centred on Asian economies. Of the major EMEs, growth in China is especially noteworthy (see Chart 2.6). Between 2008 and the end of 2017, private debt swelled from 114% of GDP to 209%. China's supervisory authorities have introduced a raft of measures to defuse systemic risks. In the event of an economic slowdown, however, it would be more difficult for Chinese policymakers to strike the right balance that would safeguard macroeconomic growth while avoiding excessive credit growth.²² Though government debt is middle of the range compared with its peer countries, the current budget deficit of just over 4% is already fairly high (see Chart 2.7).

A projected positive current account balance is one stabilising factor for China, and equally for Malaysia and Thailand; this will limit vulnerability to external funding shocks. In terms of the current account, the economies of Turkey and Argentina, in particular, reveal considerable imbalances. Dwindling investor confidence in Turkey is likely to have been exacerbated in the interim by doubts about the stability orientation of macroeconomic policy.

Owing to the country's absolute size and its position in world trade, an internal debt crisis in China, especially, would have the potential to trigger international turmoil. If the renminbi were to depreciate in a situation such as this, the detrimental effects on other countries could be even stronger.²³

For the EMEs as a group, there is the risk of negative developments in one country spilling over to others.

For the EMEs as a group, there is the risk of negative developments spilling over to other countries.

²¹ On the basis of US dollar conversions at purchasing power parities.

²² See also Deutsche Bundesbank (2018b), pp. 44 ff.

²³ See also Deutsche Bundesbank (2018b).

In an extreme case, investors would no longer differentiate between the individual countries, meaning that all countries in the group would be equally affected by a shock.

Aside from contagion via direct economic links, there could thus also be indirect contagion via information effects. In such a case, the crisis in one EME would prompt investors to reassess the risk situation in the group of EMEs as a whole. Risk premia would increase owing to the loss of confidence in such a scenario.

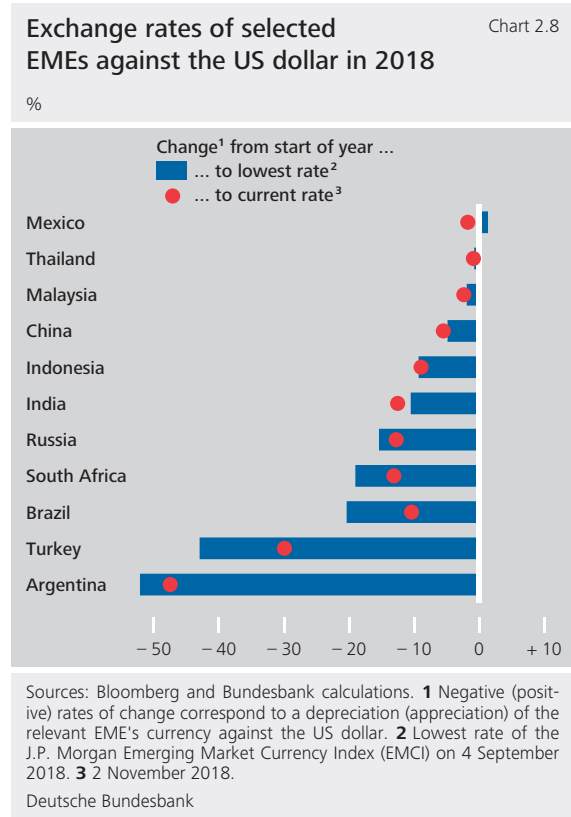
Macroeconomic fundamentals such as current account balances and foreign reserve assets have seen an overall improvement since the Asian crisis of 1997-98, reducing the risk of contagion between EMEs.²⁴ Differing exchange rate developments against the US dollar in the EMEs over the course of the year indicate that country-specific factors are of material relevance (see Chart 2.8). Even if raising external funding becomes a problem for Argentina and Turkey, and perhaps for South Africa and India as well, other countries with more stable macroeconomic characteristics could better absorb this kind of shock.

Falling asset prices could amplify shocks stemming from the macroeconomic environment

Financial conditions in the advanced economies are still very accommodative on the whole. An abrupt increase in risk-free interest rates could trigger a comprehensive reassessment of the risk/return profile in many market segments. Rising payments for debt service are a core vulnerability here.

Price slumps could be triggered by the materialisation of political risks.

Price slumps could also be triggered by the materialisation of political risks. For exam-



ple, uncertainty surrounds future economic relations between the United Kingdom and the European Union (see the box entitled "Brexit" on pp. 18 f.) as well as fiscal policy in certain countries.

In addition, stronger protectionist tendencies and uncertainty about the future of key multilateral agreements could hinder global growth. The perception of mounting risks is also reflected in the Global Economic Policy Uncertainty Index (EPU Index), which has been rising steeply since the start of 2018 and reached this year's peak in October.²⁵

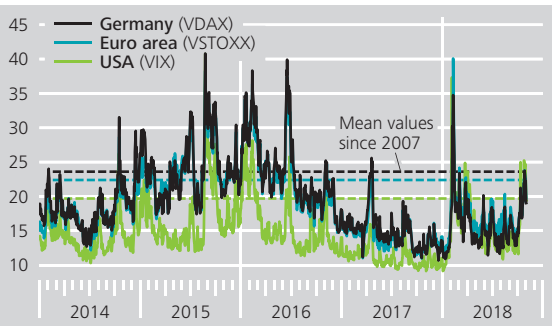
²⁴ See International Monetary Fund (2018b).

²⁵ The 20 countries in the global index are weighted by GDP at market exchange rates and on a PPP-adjusted basis. This year, the increase in the PPP-adjusted index was even more pronounced, not least due to the corresponding higher weighting given to China. The EPU Index captures the frequency with which uncertainty is discussed in newspapers by counting the mentions of certain keywords. See S.R. Baker, N. Bloom and S.J. Davis (2016); data from www.PolicyUncertainty.com

Implied volatilities on selected stock markets*

Chart 2.9

Daily data



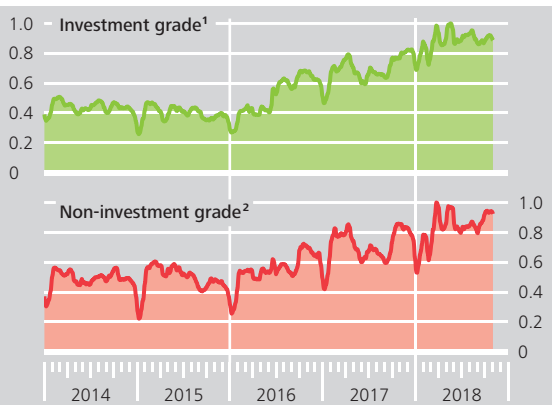
Sources: Bloomberg and Bundesbank calculations. * Derived from options prices.

Deutsche Bundesbank

Liquidity indicator for euro-denominated bonds issued by European non-financial corporations*

Chart 2.10

Daily data



Sources: Markit, ICE Data and Bundesbank calculations. * Higher values indicate improved market liquidity. The indicator's scale ranges between 0 and 1, with 0 representing the low and 1 the high in the period from August 2011 to October 2018. It is calculated using a principal component analysis for various single indicators (bid-ask spread, market efficiency coefficient, number of dealers quoting the bond averaged over one business day, and number of unique quotes received for an instrument over one business day). **1** Bonds placed by issuers with good credit quality and low default risk. **2** Bonds placed by issuers with poorer credit quality and higher default risk.

Deutsche Bundesbank

Significant drops in prices and market liquidity could set in suddenly

Over the past two years, implied stock market volatility has been well below its long-term average. This low volatility is a reflection of small risk premia and

optimistic investor sentiment. On the flip side, if volatility were to increase significantly, there could be considerable price drops and abruptly altered risk assessments. A development of this kind has been observed temporarily in recent months. In February 2018, implied stock market volatility briefly surged (see Chart 2.9). This is likely to have been triggered by the altered inflation expectations of market participants and the increased interest rate level in the United States. This example illustrates how changes in the macrofinancial setting can lead to abrupt adjustments in the financial markets. Whether or not a sudden price drop generally poses a risk to financial stability also depends on how much investors borrow in order to buy assets (see the box entitled "Asset valuation from a financial stability perspective" on pp. 36 ff.).

Changes in the macrofinancial setting can lead to abrupt adjustments in the financial markets.

In the bond markets, in particular, the drying up of market liquidity could magnify price volatility. However, this situation has improved in recent years during the protracted spell of low interest rates and high risk propensity. A broad liquidity indicator for European corporate bonds suggests that liquidity in both the investment grade and non-investment grade segments is high (see Chart 2.10). Even so, corporate bonds, which are largely traded over the counter, should still be regarded as less liquid than other asset classes such as government bonds.

Overall, monetary policy and macroeconomic conditions are contributing to a favourable liquidity situation. However, one factor that needs to be critically examined is whether market participants are being overly optimistic in assuming these conditions will persist in the future and are thus potentially falling prey to a liquidity illusion.

High valuations could indicate underestimation of risk

Risk premia for risky corporate bonds in the non-investment-grade segment in Europe and the United States are significantly lower than their long-term averages (see Chart 2.11). In the United States, this segment accounts for 8% of GDP, measured by outstanding volume, which is considerably more than in the euro area (around 3% of GDP), where enterprises obtain more funding through bank loans.

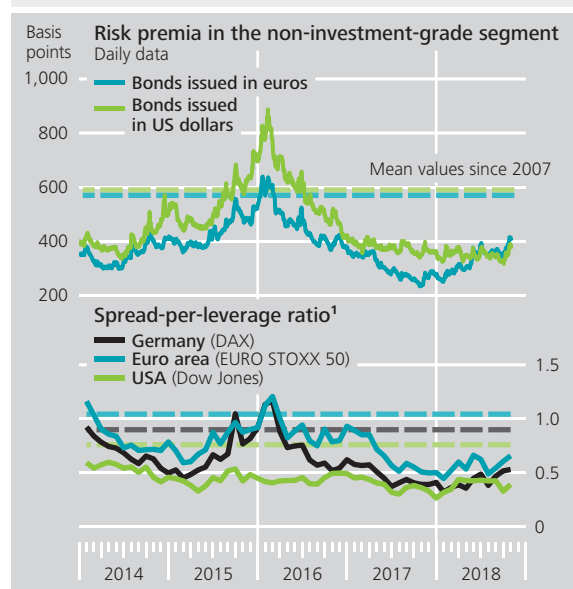
US investment grade bonds also have high valuations, measured in terms of their implied default rates. This finding is confirmed by a comparison of developments in the European corporate bond markets with the performance of a replicating portfolio comprising shares and government bonds.²⁶ There are risks, in particular, because the high valuation levels are accompanied, in many cases, by high levels of debt accrued by enterprises. The ratio of credit default swap premiums to leverage (spread-per-leverage ratio) amongst enterprises (see Chart 2.11) plus high issue volumes as well as loosened non-price conditions show that many risky enterprises had relatively easy access to borrowed funds. Low risk-free interest rates and small risk premia boost incentives to take on more debt.

There are risks, in particular, where high valuation levels are accompanied by high levels of corporate debt.

Debt amongst US enterprises active on the capital markets rose again last year, reaching its highest level for the past ten years.²⁷ The strong issuance activity of non-financial corporations is another indicator of mounting debt (see Chart 2.12).

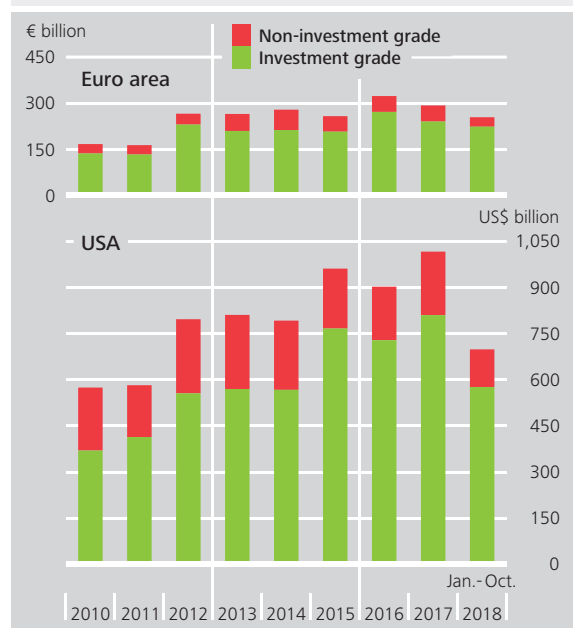
²⁶ For more on constructing replicating portfolios, see Deutsche Bundesbank (2017a), N. Dötz (2014) and R. Merton (1974).
²⁷ The debt of enterprises in the non-investment-grade segment also increased last year, following a slight decline in 2016.

Valuation metrics for the non-financial corporations sector Chart 2.11



Sources: Bloomberg, ICE Data, Markit and Bundesbank calculations.
¹ Median of the ratios of five-year credit default swap premiums to leverage of the enterprises contained in the specified stock indices.
 Deutsche Bundesbank

Gross bond issuance of non-financial corporations Chart 2.12



Source: Dealogic.
 Deutsche Bundesbank

Asset valuation from a financial stability perspective

For some years now, the international financial markets have experienced high and rising asset prices. Price exaggerations and price bubbles have therefore repeatedly been at the centre of public debate.¹ From a financial stability perspective, neither high valuations nor high price inflation represent a problem per se. What matters is the potential extent of a price correction, i.e. the size of the macroeconomic shock.² However, not every price correction entails risks to financial stability. Financial stability is jeopardised mainly if the financial system itself is vulnerable to the price correction. If this is the case – in other words, if falling prices trigger large losses in the financial system – the macroeconomic shock might be amplified, and a macroeconomic downturn could be caused or aggravated.

The financial system may directly or indirectly aggravate the macroeconomic effects of price corrections. They are typically intensified directly where either a large number of or individual systemically important market players are heavily exposed to the price changes in the asset in question, e.g. real estate, equities or government bonds. This is the case where these market players are, themselves, substantially invested in the relevant asset. Equally, price corrections may impair the value of loan collateral, heightening credit risk. Both scenarios produce losses for the financial system. This, in turn, squeezes the affected market players' capital buffers. Solvency and liquidity spirals may drive prices even lower and lead to additional losses in the financial system.³

The financial system can also amplify the effects of price corrections indirectly. Price fluctuations have an impact on household wealth. The affect-

ed households will adjust their consumption behaviour if their wealth rises or falls.⁴ Depending on the intensity of this wealth effect, adjustments which are significant from a macroeconomic perspective may occur.⁵ A change in a household's asset position also changes its credit standing. If household consumption is entirely or partly financed by credit, the financial system may amplify macroeconomic fluctuations by restricting lending.

The lessons learned from previous price corrections suggest that the effects on the real economy are markedly stronger if the financial system is directly involved. This is the case, for instance, if the preceding price inflation was accompanied by high credit growth.⁶

¹ See Deutsche Bundesbank, Monthly Report, May 2018.

² Historical experience has shown that corrections tend to be greater, the stronger the preceding price increase was. See also L. Agnello and L. Schuknecht, Booms and Busts in Housing Markets, *Journal of Housing Economics*, Vol. 20, pp. 171-190, 2011.

³ See M. Hellwig, Systemic Risks, Macro Shocks, and Macro-prudential Policy, mimeo (https://www.ecb.europa.eu/pub/conferences/shared/pdf/20180517_3rd_mp_policy_research/2018-05-17_Hellwig_paper_Systemic_risk_%20and_macro-prudential_policy_rev_May_2018.pdf); as well as S. Hanson, A. Kashyap and J. Stein, A Macroprudential Approach to Financial Regulation, *Journal of Economic Perspectives*, Vol. 25, pp. 3-28, 2011.

⁴ See M. Friedman, *A Theory of the Consumption Function*, Princeton University Press, 1957; as well as A. Ando and F. Modigliani, The "Life Cycle" Hypothesis of Saving: Aggregate Implications and Tests, *American Economic Review*, Vol. 53, No 1, pp. 55-84, 1963.

⁵ See also R. M. Sousa, Wealth Effects on Consumption: Evidence from the Euro Area, ECB Working Paper No 1050, 2009. Further key determinants of the demand effect are the affected households' propensity to consume, the size of the asset position, and the extent of the price changes. See also J. Tobin, *Asset Accumulation and Economic Activity: Reflections on Contemporary Macroeconomic Theory*, The University of Chicago Press, 1980.

⁶ See Ö. Jordà, M. Schularick and A. M. Taylor, Leveraged Bubbles, *Journal of Monetary Economics*, Vol. 76, Supplement, pp. 1-20, 2015.

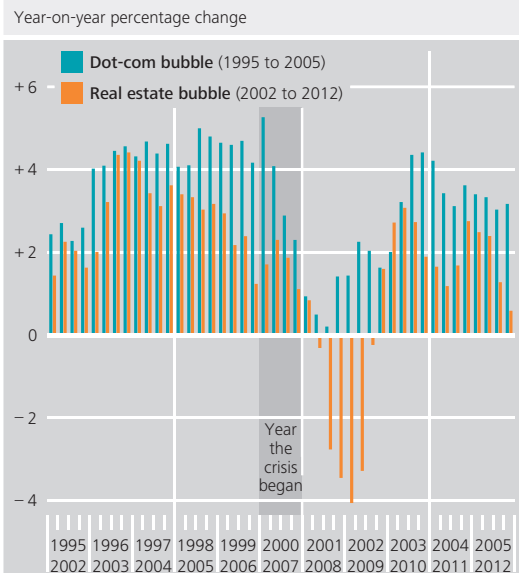
A concrete example of how the impact of price corrections varies depending on the involvement of the financial system is provided by the historical comparison between the correction in the US stock market in 2000 and the correction in the US real estate market in 2007-08. The bursting of the dot-com bubble cost US households around US\$6 trillion in financial assets between 2000 and 2002. At US\$6.2 trillion, households lost similar amounts of real estate wealth during the financial crisis of 2007-08.⁷ However, the implications of the real estate bubble of 2007-08 for the economy as a whole were far more dramatic. Although US GDP growth slowed markedly after the dot-com bubble had burst, growth rates bounced back relatively quickly. By comparison, the economic slump after the real estate bubble burst during the subsequent “Great Recession” was not only more severe, but also more persistent (see the chart). The US unemployment rate, too, remained relatively stable in the years immediately after the stock market crash.⁸ By contrast, unemployment in the United States almost doubled between 2007 and 2009 (from 5% to 9.8%).⁹ The differences in the direct impact on the financial system were just as stark, with the number of bank insolvencies a great deal higher after 2007 than in the early 2000s (see the chart). A lot of different factors influence how much of a macroeconomic impact such episodes have, with the economic policy reaction being one of them. One important reason why these

⁷ See Roosevelt Institute, *The Crisis of Wealth Destruction, Next New Deal: The Blog of the Roosevelt Institute*, 2010, available at <http://rooseveltinstitute.org/crisis-wealth-destruction>, last accessed on 28 March 2018.

⁸ Between the first quarter of 2000 and the first quarter of 2003, the US unemployment rate increased from 4.3% to 5.8%. See U.S. Bureau of Labor Statistics, *Civilian Unemployment Rate [UNRATE]*, as at 8 August 2018.

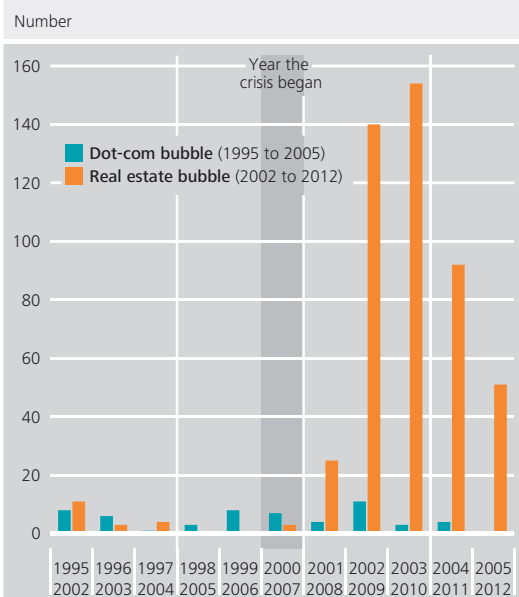
⁹ Data for the fourth quarters of 2007 and 2009. See U.S. Bureau of Labor Statistics, *Civilian Unemployment Rate [UNRATE]*, as at 8 August 2018.

Comparison of US GDP growth from 1995 to 2005 and 2002 to 2012



Source: O. Jordà, M. Schularick and A. M. Taylor, *Macrofinancial History and the New Business Cycle Facts*, NBER Macroeconomics Annual 2016, Vol 31, May 2017.
 Deutsche Bundesbank

Comparison of US bank insolvencies from 1995 to 2005 and 2002 to 2012



Source: Federal Deposit Insurance Corporation, *Failures and Assistance Transactions*.
 Deutsche Bundesbank

two episodes differed in terms of their impact is likely to have been, in particular, how vulnerable the financial system was at the time.¹⁰ In the years leading up to 2007, financial institutions had issued loans for house purchase or acquired residential mortgage-backed securities on a large scale. This made them susceptible to a price correction in the real estate market. The financial system was significantly less involved in financing the stock market boom and thus not as vulnerable to stock price corrections.¹¹

The debate on transmission channels also highlights that it is, from a financial stability perspective, decisive not only whether a price increase is, in fact, a bubble or whether it appears fundamentally justified.¹² The objective of macroprudential analysis is therefore not to identify price bubbles. Instead, the intention is to recognise those price movements that could entail potential risks to financial stability. These potential risks are determined mainly by whether and to what extent the financial system is vulnerable to such corrections.

10 The distribution of stock market and housing wealth is also likely to play a key role in this context. In the fourth quarter of 2007, the home ownership rate in the United States stood at 67.8%. By contrast, the wealthiest 20% of households held almost 90% of all stocks in 2001. The marginal propensity to consume and therefore the extent of potential demand effects also differs substantially between wealthy and less wealthy, and between indebted and less indebted, households. See A. Mian and A. Sufi, *House of Debt: How They (and You) Caused the Great Recession, and How We Can Prevent It from Happening Again*, The University of Chicago Press, 2014; as well as M. Kuhn, M. Schularick and U. Steins, *Income and Wealth Inequality in America, 1949-2016*, CEPR Discussion Paper No 12218, 2018.

11 Credit growth prior to the price crash in the real estate market was significantly higher than that preceding the correction in the stock market. Annual nominal growth of loans to households in the United States rose by 5.5% on average between 1995 and 2000, and by 8.6% on average between 2002 and 2007. See Ö. Jordà, M. Schularick and A. M. Taylor, *Macrofinancial History and the New Business Cycle Facts*, NBER Macroeconomics Annual 2016, Vol. 31, May 2017.

12 In order to determine whether prices are exaggerated – in other words, whether this is an episode during which prices are rising faster than economically justified – actual price movements must be compared with developments in an asset's fundamental value. However, the fundamental value cannot be observed objectively; it can merely be approximated using empirical methods. See also Deutsche Bundesbank, *Monthly Report*, October 2013, pp. 18 ff.; as well as F. Kajuth, T. Knetsch and N. Pinkwart, *Assessing House Prices in Germany: Evidence from a Regional Data Set*, *Journal of European Real Estate Research*, Vol. 9, No 3, pp 286-307, 2016.

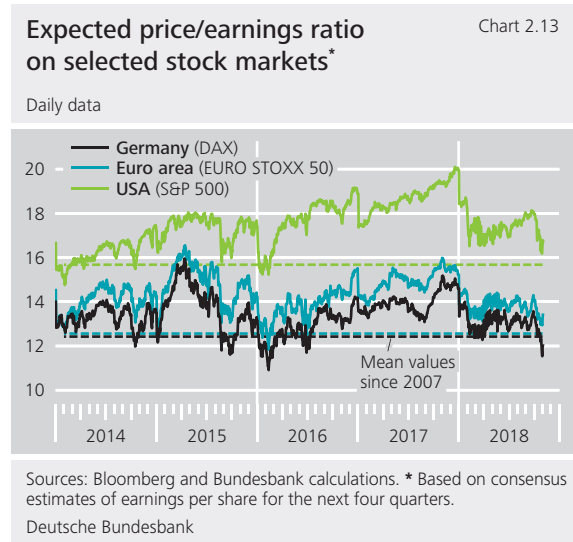
Bond issuance volumes and syndicated loans²⁸ to non-financial corporations in the non-investment-grade segment have risen considerably in Europe and particularly the United States in recent years. A large proportion of these syndicated loans have looser investor protection clauses (covenants).²⁹ The loans have primarily been used to finance corporate acquisitions.³⁰

According to the US Financial Stability Oversight Council (FSOC), relaxed financing terms contributed to the automotive loan market for households expanding by more than 50% to around US\$1,200 billion since 2012. Since 2014, this segment has tended to see an increasing proportion of delinquent loans.³¹

Similarly to the credit markets, indicators for the stock markets also point to a cyclically favourable setting. Standard valuation metrics for US shares are still higher than their long-run averages. In particular, the price/book ratio (P/B) and the price/earnings ratio (P/E) are high by historical standards (see Chart 2.13).

The favourable macroeconomic environment and the impact of the US tax reform are reflected in high profits and high book values of enterprises. Nonetheless, for many credit institutions it is still relatively expensive to obtain external capital in a risk-tolerant market environment. The price/book ratio for the bank sub-index of the STOXX Europe 600, which includes almost 50 European banks, is very low.

On account of the cyclically advantageous conditions, fragile funding structures may have been established in several market segments internationally, which will result in higher credit default rates and price corrections in future. Changes in risk premia could play a role in the transmission of shocks and the amplification of cyclical trends in the financial system. Crisis situations are precisely when risk premia see strong fluctuations and therefore materially influence financial conditions.



All things considered, the low risk premia, low implied volatility and high debt levels indicate that market participants assume the stable macroeconomic environment will persist and risks are, under certain circumstances, being overly disregarded. Negative surprises, which may be caused by the materialisation of political risks or weakening economic growth, could thus trigger comprehensive revaluations. Reduced risk propensity amongst investors on the global stage could spill over to the valuation of assets and market liquidity in Germany.

Low risk premia, low implied volatility and high debt levels indicate that market participants assume the stable macroeconomic environment will persist, and risks are being disregarded.

²⁸ A syndicated loan is granted by several banks jointly.
²⁹ See S&P Global Ratings (2018a).
³⁰ See S&P Global Ratings (2018b).
³¹ Source: Federal Reserve Bank of New York, Consumer Credit Panel.

■ List of references

- Antràs, P. and A. de Gortari (2017), On the Geography of Global Value Chains, NBER Working Paper No 23456, May 2017.
- Baker S. R., N. Bloom and S. J. Davis (2016), Measuring Economic Policy Uncertainty, *The Quarterly Journal of Economics*, Vol. 131, No 4, pp. 1593-1636.
- Bartram, S., G. W. Brown and B. Minton (2010), Resolving the Exposure Puzzle: The Many Facets of Exchange Rate Exposure, *Journal of Financial Economics*, Vol. 95, pp. 148-173.
- Bruno, V. and H. S. Shin (2015), Capital Flows and the Risk-Taking Channel of Monetary Policy, *Journal of Monetary Economics*, Vol. 71, pp. 119-132.
- Deutsche Bundesbank (2017a), Monthly Report, October 2017.
- Deutsche Bundesbank (2017b), Financial Stability Review 2017.
- Deutsche Bundesbank (2018a), Monthly Report, February 2018.
- Deutsche Bundesbank (2018b), Monthly Report, July 2018.
- Dötz, N. (2014), Decomposition of country-specific corporate bond spreads, Deutsche Bundesbank Discussion Paper No 37/2014, June 2014.
- Ehrmann, M. and M. Fratzscher (2005), Equal Size, Equal Role? Interest Rate Interdependence between the Euro Area and the United States, *The Economic Journal*, Vol. 115, No 506, pp. 928-948.
- European Systemic Risk Board (2017), European financial crises database, July 2017, available at: <https://www.esrb.europa.eu/pub/financial-crises/html/index.en.html>
- Felbermayr, G. (2018), US-Autozölle würden Deutschland fünf Milliarden Euro kosten, Ifo press release, 24 May 2018.
- International Monetary Fund (2018a), *World Economic Outlook*, October 2018.
- International Monetary Fund (2018b), *Global Financial Stability Report*, October 2018.
- Johnson, R. and G. Noguera (2017), A Portrait of Trade in Value-Added over Four Decades, *The Review of Economics and Statistics*, Vol. 99, No 5, pp. 896-911.
- Lee, E. and K. Yi (2018), Global Value Chains and Inequality with Endogenous Labor Supply, NBER Working Paper No 24884, August 2018.
- Merton, R. (1974), On the Pricing of Corporate Debt: The Risk Structure of Interest Rates, *Journal of Finance*, Vol. 29, No 2, pp. 449-470.
- S&P Global Ratings (2018a), *Leveraged Finance: A Mixed Forecast For Leveraged Loans*, May 2018.
- S&P Global Ratings (2018b), *Credit Trends: Global Financing Conditions: Issuance Is Forecast To Decline 4.2% To \$6 Trillion In 2018*, July 2018.
- Timmer, M. P., B. Los, R. Stehrer and G. J. de Vries (2016), An Anatomy of the Global Trade Slowdown based on the WIOD 2016 Release, GGDC Research Memorandum No 162, December 2016.
- Uribe, M. and V. Z. Yue (2006), Country Spreads and Emerging Countries: Who Drives Whom?, *Journal of International Economics*, Vol. 69, No 1, pp. 6-36.

Risk situation of the German financial system

Economic growth in Germany has been characterised by the longest expansion since reunification and persistently low interest rates. Asset prices, especially in the case of real estate, are at a high level amid comparatively low volatility on the financial markets. Debt is relatively low across all sectors.

However, these positive underlying conditions should not obscure the fact that vulnerabilities to adverse macroeconomic developments have built up in the German financial system. Given low insolvency rates, there is a danger of credit risk being underestimated. High valuations could lead to the value of loan collateral being overestimated. At the same time, maturity transformation is exposing financial institutions to interest rate risk.

Unlike last year, risks to future economic activity are skewed to the downside. The German economy, which is heavily reliant on exports, could be hit especially hard by global trade tensions. An unexpected, severe economic slump would probably cause assets to be revalued and thus affect large parts of the financial system. All in all, there has been a further increase in the risk of financial institutions responding in the same way in an economic downturn and excessively curtailing their lending. In such a situation, contagion within the financial system might have an adverse impact on the real economy and amplify an economic downturn. Given a downturn of this kind, these procyclical effects could be intensified further by interest rate movements. As a result, the German financial system is currently exposed to considerable cyclical risk.

Macroeconomic and financial environment in Germany

Risk situation characterised by prolonged economic boom and low interest rates

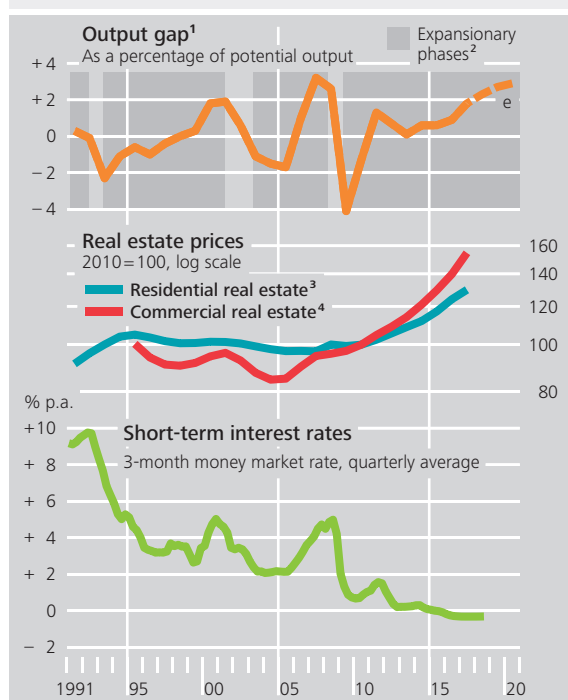
The German economy is experiencing the longest expansion since reunification. If the upswing continues until the end of 2020, as forecast in the Bundesbank's latest projection, it will be the longest expansion since Germany's "economic miracle", or *Wirtschaftswunder*.¹ Interest rate levels have been

extremely low and asset prices rising for some years now. In particular, real estate prices have been increasing at comparatively fast rates (see Chart 3.1).

The German economy is experiencing the longest expansion since reunification.

The German economy is booming. Unlike during other economic upturns, it is running ahead of the global business cycle. The output gap is in positive territory and is signalling a significant overutilisation of aggregate production capacity.

Selected macroeconomic indicators for Germany Chart 3.1



Sources: bulwiengesa AG, ECB, Association of German Pfandbrief Banks (vdp), Bundesbank estimates and calculations. ¹ Deviation of actual GDP from potential output. Bundesbank's estimate of potential output; see Deutsche Bundesbank, Monthly Report, June 2018. ² Pursuant to the recession dating of the German Council of Economic Experts; see German Council of Economic Experts, Jahresgutachten 2017/18. ³ Bundesbank calculations based on changing data providers (up to 2005 bulwiengesa AG, from 2006 vdpResearch GmbH, from 2014 Federal Statistical Office). ⁴ Bundesbank calculations based on capital growth for offices and retail properties in 127 German towns and cities calculated by bulwiengesa AG.

Deutsche Bundesbank

Just as the macroeconomic environment remains positive, the measured level of macroeconomic uncertainty remains low, as in previous years (see Chart 3.2). Implied stock market volatility – a measure of the short-term market price movements expected by investors – is comparatively low. Moreover, surveys suggest that economic forecasts are largely in agreement at present on changes in gross domestic product (GDP) and inflation (see Chart 3.3).

According to the Bundesbank's macroeconomic projections, the most probable scenario over the next few years is one in which real growth continues to be above potential growth.² This is set to be given a continued boost by impulses from abroad. The International Monetary Fund expects the global expansion to continue. Moreover, if euro area activity remains robust, this will probably facilitate a gradual rise in interest rates. This is likely to reinforce the stability of the German financial system.

Nevertheless, downside risks to economic development have increased compared with last year.³ These are primarily a product of the international environ-

¹ See Deutsche Bundesbank (2018b).

² For the Bundesbank's latest macroeconomic projections, see Deutsche Bundesbank (2018b).

³ See Deutsche Bundesbank (2018b).

ment. For example, geopolitical tensions have risen and there is a growing risk of an escalating global trade war with widespread import tariff hikes. It is, not least, unclear under what circumstances the United Kingdom will leave the European Union (see the box entitled “Brexit” on pp. 18 f.). These developments represent a considerable threat to Germany’s export-oriented economy.

Downside risks to economic development have increased.

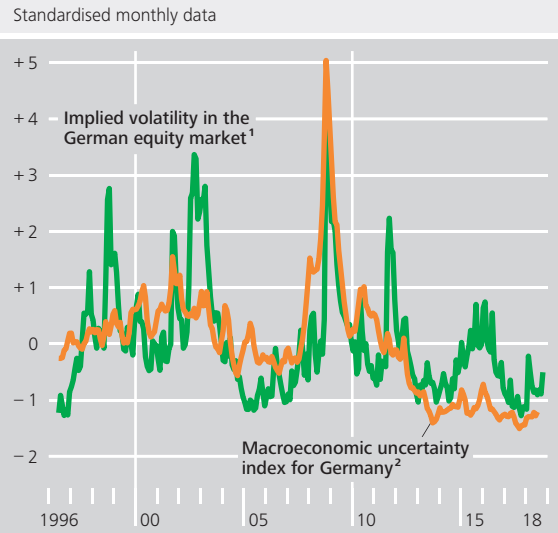
Low debt levels in the private and public sectors

German households and enterprises alike have benefited in recent years from the favourable economic environment and low interest rates. The household debt ratio has greatly receded since the turn of the millennium, amounting to around 50% of GDP in the first quarter of 2018 (see Chart 3.4). At the same time, interest rates on loans for house purchase have fallen to such an extent that the interest burden as a percentage of disposable income has decreased, on aggregate, over the past few years. The unemployment rate has been dropping for over ten years now and is at its lowest level since reunification. As a result of these developments, the number of consumer insolvencies has likewise been on the decline for a number of years.

The non-financial corporate sector has also been steadily reducing its debt ratio over the past two decades. Thus, since the late 1990s, enterprises’ equity ratio has risen by more than 10 percentage points to an average of around 30% of total assets (see Chart 3.5).⁴ Debt stood at around 60% of GDP in the first quarter of 2018. The number of insolvencies is down considerably. In view of the current positive environment, the level of credit risk emanating from the private non-financial sector therefore appears low. However, German banks’ lending to non-financial corporations has accelerated significantly over the

Uncertainty and financial market volatility in Germany

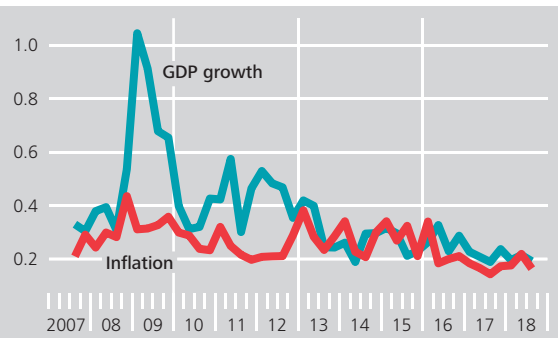
Chart 3.2



Sources: Bloomberg and Bundesbank calculations. **1** Expected volatility of the DAX, derived from options prices. **2** The index is based on the forecast errors of a large number of macroeconomic and financial indicators. See also P. Meinen and O. Röhe, On Measuring Uncertainty and its Impact on Investment: Cross-country Evidence from the Euro Area, *European Economic Review*, Vol. 92, pp. 161-179, February 2017, and the MU1 index they describe.
 Deutsche Bundesbank

Dispersion of forecasts in Germany*

Chart 3.3



Sources: Consensus Economics and Bundesbank calculations. * Standard deviations of survey participants’ quarterly forecasts, average across the forecast horizon up to five quarters.
 Deutsche Bundesbank

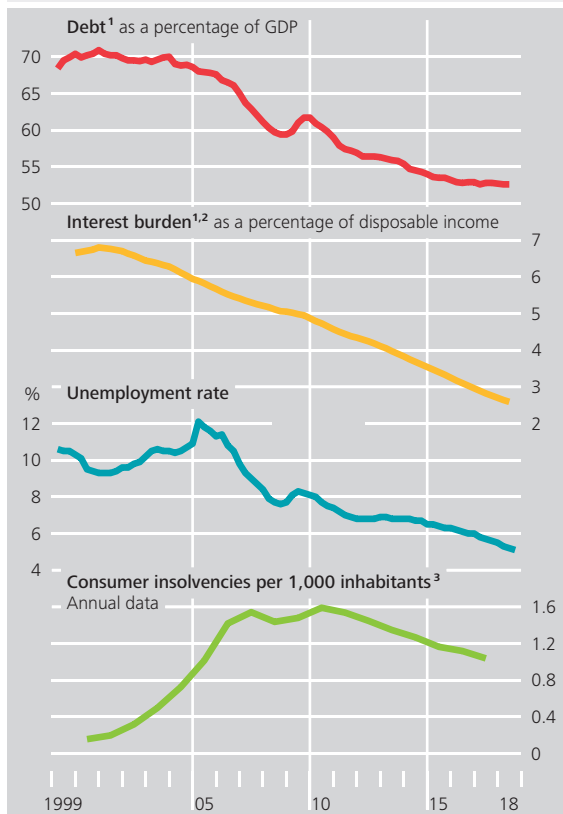
past few quarters (see the chapter entitled “Risks in the banking sector” on pp. 69 ff.).

⁴ The non-financial corporate sector has made a considerable contribution over the past few years to the present current account surpluses. See Deutsche Bundesbank (2017a).

Risk indicators for households in Germany

Chart 3.4

Quarterly data



Sources: Federal Employment Agency, Federal Statistical Office, the financial accounts of the Bundesbank and Bundesbank calculations. **1** Attributable to households, including non-profit institutions serving households. **2** Calculated from four-quarter moving sums. **3** Population in Germany aged 18 and above.
 Deutsche Bundesbank

German banks benefited from the declining insolvency rates in the private sector. In the aftermath of the crisis, they were able to reduce their risk provisioning and strengthen their capital positions, while their equity ratios increased considerably (see Chart 4.1 on p. 70).

German banks benefited from the declining insolvency rates in the private sector.

The good economic development and low interest rates also impacted positively on public finances. The debt ratio has shrunk considerably since the crisis,

largely thanks to rising tax revenue and low interest rates. It is expected to come close to the 60% threshold by the end of this year.⁵

Caution is advised when analysing the debt situation on the basis of aggregated ratios. An analysis from an aggregated perspective could mask the fact that the debt situation may nonetheless be fraught with risk at the disaggregated level. On the residential real estate market, this would be the case if, for instance, many of the households with mortgage debt had accumulated excessive debt relative to the value of the real estate. This becomes even more problematic if real estate is overvalued, as it is at present in German urban areas, and thus generally susceptible to price corrections. Additionally, risk scenarios such as a sharp interest rate hike in combination with a decline in income may put a major strain on the solvency of individuals who have taken out a loan for house purchase (see the section entitled “Considerable drop in income likely to reduce households’ debt sustainability” on pp. 65 f.). In order to be able to identify such risks as early as possible, disaggregated data are needed. In the case of housing loans in Germany, these data have so far been unavailable in the required quality.

Risks might be underestimated

During prolonged periods of economic prosperity, there is a danger of risks being increasingly underestimated and of vulnerabilities building up. Academic research suggests that market participants tend to underestimate risks in a favourable economic

Market participants tend to underestimate risks in a favourable economic environment when they are optimistic about the future.

⁵ See Deutsche Bundesbank (2018c).

environment when they are optimistic about the future.⁶

Furthermore, market participants in an environment which is characterised by low volatility and little macroeconomic uncertainty have an additional incentive to take on risk.⁷ Empirical studies indicate that the seeds of new financial crises are sown in such an environment (see the box entitled “Macroeconomic uncertainty and risks to financial stability” on pp. 20 ff.).⁸ Studies also show that shocks could trigger a stronger response at the macroeconomic level if market participants’ expectations are highly homogeneous.⁹ Should unexpected events (shocks) – an economic downturn, say – then occur under such circumstances, the potential for setbacks is especially high. If such a prolonged period of prosperity were to come to an abrupt end, the financial system could be hit especially hard.¹⁰

Vulnerabilities in the German financial system

The prolonged period of low interest rates coupled with favourable financing conditions and an ongoing economic boom have promoted the build-up of

The German financial system has considerable cyclical vulnerabilities.

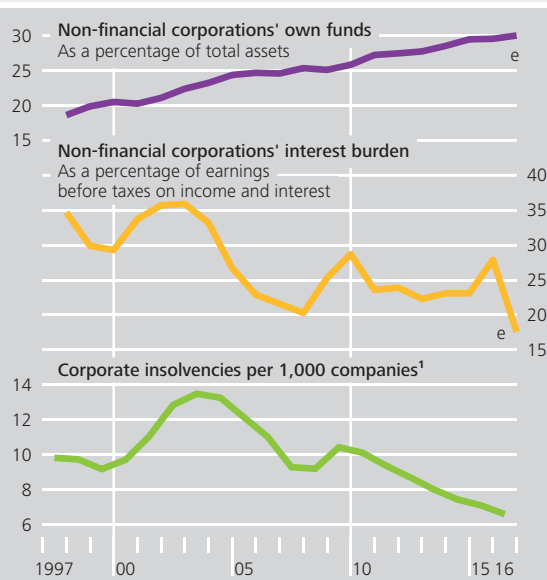
vulnerabilities in the German financial system. Such vulnerabilities include an underestimation of credit

risk, an overvaluation of assets, particularly real estate, and interest rate risk resulting from a substantial increase in maturity transformation. The German financial system therefore has considerable cyclical vulnerabilities.

The Bundesbank’s early warning model also points – from a highly aggregated perspective – to an increase in cyclical vulnerabilities (see the box entitled “Early warning models: a historical perspective on the risk

Risk indicators for enterprises in Germany

Chart 3.5



Sources: Federal Statistical Office, the Bundesbank’s corporate financial statement statistics and Bundesbank calculations. ¹ Enterprises included in the business statistics.
 Deutsche Bundesbank

of a financial crisis” on pp. 47 ff.). Breaking down the early warning indicator reveals that this increase is being driven chiefly by price movements on the German residential real estate market. This means that, in an international historical comparison, current price developments are associated with a considerably elevated likelihood of crisis. Furthermore, the closing credit-to-GDP gap has contributed to the rise. This metric shows the extent to which, in a his-

⁶ See P. Bordalo, N. Gennaioli and A. Shleifer (2018); J. Guttentag and R. Herring (1984); and H. Minsky (1977).

⁷ See also S. Bhattacharya, C. Goodhart, D. Tsomocos and A. Vardoulakis (2015).

⁸ See also J. Danielsson, M. Valenzuela and I. Zer (2018).

⁹ For information on monetary policy shocks, see the literature in Deutsche Bundesbank (2017b), p. 42. Bundesbank model calculations show that, when the distribution of individual inflation forecasts is below average, macroeconomic shocks have a significantly greater impact in the short term.

¹⁰ Lessons learned from real estate price increases, for instance, show that the stronger the preceding price increase, the greater the correction on average. See, inter alia, L. Agnello and L. Schuknecht (2011).

torical comparison, loans grow faster than a country's GDP (see Chart 4.8 on p. 74)

At the moment, the level of the early warning indicator is being dampened by Germany's large current account surplus, which, in particular, reflects the German economy's strong focus on exports. In the risk scenario of an escalating global trade conflict, there could be a reduction in the current account surplus. In that case, it would have less of a dampening effect on the early warning indicator.

Credit risks might be underestimated

Credit risks are potentially being underestimated, especially in the banking sector (see the chapter entitled "Risks in the banking sector" on pp. 69 ff.). Currently, default rates on loans are very low. In line with this, banks have sharply reduced risk provisioning for credit risk – particularly loan loss provisions for non-performing loans – over the past few years.

A downturn scenario could potentially be underrepresented in banks' risk analysis.

In addition, the regulatory capital requirements for corporate and real estate loans have been eased in many cases and are at comparatively low levels. As banks' credit risk models are typically based on the data of previous years, a downturn scenario could potentially be underrepresented in banks' risk analysis (see the chapter entitled "Risks in the banking sector" on pp. 69 ff).

Overvaluation of collateral for real estate loans

Real estate prices, and with them the value of corresponding loan collateral, have soared in recent years (see the box entitled "Housing loans and risks to financial stability" on pp. 54 ff.). The rise in housing prices has probably been driven chiefly by two factors: first, the strong economy and the associated

positive outlook for incomes and, second, the extremely low mortgage rates.¹¹ According to updated Bundesbank estimates, house prices in German urban areas were still overvalued by 15% to 30% in 2017. Other indicators for assessing property prices, such as the ratio of purchase prices to annual rents, for example, support the view that valuation levels in cities remained high in 2017.

House prices in German urban areas were still overvalued by 15% to 30% in 2017.

An abrupt change in conditions – for instance, an economic slump with a change in income prospects or a sharp interest rate rise – would translate into potential for corrections. This would also affect the commercial real estate market. This, unlike the housing market, is characterised by shorter-term financing and a higher share of variable rate loans. It thus displays a higher sensitivity to any abrupt deterioration in financing conditions.

If, in the current real estate boom, credit institutions overestimate the underlying value of real estate as loan collateral, they underestimate their risk exposure. A correction of real estate prices impairs the value of any real estate used as loan collateral.

If credit institutions overestimate the underlying value of real estate as loan collateral, they underestimate their risk exposure.

This matters for financial stability as loans for house purchase account for around 51% of all bank loans to domestic households and enterprises. Commercial real estate loans represent 16% of total claims on non-banks.

¹¹ See Deutsche Bundesbank (2018a).

Early warning models: a historical perspective on the risk of a financial crisis

Early warning models can – from an aggregated perspective – highlight vulnerabilities in the financial system. They provide information on how the current situation compares to the developments that typically preceded previous financial crises. In the early warning model used by the Bundesbank, a conceptual distinction is made between an early warning indicator and a spillover indicator (see the chart).¹ The early warning indicator provides information on financial crises of domestic origin, while the spillover indicator concerns what are known as “imported” crises.²

The underlying early warning model for financial crises is based on the experiences of industrial countries over the past decades. It issues a warning signal that a systemic banking crisis of domestic origin may emerge over the next 5 to 12 quarters if the early warning indicator exceeds a certain threshold. The threshold is determined in such a way that the model correctly flags 80% of past pre-crisis periods. An evaluation of the early warning model shows that the early warning indicator achieves a good level of forecasting quality for a number of countries, especially for the financial crisis of 2008.³ Financial crises predicted by the early warning indicator are linked to sharp declines in economic growth (see the box entitled “The relationship between financial stability risks and the real economy: a GDP-at-risk perspective” on pp. 51 f.).

Since the third quarter of 2015, there has been a considerable rise in the early warning indicator. Price movements on the German housing market made a particular contribution to this increase, as a breakdown of the early warning indicator reveals. This is due to the fact that, in an international his-

torical context, similarly sharp rises in prices were associated with considerably elevated likelihoods of crisis. The closing credit-to-GDP gap is another contributing factor. Overall, the driving forces behind the early warning model are therefore indicative of an increase in cyclical vulnerability since 2015. If property prices continue to go up, this could lead the early warning indicator to increase even further in the future, especially if the credit-to-GDP gap widens at the same time.

At the moment, the level of the early warning indicator is being lowered by Germany’s large current account surplus.⁴ The current account sur-

¹ For more details on the early warning model used here, see Deutsche Bundesbank, Financial Stability Review 2017, pp. 45 ff.; and Financial Stability Committee, Fünfter Bericht an den Deutschen Bundestag zur Finanzstabilität in Deutschland, June 2018, pp. 43 f.

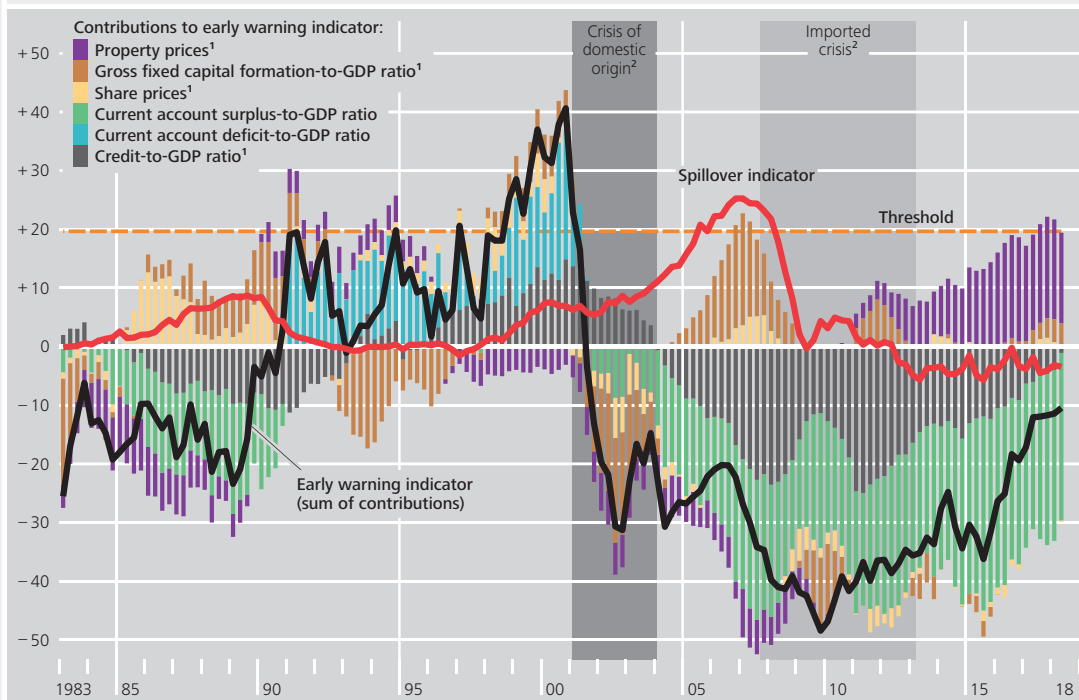
² The ECB/ESRB crises database differentiates between crises of domestic origin and “imported” crises. See M. Lo Duca, A. Koban, M. Basten, E. Bengtsson, B. Klaus, P. Kusmierczyk, J. H. Lang, C. Detken and T. Peltonen, A New Database for Financial Crises in European Countries – ECB/ESRB EU Crises Database, ECB Occasional Paper Series 194, July 2017. Imported crises are crises originating outside the domestic economy.

³ For an academic evaluation of the predictive ability of various early warning models, see J. Beutel, S. List and G. von Schweinitz, An Evaluation of Early Warning Models for Systemic Banking Crises: Does Machine Learning Improve Predictions?, Deutsche Bundesbank Discussion Paper, forthcoming.

⁴ Current account balances traditionally play an important role in the early warning literature. For example, it has been shown that credit booms combined with current account surpluses are associated with a lower likelihood of crisis than credit booms combined with current account deficits. See J. S. Davis, A. Mack, W. Phoa and A. Vandenabeele, Credit booms, banking crises, and the current account, *Journal of International Money and Finance*, Vol. 60, pp. 360-377, 2016. It should be noted that the channels through which current account balances take effect are the subject of heated debate and that deficits are more prominent in the literature than surpluses. See M. Obstfeld, Does the Current Account Still Matter?, *American Economic Review: Papers & Proceedings*, Vol. 102, No 3, pp. 1-23, 2012.

Early warning indicator and spillover indicator for Germany*

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



Sources: BIS, Bloomberg, ECB, Eurostat, IMF, OECD, Thomson Reuters, 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. The spillover indicator weights the early warning indicators of several major economies that are linked to the German financial system. These consist of the United States, Japan, Norway, and the 13 major economies of the EU. See J. Beutel, S. List and G. von Schweinitz, An Evaluation of Early Warning Models for Systemic Banking Crises: Does Machine Learning Improve Predictions?, Deutsche Bundesbank Discussion Paper, forthcoming. The weighting is based, on the one hand, on the relative significance of the German banking sector's external assets vis-à-vis each particular country and, on the other hand, on the relative significance of the German banking sector's total external assets. 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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plus reflects the high domestic rate of saving and thus, implicitly, also the low level of debt among the individual sectors in Germany (see the section entitled “Low debt levels in the private and public sectors” on pp. 43 f.).

Nevertheless, the large current account surplus is connected to the German economy's strong focus on exports. In the risk scenario of an escalating global trade conflict, the current account surplus could therefore diminish. In that case, it would also have less of a dampening effect on the early warning indicator.

The current account surpluses are counterbalanced by Germany's increased financial claims abroad (see Table 2.1 on p. 17). The stability of foreign financial systems, alongside domestic developments, is therefore of key importance for Germany. The 2008 global financial crisis, for instance, resulted in part from rising leverage and the housing market boom in the United States. A spillover indicator can be calculated to estimate potential contagion effects from abroad. This indicator weights the early warning indicators of major global economies that are linked to Germany's financial

system.⁵ Interconnectedness is measured by the volume of the German banking sector's external assets vis-à-vis each particular country in relation to its total external assets. Consequently, countries that are more relevant to the German banking system have a greater weighting in the spillover indicator. Prior to the 2008 financial crisis, the spillover indicator for Germany reached very high levels (see the chart). This shows that – alongside factoring net figures, such as the current account balance, into the early warning indicator – gross figures, such as gross external assets in the spillover indicator, also play a vital role.

The spillover indicator is currently at a low level. There are two reasons for this. First, the early warning indicators in the relevant countries are low. Second, the relative importance of external assets on the balance sheets of German banks has diminished since the financial crisis.⁶

Besides the contagion via the banking system captured by the spillover indicator, there may also be contagion effects via the other sectors of the financial system. For instance, the German investment fund sector has stepped up its foreign investment in recent years. As financial institutions are, in turn, connected with the investment fund sector, shocks emanating from abroad could additionally be transmitted to German financial institutions via this sector (see the chapter entitled "Risks for insurers, pension institutions and investment funds" on pp. 83 ff.). It should be noted that the early warning model focuses on industrial countries. Consequently, it does not capture potential contagion effects from emerging market economies.

Overall, early warning indicators and spillover indicators allow the macroeconomic and financial situation to be contextualised with regard to the past experiences of a variety of countries. Histo-

ry shows that recurring patterns often emerged in the run-up to previous crises. The aim of the early warning analysis is to highlight instances when these historical patterns reoccur so that unwelcome developments can be responded to, if necessary. Breaking the early warning indicator down into its drivers allows especially significant aggregate developments – for example, on the property market – to be identified.

It must be noted that actual future developments can deviate from these historical precedents. The indicators discussed here make forecasts under conditions of uncertainty, so there is also always the possibility of false alarms and unpredicted crises, for example due to unforeseen political shocks. As early warning indicators are based on information from past crises, they may be unable to recognise new, unprecedented types of crises. Furthermore, certain kinds of risks that accumulate in the system in a disaggregated way may not be captured by the macroeconomic indicators used. An overall assessment of the risk situation should therefore not be carried out mechanically. Instead, a key role is played by in-depth analyses at the disaggregated level (see the section entitled "Vulnerabilities in the German financial system" on pp. 45 ff.) as well as forward-looking assessments of potential risk scenarios (see the section entitled "Risk scenarios for the German financial system" on pp. 58 ff.).

⁵ The following countries are factored into the calculation of the early warning and spillover indicators: United States, Japan, Norway, and the 13 major economies of the EU.

⁶ See Deutsche Bundesbank, Financial Stability Review 2017, pp. 78 f. For information on a similar global development in international interlinkages, see P. Lane and G. Milesi-Ferretti, The External Wealth of Nations Revisited: International Financial Integration in the Aftermath of the Global Financial Crisis, IMF Economic Review, Vol. 66, No 1, pp. 189-222, 2018.

High interest rate risk

Small and medium-sized German banks, in particular, have high interest rate risk (see the chapter entitled “Risks in the banking sector” on pp. 69 ff.). In an environment characterised by low rates, these banks have been increasingly generating income by expanding their maturity transformation in recent years. Increased maturity transformation is the result, first, of a significantly higher percentage of short-term deposits. Second, banks have extended their assets’ interest rate fixation: the percentage of long-term loans to non-banks has risen continuously in recent years.

Interest rate risk does not just affect the banking system. Investment funds have likewise increased the interest rate sensitivity of their securities portfolios in recent years (see the chapter entitled “Risks for insurers, pension institutions and investment funds” on pp. 83 ff.). Investment fund holders are thus also raising the interest rate sensitivity of their assets.

An empirical analysis of the portfolio structures of German market participants between 2006 and

German investment funds, insurers, pension funds and households have invested in riskier bonds and bonds with longer maturities.

2016 shows that German investment funds, insurers, pension funds and households, in particular, invested in bonds with worse ratings and longer maturities during the prolonged period of low interest rates.¹² They therefore took on higher interest rate and credit risk with their investments. This means that there has been an increase in vulnerabilities to unexpected macroeconomic developments such as an economic downturn or abrupt interest rate hike.

Some countries are addressing cyclical vulnerabilities

Alongside domestic developments, the stability of foreign financial systems is of key importance for Germany (see the chapter entitled “The international environment” on pp. 15 ff. and the box entitled “Early warning models: a historical perspective on the risk of a financial crisis” on pp. 47 ff.).

Several European countries have implemented macroprudential measures to address the build-up of cyclical vulnerabilities.

Several European countries have implemented macroprudential measures.

One of these measures is the activation of the countercyclical capital buffer (see Table 3.1 on p. 53).¹³ This is intended to make the banking sector more resilient to cyclical risk. To this end, it is activated during periods in which cyclical risks build up and released when those risks abate.

According to the recommendations of the European Systemic Risk Board (ESRB), the activation of the countercyclical capital buffer follows the principle of “guided discretion”.¹⁴ The rules-based component is what is known as the buffer guide, which is based on the credit-to-GDP gap. However, the countercyclical buffer should not be activated mechanically based on the credit-to-GDP gap, but rather based on the bigger economic picture. Several European countries have activated the countercyclical capital buffer accordingly, though their buffer guides are set at 0%. These countries cite, in particular, the intention to take preventive action and elevated growth rates in single credit segments as reasons behind this move.

¹² See P. Abbassi and M. Schmidt (2018).

¹³ Information on countercyclical capital buffers in EU countries can be found on the ESRB’s website: https://www.esrb.europa.eu/national_policy/ccb/all_rates/html/index.en.html

¹⁴ See European Systemic Risk Board (2014).

The relationship between financial stability risks and the real economy: a GDP-at-risk perspective

Economic activity in Germany has been subject to major fluctuations over time, with periods of strong economic growth alternating with periods of weak or negative growth. Occasionally, these declines in economic growth can be very steep and abrupt. It is precisely these sharp declines that are of particular importance from the perspective of financial stability. For one thing, a severe economic slump can jeopardise financial stability; for another, an economic downturn can be amplified by the financial system or triggered by financial shocks.

What is striking is that stress has materialised in the financial system during every recession in Germany since the 1970s, with the effect being particularly pronounced during the financial crisis in 2008. This is revealed by comparing periods with negative growth and periods identified by the European Systemic Risk Board (ESRB) as systemic financial crises or episodes of elevated financial stress (see the adjacent chart).¹

This raises the question as to whether indicators of systemic financial stability are conducive to forecasting particularly sharp declines in gross domestic product (GDP), such as the 5% largest drops in GDP. The fifth percentile of the distribution of forecast GDP growth is called GDP-at-risk.² Outcomes from the literature show that, in the United States, both financial stress indicators and financial cycle indicators contain useful information for forecasting GDP-at-risk.³

The relationship between GDP-at-risk and indicators of systemic financial stability in Germany are considered below using a country-specific stress

Gross domestic product and episodes of stress in Germany's financial system

Year-on-year percentage change, seasonally and calendar adjusted



Sources: Federal Statistical Office and Bundesbank calculations. ¹ According to the European financial 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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¹ For information on episodes of financial market stress, see M. Lo Duca, A. Koban, M. Basten, E. Bengtsson, B. Klaus, P. Kusmierczyk, J. H. Lang, C. Detken and T. Peltonen, A New Database for Financial Crises in European Countries – ECB/ESRB EU Crises Database, ECB Occasional Paper Series No 194, July 2017.

² See S. G. Cecchetti, Measuring the Macroeconomic Risks Posed by Asset Price Booms, in Asset Prices and Monetary Policy, University of Chicago Press, pp. 9-43, 2008.

³ For information on forecasting GDP-at-risk using financial stress indicators, see T. Adrian, N. Boyarchenko and D. Giannone, Vulnerable Growth, Staff Reports, No 794 (revised), Federal Reserve Bank of New York, November 2017. For information on forecasting GDP-at-risk using financial cycle indicators, see B. Hartwig, C. Meinerding and Y. Schüler, Quantifying the Costs of Systemic Risk, Deutsche Bundesbank, mimeo, 2018.

Forecasting steep declines in activity using financial stress and financial cycle indicators

Relative forecast errors¹ as a percentage

Model	Forecast horizon in quarters		
	1	4	12
Financial stress indicator ²	87	94	97
Financial cycle indicator ³	89	65	89
Early warning indicator	97	87	96
Early warning indicator and spillover indicator	116	56	48

¹ The table shows the relative forecast errors produced by a quantile regression for the fifth percentile of GDP. Past GDP growth is used as an additional predictive variable alongside each of the indicators shown, with the forecast errors produced by each model being analysed relative to a base model where the only input is past GDP growth. The base model's relative forecast error is normalised to 100%. Relative forecast errors of less than 100% thus indicate a corresponding improvement in forecasting quality over the base model. ² Country Level Index of Financial Stress. ³ See Y. Schüler, P. Hiebert and T. Peltonen, Characterising the Financial Cycle: A Multivariate and Time-varying Approach, ECB Working Paper 1846, September 2015.

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indicator.⁴ This indicator measures simultaneous stress in equity, bond and currency markets. To show how systemic risk accumulates over time, the Bundesbank's early warning indicator of systemic financial crises (see the box entitled "Early warning models: a historical perspective on the risk of a financial crisis" on pp. 47 ff.) is employed, together with a financial cycle indicator.⁵ This latter indicator measures the synchronisation of loans and asset prices (house prices, equity and bond prices). The early warning indicator can be supplemented by a spillover indicator to better record cyclical downturns resulting from international contagion effects.

The predictive power of these indicators is put to the test within a forecast model for the fifth percentile of GDP growth.⁶ The results show that the indicators under analysis do contain information that is conducive to forecasting sharp

economic declines in Germany (see the adjacent table). In terms of its design, the financial stress indicator reflects the materialisation of systemic risk, which makes it especially suited to forecasting GDP-at-risk in the short term (one quarter ahead). By contrast, the other indicators under consideration reflect the accumulation of systemic risk, so they particularly come to the fore when the forecast horizon is extended (to one to three years ahead). The model with an early warning indicator and a spillover indicator significantly improved its forecasts for forecast horizons of one and three years primarily on account of the spillover indicator's steep rise before the 2008 global financial crisis and the major economic downturn that followed.

Overall, then, the indicators under consideration provide valuable pointers, not only of financial crises but also of potential downturns in the real economy associated with financial stress.

⁴ This is known as the Country Level Index of Financial Stress (CLIFS); see T. Duprey, B. Klaus and T. Peltonen, Dating Systemic Financial Stress Episodes in the EU Countries, *Journal of Financial Stability*, Vol. 32, pp. 30-56, 2017.

⁵ For more information on this indicator, see Y. Schüler, P. Hiebert and T. Peltonen, Characterising the Financial Cycle: A Multivariate and Time-varying Approach, ECB Working Paper 1846, September 2015; and Y. Schüler, P. Hiebert and T. Peltonen, Coherent Financial Cycles for G-7 Countries: Why Extending Credit can be an Asset, ESRB Working Paper 43, May 2017.

⁶ To assess the indicators' forecasting quality, out-of-sample forecasts are taken using quantile regressions for the fifth percentile of GDP. Financial stress and financial cycle indicators as well as past GDP growth are used as predictive variables. The out-of-sample forecasts were configured in line with T. Adrian, N. Boyarchenko and D. Giannone, Vulnerable Growth, Staff Reports, No 794 (revised), Federal Reserve Bank of New York, November 2017. First, forecasts are generated based on an observation period from 1978 to 1998. The regression window is then extended stepwise by one quarter. The forecasting quality of the model used is measured by its deviations from the fifth percentile.

Countercyclical capital buffer in selected European countries* Table 3.1

As at Q3 2018

Country	Quarter in which CCyB was changed	CCyB (%)	Buffer guide ¹ (%)	Reason for changing the CCyB
France	Q2 2018	0.25	0	- High and rising private non-financial sector debt - Preventive action in robust macroeconomic environment and in light of continued credit cycle acceleration
Ireland	Q3 2018	1.00	0	- Aggregate credit growth stagnant, but growth rates in single credit segments high - Boosting resilience in banking sector at an early stage given growing signs of (broader) cyclical risks
Lithuania	Q4 2017 Q2 2018	0.50 1.00	0 0	- Robust credit and real estate market growth, but activation not primarily motivated by increasing cyclical risks - Buffer should be at a minimum of 1.00% even in the absence of cyclical imbalances - This enables a slower and steadier build-up of the CCyB with a lesser impact on lending and the real economy
Norway	Q4 2013 Q2 2015 Q4 2016	1.00 1.50 2.00	1.75 1.00 0.25	- Build-up of financial imbalances (credit markets, real estate prices) - High and further increasing household debt
Slovakia	Q3 2016 Q3 2017 Q3 2018	0.50 1.25 1.50	0.25 1.50 1.50	- High and further increasing overall debt in the private non-financial sector, attributable particularly to households - Expansionary stage of financial cycle
Sweden	Q3 2014 Q2 2015 Q1 2016 Q3 2018	1.00 1.50 2.00 2.50	1.75 1.50 0.50 0.10	- High credit growth, high household debt - Risks relating to financial imbalances elevated and further increasing
United Kingdom	Q2 2017 Q4 2017	0.50 1.00	0 0	- No elevated cyclical risks; risks neither subdued nor elevated - Buffer should be at 1.00% in such an environment (strategic decision)

Sources: ESRB and national authorities. * Breakdown by date on which countercyclical capital buffer (CCyB) rate decision was published. After the decision to raise the rate is announced, banks generally have 12 months to build up the buffer. In addition to the countries listed here, the following EU and EEA countries have announced a CCyB rate set at a level other than 0%: Bulgaria (0.50%), Czech Republic (1.50%), Denmark (1.00%) and Iceland (1.75%). ¹ The buffer guide is derived from the credit-to-GDP gap. This shows the extent to which, in a historical comparison, loans grow faster than a country's GDP. A positive gap may be a sign of excessive credit growth. If a positive credit-to-GDP gap exceeds a threshold of 2 percentage points, a buffer guide derived from this will suggest a possible need for macroprudential action (rules-based component). The macroprudential supervisory authorities will also take additional indicators into account when making their decision (discretionary component). For more information, see also Deutsche Bundesbank, Financial Stability Review 2015, pp. 76-79.

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In addition to activating the countercyclical capital buffer, more than two-thirds of EU Member States are currently using macroprudential instruments in the housing market (see the box entitled "The macroprudential toolkit for housing markets from a European perspective" on pp. 59 ff.).

Structural vulnerabilities may facilitate the transmission of shocks

In addition to cyclical vulnerabilities that build up over time, the structure of the financial system is also im-

portant for financial stability. This may yield risks to the financial system. For example, if individual market participants do not take sufficient account of their influence on the system as a whole, the distress of that individual market participant may jeopardise the stability of the entire financial system. Large and interconnected banks, in particular, are typically classified as potentially systemically important banks. It is these banks, especially, that are currently vulnerable to unfavourable macroeconomic developments (see the chapter enti-

The structure of the financial system may yield risks to financial stability.

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Housing loans and risks to financial stability

Risks to financial stability are especially likely to build up on residential real estate markets if price exaggerations are accompanied by excessive lending and a significant easing of lending standards.¹ In particular, there is a risk of market participants systematically underestimating risks in connection with housing loans.

House prices rising further

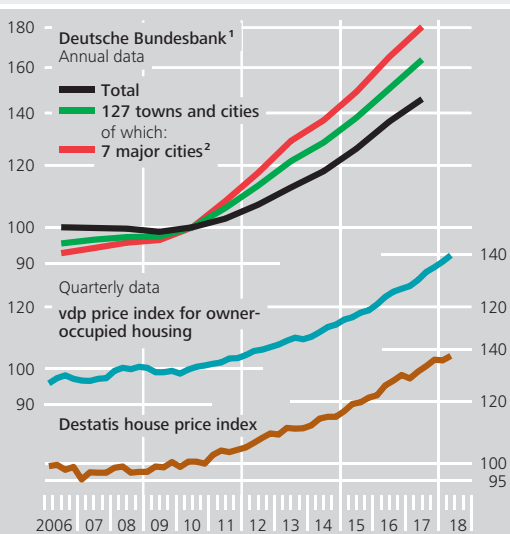
The upturn on the German residential real estate market in evidence since 2010 has continued (see the chart). According to Bundesbank calculations based on annual data provided by bulwiengesa AG, house prices rose by an average of 6.8% in 2017, after 8.3% in 2016.² In the seven largest German cities, which again experienced the fastest price growth last year, house price infla-

tion eased from an average of 10.8% in 2016 to 9.3% in 2017. In the larger cities – excluding the seven largest – by contrast, price growth accelerated during this period. Regional overvaluations in parts of the German residential property market ranged from 15% to 30% in urban areas in 2017, as in the previous year.³ Additional indicators for assessing property prices, such as the ratio of purchase prices to annual rents, for example, support the view that valuation levels in cities were still high in 2017. Looking at 2018 to date, quarterly data from the Association of German Pfandbrief Banks and the Federal Statistical Office again show a slight increase in average price growth for Germany as a whole.

The main reason why prices are rising is strong demand for housing. This was driven by factors such as the good income prospects for households, positive labour market developments and the fact that mortgage rates remain extremely low.⁴ Although housing supply was expanded during the ongoing economic boom, this was

Residential property prices in Germany

2010 = 100, log scale



Sources: bulwiengesa AG, Association of German Pfandbrief Banks (vdp), Federal Statistical Office (Destatis) and Bundesbank calculations.
1 Transaction weighted. Bundesbank calculations based on price data provided by bulwiengesa AG. **2** Berlin, Cologne, Düsseldorf, Frankfurt am Main, Hamburg, Munich and Stuttgart.
 Deutsche Bundesbank

1 See also Y. Demyanyk and O. Van Hemert, Understanding the Subprime Mortgage Crisis, *The Review of Financial Studies*, Vol. 24, No 6, pp. 1848-1880, 2011; and G. Dell'Ariccia, D. Igan and L. Laeven, Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market, *Journal of Money, Credit and Banking*, Vol. 44, No 2-3, pp. 367-384, 2012.

2 Information on the German residential real estate market is provided by the Bundesbank's system of indicators, which is available at www.bundesbank.de/residential_property

3 The results are based on updated Bundesbank estimates. Overvaluations refer to the deviation of actual prices from their estimated fundamental values, which are based in conceptual terms on the sustainable components of economic and socio-demographic factors. For more information on the methodology, see F. Kajuth, T. Knetsch and N. Pinkwart, Assessing House Prices in Germany: Evidence from a Regional Dataset, *Journal of European Real Estate Research*, Vol. 9, No 3, pp. 286-307, 2016.

4 See Deutsche Bundesbank, Monthly Report, February 2018, pp. 51 ff.

not enough to eliminate excess demand.⁵ The ratio of housing investment to gross domestic product (GDP) was 6.3% in the second quarter of 2018, just above the average of 6.1% since the beginning of 1991. The number of completed dwellings increased slightly in 2017, but still fell significantly short of the number of building permits granted. It was also below the estimated annual demand for new buildings.⁶

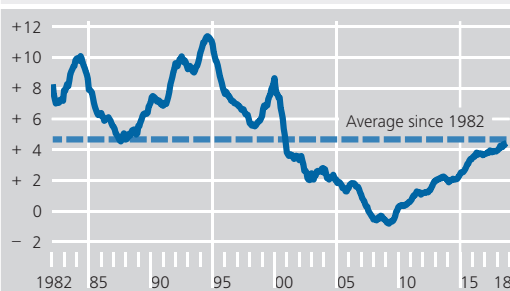
Growth rate of housing loans still below long-term average

The growth rate of loans to domestic households for house purchase has risen continuously since 2010 and stood at 4.4% year on year at the end of the third quarter of 2018 (see the chart). Growth was therefore still below the long-term average since the early 1980s of 4.8%. Nor does current credit growth look unusual in relation to the nominal annual growth rate of GDP of 4% in the fourth quarter of 2017. Growth in lending volumes has differed among the individual banking categories. As measured by the total volume of outstanding housing loans to German households, the savings banks' market share rose from 30% at the beginning of 2010 to 33% in the third quarter of 2018. Credit cooperatives' share rose from 20% to 25% in the same period, while commercial banks commanded an unchanged share of around 25%.⁷

There is evidence to suggest that there are tendencies towards an easing of lending standards for mortgage loans in 2018. In the Eurosystem's quarterly Bank Lending Survey (BLS), the 34 German respondents indicated, on balance, that they had eased their credit standards for housing loans for the fifth time in succession in the third quarter of 2018. Nonetheless, they stated that credit standards in the first quarter of 2018 were

German banks' lending to domestic households for house purchase*

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

still relatively tight in a longer-term comparison. The BLS additionally suggests that the surveyed banks have further tightened their margins on loans for house purchases in 2018 – both for average-risk and riskier exposures.⁸ Lower interest margins could be a reflection of banks not taking sufficient account of credit risk and could thus be associated with a build-up of risks to financial stability.

⁵ See Deutsche Bundesbank, Monthly Report, December 2017, pp. 19 ff.

⁶ See Federal Institute for Research on Building, Urban Affairs and Spatial Development, Wohnungs- und Immobilienmärkte in Deutschland, Analysen Bau.Stadt.Raum, Vol. 12, September 2016, pp. 35 ff.

⁷ Mortgage banks' market share, in particular, fell from just under 7% to slightly more than 2%. Building and loan associations, Landesbanken and banks with special, development and other central support tasks also hold mortgage loans.

⁸ In the BLS, the margin is defined as the difference between the lending rate and the relevant reference market rate (e.g. EURIBOR, LIBOR or interest rate swap for the corresponding maturity). Another definition is the difference between the interest rate charged for new housing loans and the interest rate for new bank deposits by households. Based on data from the MFI interest rate statistics, the average margin was thus relatively low in the first half of 2018 and remained roughly constant compared with the end of the previous year.

A further indicator of systemic risk stemming from mortgage financing is the relationship between loan volume and property value. A higher proportion of borrowed funds could result in greater losses for lenders if the real estate used as collateral is liquidated in the event of a loan default. The results of the BLS do not suggest that banks have noticeably lowered collateral requirements for housing loans or that sustainable loan-to-value (LTV) ratios have risen significantly.⁹ However, information provided by a loan brokerage platform indicates that the importance of loans with high sustainable LTV ratios has tended to increase of late.¹⁰

According to the available data, German households' debt sustainability has not deteriorated. Aggregate debt totalled around 50% of GDP at the end of 2017, which is fairly low by historical and international standards (see Chart 3.4 on p. 44). In the euro area, household debt at that time averaged 58% of GDP.¹¹ A structural feature of mortgage financing in Germany is that interest rates are fixed for long periods. Longer interest rate fixation periods reduce the risk of the credit burden on borrowers increasing as interest rates rise. The percentage of new loans for house purchase with an interest rate fixation period of over ten years rose significantly from 26% in the first quarter of 2010 to 45% in the second quarter of 2018. On aggregate, households' interest rate risk has thus tended to drop, whereas credit institutions' interest rate risk has probably tended to increase (see the section entitled "Interest rate risk still high for small and medium-sized banks" on pp. 76 ff.).

All in all, the available data on price developments, lending and household debt currently do not point to any substantial build-up of risks to financial stability arising from new housing loans.

The prerequisites for activating the borrower-based macroprudential instruments created in June 2017 are consequently not met at present.¹² However, from a macroprudential perspective, observers will have to keep a close eye on whether tendencies towards an easing of lending standards continue. When contemplating the possible use of borrower-based instruments and analysing their impact, it should also be borne in mind that the relevant data are currently not available in the quality and quantity recommended by the German Financial Stability Committee.

⁹ The sustainable LTV ratio is the ratio between the volume of a real estate loan and the mortgage lending value for the property in question. The latter is the value of a property resulting from a prudent assessment, taking into account the fundamental determinants of the value of the property (see Section 16(2) of the Pfandbrief Act, or *Pfandbriefgesetz*).

¹⁰ The loan brokerage platform EUROPACE provides details on the terms and conditions for loans on the loan applications it receives, available at <https://report.europace.de/ebix-etb/>

¹¹ This figure refers to statistics compiled by the Bank for International Settlements, which are available at <http://stats.bis.org/statx/srs/table/f3.1>

¹² See Section 48u of the German Banking Act (*Kreditwesengesetz*) as well as Deutsche Bundesbank, Financial Stability Review 2017, pp. 54 ff.

tled “Risks in the banking sector” on pp. 69 ff.). In a negative scenario such as an economic downturn, these banks could play a part in potentially jeopardising financial stability – and not just via their procyclical adjustments. In fact, they could, through either direct or indirect contagion effects, additionally transfer stress to other financial institutions.

Direct contagion can stem from contractual relationships between financial institutions (see Table 3.2). Within the banking sector, banks are interconnected chiefly via credit relationships on the interbank market.¹⁵ As in many other countries, the interbank market in Germany is characterised by a core-periphery structure.¹⁶ The core is primarily made up of large, systemically important institutions, which are heavily interconnected.¹⁷ They account for a large share of domestic interbank claims. The small banks make up the periphery. They are closely intertwined with the core, but the degree of their interconnectedness with each other is relatively low. Provided the core is resilient enough, such a structure is comparatively robust against the default of individual institutions.

It is not just direct financial links that are of relevance with respect to contagion risks between financial institutions; indirect links are, too. In particular, indirect contagion through what are known as fire sales plays a major role.¹⁸

Indirect contagion through what are known as fire sales plays a major role.

Losses – following an economic slump or an abrupt revaluation of financial assets, for instance – might force market participants to sell financial assets, for example (see the section entitled “Interest rate sensitivity of the German investment fund sector harbours risks to financial stability” on pp. 100 f.). Portfolio adjustments of this kind can send financial asset prices into a downward spiral. This potentially affects all holders of these financial assets, particularly in case of mark-to-market accounting. Adjustment responses within the financial system can thus drive losses even higher.

Interconnectedness in the German financial system based on selected sectors*

Table 3.2

End-of-quarter data as a percentage of GDP, as at Q2 2018

Debtors	Creditors				
	Households ¹	Non-financial corporations	Monetary financial institutions	Insurers	Investment funds ²
Households ¹			49.3	2.1	
Non-financial corporations	14.2	34.7	26.5	1.7	3.5
Monetary financial institutions	69.8	16.4	63.0	7.6	4.2
Insurers	42.4	1.7	0.1	3.7	0.4
Investment funds ²	10.8	4.2	9.1	17.3	7.2

Sources: Financial accounts of the Bundesbank, Federal Statistical Office, and Bundesbank calculations. * Data on the following claims were taken into account: deposits, debt securities, loans, listed shares, investment fund shares, insurance technical reserve entitlements and trade credits. ¹ Including non-profit institutions serving households. ² Excluding money market funds.

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The potential for contagion can, moreover, rise if financial institutions adjust their behaviour in times of crisis in response to changes in the underlying conditions. For instance, by virtue of their balance sheet structure, insurers can have a stabilising effect on the financial system as a whole. The long investment horizon and the very long maturity of their liabilities means that insurers are able to ignore short-term fluctuations in market value and hold securities over the long term. As holders of claims on other sectors, insurers may thus, in principle,

Insurers may have become more vulnerable to fluctuations in value in times of crisis.

¹⁵ For an overview of relevant contagion channels in financial systems, see also M. Hellwig (2018).

¹⁶ See B. Craig and G. von Peter (2014).

¹⁷ See Deutsche Bundesbank (2017b), p. 76.

¹⁸ See, inter alia, P. Glasserman and H. P. Young (2015).

have a stabilising effect on the financial system in times of crisis. However, it is possible that, in part due to market-consistent valuation under Solvency II, they have become more vulnerable to fluctuations in value in times of crisis (see the chapter entitled “Risks for insurers, pension institutions and investment funds” on pp. 83 ff.).

Cyber risks represent an additional contagion channel (see the box entitled “Cyber risks and financial stability” on pp. 63 ff.). These have increasingly taken a place at the forefront of financial stability analysis in recent years.

Risk scenarios for the German financial system

From a macroprudential perspective, how resilient the financial system is to adverse scenarios is important. This refers to scenarios which, though unlikely to occur, would entail considerable real economic costs.¹⁹ The identified cyclical vulnerabilities – underestimating credit risk, overvalued real estate prices and interest rate risk – highlight the fact that the German financial system currently has cyclical vulnerabilities to adverse macroeconomic scenarios, which are, in some cases, positively correlated. These scenarios include, in particular, an unexpected, strong economic downturn, marked corrections of asset and especially real estate prices, and a sharp rise in interest rates. Overall, the German financial system therefore faces considerable cyclical risks.

The German financial system currently has cyclical vulnerabilities to adverse macroeconomic scenarios, which are, in some cases, positively correlated.

nerabilities to adverse macroeconomic scenarios, which are, in some cases, positively correlated. These scenarios include, in particular, an unexpected, strong economic

Economic downturn would be amplified by the financial system

The possibility of the German economy experiencing a downturn has become more palpable than it was last year. This is because risks to future economic activity are now skewed to the downside. In the risk scenario of an economic downturn, the banking sector might come under pressure should a lot of banks, faced with rising loan losses, need to increase their risk provisioning and meet higher capital requirements. Consequently, banks’ free own funds could shrink significantly.

This heightens the risk of banks displaying herding behaviour in order to meet the capital ratios set by regulators or expected by the market. However, it is difficult to raise capital during an economic downturn. Banks are therefore likely to respond by deleveraging to stabilise their capital ratios.²⁰ The banking system could reduce credit lines or curtail lending excessively. It would then no longer perform its key economic function of supplying the economy with sufficient credit even during an economic downturn. As a result, the banking system would have a procyclical impact if it amplifies the economic downturn by deleveraging (see the chapter entitled “Risks in the banking sector” on pp. 69 ff.).

The banking system would have a procyclical impact if it amplifies the economic downturn by deleveraging.

¹⁹ For more on the high economic costs of recessions accompanied by financial crises, see also Ö. Jordà, M. Schularick and A. Taylor (2015); and C. Reinhart and K. Rogoff (2009).

²⁰ The microeconomic evidence on individual German banks’ reactions during the global financial crisis illustrates this transmission channel: banks that suffered major losses curtailed their loan supply more strongly or restructured their loan portfolio to include less risky loans. See M. Puri, J. Rocholl and S. Steffen (2011) as well as S. Ongena, G. Tümer-Alkan and N. von Westernhagen (2018).

The macroprudential toolkit for housing markets from a European perspective

Past banking crises were often preceded by credit-financed housing market bubbles.¹ However, many countries did not have suitable macroprudential instruments for their housing markets. This prompted international organisations to recommend the creation of an extensive toolkit of instruments.² The German Financial Stability Committee (*Ausschuss für Finanzstabilität* – AFS) made such a recommendation to the Federal Government in 2015.³

The macroprudential instruments for housing markets can be divided into two categories. Capital-based instruments are designed to boost the capital levels of lenders, thereby strengthening their resilience to setbacks. The aim of borrower-based instruments, on the other hand, is to prevent excessive lending or the granting of excessively risky loans. To this end, minimum standards for new lending are being introduced which limit the ratio of the total loan amount to the property value or to the income of the household. In addition, requirements can be stipulated with regard to the amortisation or maturity of a loan. At present, these two options are partly or fully in place in 14 of the 19 countries of the euro area.⁴ In Germany, the Act on the Amendment of Financial Supervisory Law (*Finanzaufsicht-rechtergänzungsgesetz*) of June 2017 created the legal basis for potentially imposing limits on the loan-to-value ratio, or LTV, as well as for amortisation requirements.⁵

The main objective in deploying these macroprudential instruments is to contain risks to national financial stability. Particularly in a banking and monetary union, macroprudential measures are

important as a means of countering risks when individual countries' financial cycles differ.⁶ The first crucial aspect when selecting and calibrating an instrument to be deployed is that the instrument addresses the identified risk. Moreover, it should be ensured that the depth of intervention is adequate to tackle the risk. A number of countries have decided initially to issue a recommendation instead of deploying instruments that have a binding effect.⁷ These recommendations can refer to the desired level of compliance with certain minimum lending standards as well as to

¹ Roughly two-thirds of 50 systemic banking crises have been preceded by exaggerations in the real estate market. See C. Crowe, G. Dell'Ariccia, I. Deniz and P. Rabanal, *How to Deal with Real Estate Booms: Lessons from Country Experiences*, IMF Working Paper, WP/11/91, April 2011.

² See European Systemic Risk Board, *Recommendation on intermediate objectives and instruments of macroprudential policy*, June 2013. For Germany, the International Monetary Fund recently recommended supplementing the macroprudential toolkit for housing markets with income-related instruments that were still lacking. See International Monetary Fund, *Germany, Article IV Consultation, Country Report No 18/208*, July 2018.

³ See Financial Stability Committee, *Recommendation on new instruments for regulating loans for the construction or purchase of residential real estate*, June 2015.

⁴ In December 2016, the ECB Governing Council recommended the availability of borrower-based instruments for euro area countries.

⁵ For a detailed description, see Deutsche Bundesbank, *Financial Stability Review 2017*, pp. 54-56.

⁶ See M. Rubio, *The Role of Macroprudential Policies in Prevention and Correction of Asset Imbalances in the Euro Area*, European Parliament, May 2017.

⁷ See, for example, Banco de Portugal's macroprudential recommendation, which has been in effect since July 2018, on LTV and DSTI requirements and limited maturities for housing loans; see Banco de Portugal, *Macroprudential Measure Within the Legal Framework of Credit for Consumers*, February 2018. In Denmark, the microprudential supervisory authority in 2014 introduced a regulatory framework known as the supervisory diamond for mortgage credit institutions. In the meantime, macroprudential supervisors, too, have implemented measures, such as the introduction of LTV limits; see International Monetary Fund, *Denmark – Selected Issues*, IMF Country Report No 18/178, June 2018.

Combined use of macroprudential instruments in the EU*

If one of these instruments is activated, ... ¹	... one of these instruments is also activated in x% of cases.				
	LTV ²	Amortisation/maturity ³	DSTI ⁴	LTI/DTI ⁵	RW/LGD ⁶
LTV ² (16)	—	● 50%	● 38%	● 19%	● 19%
Amortisation/maturity ³ (8)	● 100%	—	● 50%	● 25%	● 13%
DSTI ⁴ (6)	● 100%	● 67%	—	● 17%	0%
LTI/DTI ⁵ (4)	● 75%	● 50%	● 25%	—	● 50%
RW/LGD ⁶ (7)	● 43%	● 14%	0%	● 29%	—

Sources: ESRB and Bundesbank calculations. * Including Norway. ¹ In brackets: number of countries which have activated the instrument. ² Loan-to-value ratio. ³ Of housing loans. ⁴ Debt-service-to-income ratio. ⁵ Loan-to-income ratio/debt-to-income ratio. ⁶ Risk weight (RW) pursuant to Article 124/Article 458 CRR; loss given default (LGD) pursuant to Article 164 CRR.

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measures to strengthen lenders' capital position.⁸ The design of macroprudential instruments can be relatively flexible, and they can be adapted to national circumstances and specific risk factors. A combination of instruments is also possible, e.g. by specifying the size of risk weights together with LTV limits. Moreover, measures can also apply to sub-markets.

The task of the European Systemic Risk Board, or ESRB, in the European Union is to monitor the accumulation of risks and the appropriateness of the macroprudential policy stance in Member States. At the end of 2016, after identifying medium-term risks in their housing markets, the ESRB issued warnings to eight Member States.⁹ More than two-thirds of EU Member States have activated macroprudential instruments for their housing markets. Limits on LTVs are currently in place in 16 countries, making them the most commonly deployed instrument. Nine countries have implemented measures that focus on the borrowers' debt sustainability (debt service-to-income ratio, DSTI; loan-to-income ratio, LTI; debt-to-income ratio, DTI). Requirements with regard to the maturity or amortisation of housing loans

have been activated in eight countries. By influencing the repayment, the latter instrument at the same time has an impact on the amount of the outstanding loan in relation to the property value. Moreover, this instrument has an effect on the ongoing servicing of debt and therefore on the DSTI. The combined use of instruments makes it possible to prevent leakages.¹⁰ For example, half of the countries which specified amortisation requirements also imposed limits on the DSTI (see the chart). This ensures that the loan is repaid in a shorter period of time without the ongoing servicing of the debt being potentially increased to unsustainable levels.

Most macroprudential instruments for EU housing markets have only been implemented in the last few years. For this reason, no systematic

⁸ See European Systemic Risk Board, A Review of Macroprudential Policy in the EU 2017, April 2018, Annex 2 and Annex 3.

⁹ Austria, Belgium, Denmark, Finland, Luxembourg, the Netherlands, Sweden and the United Kingdom.

¹⁰ See J. Cizel, J. Frost, A. Houben and P. Wierst, Effective Macroprudential Policy: Cross-sector Substitution from Price and Quantity Measures, IMF Working Paper, WP/16/94, April 2016.

evaluations of the combined effect of multiple instruments are as yet available.¹¹ However, the number of instrument activations is rising steadily, which will raise the possibility of conducting such analyses going forward.¹² In some cases, significantly longer horizons of experience are to be found in the non-European context. Taking into account country-specific circumstances, these can provide additional yardsticks for the selection and calibration of macroprudential instruments in the EU.¹³

11 For an example of an ex post evaluation, see R. Kelly, F. McCann and C. O’Toole, Credit Conditions, Macroprudential Policy and House Prices, ESRB Working Paper No 36, February 2017.

12 In this context, it is necessary to capture measures systematically so that more extensive evaluations can be carried out going forward. See U. Kochanska, The ESRB Macroprudential Measures Database, December 2017.

13 See E. Cerrutti, S. Claessens and L. Laeven (2017), The Use and Effectiveness of Macroprudential Policies: New evidence, Journal of Financial Stability, Vol. 28, pp. 203-224.

Impairment of loan collateral would additionally increase pressure on banks

An unexpected, severe economic downturn would probably be accompanied by a correction of asset prices, especially overvalued real estate prices. A

An unexpected, severe economic downturn would probably be accompanied by a correction of real estate prices.

correction of real estate prices means, for banks, that assets used as loan collateral lose value. If such a correction is larger than what banks may

have already allowed for, there would be an unexpectedly strong increase in loss given default. An economic downturn and a correction of real estate prices would hit large parts of the banking system simultaneously, with the likely outcome that the procyclical effect would be even more pronounced.

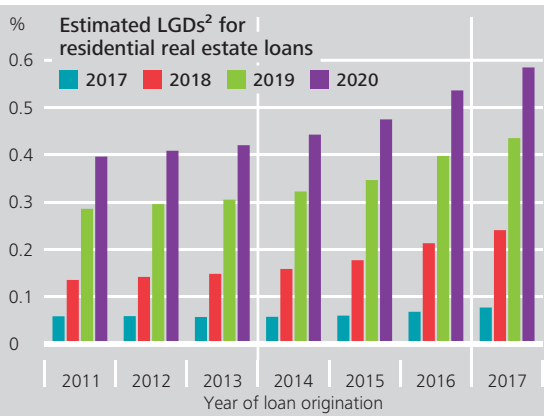
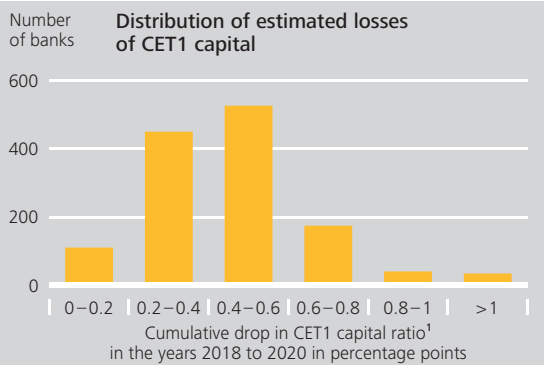
The Bundesbank carries out residential real estate stress tests in order to estimate the potential losses that German banks might incur on their portfolios of residential real estate loans.²¹ The current stress test for 2018 is based upon bank-level data for the German banking system as a whole as well as granular regional house price data.²² In the stress scenario assumed in that test, nominal house prices fall by a total of 30% in the years 2018 to 2020. In addition, the unemployment rate rises by 6 percentage points. Over a forecast horizon from 2018 to 2020, losses are estimated on the basis of the impairments that banks are expected to make in response to this shock.

21 See N. Barasinska, P. Haenle and T. Siemsen (2018).

22 See N. Barasinska, P. Haenle, A. Koban and A. Schmidt (2018) as well as Deutsche Bundesbank (2017a).

Estimated stress test effects for German banks*

Chart 3.6



* Stress test scenario: macroeconomic shock with falling house prices and rising unemployment. The stress test relates solely to estimated expected losses on residential real estate loans. 1,338 banks were analysed in total. ¹ CET1 capital as a percentage of risk-weighted assets. ² Estimated expected losses as a percentage of the outstanding loan volume.
 Deutsche Bundesbank

Higher unemployment translates into a higher probability of default for loans. This correlation can be explained by declining household incomes as unemployment rises (see the section entitled “Considerable drop in income likely to reduce households’ debt sustainability” on pp. 65 f.). In addition, the decline in house prices also causes the loss given default to rise. Both factors together lead to a significant increase in expected losses in the banking sector. Expected losses would rise from an average of less

The estimated stress effects affect large parts of the banking system.

than 0.1% of loans outstanding in base year 2017 – i.e. the last year prior to the adverse shock – to just under 0.5% at the end of the forecast horizon in 2020. Measured in terms of the CET1 ratio, the stress effects are significant. On aggregate, the expected decline in the CET1 ratio is around 0.5 percentage point. Moreover, the estimated stress effects are not confined to just a few institutions, but affect large parts of the banking system (see Chart 3.6).

The stress test further shows that losses would affect not only new, but also older loan vintages. In other words, the fact that rising prices have brought about a significant appreciation of this loan collateral has not eliminated the risk of losses in the loan portfolio.

The results should be interpreted as more of a lower bound for potential losses both at the individual bank level and on aggregate, since the stress test only captures the impairment of residential real estate loans expected in the stress scenario. The decline in the CET1 capital ratio would, for example, be higher if an increase in risk-weighted assets or a decline in interest income as a result of heavier loan losses were also modelled.²³ Furthermore, losses and thus the decline in capital would be significantly higher in the event of contagion effects on other asset classes or second-round effects.²⁴ For this reason, an integrated stress test was carried out for the entire German banking system, giving a more comprehensive picture of the consequences of an economic downturn accompanied by a drop in real estate prices. This includes not only losses from the residential real estate loan portfolios but also other lending business sub-portfolios (see the chapter entitled “Risks in the banking sector” on pp. 69 ff.).

²³ See T. Siemsen and J. Vilsmeier (2017).
²⁴ Second-round effects may arise, for instance, if banks curtail lending as a result of the losses incurred in the stress scenario and thus further amplify the economic downturn.

Cyber risks and financial stability

The advance of digitalisation and growing interconnectedness in the financial system are increasingly pushing cyber risks to the forefront of financial stability analysis.¹

Cyber attacks on banks, insurers or market infrastructures such as payment systems can pose a threat to the confidentiality, integrity and availability of their data and IT systems. This gives them the potential to impair the functional viability of the entire financial system. Of particular importance for financial stability are attacks on systemically important market participants or on a large number of financial institutions. If, in extremis, those institutions were to fail, this could destabilise the entire system.

There are generally three transmission channels through which cyber attacks operate:

- A cyber attack can cause financial losses directly if, for instance, balances are funnelled to the attacker's accounts.
- A concrete functional threat may exist, say, in cases where systemically important services such as payments are either no longer possible or subject to considerable restrictions.
- Cyber attacks can also take the form of misinformation aimed at damaging the reputation of a market player. For example, the systematic dissemination of rumours in social networks casting doubt on banks' solvency could result in bank runs.²

Procedures for integrating cyber risks into macroprudential analysis are currently being developed. The Bundesbank uses a macroprudential

cybermapping approach to schematically model the channels through which cyber risks can be transmitted to the financial system (financial network) (see the chart).³

The cyber network comprises, inter alia, software, hardware and communication service providers, and thus elements on which the operational processes of the financial system are based. Direct connection points between the financial network and the cyber network are created when financial institutions use a certain product or the services of a given IT provider.

A connection point is created if, for example, multiple financial institutions procure their IT services from the same third-party vendor (such as a cloud vendor). This can create considerable concentration risk for the financial system. Shocks could then be transmitted from the cyber network to the financial network, thus jeopardising the latter's stability – especially where the networks' points of contact are located among systemically important agents in the financial system.

The cybermapping approach makes it clear that cyber risks also differ from conventional structural and cyclical risks to financial stability with regard to their propagation properties. One dif-

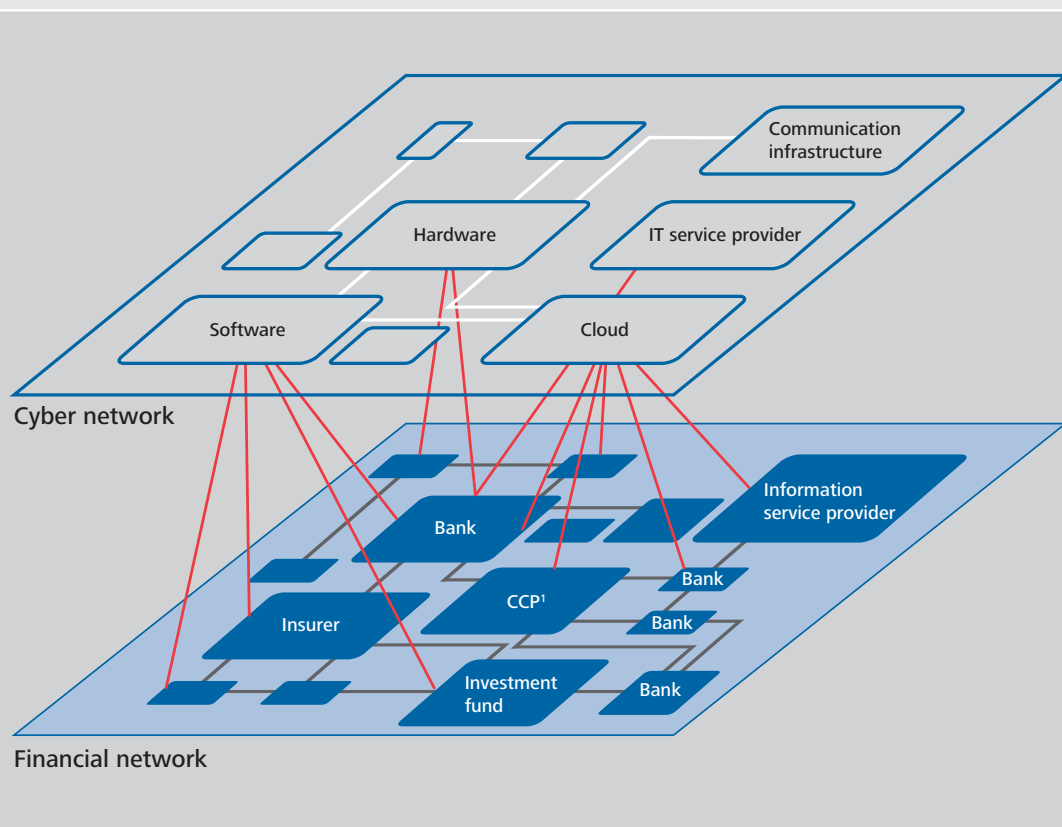
¹ For more on the term cyber risks, see, for example, Financial Stability Committee, Fünfter Bericht an den Deutschen Bundestag zur Finanzstabilität in Deutschland, June 2018, pp. 40 f.; and Financial Stability Committee, Dritter Bericht an den Deutschen Bundestag, June 2016, pp. 40 f.

² In 2014, such an attack on a Bulgarian bank forced the Bulgarian central bank to provide that institution with emergency liquidity.

³ See Financial Stability Committee, Fünfter Bericht an den Deutschen Bundestag zur Finanzstabilität in Deutschland, June 2018.

Cybermapping the German financial system

schematic view



¹ Central counterparty.

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ference is that cyber risks are independent of financial cycles and the structure of the financial system. Another is that a single security gap in a widely used hardware or software product can already suffice to destabilise the entire cyber network – and with it the financial system.

Structured information on cyber incidents and on the interconnectedness between the financial system and the cyber network is hardly available. This deficit remains the core roadblock to a concrete assessment of the risk situation. For instance, there is no established and compre-

hensive reporting regime for the financial system with a sufficient basis for a robust analysis of systemic cyber risks.

Considerable drop in income likely to reduce households' debt sustainability

Overestimating the intrinsic value of loan collateral is a problem especially if borrowers' debt sustainability deteriorates materially. This would be the case, for instance, if indebted households were, in an economic downturn, hit not only by falling incomes as a result of rising unemployment, but also by higher financing costs. To illustrate potential effects, the Bundesbank carried out an analysis based on data

Overestimating the value of loan collateral is a problem especially if borrowers' debt sustainability deteriorates.

from a survey conducted by the Association of German Pfandbrief Banks (vdp).²⁵

This analysis shows, for 2017, that a significant drop in income

accompanied by a marked rise in interest rates noticeably lifts debt service ratios, i.e. the percentage of disposable income spent on servicing the loan. An isolated interest rate increase, by contrast, would expose indebted households to moderate risks.²⁶

The calculations are based on a fictitious household assumed, respectively, to have taken out a mortgage for an owner-occupied apartment or a house in 2017 whose income and loan terms correspond to the average responses in the vdp survey for 2017 (see Table 3.3).²⁷ The household's debt service ratio was roughly 25% in the first year, 2017. The loan needs to be refinanced after the average interest rate fixation period of 14 years.²⁸ For the stress scenario, the household is assumed to have suffered a 50% drop in income when the loan is rolled over as compared to when the loan was first granted. That would be conceivable, say, if one of two earners in the household becomes unemployed. At the same time, the household is confronted with a hypothetical interest rate hike: when the mortgage is refinanced, the new interest rate is 4.7%. This equals the rate of 2009 and represents an increase of slightly more than 2.8 percentage points compared with the level in mid-2018.

Assumptions for calculating the debt service ratio*

Table 3.3

Item	Loan for house purchase	Loan for the purchase of an owner-occupied apartment
Amount of the loan (€ thousand)	261	203
Agreed interest rate (% p.a.)	1.86	1.86
Initial amortisation rate (% p.a.)	3.23	3.23
Net household income (monthly, in €)	4,400	3,500
Interest rate fixation period (in years)	14	14
Amount of the loan outstanding at the end of the fixed interest period (€ thousand)	126	99
New interest rate after the end of the interest rate fixation period (% p.a.)	4.70	4.70

Sources: Association of German Pfandbrief Banks (vdp) and Bundesbank calculations. * Loans are assumed to be annuity loans. For the calculations, it is assumed that no one-off repayments are made.

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The lower income combined with the increase in monthly mortgage payments means that the debt service ratio rises to a critically high level of 62% for apartments and 63% for houses. These ratios are well above the levels observed in Germany in the past.²⁹ They are also above the 40% mark, which international studies identify as a critical level.³⁰ The

²⁵ See Association of German Pfandbrief Banks (vdp) (2017).

²⁶ Interest rate risk on the part of lenders means that an interest rate shock can nevertheless hit the banking system hard.

²⁷ The same calculations were also carried out with a fictitious borrower in 2015. The results are very similar.

²⁸ The assumption is made that the amortisation rate is not adjusted when the loan is refinanced.

²⁹ According to data provided by vdp, the debt service ratio for homebuyers in the period from 1995 to 2003 was 33% to 34%. See Association of German Pfandbrief Banks (vdp) (2017).

³⁰ In international empirical studies, a debt service-to-income ratio of 40% is regarded as the level above which a significant increase in borrower vulnerabilities can be expected. See R. Djoudad (2010); O. Bover (2011) as well as S. Costa and L. Farinha (2012).

probability of default would therefore likely rise significantly.

The main factor driving the rise in the debt service ratio is the drop in income. In a scenario in which interest rates rise to 4.7% while incomes grow by 2% a year, the debt service ratio is only 23% for apartments and 24% for houses when the loan is rolled over. Debt sustainability for the fictitious household analysed here would thus not deteriorate.

Interest rate movements could amplify economic downturn

Interest rate developments have a particular significance in the event of an unexpected, severe economic downturn. Unlike in previous downturns, the financial system is at the end of a protracted low interest rate environment and thus vulnerable both to the risk scenario of an unexpectedly strong rate hike and to a continued low interest rate environment (see the section entitled “High interest rate risk” on p. 50). Interest rate developments could therefore further amplify the procyclical effects in an economic downturn.

If interest rates rise unexpectedly sharply, small and medium-sized banks, in particular, are likely to suffer losses in the short term. Other areas of the financial system, such as the insurance and the investment fund sectors, could also trigger a procyclical effect if they respond to sharp interest rate rises by changing their investment behaviour (see the chapter entitled “Risks for insurers, pension institutions and investment funds” on pp. 83 ff.).

A continued low interest rate environment would heighten the vulnerabilities within the financial system as a whole.

A continued low interest rate environment would heighten the vulnerabilities not only within the banking system, but across

the financial system as a whole. Life insurers would find it increasingly difficult, for instance, to meet the sometimes high guaranteed returns promised to policyholders in the past.

How interest rates in Germany develop during an economic downturn depends on whether the downturn is accompanied by an increase in risk aversion and whether it is confined to Germany or affects the euro area as a whole. An economic downturn typically entails an increase in risk aversion and risk premia. This would affect the funding costs of the banking sector as a whole (see Chart 4.4 on p. 71), causing existing interest rate risk to materialise.

Cyclical risks call for preventive action

The aim of macroprudential supervision is to recognise risks to financial stability at an early stage. In an economic boom, in particular, there is a risk of market participants underestimating risks and overestimating their own resilience. Overall, the analyses paint the picture of a financial system in which cyclical risks have built up in recent years.

Risks to financial stability may arise, in particular, if developments in the macroeconomic and financial environment differ significantly from what is expected. In the current situation, credit risk, real estate risk and interest rate risk may occur simultaneously and reinforce each other. An economic downturn might thus result in herding behaviour within the financial system and be amplified by the financial system. Action is therefore needed from a macroprudential perspective. The good times should be used to heighten resilience for potential bad times.

The good times should be used to heighten resilience for potential bad times.

■ List of references

- Abbassi, P. and M. Schmidt (2018), Yield-oriented Investment Behaviour in Debt Securities Markets, Deutsche Bundesbank, mimeo.
- Agnello, L. and L. Schuknecht (2011), Booms and Busts in Housing Markets: Determinants and Implications, *Journal of Housing Economics*, Vol. 20, No 3, pp. 171-190.
- Association of German Pfandbrief Banks (vdp) (2017), *Strukturen der Wohneigentumsfinanzierung 2017*, October 2017.
- Barasinska, N., P. Haenle, A. Koban and A. Schmidt (2018), Stress Testing the German Mortgage Market, Deutsche Bundesbank, mimeo.
- Barasinska, N., P. Haenle and T. Siemsen (2018), Two stress tests examine the resilience of German banks to a drop in real estate prices, Deutsche Bundesbank, Research Brief No 19, June 2018.
- Bhattacharya, S., C. Goodhart, D. Tsomocos and A. Vardoulakis (2015), A Reconsideration of Minsky's Financial Instability Hypothesis, *Journal of Money, Credit and Banking*, Vol. 47, No 5, pp. 931-973.
- Bordalo, P., N. Gennaioli and A. Shleifer (2018), Diagnostic Expectations and Credit Cycles, *Journal of Finance*, forthcoming.
- Bover, O. (2011), Survey of Household Finances (EFF) 2008: Methods, Results and Changes since 2005, Banco de España, Occasional Papers No 1103, July 2011.
- Costa, S. and L. Farinha (2012), Households' Indebtedness: A Microeconomic Analysis Based on the Results of the Households' Financial and Consumption Survey, Banco de Portugal, Financial Stability Report, May 2012.
- Craig, B. and G. von Peter (2014), Interbank Tiering and Money-Center Banks, *Journal of Financial Intermediation*, Vol. 23, No 3, pp. 322-347.
- Danielsson, J., M. Valenzuela and I. Zer (2018), Learning from History: Volatility and Financial Crises, *Review of Financial Studies*, forthcoming.
- Deutsche Bundesbank (2017a), Monthly Report, March 2017.
- Deutsche Bundesbank (2017b), Financial Stability Review 2017.
- Deutsche Bundesbank (2018a), Monthly Report, February 2018.
- Deutsche Bundesbank (2018b), Monthly Report, June 2018.
- Deutsche Bundesbank (2018c), Monthly Report, August 2018.
- Djoudad, R. (2010), The Bank of Canada's Analytic Framework for Assessing the Vulnerability of the Household Sector, *Bank of Canada Financial System Review*, June 2010.
- European Systemic Risk Board (2014), Recommendation of the European Systemic Risk Board of 18 June 2014 on guidance for setting countercyclical buffer rates, Recommendation ESRB/2014/1, June 2014.
- Glasserman, P. and H. P. Young (2015), How Likely is Contagion in Financial Networks?, *Journal of Banking and Finance*, Vol. 50, pp. 383-399.
- Guttentag, J. and R. Herring (1984), Credit Rationing and Financial Disorder, *Journal of Finance*, Vol. 39, No 5, pp. 1359-1382.
- Hellwig, M. (2018), Germany and the Financial Crises 2007 – 2017, mimeo.

Jordà, Ò., M. Schularick and A. Taylor (2015), Leveraged Bubbles, *Journal of Monetary Economics*, Vol. 76(S), pp. 1-20.

Minsky, H. (1977), The Financial Instability Hypothesis: An Interpretation of Keynes and an Alternative to "Standard" Theory, *Challenge*, Vol. 20, No 1, pp. 20-27.

Ongena, S., G. Tümer-Alkan and N. von Westernhagen (2018), Do Exposures to Sagging Real Estate, Subprime, or Conduits Abroad Lead to Contraction and Flight to Quality in Bank Lending at Home?, *Review of Finance*, Vol. 22, No 4, pp. 1335-1373.

Puri, M., J. Rocholl and S. Steffen (2011), Global Retail Lending in the Aftermath of the US Financial Crisis: Distinguishing between Supply and Demand Effects, *Journal of Financial Economics*, Vol. 100, pp. 556-578.

Reinhart, C. and K. Rogoff (2009), *This Time Is Different: Eight Centuries of Financial Folly*, Princeton University Press, Princeton and Woodstock.

Siemsen, T. and J. Vilsmeier (2017), A Stress Test Framework for the German Mortgage Market - Methodology and Application, Deutsche Bundesbank Discussion Paper No 37/2017, December 2017.

I Risks in the banking sector

German banks play a key role in the German financial system and thus in the provision of financial services to the economy. In order to carry out this important economic role, banks need to be soundly financed and be able to withstand unexpected economic developments. It is therefore to be welcomed that banks have significantly improved their capital resources in recent years. The comprehensive financial market regulatory reforms since the financial crisis have contributed to this in no small way.

However, the prolonged period of favourable economic development over recent years has also meant that risks from an unexpected worsening of the economic situation might be underestimated and undervalued. For example, risk provisions are currently low, and risk weights, which are used by large banks in particular to calculate their regulatory capital requirements for lending, are also low in some cases. This has made the German banking system vulnerable to a scenario of an unexpectedly pronounced worsening of the macroeconomic environment. In the event of an economic slump, risk provisioning and risk weights could rise sharply, thus considerably reducing banks' free own funds. In response to this, banks could scale back their lending, which could intensify a downturn.

Furthermore, the current high interest rate risks at banks could contribute to an accelerated reduction of assets during an economic downturn. In an environment of low interest rates, along with corresponding adjustments to investment portfolios, there has been a build-up of interest rate risks at many banks. If there were an unexpectedly sharp rise in interest rates, this would lead to losses and amplify any pro-cyclical adjustment by the banking system.

Indications that risks are being underestimated

Households and enterprises in Germany are currently benefiting from an exceptionally positive economic environment. The German economy is experiencing the longest period of economic expansion since the country's reunification. Interest rates are historically low and housing prices are rising sharply. As a result of falling credit default rates and the rise in value of real estate collateral, banks' risk provisioning for lending operations has fallen considerably. Capital requirements for lending have also been reduced substantially in some cases, especially for larger banks, many of which use internal models to determine risk weights. These developments have been accompanied by a sharp decline in volatility on the financial markets, which has tended to lower capital requirements for banks engaged in trading. In this

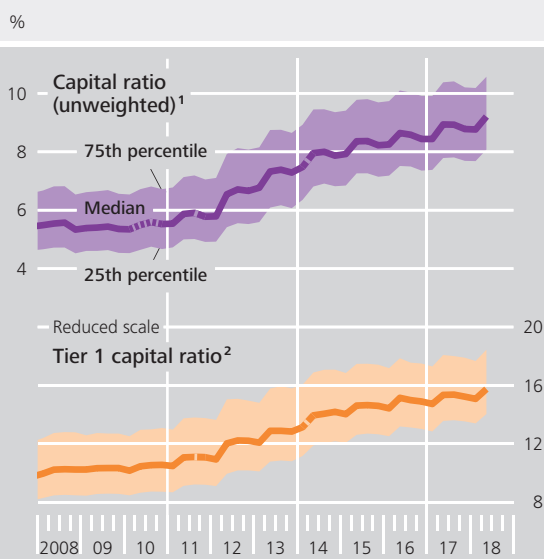
buoyant setting there is a danger of vulnerabilities gradually mounting and risks in the banking sector being underestimated.

Risk provisioning at a historically low level

Over the past ten years, capital resources at German banks have improved significantly (see Chart 4.1). This development is attributable, not least, to numerous microprudential regulatory measures and the capital buffers for systemically important banks. Other contributing factors include, in particular, the favourable economic growth and the sharp drop in risk provisioning. Falling value adjustments in banks' lending business are attributable in part to the robust economic situation of German non-financial corporations. Their capital ratios rose significantly, from 19% in 1997 to 30% in 2015. At last count, the share of non-performing loans at German banks had fallen to 3.8%, which is substantially below the long-term average of 4.6%.¹ Credit institutions' risk provisioning also fell to a historically low level as a result. Alongside the lower default risks, the increased value of collateral to secure loans, particularly in the case of real estate, is likely to have contributed to the low risk provisioning.

However, contrary to what the term might suggest, risk provisions are suitable as a measure of medium-term cyclical risks only to a limited degree. As the bulk of risk provisions consist of specific loan loss provisions, only realised or very short-term risks tend to be covered. (see Chart 4.2). The decisive factor is that, according to the applicable accounting rules, specific loan loss provisions are only made if the borrower falls into arrears or a default is likely.

Capitalisation of German banks* Chart 4.1



* In 2011 and 2014, the valuations of tier 1 capital and risk-weighted assets changed as a result of Capital Requirements Directives CRD III and CRD IV. ¹ Tier 1 capital in relation to total assets; transitional period in 2010 pursuant to the Accounting Law Modernisation Act (*Bilanzrechtsmodernisierungsgesetz*). ² Tier 1 capital in relation to risk-weighted assets.
 Deutsche Bundesbank

¹ Non-performing loans include loans with specific loss provisions prior to deduction of specific value adjustments, loans past due and loans with an increased probability of default.

A counterfactual scenario can be used to illustrate how significant the drop in risk provisions has been

If risk provisioning had remained at its historical average, the tier 1 capital ratio would currently be 2 percentage points lower.

for the changes in the tier 1 capital ratio. In this scenario it is assumed that risk provisioning in recent years has remained constant at its historical average

Overall, the tier 1 capital ratio, assuming no change in payout behaviour, would currently be more than 2 percentage points lower (14.5% instead of 16.7%; see Chart 4.3).

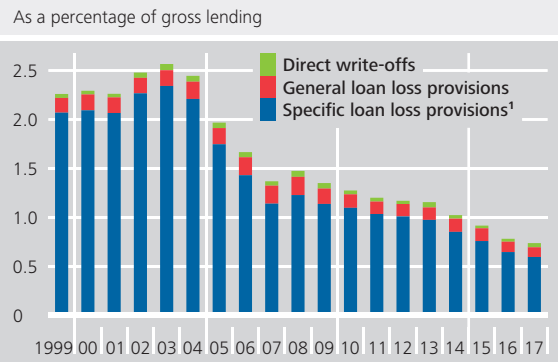
Risk premia unlikely to adequately cover cyclical risks

Since the height of the European sovereign debt crisis in 2011, risk premia for wholesale financing, i.e. financing via institutional investors or via the interbank market, have declined considerably (see Chart 4.4). This development is, above all, relevant for large banks, which use this type of financing to a greater extent than small and medium-sized institutions. Together with the declining general (risk-free) level of interest rates, the falling risk premia have helped institutions to lower their financing costs.²

However, the standard market risk premia are unlikely to adequately cover the cyclical risks of the banking sector. For one thing, funding via institutional investors or the interbank market is predominantly short-term. As a result, the risk premia apply to short-term default risks for the most part, rather than medium-term cyclical default risks.

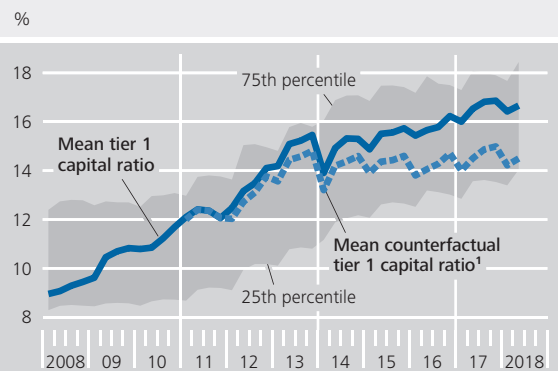
² However, a low interest rate level also puts pressure on interest income in the medium term, with the overall effect on net interest income usually being negative in the long term.

Components of risk provisioning in lending business* Chart 4.2



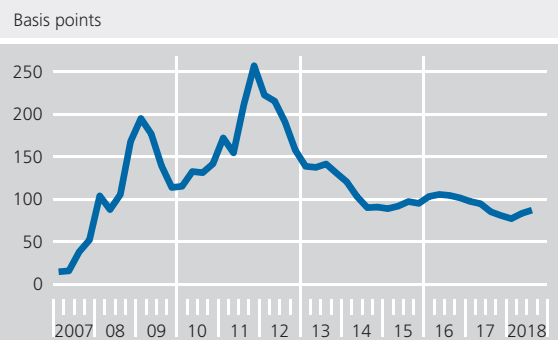
* Data pursuant to the Audit Report Regulation (*Prüfungsberichtsverordnung*). ¹ Including generalised specific loan loss provisions.
 Deutsche Bundesbank

Counterfactual tier 1 capital ratio Chart 4.3



¹ Calculation made under the counterfactual assumption that credit risk provisioning for each institution as of 2011 onwards corresponds to the average from 1999 to 2010.
 Deutsche Bundesbank

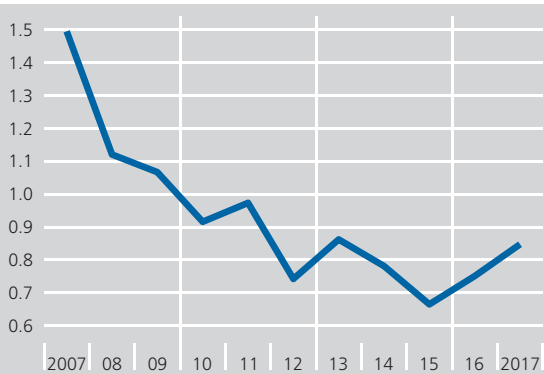
Credit default swap premiums of German banks* Chart 4.4



Sources: Bloomberg, Markit and Bundesbank calculations. * Quarterly mean value of the trading day average over the available five-year credit default swap premiums (16 banks).
 Deutsche Bundesbank

Price/book ratios of German banks Chart 4.5

Median of 8 listed banks



Sources: SNL Financial and Bundesbank calculations.
 Deutsche Bundesbank

Furthermore, implicit state guarantees may have the effect of skewing risk premia at large banks downwards.³ As a result, risk premia are likely to under-

The lower risk premia are likely to underestimate medium-term, systemic and cyclical risks.

estimate medium-term, systemic and cyclical risks. However, financing costs could climb again quickly if market sentiment changes.

The fact that financing costs react in a volatile manner is shown, for example, by the development of credit default swap spreads. These are a common measure of risk premia in banks' refinancing.

If risk premia rise, banks could come under pressure on two fronts. First, the higher funding costs weigh on banks' earnings – and in the event of losses, even on their capital.

Second, banks could feel forced to raise their capital ratio in order to become more attractive to institutional investors. However, raising capital on the capital market is currently relatively expensive for listed German banks. For example, the price/book ratio of listed German banks has fallen sharply since 2007 (see Chart 4.5). This is likely to reflect, above all, the low earnings prospects of these institutions.

Economic risks could be underestimated

Due to the good situation in the corporate sector, the ratings of loans have also improved. As a result, the risk classification and thus the capital requirement for the credit portfolio has fallen, particularly at large banks. The regulatory minimum capital requirement is calculated directly in relation to the level of risk-weighted assets. The risk weights for lending can be determined using two different approaches.

The good situation in the corporate sector has led to lower capital requirements for the credit portfolio, particularly at large banks.

In the credit risk standardised approach they are set on the basis of external ratings. Small and medium-sized banks, in particular, use this approach because it is relatively easy to implement. As most German companies are not rated, their loans are evaluated with a predetermined, fixed risk weight. This also applies to loans to households.

Larger banks, by contrast, use internal risk measurement models (internal ratings-based approach – IRBA) more frequently. These models are reviewed by supervisors and are subject to approval before they can be used to calculate capital requirements. In principle, internal models provide a more precise picture of bank-specific risks than standardised approaches.⁴ The resulting risk weights reflect the credit risk of the respective borrowers at the current point in time. However, this means that they are also considerably more risk-sensitive over time and change to a greater extent as a result of macroeconomic changes than risk weights in the standardised approach.

³ See Deutsche Bundesbank (2016), pp. 41-42.
⁴ By contrast, the risk weights in the credit risk standardised approach have been calibrated on an international basis, which means that the credit risk of German enterprises may be subject to a certain degree of valuation error.

If many significant banks use internal models, this can lead to systemic risks. While the average risk weights for loans to enterprises surged after the 2008 crisis, they have since been falling continually (see Chart 4.6). This decline, which can also be seen in retail business,

Risk weights calculated using internal models could currently be considered optimistic.

is for the most part attributable to the economic setting, which has been favourable for quite some time.

This means that the risk weights calculated using the internal models could currently be considered optimistic.

Regulation requires a time horizon of at least five to seven years for the calibration of the models. As internal models for calculating regulatory capital for credit risk have been approved since 2007, many institutions can indeed draw on a long data history. Nevertheless, due to the current unusually prolonged period of economic expansion, recessions may potentially be underrepresented. There is therefore a danger of economic risks being underestimated in the banking sector as a whole if risk weights fall continually.⁵

Using bank-specific risk measures, it is possible to determine the riskiness of loans on banks' balance sheets issued to enterprises of a given sector.⁶ These bank-specific risk measures can be used as comparative values when assessing the development of risk weights calculated by banks. For this purpose, the outstanding loans to enterprises are viewed on a sector-by-sector basis.

For each sector, checks are made to establish how enterprises' equity ratios and interest coverage ratios

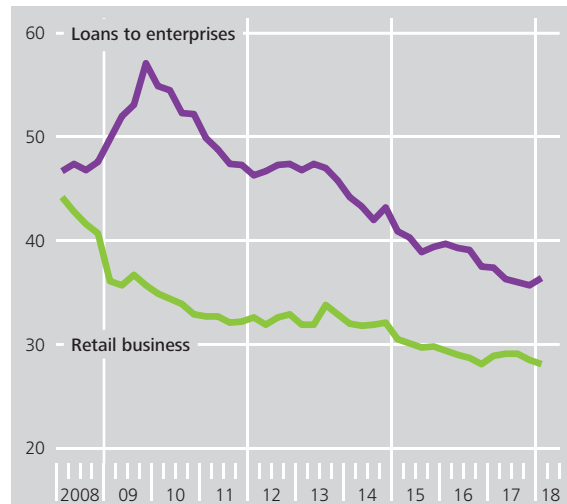
At large banks, risk measures for credit risk have changed less than the corresponding risk weights for loans to enterprises.

have developed in aggregate terms.⁷ These metrics are then weighted for each bank with the respective lending volumes per sector. This results

in two risk measures of credit risk on banks' balance

IRBA RWA densities* of German banks for loans to enterprises and in retail business Chart 4.6

Mean value as a percentage



* The RWA density is determined as the ratio of risk-weighted assets (RWAs) to the respective gross exposures. In addition, it is taken into account that in the internal ratings-based approach (IRBA), regulatory corrections to value adjustments are made to the capital that must be held.

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sheets. Both indicators have tended to improve in median terms, indicating a falling credit risk (see Chart 4.7). At large banks, these risk measures have changed in a less pronounced fashion than the corresponding risk weights for loans to enterprises.

It should be noted here that there is a non-linear correlation between the chosen balance sheet indicators and the probability of default. Thus, even a slight improvement in the indicators can mean a significant decline in the measured probability of default.⁸ On the other hand, however, a moderate worsening of the balance sheet indicators – ushered

⁵ See P. Bordalo, N. Gennaioli and A. Shleifer (2018); S. Jesus and J. Gabriel (2006); P. Lowe (2002) and H. Minsky (1977).

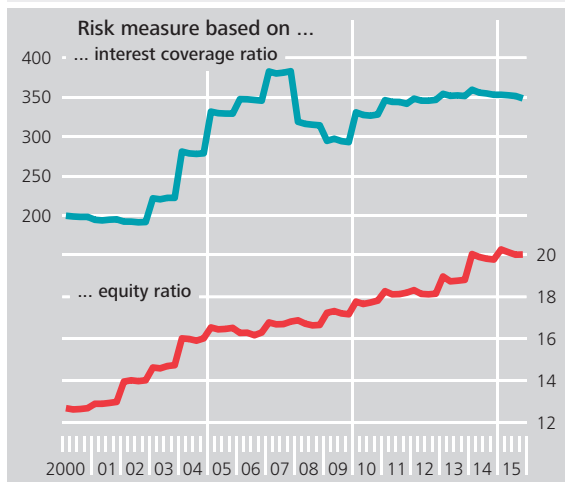
⁶ These analyses are based on data from borrowers statistics and corporate balance sheet statistics.

⁷ The interest coverage ratio is the ratio of the annual result before interest and taxes to interest expenditure.

⁸ This effect occurs, for example, in the logistic regressions frequently used to measure probabilities of default.

Bank-specific risk measures for loans to enterprises* Chart 4.7

Median as a percentage

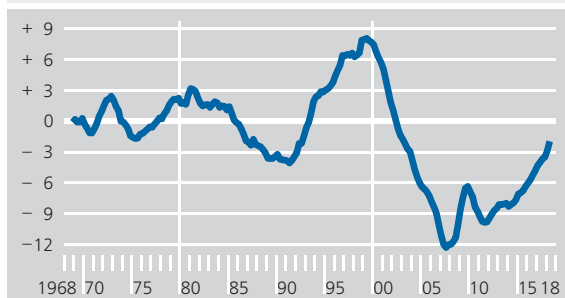


* Average interest coverage ratio and equity ratio of the bank's domestic credit portfolio, representing the median of the calculated risk measures. The calculations are based on borrowers statistics and extrapolated data from the annual financial statements of German enterprises. In the first step, aggregate interest coverage ratios and equity ratios are determined at the level of individual economic sectors. In the second step, bank-specific risk measures are calculated as the sum of the weighted lending to the individual domestic economic sectors.

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Credit-to-GDP gap in Germany* Chart 4.8

Percentage points, quarterly



* Deviation of the credit-to-GDP ratio from its long-term trend. Loans and bill-based loans from domestic monetary financial institutions (excluding the central bank) to domestic non-financial corporations, households, and non-profit institutions serving households as well as debt securities issued by German non-financial corporations.

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in, for example, by an economic turnaround – could be accompanied by a steeper rise in the measured probability of default in the corporate sector.

Uneven development in lending across sectors

Thus far, banks have, for the most part, responded to the favourable economic development and falling credit risk by moderately expanding their lending. Credit growth since 2010 has been largely attributable to loans to the services, construction and household sectors. It is likely that the latter sectors are being boosted by the prolonged real estate boom.

Lending by German banks to domestic enterprises and households has accelerated recently. In the second quarter of 2018 it was around 4% higher than in the comparable period of 2017, and thus at its highest level since 2003. For loans to enterprises and self-employed persons, growth was even higher, at roughly 5%. Above average growth rates can be seen in the services, energy and construction sectors.

Lending by German banks to domestic enterprises and households was recently at its highest level since 2003.

Credit growth is being driven primarily by the economic cycle. Risks to financial stability arise, in particular, when aggregate debt levels are disproportionately high.

One measure of potential excessive debt is the credit-to-GDP gap (see Chart 4.8). This indicator shows the extent to which lending is growing more quickly than a given country's gross domestic product (GDP) by historical standards. A positive gap can be an indication that lending growth is too high. The credit-to-GDP gap in Germany is currently negative and is not indicative of excessive borrowing at present. The fact that the gap is now rapidly closing might, however, point to mounting risks.

The rapid closing of the credit-to-GDP gap seen at present could point to mounting risks.

The expansion of lending has also been increasingly associated with allocation risks in recent years. For instance, banks have stepped up lending to comparatively risky companies. This is reflected in the equity ratios and interest coverage ratios of the enterprises concerned (see Chart 4.9). The International Monetary Fund (IMF) has made a similar finding for corporations in Germany.⁹ If this trend continues, the loan portfolio of banks could become riskier on the whole. This negative effect is currently only being offset because expected default risks have fallen overall.

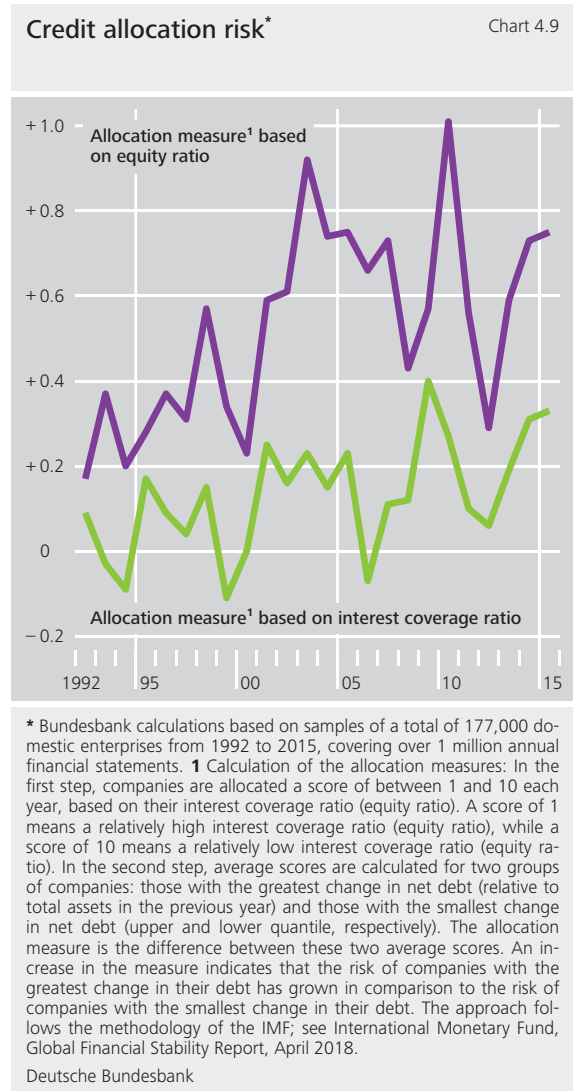
Low capital requirements for market risk reflect low volatility

One of the key reasons that tier 1 capital ratios at large banks have improved is because the risk-weighted assets for market risk have fallen markedly in recent years. This decline, which is partly attributable to a reduction in trading, has led to the tier 1 capital ratio of other systemically important institutions (O-SIIs) rising by 0.6 percentage point over the past two years (see Chart 4.10). The contribution made by falling credit risk was also 0.6 percentage point. This is noteworthy

Risk-weighted assets for market risk have fallen markedly in recent years.

because the contribution of market risk to the overall risk-weighted assets at large banks is on average only 7%. However, risk-weighted assets for market risk are subject to large fluctuations. At the start of 2012 the contribution was just over 12% and thus significantly higher than its current level.

Receding volatility on the financial markets up to the end of 2017 may have contributed to this decline (see Chart 4.11). At present, volatilities in the key coupon rates are currently even below the lows seen prior to the financial crisis.¹⁰ An increase in volatilities could therefore cause a significant rise in the capital requirements for market risk.¹¹



⁹ See International Monetary Fund (2018), pp. 62 ff.

¹⁰ The decline in trading portfolios also played an important role in this development. A regression analysis can be used to determine the weights of the explanatory factors. The risk-weighted assets for market risk feed into the regression as a dependent variable, while the volatility measure and trading portfolios are added as explanatory variables.

¹¹ The capital requirements for market risk are currently being revised in the Fundamental Review of the Trading Book by the Basel Committee on Banking Supervision (BCBS). More robust capital requirements may therefore be on the cards in future.

Components of the change in the tier 1 capital ratio of O-SIIs* Chart 4.10



* The current list of O-SIIs (other systemically important institutions) for 2018 was used in the calculation. This took account of the merger of two O-SIIs in the third quarter of 2016 by including the Q2 2016 figures of both institutions involved in the merger.
 Deutsche Bundesbank

Relationship between the market risk of German O-SIIs and market volatility* Chart 4.11



Sources: Bloomberg, Bundesbank statistics and Bundesbank calculations. * Changeover in reporting standards at the start of 2014. The calculation for the O-SIIs (other systemically important institutions, list for 2018) took into account the merger in Q3 2016 by including the sum of the figures for the two institutions involved over the entire period. ¹ Interest rate volatility is approximated by long-term at-the-money euro interest rate swaption (3M10Y). ² VSTOXX: implied volatility of the EURO STOXX 50.
 Deutsche Bundesbank

Interest rate risk still high for small and medium-sized banks

In the low interest rate environment, many institutions have experienced an expansion in both their credit volumes and the level of maturity transformation due to supply and demand effects. Maturity transformation increases if the maturities and interest rate lock-in periods of claims are extended or the liabilities' maturities are shortened. Small and medium-sized institutions, in particular, have a high level of maturity transformation. The share of long-term loans and advances to non-banks, for example, has grown continuously since 2007,¹² while the share of short-term overnight deposits has also risen significantly over the same period. Data on new business also indicate an increase in lock-in periods for loans to households and to non-financial corporations. This growth is particularly strong for mortgage loans to households.

Smaller and medium-sized institutions, in particular, have a high level of maturity transformation.

Expanding maturity transformation – and the associated risks – may also entail a higher yield potential, however. Interest income and interest rate risk appear to be strongly correlated, where an increase in what is known as the Basel interest rate coefficient by 10 percentage points is accompanied by a rise in the interest margin (the ratio of net interest income to total assets) of 0.2 percentage point (see Chart 4.12).¹³ This corresponds to around half of the banks' average net operating income. The Basel interest rate coefficient is a standard measure of banks' interest rate risk. It divides the present-value loss resulting from an

¹² Interest rate lock-in periods are of particular relevance. In the case of fixed-rate loans, which make up a large part of the claims, interest rate lock-in periods and maturities probably match.
¹³ It is also conceivable that banks with a higher interest rate risk coefficient conduct other business activities and thereby generate higher margins. The business model of the banks concerned is comparatively homogeneous, however.

abrupt rise of 200 basis points across all maturities (Basel interest rate shock) by banks' regulatory own funds. The statistical relationship described above is confirmed by another study that shows that banks, on average, generate around 35% of their net interest income via maturity transformation.¹⁴

According to a prudential definition, 63% of credit cooperatives and 42% of savings banks currently show elevated interest rate risk.¹⁵ In the case of larger

63% of credit cooperatives and 42% of savings banks show elevated interest rate risk.

banks, the expected present value losses caused by the interest rate shock under consideration are much lower. This is likely due

to their assets' shorter interest rate lock-in periods as well as their business models, which are less reliant on lending and deposit business compared to savings banks and cooperative banks. Moreover, large banks in particular appear to be using derivatives to a greater extent to hedge against interest rate changes. This is reflected by a rise in the notional amount of hedged interest business (see Chart 4.13).

The interest rate coefficient has been relatively stable since 2012, and the current aggregate stands at around 20%. The numerators (changes in present value) and denominators (regulatory own funds) do reveal a considerable level of momentum, however (see Chart 4.14). The rise in (hypothetical) present value losses suggests that banks have expanded their

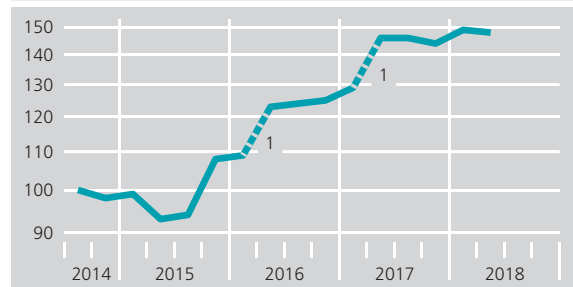
Basel interest rate coefficient and net interest income for 2017* Chart 4.12



* Number of observations: 1,475 banks. To aid visualisation, the chart pools 50 of the adjacent observation points based on their averages in each case. **1** Changes in the present value (as a percentage of own funds) of positions in the banking book exposed to interest rate risk due to an abrupt interest rate rise of 200 basis points across all maturities. The analyses are based on reports from institutions for the Basel interest rate coefficient.

Deutsche Bundesbank

Hedging through interest rate derivatives* Chart 4.13



* Notional amount of hedged interest business. The group of institutions comprises German banks reporting data on interest rate derivatives as part of their supervisory reporting. **1** Expansion of the group of reporting institutions.

Deutsche Bundesbank

¹⁴ See R. Busch and C. Memmel (2016). The contribution of maturity transformation to net interest income, as mentioned in the study, refers to figures from 2012 and 2013.

¹⁵ From a prudential perspective, a bank's interest rate risk is considered to be elevated if the Basel interest rate risk coefficient is greater than 20%. This coefficient calculates the loss in present value by taking the worse result that arises when there is a parallel upward and downward shift of 200 basis points in the yield curve. This result is then divided by own funds. However, the Basel interest rate coefficient considered here only refers to changes in present value that arise from an interest rate hike of 200 basis points across all maturities. Generally, the values of these two coefficients are close to each other.

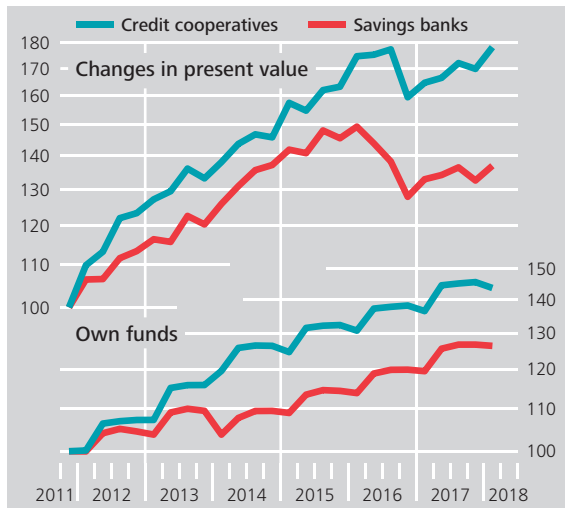
¹⁶ See Deutsche Bundesbank (2017b), p. 72.

maturity transformation significantly overall, while having also built up their own funds. Present value losses were seen to decline in 2016 and 2017, probably due to the stricter regulation of interest rate risk.¹⁶ That said, present value losses from a hypothetical shock have been rising again since 2017.

Interest rate risk: present value losses in the event of an interest rate hike and own funds*

Chart 4.14

Q4 2011 = 100, log scale



* These present value losses are negative changes in the present value of positions in the banking book exposed to interest rate risk due to an abrupt interest rate rise of 200 basis points across all maturities. The analyses are based on reports from institutions for the Basel interest rate coefficient.
 Deutsche Bundesbank

Unlike credit and market risk, interest rate risk in the banking book is not recorded under risk-weighted assets and is therefore not directly included under the general capital requirements (Pillar 1 requirements). Banks nevertheless have to observe additional capital requirements for these risks. The size of this capital add-on is set by each individual bank's supervisor in the supervisory review and evaluation process (SREP). The regulatory capital add-on for interest rate risk is measured initially as half of the negative change in present value as a result of the Basel interest rate shock.¹⁷ Add-ons can then be reduced in a second step using the qualitative risk profile score for interest rate risk in the banking book, which evaluates the quality of the risk management at the bank in question.

The median capital add-on for interest rate risk is around 1 percentage point of risk-weighted assets, thereby covering 61% of half of the present value loss-

es arising from the Basel interest rate shock, as required in the first step. This comparatively low value is mainly due to the German banks' good risk management rating. A considerable number of banks do not even have to carry a capital add-on for interest rate risk because they have been rated with the highest profile score and show a maximum change in present value of 2.75% of risk-weighted assets. However, this does not mean that the on-balance-sheet interest rate risk is negligible. Institutions without a capital add-on have, on average, an interest rate risk coefficient of 13%.

Capital add-on for interest rate risk covers 61% of half of the present-value losses arising from the Basel interest rate shock, as required in the first step.

For an individual bank, interest rate risk may be less serious if there is good risk management in place. In the short term, interest rate risk can be managed, for example, by using interest rate hedges. From a macroprudential perspective, it should be noted, however, that while derivatives redistribute interest rate risk, it cannot be reduced at a systemic level. The question of whether this causes a stabilising effect depends, amongst other things, on which financial market agents are ultimately bearing the risk. Comprehensive macroprudential monitoring of interest rate risk is therefore vital.

Comprehensive macroprudential monitoring of interest rate risk is vital.

Overall, it should be noted that there are other supervisory instruments that address banks' interest rate risk besides the strict capital requirements for interest rate risk. Under the SREP, banking supervisors are able to deliver a recommendation regarding the level of capital necessary to cover interest rate risk. In median terms, these recommendations amount to

¹⁷ See Deutsche Bundesbank (2017a), pp. 43-56.

around 2.5% of risk-weighted assets for small and medium-sized banks.

Potential procyclical impact of the banking system

Latent, cyclical risks have accumulated in the German banking sector within the protracted positive

If underlying macroeconomic conditions were to deteriorate suddenly, credit losses and higher risk provisioning could sharply reduce banks' free own funds.

macroeconomic environment. If these underlying macroeconomic conditions were to deteriorate suddenly, credit losses could increase more steeply than expected. At the same time, it is not only risk-weighted assets and, therefore, the regulatory capital requirements for credit and market risk that would increase. Credit losses and higher risk provisioning could also sharply reduce banks' free own funds. Moreover, housing prices would come under pressure as aggregate demand faltered, which would result in an increase in losses given default when real estate collateral was liquidated (see the section entitled "Impairment of loan collateral would additionally increase pressure on banks" on pp. 61 ff.).

As a consequence, banks might run down assets (deleveraging) and excessively restrict lending beyond the cyclical decline in demand.¹⁸ This adjustment reaction by the banking sector could therefore have a procyclical effect, i.e. it could intensify the economic downturn.

An economic downturn could prompt deleveraging in the banking sector

Larger banks, in particular, could resort to restricted lending in an attempt to maintain a sufficient buffer

to cover the equity ratios required by supervisors or the market. Empirical studies confirm that these institutions behave more cyclically in domestic lending than small and medium-sized banks.¹⁹ These institutions' lending remained stable or even increased during the global financial crisis, whereas large banks reduced their balance sheets considerably.

Small and medium-sized banks' stable lending was, however, buoyed up by the fact that they did not sustain major losses during the crisis.²⁰ It is questionable whether these institutions would also be able to stabilise macroeconomic lending in a future economic downturn if they themselves were affected by higher losses. Credit losses could increase, particularly in the real estate lending market, to which these banks are quite heavily exposed. One reason for this is that during an economic downturn, many households are unable to service their loans due to rising unemployment. Furthermore, the value of loan collateral, such as real estate, which banks can realise if a borrower defaults, is likely to fall.

It is questionable whether small and medium-sized banks could also stabilise macroeconomic lending in a future economic downturn.

These institutions are also vulnerable on account of their comparatively high exposure to interest rate risk. Aside from increasing credit losses, the existing interest rate risk could also materialise in a downturn.

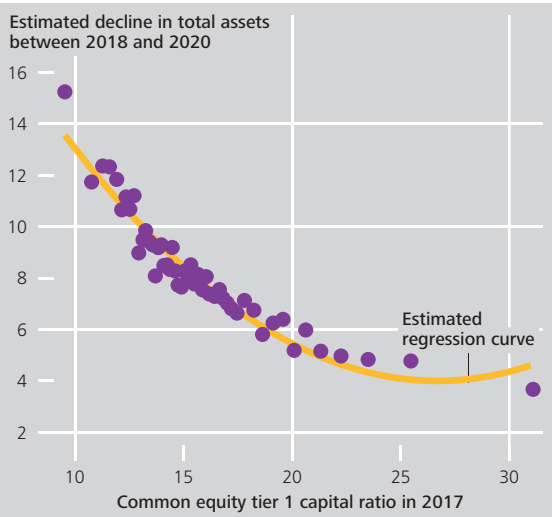
¹⁸ A recent empirical study for the United States suggests that increased capital requirements cause a short-term restriction in lending. See S. Eickmeier, B. Kolb and E. Prieto (2018).

¹⁹ See T. Schmidt and L. Zwick (2018).

²⁰ Empirical studies suggest that there were negative supply effects for individual savings banks during the global financial crisis. Savings banks that suffered heavy losses through their participating interests in Landesbanken were more restrictive in their lending and rejected significantly more loan requests than those which were unaffected by Landesbank-related losses. See, inter alia, M. Puri, J. Rocholl and S. Steffen (2011).

Decline in total assets in a stress test and CET1 capital ratio in 2017* Chart 4.15

Percentage average



* Number of observations: 1,494 banks. To aid visualisation, the chart pools 50 of the adjacent observation points based on their averages in each case. Observations with a common equity tier 1 capital ratio above 40% are not shown. In the stress scenario, the write-down ratios rise to the average from 2003 to 2006, and additionally by one standard deviation for highly cyclical sectors.

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Further losses could occur, reducing capital. Unlike after the global financial crisis, in this scenario, small and medium-sized banks would be unable to compensate for the reduction in lending by large banks, or would even themselves scale back lending.²¹

Write-downs and capital requirements increase during economic downturn

A simple scenario analysis based on supervisory data shows how strongly regulatory capital ratios could come under pressure when loan loss ratios, and thus risk provisioning, return to normal or even increase beyond the normal cyclical level. Here it is assumed that loan loss ratios increase at an above average rate in cyclically sensitive sectors.²² For other sectors, the ratios are assumed to converge with their average. The adjustment period lasts a total of three years, from 2018 to 2020. These assumptions follow

the stress scenario for the German financial system (see the chapter entitled “Risk situation of the German financial system” on pp. 41 ff.). It is, moreover, assumed that the value of real estate would fall by a total of 30% over three years. This increases defaults on mortgages and the losses that occur rise due to the falling value of the collateral.

In the stress scenario, the average aggregate write-downs amount to around €13 billion a year, accumulating to around €38 billion after three years. Loans for private housing account for around one-third of the specific loss provisions. By comparison, the valuation adjustments to the portfolio under consideration were just €3.5 billion in 2017. Taken in isolation, these write-

In the stress scenario, banks would presumably respond by at least partially reducing their assets in order to keep their tier 1 capital ratio constant.

downs would cause an aggregate reduction in the regulatory tier 1 capital ratio of no less than 1.4 percentage points. For certain banks, this decline would be significantly greater. Other negative effects besides this direct impact on solvency would also be likely. Banks would presumably respond by at least partially reducing their assets in order to keep their tier 1 capital ratio constant. Assuming that banks followed this strategy entirely in this – improbable – stress event, aggregate total assets would fall by 8% (see Chart 4.15). Banks whose tier 1 capital ratios are currently closer to the regulatory minimum would reduce their loans or assets to a much greater extent, meaning that the 10% of banks with the lowest tier 1 capital ratios would scale back their total assets by as much as 15%.

²¹ Studies point to an apparent trade-off between credit risk and interest rate risk. See C. Memmel (2018) as well as C. Schrand and H. Unal (1998).

²² It was also assumed that the loss provisioning rates will rise to the mean value plus one standard deviation relative to the period from 2003 to 2006.

Mounting capital requirements could significantly intensify deleveraging in the banking sector, especially for banks which use internal models to assess risk. If it is assumed in an unusually adverse scenario that

Banks, especially those that use internal models to assess risk, could intensify their deleveraging due to mounting capital requirements.

those large banks that use internal models would fall by 4.4 percentage points. The risk-weighted assets for market risk could likewise rise significantly in the event of a crisis. If the value-at-risk, the risk measure on which the risk-weighted assets are based, were to increase to the considerably higher values during the financial crisis,²³ large banks' tier 1 capital ratio would decline by between 0.4 and 0.9 percentage point.²⁴

High interest rate risk could exacerbate these developments. Banks could then respond to their risks (which may be high in the aggregate) more strongly. The adjustment reactions could gather additional momentum if interest rates were actually to rise. This kind of scenario is conceivable if the economic downturn remains limited to Germany while euro area interest rates continue to go up in a persistently favourable economic environment. Moreover, an economic downturn usually causes risk premia to rise as the willingness of market participants to take risks falls.

Cyclical risks call for preventive action

Capital buffers reduce the danger of cyclical risks intensifying in the financial system. With regard to financial stability, it is therefore a welcome development that German banks have improved their capital levels in recent years. Stricter microprudential requirements and additional capital buffers such as

those for systemically important banks have contributed to this.

The existing buffers may not be sufficient, however, to limit cyclical risk and negative feedback loops from the financial system to the real economy. There is a danger at present that credit risk, real estate risk and interest rate risk

may materialise at the same time and lead to herding behaviour in

the financial system. As a result, macroprudential action is needed as the German banking system could amplify an unexpected economic slump by scaling back its lending.

Macroprudential action is needed.

List of references

Bordalo, P., N. Gennaioli and A. Shleifer (2018), Diagnostic Expectations and Credit Cycles, *Journal of Finance*, Vol. 73, No 1, pp. 199-227.

Busch, R. and C. Memmel (2016), Quantifying the Components of the Banks' Net Interest Margin, *Financial Markets and Portfolio Management*, Vol. 30, No 4, pp. 371-396.

Deutsche Bundesbank (2016), *Financial Stability Review 2016*.

Deutsche Bundesbank (2017a), *Monthly Report*, October 2017.

Deutsche Bundesbank (2017b), *Financial Stability Review 2017*.

²³ Stressed value-at-risk served as a basis for the calculations. This also has to be calculated by the institutions, and for most banks it reflects how they developed during the financial crisis.

²⁴ These calculations are the weighted average.

Eickmeier, S., B. Kolb and E. Prieto (2018), The Macroeconomic Effects of Bank Capital Requirement Tightenings: Evidence from a Narrative Approach, Deutsche Bundesbank Discussion Paper, forthcoming.

International Monetary Fund (2018), Global Financial Stability Report, April 2018.

Jesus, S. and J. Gabriel (2006), Credit Cycles, Credit Risk, and Prudential Regulation, International Journal of Central Banking, Vol. 2, No 2, pp. 65-98.

Lowe, P. (2002), Credit Risk Measurement and Procyclicality, BIS Working Papers No 116, September 2002.

Memmel, C. (2018), Why Do Banks Bear Interest Rate Risk?, Schmalenbach Business Review, Vol. 70, No 3, pp. 231-253.

Minsky, H. (1977), The Financial Instability Hypothesis: An Interpretation of Keynes and an Alternative to "Standard" Theory, Challenge, Vol. 20, No 1, pp. 20-27.

Puri, M., J. Rocholl and S. Steffen (2011), Global Retail Lending in the Aftermath of the US Financial Crisis: Distinguishing between Supply and Demand Effects, Journal of Financial Economics, Vol. 100, No 3, pp. 556-578.

Schmidt, T. and L. Zwick (2018), Loan Supply and Demand in Germany's Three-Pillar Banking System during the Financial Crisis, International Finance, Vol. 21, No 1, pp. 23-38.

Schrand, C. and H. Unal (1998), Hedging and Coordinated Risk Management: Evidence from Thrift Conversions, Journal of Finance, Vol. 53, No 3, pp. 979-1013.

Risks for insurers, pension institutions and investment funds

Solvency at insurance companies in Germany has improved somewhat, largely as a result of the slight uptick in interest rates. A gradual rise in rates would bolster solvency levels further. In funded pension provision, assets have far shorter maturities than liabilities, which means that they each respond in different ways to changes in interest rates. A very sharp rise in interest rates could trigger an upsurge in life insurance policy lapses and lead to outflows of liquidity. All things considered, a scenario of very low interest rates is the greater risk to financial stability. For instance, many life insurers are currently not generating enough capital investment income to fund the provisions required under German accounting rules.

German insurers are closely interconnected with the banking system and the investment fund sector by way of their asset holdings. Their links to the fund sector can be beneficial to financial stability because investment via specialised funds enables insurers to smooth their income flows and create buffers. Insurers' direct investment is focused mainly on Germany, but their fund investment has a more diversified international profile. This means that insurance companies are vulnerable to a downturn in the German economy in particular via their direct investment activities. In times of crisis, life insurers can amplify losses in value.

German open-end investment funds have stepped up their exposures to non-European sovereigns, particularly the United States. This means that the German investment fund sector is now more at risk of contagion from crises in international securities markets. In addition, German investment funds have accumulated significant holdings of interest rate sensitive securities for insurers, banks and funds. If capital market interest rates were to increase abruptly, these holder groups would be hardest hit by contagion effects.

Risk situation at funded pension providers

Providers of funded pension plans are key to financial stability in Germany for two reasons. First, they have a major say in how financial resources and risks are allocated in the national economy – in the second quarter of 2018, German life insurers and pension institutions were managing asset holdings worth roughly €1.8 trillion, or 12% of the aggregate stock of financial assets held by German financial intermediaries. Second, if funded pension providers run into solvency problems, their direct and indirect financial interconnectedness with other financial intermediaries is a potential source of contagion within the financial system.

Solvency of German life insurers according to Solvency II has improved slightly

Supervisory solvency metrics like the ones introduced in 2016 by the Solvency II prudential regime rank among the core components of microprudential regulation. However, they are hugely important for macroprudential surveillance, too, because they offer insights into common sources of vulnerability for institutions and can also shed light on idiosyncratic solvency problems at systemically important insurers.

The key capital adequacy measure for insurers under the Solvency II regime is the solvency ratio, which shows the ratio of an insurer's own funds to the regulatory own funds requirements. In mid-2018, most

Solvency ratios slightly up on previous year's level.

German insurers' solvency ratios were well above the 100% bar set by supervisors. The median solvency ratio of life insurers stood at around 375%, slightly up on the previous year's level. Solvency levels would probably improve further if, as the markets are expecting, interest rates rise slowly.

Not only do solvency ratios vary considerably from one insurer to the next (see Chart 5.1), they are also subject to significant short-term volatility over time, because measurement

under the Solvency II regime is based on market values. These market values fluctuate

Solvency ratios vary considerably from one insurer to the next.

as interest rates change, because German life insurers tend to invest a large part of their asset holdings in long-dated fixed income paper and have promised long-term guaranteed returns to their policyholders. This can cause the value of the own funds carried on insurers' Solvency II balance sheets to be highly volatile over the short term. Solvency II, therefore, contributes to increased levels of interest rate sensitivity in the financial system.

At present, the solvency ratios do not yet fully reflect German life insurers' economic resilience, because around two-thirds of them are making use of regulatory transitional measures. These temporary measures are in place to ensure a smooth transition to the Solvency II regime with its market-value-oriented approach to measurement.¹ As a result of these transitional measures, it is possible for insurers to report higher solvency ratios than under a full market-value-oriented measurement regime. The solvency ratios without transitional measures are thus far lower (see Chart 5.2). At the end of 2017, 8 out of a total of 86 German life insurers were reliant on transitional measures to satisfy the regulatory capital requirements, compared with 14 at the end of 2016. This came about largely because interest rates rose somewhat in 2017. However, a number of insurers only just managed to exceed the

At present, solvency ratios do not yet fully reflect German life insurers' economic resilience.

¹ The transitional measures are described in detail in BaFin (2016).

required ratio of 100%. They are thus especially at risk of falling short of this mark if interest rates go back into reverse. Compared with their European peers, German life insurers are benefiting particularly strongly from the transitional measures. That said, numerous life insurers in other European insurance markets are also reliant on these measures.²

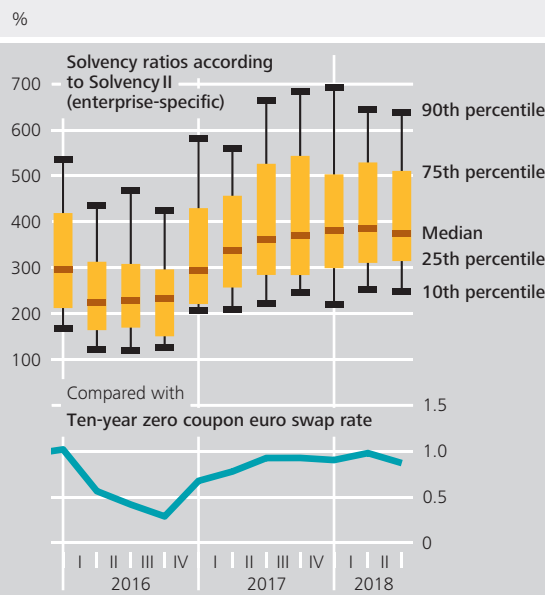
Regulatory measures improving stretched solvency figures under German accounting rules

Besides having to fulfil the solvency requirements set forth under Solvency II, insurers are also expected to comply with the German Commercial Code (*Handelsgesetzbuch*). The principle of prudence enshrined in the Commercial Code requires the premium reserve to be adjusted stepwise when interest rates are low to the higher market value of the liabilities from policy commitments. This is done using the additional interest provision, a reporting item which exists to better reflect and internalise economic burdens. This has the effect of making insurers set aside assets on their balance sheets for future payments, retain them within the company, and distribute fewer funds, thereby increasing insurance companies' resilience and strengthening financial stability throughout the entire sector.

The additional interest provision is accumulated with a time lag, as the applicable discount rate is a moving average of market interest rates over the past ten years. In the low interest rate setting, current investment income is no longer sufficient to cover the allocations to the additional interest provision. Owing to the accounting standards, insurers are forced to sell off assets with higher market values than book values in order to unlock hidden reserves. In the pre-

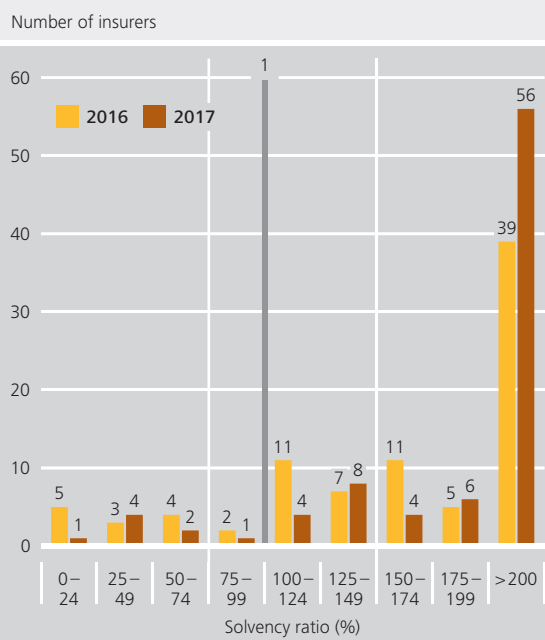
² The European Insurance and Occupational Pensions Authority (EIOPA) prepares an annual report on the impact of transitional measures. See European Insurance and Occupational Pensions Authority (2017b), pp. 128 ff.

Solvency ratios of German life insurers according to Solvency II* Chart 5.1



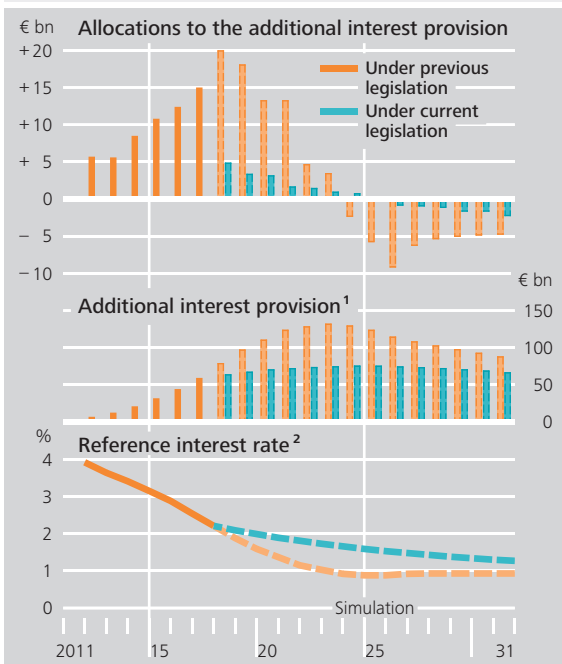
Sources: BaFin and Bundesbank calculations. * The chart shows the solvency ratios of the 66 life insurance companies for which quarterly reports are available for all reporting dates. The first report was published on 1 January 2016.
 Deutsche Bundesbank

Solvency ratios of German life insurers without transitional measures Chart 5.2



Sources: BaFin and Bundesbank calculations. **1** Solvency ratio of 100% required by regulation.
 Deutsche Bundesbank

New regulations governing German life insurers' additional interest provision* Chart 5.3



Sources: BaFin and Bundesbank calculations. * Development of the additional interest provision for two trends in the reference interest rate assuming the unchanged market interest rate of September 2017. **1** The additional interest provision is a constituent part of the premium reserve which companies must put in place for policies for which the reference interest rate is lower than the original technical interest rate of relevance for the premium reserves. **2** Under previous legislation, the reference interest rate was derived from the ten-year average of yields on zero coupon euro interest rate swaps with a maturity of ten years. The reference interest rate under current legislation is yielded by a further smoothing.
 Deutsche Bundesbank

ers to tap into their hidden reserves by selling off asset holdings encourages herding behaviour. Viewed in isolation, this may damage financial stability. In addition, insurers' solvency and financial condition reports reveal isolated instances where funds have been withdrawn from the bonus and rebate provisions³ to offset losses.

The Federal Ministry of Finance has modified the formula for the applicable discount rate to the effect that the additional interest provision will be built up at a slower pace than hitherto as from the year 2018 (see Chart 5.3).⁴ To

New legislative arrangement probably makes it easier for many life insurers to build up additional interest provisions.

gauge the impact of this change, the Federal Financial Supervisory Authority (BaFin) surveyed insurers' responses to a number of different interest rate scenarios in its extended forecast. Using the old arrangement, allocations for 2018 and 2019 in a scenario of persistently low interest rates would come to €38.1 billion (equating to 64% of the additional interest provision in 2017), compared with €8.5 billion under the new legislative arrangement. Many life insurers will probably find that the modified discount rate makes it easier for them to build up the additional interest provision from their current income.

vailing market environment, the sales proceeds would generally be reinvested at a lower coupon rate than before. The resulting deterioration in the

In the low interest rate setting, current investment income is no longer sufficient to cover allocations to the additional interest provision.

current return on investment on the assets side of the balance sheet would widen the gap still further between what insurers earn on their asset

holdings and what they have committed to pay out on the liabilities side. Furthermore, the implied pressure on life insur-

An upturn in interest rates will ease the burden on life insurers over a longer-term horizon. Even in this scenario, however, they would initially have to make further allocations to the additional interest provi-

³ The bonus and rebate provisions consist of provisions that are eligible as own funds as well as earmarked provisions. Policyholders do not yet have any actual entitlements to provisions eligible as own funds, which means that, provided they have the approval of the supervisory authority and pursuant to Section 140 of the Insurance Supervision Act (*Versicherungsaufsichtsgesetz*), insurers can draw on these provisions.

⁴ See the Third Regulation Amending Regulations Under the Insurance Supervision Act (*Dritte Verordnung zur Änderung von Verordnungen nach dem Versicherungsaufsichtsgesetz*) of 10 October 2018.

sion under the previous rules owing to the applicable discount rate being based on a moving average. BaFin also surveyed insurers' responses to scenarios in which interest rates increase. The authority found that, under the old rules, an abrupt 100-basis-point hike in rates would result in reported expenses of €31.1 billion (equating to 52% of the additional interest provision in 2017) between 2018 and 2021. Based on the new legislation, by contrast, income would be generated from the release of the additional interest provision of €6.1 billion over the same horizon.

An increase in interest rates would erode the value of hidden reserves, however. This would make it difficult for life insurers to fund the additional interest provision under the old discount rate regime. To still be in a position to unlock unrealised gains, they would have no option but to offload bonds with higher interest coupons. Depending on the overall demand for these assets, a situation could well arise in which the prices of illiquid, long-dated asset holdings crumble, especially since a raft of life insurers would have similar exposures. There is a risk that poorly capitalised insurance companies with low current income levels might teeter on the brink of overindebtedness if interest rates were to rise sharply. Modifying the additional interest provision arrangements eases these problems significantly.

Under the new arrangement, the additional interest provision will be accumulated at a slower pace, thereby reducing insurers' expenditure. The funds this saves should not be distributed, however. Time

The funds freed up by slowing the pace at which the additional interest provision is accumulated should not be distributed.

inconsistency between the interests of shareholders and those of policyholders is a fundamental issue affecting insurers' payout calculations. While policyholders are counting on drawing the contractual benefits when their policies mature, there is an

incentive for shareholders to withdraw profits early. All other things being equal, the reform of the additional interest provision will allow more funds to be shared among shareholders and the various policy generations in the community of policyholders.⁵ This is an appropriate course of action when interest rates are increasing. However, if rates stay low, insurers will need to keep setting aside reserves as long as their hidden losses exceed their hidden reserves. The Life Insurance Reform Act (*Lebensversicherungsreformgesetz*) of 2014 lays down a restriction on distribution in the event that hidden losses are greater than hidden reserves. This restriction does not, however, apply to insurers which have concluded a profit transfer agreement under which the parent company commits to absorb any losses. It is currently the case that parent companies continue to be liable for losses for five years if such agreements are terminated, which is significantly shorter than the terms of most insurance policies. As a result of its evaluation of the Life Insurance Reform Act, the Federal Ministry of Finance has announced plans to amend this legislation⁶ by making the termination of any profit transfer agreement subject to BaFin's express approval. This way, BaFin can ensure that the parent company stays on the hook to absorb any losses over the long run in the low interest rate environment. This provision, which is to be elucidated in the Insurance Supervision Act (*Versicherungsaufsichtsgesetz*), will also benefit financial stability, because it will bolster the long-term resilience of life insurers.

The Life Insurance Reform Act has applied a limit to policyholder participation in the valuation reserves. The intent here was to stem outflows of any funds needed to safeguard the guaranteed returns which

⁵ Note that the amount of valuation reserves which insurers are allowed to release is smaller under the new regime. This means that there are fewer resources which can be distributed than under otherwise identical conditions.

⁶ See Federal Ministry of Finance (2018).

insurers have promised to pay out to policyholders.⁷ The Finance Ministry's evaluation report found that policyholder participation in the valuation reserves came to a total of €3.4 billion in the 2015-17 period. Disregarding the impact of the Life Insurance Reform Act, that figure would have been €18.7 billion according to the data provided by insurance companies for BaFin's extended forecast. It can be concluded, then, that the Life Insurance Reform Act has reduced insurers' outflows of funds by €15.3 billion, or 11% of the valuation reserves in 2017, strengthened their buffers, and prevented what would otherwise have been an even greater realisation of valuation reserves.

Funding gap at German institutions for occupational retirement provision amid persistently low interest rates

Besides life insurers, institutions for occupational retirement provision (IORPs) are also particularly exposed to the challenges presented by the low interest rate environment.

Low interest rate environment a particular challenge for institutions for occupational retirement provision.

If IORPs experience a funding shortfall, this could put a long-term strain on the German business sector, as a stress test exercise carried out by the European Insurance and Occupational Pensions Authority (EIOPA) amongst European IORPs reveals.⁸ This stress test applies a uniform pan-European valuation methodology which EIOPA developed on the basis of market-consistent standards.⁹ Being the sole prudential source of market-oriented data, this stress test provides results which are comparable across Europe and can identify risk at an early stage.¹⁰

This stress test exercise indicates that German IORPs have insufficient assets to cover all their liabilities at market values. The funding gap in a scenario of persistently low interest rates comes to 13%, compared

with 29% in an adverse market scenario.¹¹ Extrapolated to the market value of the total liabilities of German IORPs, which range between roughly €246 billion and €264 billion in the scenario of persistently low interest rates, and between €260 billion and €283 billion in the adverse market scenario, this equates to approximately €32 billion to €34 billion, and €75 billion to €82 billion in underfunded pension commitments.¹²

13% funding gap at German IORPs in a scenario of persistently low interest rates.

Risks at IORPs can also spill over to the business sector. If IORPs do not have sufficient assets to fully pay out the retirement benefits promised, employers will have no option but to step in. At the Europe-

Sponsors might underestimate risks associated with burdens expected at IORPs.

⁷ See Deutsche Bundesbank (2014a), pp. 67-75; A. Kablau and M. Weiß (2014); and Deutsche Bundesbank (2014b).

⁸ See European Insurance and Occupational Pensions Authority (2017a).

⁹ This methodology measures IORPs' assets and liabilities at market values. In design terms, the resulting balance sheet broadly corresponds to insurers' Solvency II balance sheets. In addition, it takes account of the special features of IORPs. For example, support from (corporate) sponsors and from pension protection schemes are recognised as assets.

¹⁰ Unlike the market-oriented Solvency II regime for insurers, the solvency regulations for IORPs continue to be based on the heterogeneous national accounting standards in Europe, most of which take more of a short-term perspective.

¹¹ The adverse market scenario assumes a parallel downward shift of about 50 basis points in the yield curve and a decline of about 10 basis points in the rate of inflation. It also simulates a drop in the prices of variable rate assets of between 5% and 50%, depending on the asset class. For instance, the value of European equities falls by 48%, those of European real estate funds by 41%.

¹² According to BaFin's primary insurer statistics, the liabilities of German IORPs had a book value of around €189 billion at the end of 2016. The market value of the liabilities is estimated from their given book value using the modified duration, which ought to stand at between 15 and 20. Given an average spread of roughly 2 percentage points between the market interest rate and the national discount rate, it can then be said that the estimated market value of the liabilities exceeds their book value by 30-40% in the scenario of persistently low interest rates and by 37.5-50% in the adverse market scenario.

an level, the burdens which these enterprises are expected to face in the adverse market scenario is estimated to come to roughly 12% of their market values. German enterprises are not required to make any provisions for such burdens resulting from IORPs on their balance sheets prepared in accordance with the German Commercial Code. There is a danger, then, that sponsors might be collectively underestimating the risks this involves.

Moreover, IORPs are major investors at the European level whose investment behaviour can either amplify or weaken capital market shocks. An additional survey conducted as part of the EIOPA stress test exercise found that IORPs, on aggregate, would act in a slightly countercyclical manner in the adverse scenario. A slim majority of the IORPs surveyed reported that they would return their investment portfolio to its original composition and stock up on securities whose prices had fallen the most.

Duration gap at German life insurers

The root cause of the problems facing IORPs and life insurers can be found in the nominal guaranteed returns that they have promised to savers. Life insurers in Germany commonly offer products that incorporate fixed guaranteed nominal returns over a very long maturity period. In effect, life insurers assume interest rate risk for households. They could theoretically hedge this market risk in the capital market by investing in very long-dated fixed income securities. They often do not do so, however, and the maturity of their asset holdings is usually much shorter than that of their liabilities. This exposes life insurers to substantial interest rate risk.

One key metric used to determine interest rate risk is the duration gap, which measures the difference in duration – and thus in interest rate sensitivity – between liabilities and asset holdings. The wider the duration gap, the greater the risk when interest rates

decline. In the case of a wide duration gap, the value of an insurer's liabilities will rise more quickly than that of its asset holdings if interest rates fall. All other things being equal, if life insurers raise the duration of their asset holdings, they narrow the duration gap. In this case, the rising value of their asset holdings caused by a fall in interest rates will offset some of the increase in the value of their liabilities. This is how insurers mitigate their long-term risks in a scenario of declining interest rates.

The wider the duration gap, the greater the risk when interest rates decline.

In the middle of the first decade of this millennium, the duration of German life insurers' asset holdings was very low. The median value for the country's 60 largest life insurers came to 5 – that is to say, if interest rates dropped by 1 percentage point, the median increase in value would be 5%.¹³ Since then, the duration of asset holdings has generally been increasing, the median figure climbing from around 5 to 8 between 2005 and 2017. This spell saw insurers add substantially to their stocks of very long-dated European government bonds.¹⁴ The duration gap left insurers exposed to the fall in interest rates which materialised in the meantime. By gradually pushing up the duration of their asset holdings over time, insurers have narrowed their duration gap, partly as a hedge against a further drop in interest rates in the future. This might also have contributed to the significant

Multi-year comparison shows that duration of asset holdings is generally increasing.

¹³ This estimate is based on reported changes in value in the scenarios included in BaFin's annual extended forecast. Modified duration is a proxy for semi-elasticity, i.e. the percentage change in a value if interest rates move by 1 percentage point.

¹⁴ See H. S. Shin (2017).

decline in long-term interest rates as part of a self-reinforcing process.¹⁵

Bucking the long-term trend of rising durations of asset holdings, 2017 was the first year that saw asset durations decline again for a number of insurers. There

2017 was the first year that saw asset durations decline again for a number of insurers.

are two possible explanations for this. The first is that several insurers are expecting interest rates to rise and are looking to avoid losses. Some of them are using derivatives to hedge specifically against the risk of a strong hike in interest rates.¹⁶

Second, liability duration has remained more or less unchanged of late. Between 2014 and 2017, the median liability duration of German life insurers dipped slightly from 17 to 16.¹⁷ The duration gap, then, was narrowed by the increase in the duration of asset holdings, at least up until 2016.

Incentives for an upsurge in policy lapses should interest rates rise abruptly

While a high asset duration reduces life insurers' vulnerability to persistently low interest rates, it also

High asset duration means greater vulnerability to an abrupt interest rate hike.

makes them more vulnerable in the event of an abrupt interest rate hike. This is because the market value losses on asset holdings in a scenario of rising interest rates increase with the level of the asset duration.

Given that surrender values in Germany are fixed under the existing regulatory framework, which means that they are not sensitive to changes in interest rates, a very sharp hike in interest rates – unlikely though that scenario may be – would erode the market value of German life insurers' asset hold-

ings to such a degree that these surrender values would no longer be fully funded. Looking beyond the benefits for policyholders of having insurance cover against biometric risks, the loss of tax advantages and the incurrence of lapse fees, this scenario would give policyholders an incentive to lapse their life insurance policy.¹⁸

For larger German life insurers, the enterprise-specific critical interest rate level – the level above which the fixed surrender values promised to policyholders would no longer be fully funded – shrank in median terms from 5.9% in 2007 to 3.4% in 2017 (see Chart 5.4). Part of the reason for this decline is that life insurers have pushed up the duration of their fixed income asset holdings, meaning that their market values now respond more strongly to changes in interest rates. Regulators could mitigate this vulnerability by making surrender values sensitive to interest

Regulators could mitigate vulnerability to interest rate risk by making surrender values sensitive to interest rates.

¹⁵ More long-dated bonds need to be added to a portfolio in order to narrow an existing duration gap. This can push down long-term interest rates, thus causing an existing duration gap to widen. See D. Domanski, H. S. Shin and V. Sushko (2017).

¹⁶ One potential investment strategy would be to hold not just long-dated bonds but also payer swaptions that are far out of the money. Payer swaptions are derivatives which give the purchaser the option to swap a fixed rate for a floating rate at or above a certain interest rate level. The value of these derivatives is not particularly sensitive to interest rates if rates continue to decline. However, if rates spike higher, these swaptions increase significantly in value, thus offsetting the dwindling value of the long-dated bonds.

¹⁷ This estimate is based on the off-balance-sheet increase in value proxied by the amount needed to safeguard the interests of continuing policyholders and the additional interest provision. Repeated calculations for the annual balance sheets permit an estimation of the development over time since 2014. Details can be found in A. Möhlmann (2017).

¹⁸ For more detailed information on this topic, see T. Förstemann (2018); Deutsche Bundesbank (2015), p. 52; and E. Berdin, H. Gründl and C. Kubitzka (2017). Furthermore, A. Ellul, C. Jotikasthira, A. V. Kartasheva, C. T. Lundblad and W. Wagner (2018) explore collective fire sales by life insurers and their impact on financial stability in the event of moderate shocks.

rates.¹⁹ In a recent step to counteract the long-term trend, some life insurers lowered the duration of their assets in 2017, thus reducing their vulnerability to an increase in interest rates.²⁰

An upsurge in policy lapses triggered by an abrupt increase in interest rates would send liquidity flooding out of life insurers, forcing them to sell off their assets. This might accelerate the fall in the price of fixed income paper and thus further amplify the upside pressure on interest rates. A straightforward example shows just how substantial this effect might be. If interest rates had risen abruptly – for instance,

An upsurge in policy lapses at life insurers could amplify a rise in interest rates.

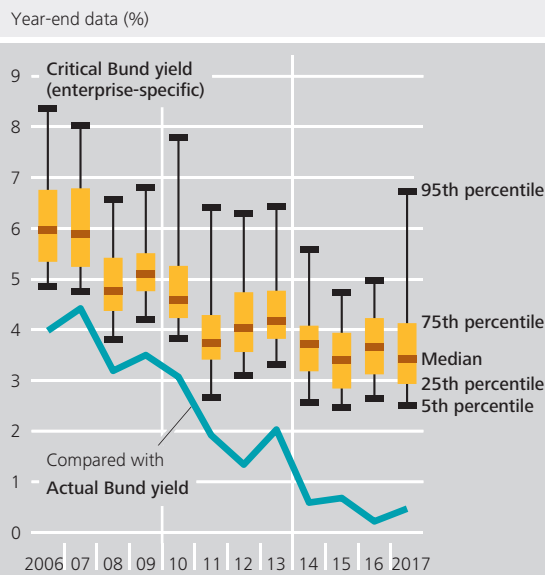
by 300 basis points – the enterprise-specific critical interest rate levels at a host of German life insurers

would have been exceeded at the end of 2017. These particular life insurers would have been holding fixed income securities with a market value of around €612 billion, which the spike in rates would have shrunk – all other things being equal – to roughly €436 billion.²¹ An upsurge in policy lapses would have left the life insurers with no option but to offload these securities. Let us now assume for the sake of simplicity that the price of fixed income securities diminishes by 1 basis point on average when their supply increases by €1 billion.²² That is to say that selling fixed income securities worth €436 billion would lower their price by 4.36%. That would equate to a further interest rate hike of approximately 45 basis points.²³ The original shock would therefore be amplified by roughly 15%.

Asset holdings and interconnectedness as sources of risk

German insurers are closely interconnected with the other financial sectors and the real economy. Direct

Critical interest rate level for life insurers given an upsurge in policy lapses* Chart 5.4



* Yield on Bunds with a residual maturity of ten years, above which an upsurge in policy lapses could impair life insurers' stability. The analysis covered the approximately 55 largest German life insurance companies with a premium reserve of more than €1 billion each and for which data are available until 2017.

Deutsche Bundesbank

19 Surrender values that are sensitive to interest rates move inversely to market interest rates. For instance, they fall when interest rates rise. As a result, interest rate sensitive surrender values reflect the market value of insurers' stocks of fixed income asset holdings and, therefore, hedge them against the risk of an upsurge in policy lapses.

20 The rise in the 95th percentile in 2017 shown in Chart 5.4 is attributable to a number of insurers having reduced their duration levels.

21 These calculations assume that the fixed income asset holdings of the insurance companies concerned have a modified duration of 9.6. For more detailed information on this topic, see T. Förstemann (2018). A 300-basis-point hike in interest rates would thus lower the market value of these insurers' fixed income asset holdings by 28.8% to €435.7 billion (€612 billion x (1-0.096 x 3) = €435.7 billion).

22 A linear relationship of this kind between an increase in the supply of securities and their price is also known as the Amihud ratio, following Y. Amihud (2002). The empirical estimates of Amihud ratios vary strongly over time and from one asset class to the next. The Amihud ratio used in this example – a price decline of 1 basis point given securities sales of €1 billion – can be found, inter alia, in R. Greenwood, A. Landier and D. Thesmar (2015).

23 Given an average modified duration of 9.6 for the offloaded fixed income securities, the 4.36% drop in the price translates into an interest rate hike of 45.4 basis points (4.36 x 100/9.6 = 45.4).

Distribution of the share of German insurers' asset holdings with banks* Chart 5.5

Number of insurers, as at Q2 2018



Sources: BaFin and Bundesbank calculations. * The data refer to all insurers who report a list of assets (Template S.06.02) in their Solvency II quarterly reports.

Deutsche Bundesbank

links exist, in particular, on account of their substantial investments with credit institutions and in investment funds. Indirect contagion effects can arise if insurers hold investment portfolios similar to those of other financial intermediaries.

Insurers' direct and indirect interconnectedness can either amplify or dampen the cyclical nature of the financial system, depending on whether they invest procyclically or countercyclically (see the section entitled "Life insurers' cyclical investment behaviour" on p. 95).

Insurers interconnected with banks through asset holdings

In the second quarter of 2018, German insurers had invested a total of €505 billion worth, or 25%, of their asset holdings with banks. These include insurers' indirect investments with banks by way of fund vehicles. Only €38 billion has been invested with banks by way of German funds,²⁴ which account for around 84% of all fund investment by insurers. This indicates that German insurers' exposures to banks are largely being kept on their own balance sheets and not outsourced to fund vehicles.

Interconnectedness between insurers and banks is more pronounced among primary insurers (non-life insurers, life insurers and health insurers) than among reinsurers. Around one-tenth of German insurers have placed more than 60% of their asset holdings in the banking sector (see Chart 5.5). This high concentration makes these insurers particularly vulnerable to shocks in the banking sector. However, these are small insurers which, taken together, account for only 0.4% of the insurance sector's asset holdings.

Interconnectedness with banks is more pronounced among primary insurers than among reinsurers.

Insurers' investment in the banking sector is almost exclusively in the form of (secured) debt instruments, such as Pfandbriefe and bonds. Since only around 1% of their asset holdings with banks is equity (such as shares), insurers are assuming only a very small amount of entrepreneurial risk from the banking sector on their balance sheets.

Insurers' investment in the domestic banking sector amounts to around €256 billion, representing more than half of their asset holdings with banks. Shocks to the German banking sector could, therefore, be propagated to the German insurance sector through this channel. At the same time, German insurers are a key source of funding for the German banking system, accounting for around 25% of institutional funding excluding the interbank market.²⁵ Since the funding provided by insurers is largely

Insurers' investment in the domestic banking sector represents more than half of their asset holdings with banks.

²⁴ German funds comprise all funds established under German law and thus contained in the investment funds statistics.

long-term, insurance companies can have a stabilising impact on the banking system.

Interconnectedness between insurers and fund vehicles

Insurers are even more interconnected with the fund sector than with the banking sector. In the second quarter of 2018, German insurers had invested a total of €649 billion worth, or 32%, of their asset holdings via investment funds. The considerable growth in fund investment from 2005 to mid-2017 has not continued, however.²⁶ One

Insurers are even more interconnected with the fund sector than with the banking sector.

reason is that, in 2017, funds increasingly disbursed earnings to insurers. Over 84% of the German insurance

sector's fund shares were issued by funds established under German law. The investment funds statistics contain detailed information – which will be used in the following – for this group of funds regarding their investments and fund characteristics.

In terms of risks caused by interconnectedness between insurers and the fund sector, a distinction has to be made between specialised funds and retail funds. With regard to retail funds, in particular, there is a risk of multiple investors pulling out at the same time, thus passing losses on to the remaining investors. What causes the attendant risk of a run is that, in most cases, the large number of heterogeneous investors cannot coordinate their actions (see the section entitled “Risk situation in the German investment fund sector” on pp. 98 ff.). However, retail funds make up only 8% of the German fund portfolio of German insurance companies.

Most insurers' fund investment, however, is in specialised funds with few shareholders, or even only a single shareholder. “Single-investor specialised funds”, in which one insurance company holds all of

the fund shares, accounted for more than 80% of the insurance sector's aggregate German fund investment in the second quarter of 2018.²⁷ There is no risk of a run in such cases.

Most insurers' fund investment is in “single-investor specialised funds”.

There is variation in the extent to which different types of insurance companies outsource their asset management to fund vehicles. Whereas reinsurers hold only 4% of their investments through funds, for life insurers the figure is 42%. The majority of this is through single-investor funds, where life insurers can shape the fund's investment

Single-investor funds enable life insurers to shape the fund's investment and dividend payment strategy.

strategy as well as the quantity and timing of fund dividend payments. Under German accounting and supervisory law, life insurers are permitted to create hidden reserves in a targeted manner by steering these fund dividend payments, as only capital gains accruing to insurers are recognised in profit or loss according to the “realisation principle” set

The cushioning function performed by insurers' fund investment impacts positively on financial stability.

out in the German Commercial Code. These earnings must then be allocated on a pro rata basis among policyholders and shareholders (in accordance with the Minimum Allocation Regulation (*Mindestzuführungsverordnung*)). However, if capi-

²⁵ Institutional funding excluding the interbank market comprises German banks' liabilities to other financial intermediaries (excluding banks) and enterprises. If the interbank market is included, German insurers provide 9% of the aggregate institutional funding of German banks.

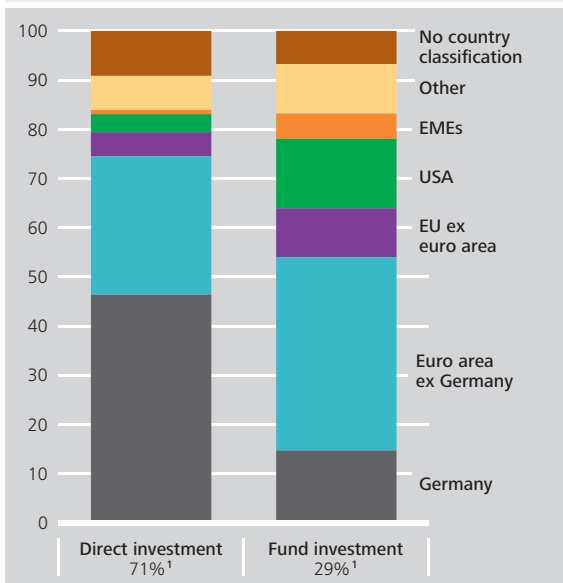
²⁶ See Deutsche Bundesbank (2017).

²⁷ Owing to differences in statistical definitions, funds are already classified as single-investor funds here if a single insurance company holds at least 98% of the fund shares.

International diversification of German insurers' asset holdings*

Chart 5.6

Percentage share of the portfolio, as at Q2 2018



Sources: BaFin and Bundesbank calculations. * The data refer to all insurers who report a list of assets (Template S.06.02) in their Solvency II quarterly reports. ¹ Share of total asset holdings.
 Deutsche Bundesbank

tal gains such as profits from sales or dividends are retained by funds, then they represent hidden reserves for life insurers. Life insurers can draw on these reserves later – for instance, to fund guaranteed payments to policyholders. Within those parameters, this cushioning function performed by fund investment can impact positively on financial stability.²⁸

International diversification of asset holdings and potential contagion risk

Since insurance companies hold around one-third of their assets via fund vehicles, a comprehensive assessment of vulnerability hinges on looking not only at their direct asset holdings but also at insurers' holdings of assets via fund vehicles. Up to now, it has been possible to look through these fund vehicles only to a limited extent. The new Solvency II

prudential supervisory data now make it possible, for the first time, to analyse the countries and financial instruments in which funds held by insurers are invested.

On the whole, insurers diversify their fund investment on a more international scale than their direct asset holdings, although the differences regarding financial instruments are minimal. Interest-bearing securities represent the focal point of both investment forms, accounting for over 60% of the portfolio. Lending by insurers, by contrast, is largely direct. Direct lending makes up a share of 7%, whereas the figure is only about 1% in terms of lending via funds.

Insurers' direct asset holdings are focused on Germany – nearly half of all exposures are to the insurers' home country (see Chart 5.6). This means that insurers are highly vulnerable to developments in

Insurers' direct asset holdings are focused on Germany.

the German business cycle. Insurers' fund-based investments, however, are more diversified internationally. Over 85% of these asset holdings are foreign exposures, especially to the euro area and the United States. In the past few years, German insurers have invested more heavily in other countries – also in the light of low interest rates in Germany.²⁹ Risks from other countries can thus affect insurers, in particular, through their fund investment.

Risks from other countries can affect insurers, in particular, through their fund investment.

Insurers also use funds to invest in higher-risk countries, with emerging market economies (EMEs) accounting for 5% of their fund investment but less

²⁸ See Deutsche Bundesbank (2017).
²⁹ See Deutsche Bundesbank (2016).

than 1% of their direct investment activities. On the whole, however, German insurers' exposure to contagion risk from EMEs is limited (see the chapter entitled "The international environment" on pp. 15 ff.).

Life insurers' cyclical investment behaviour

Life insurers play a particularly important role in investment; in the second quarter of 2018, they managed around €1.2 trillion, or 56%, of the asset holdings of all insurers. Owing to their long-dated liabilities,³⁰ life insurers, economically speaking, can, in principle, disregard short-term price swings and hold securities over the long term. To this extent, life insurers would be better suited than other market actors to retain illiquid asset holdings. In addition, by investing in these assets, life insurers can earn illiquidity premiums.

Owing to their long-dated liabilities, life insurers can disregard short-term price swings.

Illiquid asset holdings, however, are not very conducive to asset-liability duration matching. As a case in point, in Solvency II, real estate holdings are not taken

There is a trade-off between higher investment income and smaller duration gaps.

into account when calculating asset duration. Analyses show that life insurers whose asset holdings have a longer duration hold more government bonds and less real estate.³¹ This is consistent with disadvantages regarding the obtainable illiquidity premium since government bonds are more liquid and thus yield a smaller illiquidity premium than real estate. Life insurers, therefore, face a trade-off between higher investment income and smaller duration gaps (i.e. less on-balance-sheet interest rate risk). At the same time, life insurers with smaller duration gaps report higher trading volumes, as they can also reduce their interest rate exposure

on the balance sheet by selling off fixed income securities once their residual maturity has shrunk considerably.³²

In times of crisis, life insurers – unlike under normal circumstances – can also very well be vulnerable to short-term fluctuations in value. For instance, they could be forced to liquidate their assets if policyholders lapse their policies as a result of a loss of confidence. Solvency II, a prudential supervisory regime oriented to market value and risk, could also generate selling pressure,³³ even though it contains elements designed to temper this procyclicality (see the box entitled "Macprudential instruments for the insurance sector" on pp. 96 f.). If, for instance, asset values were to drop sharply during a financial crisis, this would diminish insurers' solvency ratios since the loss in value reduces own funds. Insurers could attempt to improve their solvency ratios by selling off the affected assets and purchasing assets subject to less stringent own funds requirements. This means that they would be behaving procyclically at the precise moment when a stabilising role in the financial

In times of crisis, life insurers could be vulnerable to short-term fluctuations in value.

³⁰ In principle, German life insurers' liabilities are stable over the long term. However, the fact that policyholders can lapse their policies at any time has a contrary effect (see the section entitled "Incentives for an upsurge in policy lapses should interest rates rise abruptly" on pp. 90 f.) In addition, liabilities are marked to market under Solvency II, i.e. their valuation fluctuates over time (see the section entitled "Solvency of German life insurers according to Solvency II has improved slightly" on pp. 84 f.).

³¹ Analysis with single-entity microdata from BaFin's extended forecast. The mean duration gap is estimated based on hidden reserves and losses in the single-entity financial statement for the years 2014 to 2017. Attributes for the previous year, 2013, are used for analysing asset holdings. For more on the methodology, see A. Möhlmann (2017).

³² The duration of a fixed income security declines over time, since the residual maturity shrinks. A typical strategy for extending the duration of asset holdings is to replace securities with a diminished duration with newer long-dated securities.

³³ See C. Lepore, M. Tanaka, D. Humphrey and K. Sen (2018).

Macroprudential instruments for the insurance sector

Macroprudential instruments are intended to reduce systemic risks. Systemic risks can arise from individual enterprises that are large in size or highly interconnected, but they can also result from multiple enterprises, including smaller ones, having similar business models or uniform strategies or displaying collective behaviour.¹ In the insurance sector, for instance, many life insurance companies have invested in the same types of assets and taken on similar liabilities with long-term obligations. This can lead to contagion effects if insurers adjust to shocks on the assets side or the liabilities side of their balance sheets and, if necessary, offload assets. By doing so, these enterprises can amplify or pass on shocks to the rest of the financial system as well as to the real economy.

Within the insurance sector, life insurance companies have a particular bearing on financial stability owing to their risk profiles and their size. Most importantly, they are similarly exposed to interest rate risk. Past financial crises have also shown that life insurers often run into difficulties due to the correlation of their enterprise-specific risks with the business cycle.²

Furthermore, market-based supervisory regimes, such as Solvency II, can fundamentally contribute to procyclical behaviour, i.e. insurers sell off securities when their prices drop. However, Solvency II also contains elements that are intended to counteract procyclical behaviour. These include, for instance, the volatility adjustment as a permanent feature as well as the transitional period from Solvency I to Solvency II up until the end of 2031.³ Unlike in the case of banks, there are as yet no instruments motivated explicitly by macroprudential considerations for insurers in Germany. One exception is the legal basis for instruments in

the area of residential property loans, which was created in Germany in 2017. The provisions pertaining to banks regarding the loan-to-value ratio (LTV) and the amortisation requirement laid down in the German Banking Act (*Kreditwesengesetz*) were also enshrined in the Insurance Supervision Act (*Versicherungsaufsichtsgesetz*).

The European Systemic Risk Board (ESRB) and the European Insurance and Occupational Pensions Authority (EIOPA) are currently working on a conceptual framework for analysing and containing systemic risks in the insurance sector. The outcome of their deliberations will feed into the European Commission's review of Solvency II.⁴

The following instruments in particular are under discussion: insurer-specific systemic capital add-ons, countercyclical capital buffers and the greater recognition of liquidity risks. Using a capital add-on for systemic risks, regulators could address risks arising from the size and interconnectedness of individual insurers, make activities

¹ For more information on the current debate on systemic risks in the insurance sector, see International Monetary Fund, *Global Financial Stability Report*, April 2016; European Insurance and Occupational Pensions Authority, *Systemic Risk and Macroprudential Policy in Insurance*, February 2018; European Systemic Risk Board, *Report on Systemic Risks in the EU Insurance Sector*, December 2015; and F. Hufeld, *A Regulatory Framework for Systemic Risk in the Insurance Industry*, in *The Economics, Regulation, and Systemic Risk of Insurance Markets*, Oxford University Press, 2016.

² See European Insurance and Occupational Pensions Authority, *Failures and Near Misses in Insurance – Overview of the Causes and Early Identification*, July 2018.

³ See Deutsche Bundesbank, *Financial Stability Review 2015*, pp. 48 f.; and Bank of England, *Financial Stability Report*, July 2016, p. 25.

⁴ See European Systemic Risk Board, press release dated 4 October 2018; and European Insurance and Occupational Pensions Authority, *Other Potential Macroprudential Tools to Enhance the Current Framework*, July 2018.

with potential for systemic risk more costly, and, in doing so, possibly reduce risky behaviour. Such a tool would be compatible with existing legal provisions under Solvency II as well as with work currently being undertaken by the International Association of Insurance Supervisors (IAIS).

Countercyclical capital buffers are intended to reduce procyclical behaviour amongst insurers. In this regard, the ESRB and the International Monetary Fund have proposed making symmetrical adjustments to countercyclical capital buffers.⁵ Such measures are intended not only to reduce the valuation of insurers' liabilities in stress situations in the future – as has so far been the case with Solvency II, for example – but also to lead to additional reserves being accumulated when times are good.

Furthermore, minimum liquidity requirements are also under discussion. Although liquidity risks are generally quite a rare phenomenon amongst insurers, they can have a considerable impact when they materialise. A first step could initially consist of improving the monitoring and evaluation of liquidity risks, for instance by using suitable indicators of liquidity risk.

When developing macroprudential instruments for the insurance sector, possible repercussions for, and interdependencies with, other financial sectors and the real economy must be taken into consideration. The aim is always to look at the bigger picture of the financial system. Potential evasive action and regulatory arbitrage between financial sectors must be kept in mind.⁶ Moreover, rule-based measures are preferable to discretionary measures, as the latter make it more difficult for market participants to form expectations.⁷

Misalignments can, however, also often be corrected using softer tools, such as financial

stability-related analyses which highlight vulnerabilities. Market participants can then adapt their behaviour based on the resultant risk assessment. One example of this is the debate surrounding the risk-free yield curve according to Solvency II. Analyses indicated that the yield curve that was applied initially could underestimate insurers' liabilities, thereby making the insurance sector vulnerable.⁸ Within the scope of the Solvency II review, EIOPA revised the applicable yield curve downwards earlier this year.

Macroprudential action at the supranational level should take account of the special institutional features in each individual country. National supervisory authorities and central banks possess specific knowledge of their own financial systems and can offer more targeted responses to misalignments in their own country. The interest rate insensitive surrender values of common life insurance policies in Germany are a case in point. In the event of an abrupt hike in interest rates, these could become systemically significant (see the section entitled "Incentives for an upsurge in policy lapses should interest rates rise abruptly" on pp. 90 f.). The introduction of interest rate sensitive surrender values in Germany would afford insurers protection against the risk of such an upsurge in policy lapses.⁹

⁵ See European Systemic Risk Board, Report on Systemic Risks in the EU Insurance Sector, December 2015; and International Monetary Fund, Euro Area Policies: Financial System Stability Assessment, July 2018.

⁶ See C. Borio, Macroprudential Frameworks – Experience, Prospects and a Way Forward, BIS speech, June 2018.

⁷ See Deutsche Bundesbank, Monthly Report, April 2012, p. 34.

⁸ See Deutsche Bundesbank, Financial Stability Review 2016, p. 59 f.; and European Systemic Risk Board, Regulatory Risk-Free Yield Curve Properties and Macroprudential Consequences, August 2017.

⁹ See Financial Stability Committee, Fünfter Bericht an den Deutschen Bundestag zur Finanzstabilität in Deutschland, June 2018, p. 25.

system would be desirable from a macroprudential perspective.³⁴

Risk situation in the German investment fund sector

As at end-August 2018, the total assets under management by German open-end investment funds amounted to €2,188 billion.³⁵ Around three-quarters, or €1,660 billion, were in open-end specialised funds, which are primarily reserved for institutional investors.³⁶ The German open-end investment fund sector has boomed over the past five years, with

Growth throughout the fund sector is being driven primarily by mixed securities funds.

retail funds and specialised funds alike recording a surge in net inflows of funds. Growth throughout the sector is still being driven primarily by mixed securities funds, which, at €44 billion or 45.9%, accounted for nearly half of the total net inflows of funds to the sector over the past 12 months.³⁷

Growing internationalisation of German open-end investment funds' securities portfolio

The German investment fund sector is interconnected with foreign counterparties via both sides of the balance sheet: foreign investors can hold German investment fund shares and German investment funds can add securities issued by non-residents to their portfolios. German funds are therefore sensitive to developments on international capital markets.

The holder structure of German open-end investment funds is dominated by German investors, with 87% (retail funds) and 95% (specialised funds) of German fund units being held by residents (as at June 2018).³⁸ Owing to this holder structure, chang-

es in the value of German investment fund shares are largely passed through to domestic investors. Foreign investors' investments which are redeemable at short notice in stressed periods are limited, by contrast. This hampers the transmission of international shocks through the liabilities side of the German investment fund sector.

The German open-end investment funds' securities portfolio is more international by comparison, with the German investment fund sector currently holding securities issued in 167 different countries and around 70 currency areas. There has been a visible shift over the past years towards securities denominated in US dollars: the ratio of euro-denominated securities to all securities managed by German investment funds has fallen from 84.0% in September 2009 to a current level of 73.6%, while the share of US dollar-denominated securities has gone up from 7.5% to 16.2% over the same period.

The share of US dollar-denominated securities in the German fund sector has increased.

In general, there is a preference for securities issued by German entities or issuers with close geographical proximity within the German investment fund sector (a phenomenon known as "home bias"³⁹). Expressed in figures, 27.3% of the securities currently held by German investment funds were issued in Germany, 37.7% in the rest of the euro area and

³⁴ See G. Chodorow-Reich, A. C. Ghent and V. Haddad (2018).

³⁵ The investment funds statistics and the securities holdings statistics form the underlying dataset for the sections to follow.

³⁶ As at end-August 2018, the total assets under management by open-end retail investment funds amounted to around €528 billion.

³⁷ Moreover, real estate funds (€17.0 billion or 17.8%) and equity funds (€10.9 billion or 11.3%) also registered strong inflows.

³⁸ This means that residents' holdings of retail fund units amount to a value of €430 billion and those of specialised fund units to a value of €1,506 billion (as at end-June 2018).

³⁹ For more on the term "home bias", see e.g. L. L. Tesar and I. M. Werner (1995).

8.5% in the remainder of the European Union (see Chart 5.7).⁴⁰ The share of securities issued in non-European countries, however, has picked up by 10.6

The weight of US securities has risen particularly sharply.

percentage points since September 2009 to 26.4%. The weight of US securities rose particularly sharply: driven by equities as well as corporate and government bonds, the share of US instruments in German funds' securities portfolio has gone up from 7.7% (€63.9 billion) in September 2009 to a current level of 12.6% (€231.9 billion).

It is particularly the international focus of assets, then, which is shaping the German fund sector's risk of potential contagion from crises on the international securities markets. The decline in home bias is having two direct effects with regard to financial stability. One is that German investors are at increased risk of being directly and indirectly impacted by asset

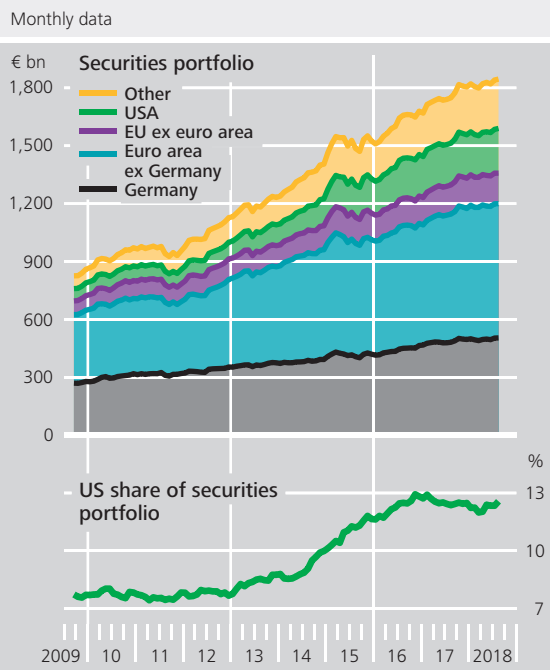
A more international focus of assets is tending to dampen the sector's vulnerability to an unexpected downturn in Germany.

price shocks in periods of stress on the international financial markets. Another, by contrast, is a reduction in vulnerability to periods of stress on the German capital market.⁴¹ The more international focus of German funds' assets is tending to dampen, in this manner, the sector's vulnerability to an unexpected downturn in Germany and the euro area (see also the chapter entitled "Risk situation of the German financial system" on pp. 41 ff.).

Open-end investment funds highly interconnected with other sectors in the financial system

Investment funds are interconnected both with one another and with the rest of the financial system.

Portfolio structure of German open-end investment funds by issuer country Chart 5.7



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Interconnectedness is to be found on both sides of the balance sheet since the German investment fund sector holds fund units and securities from the rest of the financial sector, while counterparties from the financial sector themselves hold investment fund shares (see Chart 5.8).

In June 2018, €1,053 billion or around 50% of total assets under management by German investment funds were issued by financial sector entities. Of this, €684 billion, or 32.3%, worth of assets were from

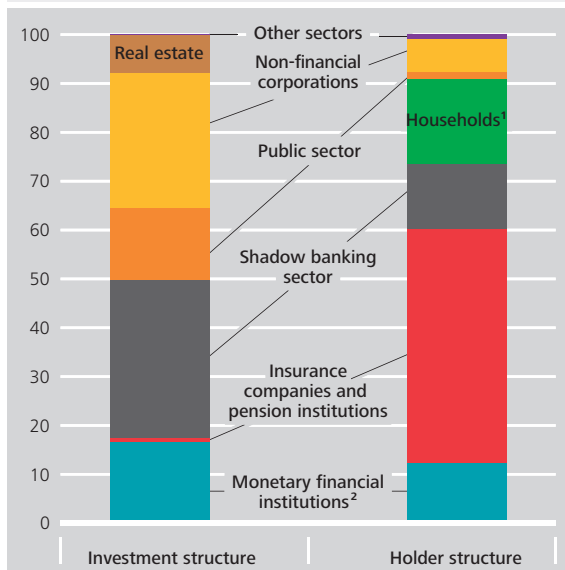
⁴⁰ German investment funds' non-euro area European securities investment activities are focused on the United Kingdom: UK-issued securities at present account for around €91 billion of the total of €158 billion. The UK securities share of German funds' total securities investment has remained stable at between 5% and 7% since September 2009.

⁴¹ Irrespective of these direct contagion effects, however, spillover effects must also be expected, which means that price collapses on international securities markets can impact adversely on prices on local securities markets, and vice versa.

Balance sheet structure of open-end investment funds in Germany by sector

Chart 5.8

%, as at June 2018



¹ Including non-profit organisations serving households. ² Excluding money market funds.

Deutsche Bundesbank

the shadow banking sector,⁴² while €348 billion, or 16.5%, worth of assets were from the banking sector. Among the shadow banking sector's assets, investment fund units, with a volume of €425 billion, play the most important role.⁴³

The holder structure of German investment funds allows inferences to be drawn about the extent to

The financial sector is by far the largest investor in German investment funds.

which potential losses would have to be borne by other financial intermediaries. The financial sector is by far

the largest investor in German investment funds; as at end-June 2018, it held around three-quarters of aggregate net assets.⁴⁴ Within the financial sector, the largest group of holders comprises insurance companies and pension institutions (€993 billion or 48%), followed by banks (€252 billion or 12%) and investment funds (€247 billion or 12%).⁴⁵

Owing to this interconnectedness with the German investment fund sector, German insurance companies and pension institutions, in particular, but also banks and investment funds, would be exposed to contagion risk in the event of potential losses on the capital markets, for example in the wake of an abrupt rise in capital market interest rates or a distinct cyclical downswing (see also the chapter entitled "Risk situation of the German financial system" on pp. 41 ff.).

Owing to interconnectedness, German insurance companies and pension institutions, in particular, are exposed to contagion risk.

Interest rate sensitivity of the German investment fund sector harbours risks to financial stability

Open-end investment funds can hold large volumes of interest-bearing securities, amongst other assets, especially bond funds and mixed securities funds. Since their assets are longer term, but their liabilities are mostly redeemable at short notice, they engage in maturity transformation and are thus exposed to interest rate risk. If investment funds step up their maturity transformation, their interest rate sensitive assets – especially bonds and other interest-bearing securities – will depreciate more sharply if interest rates go up. As a consequence, the value of the fund units issued – all other things being equal – will drop more sharply in such a scenario. The distribution of

⁴² According to the ESA 2010 statistics standard, the shadow banking sector comprises investment funds, money market funds and other financial intermediaries; see also Deutsche Bundesbank (2015).

⁴³ For more information on the growing direct interconnectedness between German investment funds, see also Deutsche Bundesbank (2017), pp. 97-99.

⁴⁴ In June 2018, the financial sector held around 87% of all open-end specialised fund units and 31% of all open-end retail fund units.

⁴⁵ The rest of the shadow banking sector holds around €26 billion worth of fund units.

the resultant losses in share value across fund investors depends here on the holder structure of the affected funds.

From a financial stability viewpoint, the distribution of interest rate risk in the fund sector is relevant for several reasons. If interest rate sensitive investment funds are held particularly by financial sector agents (e.g. banks, insurers or investment funds), these

If interest rate sensitive investment funds are held particularly by financial sector agents, these agents are exposed to common risk factors.

agents are exposed to common risk factors and, if capital market interest rates were to rise, would be equally affected directly (direct contagion risk).

Moreover, interest rate sensitive funds could see themselves forced to make further portfolio adjustments following price losses, for instance if fund managers have to close positions in the affected market segments (“fire sales”). The portfolio adjustments do not necessarily have to be restricted to the interest rate sensitive part of the portfolio but could also involve other assets such as equities or real estate. For instance, the interest rate shock could induce fund managers to sell off equities in order to restore the target equity ratio.⁴⁶ Such portfolio adjustments could put the prices of the affected assets under further pressure, thereby triggering price reductions for these assets. In this manner, further – possibly previously unaffected – holders could be caught up in a fire sale mechanism (indirect contagion risk).⁴⁷

Another key macroprudential issue is that falling fund unit prices could cause shareholders to withdraw

Increased maturity transformation in the fund sector can amplify already existing run risks.

their funds (flow-performance relationship).⁴⁸ This could, in stress periods, particularly force investment funds with less liquid

assets and small liquidity buffers to sell off their

assets abruptly.⁴⁹ Moreover, increased maturity transformation in the fund sector can amplify already existing run risks since investors’ potential losses from bond sales will be magnified if interest rates rise. If investors expect these losses from redemptions of fund shares to be passed on to the remaining investors, this could consequently strengthen the incentives to redeem fund shares as quickly as possible (in order to obtain what is known as a “first mover advantage”). Owing to the large number and heterogeneity of shareholders and the resultant, potentially greater information asymmetries, such run risks are likely to be much more strongly pronounced for retail funds than for specialised funds.

Heightened interest rate risk despite dwindling stocks of interest-bearing assets

The portfolio duration⁵⁰ is a standard indicator of a securities portfolio’s sensitivity to interest rates. The higher the duration, the more sensitive the securities portfolio in question is to changes in interest rates. German open-end invest-

German open-end investment funds have increased the mean duration of their bond portfolios.

ment funds have increased the mean duration of their bond portfolios as an overall aggregate over the past years.⁵¹ This trend has made the fund sector, on the whole, more sensitive to interest rate risk

⁴⁶ The interest rate shock causes the value of the bond portfolio to drop, thus automatically increasing the fund’s equity ratio.

⁴⁷ For more information on contagion effects between financial intermediaries caused by portfolio overlap, see e.g. R. Cont and E. F. Schaanning (2017) as well as C. Fricke and D. Fricke (2017).

⁴⁸ More information on the flow-performance relationship can be found, inter alia, in E. R. Sirri and P. Tufano (1998); J. B. Berk and R. Green (2004); and C. Fricke and D. Fricke (2017).

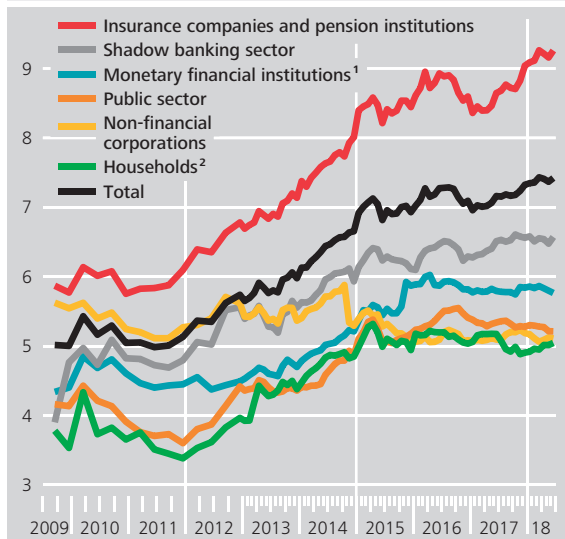
⁴⁹ See also I. Goldstein, H. Jiang and D. T. Ng (2017).

⁵⁰ Here and in the following section, the portfolio duration is defined as the value-weighted duration of the interest-bearing securities portfolio of German open-end investment funds according to Macaulay (1938).

⁵¹ See Deutsche Bundesbank (2017), pp. 94 f.

Portfolio duration of German open-end investment funds by holder groups* Chart 5.9

Weighted means in years



Sources: Centralised Securities Database (CSDB), Deutsche 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 organisations serving households.

Deutsche Bundesbank

(see Chart 5.9).⁵² The picture for sector aggregates is mixed: between June 2017 and June 2018, the duration of fund investment increased particularly for insurance companies and pension institutions (+7.1%), whereas that of households and the public sector declined (-2.5% and -2.4% respectively). Banks (-0.5%) and the shadow banking sector (+0.9%), by contrast, held the duration of their fund investment largely constant.

The duration of fund investment has increased particularly for insurance companies and pension institutions.

In order to gauge the implications of an abrupt rise in capital market interest rates for the assets under management in the German investment fund sector, account needs to be taken not only of the duration but also of the volume of German investment funds' interest-bearing securities. As at end-August 2018,

the German investment fund sector held €953 billion worth of interest-bearing securities. Although these instruments still represent more than half of all security assets under management in the German investment fund sector, their portfolio weight has been declining for years, with the share of interest-bearing products in the German investment funds' securities portfolio dropping from 66% in September 2009 to a current level of 51.8%. All the same, the sector's vulnerability to interest rate risk could have risen overall, despite reduced stocks of interest-bearing securities, since the average portfolio duration has shown stronger growth in percentage terms over the same period.⁵³ In addition, investment funds are increasingly holding units issued by other investment funds.⁵⁴ The indirect vulnerability of German funds to interest rate changes arising through the holding of funds with significant stocks of interest-bearing securities can only be imperfectly approximated.

In the event of an abrupt and unexpected rise in capital market interest rates, there is a risk of direct contagion via the German investment fund sector to the German financial sector (see the section entitled "Open-end investment funds highly interconnected with other sectors in the financial system" on pp. 99 f.). German financial intermediaries have built up significant positions in interest rate sensitive securities via funds. As at end-June 2018, insurance companies and pension institutions (€491 billion or 53%), banks (€124 billion or 13%) and the shadow banking sector (€133 billion

German financial intermediaries would be hit hardest by contagion effects.

⁵² Bond funds incur greater interest rate risk than mixed securities funds in this respect. Since September 2009, their mean portfolio duration has always been higher than that of mixed securities funds, rising by a further 2.6% between June 2017 and June 2018.

⁵³ The mean portfolio duration of German funds has risen by around 48% since September 2009, while their interest-bearing portfolio holdings have declined by only 21%.

⁵⁴ See Deutsche Bundesbank (2017), pp. 97-99.

or 14%) together held, via fund units, around 80% of all interest-bearing securities being held in the German investment fund sector. Since these financial intermediaries also hold the most interest rate sensitive fund portfolios, they would be hit hardest by contagion effects in the event of a period of stress triggered by an abrupt increase in capital market interest rates.

Increased interest rate sensitivity of German investment funds has holder-specific implications

The overall effects on insurance companies and pension institutions, investment funds and banks, as holders of German investment funds, are different. Insurers would be hit the hardest by an unexpected rise in interest rates owing to the long duration of their investment fund shares and the large volumes of interest-bearing securities that they hold via funds. However, the increased portfolio duration of their funds helps them to align the total duration on their assets side to that on the liabilities side and thus to shrink their duration gap (see the section entitled "Duration gap at German life insurers" on pp. 89 f.). The latter aspect is welcome in terms of financial stability. By contrast, the duration gap at banks and investment funds tends to widen when the duration of their assets rises. To that extent, the largely constant duration of these agents' fund investment indicates their continued willingness to take on increased interest rate risk (see also the section entitled "Interest rate risk still high for small and medium-sized banks" on pp. 76 ff.).

■ List of references

Amihud, Y. (2002), Illiquidity and Stock Returns: Cross-section and Time-series Effects, *Journal of Financial Markets*, Vol. 5, No 1, pp. 31-56.

BaFin (2016), Solvency II-Übergangsmassnahmen zur Rückstellungsbewertung: Eine erste Bestandsaufnahme, *BaFin-Journal*, March 2016.

Berdin, E., H. Gründl and C. Kubitzka (2017), Rising Interest Rates, Lapse Risk, and the Stability of Life Insurers, *ICIR Working Paper Series No 29/17*, July 2017.

Berk, J. B. and R. Green (2004), Mutual Fund Flows and Performance in Rational Markets, *Journal of Political Economy*, Vol. 112, No 6, pp. 1269-1295.

Cont, R. and E. F. Schaanning (2017), Fire Sales, Indirect Contagion and Systemic Stress Testing, *Norges Bank Research Working Paper No 2/2017*, March 2017.

Chodorow-Reich, G., A. C. Ghent and V. Haddad (2018), Asset Insulators, *NBER Working Paper No 24973*, August 2018.

Deutsche Bundesbank (2014a), *Monthly Report*, July 2014.

Deutsche Bundesbank (2014b), Statement by the Deutsche Bundesbank for the public hearing of the Financial Committee of the Bundestag on 30 June 2014 regarding the Federal Government's draft Act to safeguard stable and fair benefits for life insurance policyholders (Life Insurance Reform Act) (Stellungnahme der Deutschen Bundesbank anlässlich der öffentlichen Anhörung des Finanzausschusses des Deutschen Bundestages am 30. Juni 2014 zum Gesetzentwurf der Bundesregierung "Entwurf eines Gesetzes zur Absicherung stabiler und fairer Leistungen für Lebensversicherte (Lebensversicherungsreformgesetz – LVRG)"); available online at <https://www.bundesbank.de/resource/blob/765404/5bdefa0b35856a28e200682106867cd9/mL/2014-06-30-stellungnahme-lebensversicherungsreformgesetz-data.pdf>

- Deutsche Bundesbank (2015), Financial Stability Review 2015.
- Deutsche Bundesbank (2016), Financial Stability Review 2016.
- Deutsche Bundesbank (2017), Financial Stability Review 2017.
- Domanski, D., H. S. Shin and V. Sushko (2017), The Hunt for Duration: Not Waving but Drowning?, IMF Economic Review, Vol. 65, No 1, pp. 113-153.
- Ellul, A., C. Jotikasthira, A. V. Kartasheva, C. T. Lundblad and W. Wagner (2018), Insurers as Asset Managers and Systemic Risk, CEPR Working Paper No 12849, April 2018.
- European Insurance and Occupational Pensions Authority (2017a), 2017 IORP Stress Test Report, December 2017.
- European Insurance and Occupational Pensions Authority (2017b), Report on Long-term Guarantees Measures and Measures on Equity Risk 2017, December 2017.
- Federal Ministry of Finance (2018), Evaluierung des Lebensversicherungsreformgesetzes, Bericht an den Finanzausschuss des Deutschen Bundestages, June 2018.
- Förstemann, T. (2018), Lethal Lapses – How a Positive Interest Rate Shock Might Stress Life Insurers, Deutsche Bundesbank, mimeo.
- Fricke, C. and D. Fricke (2017), Vulnerable asset management? The case of mutual funds, Deutsche Bundesbank Discussion Paper No 32/2017, October 2017.
- Goldstein, I., H. Jiang and D. T. Ng (2017), Investor Flows and Fragility in Corporate Bond Funds, Journal of Financial Economics, Vol. 126, pp. 592-613.
- Greenwood, R., A. Landier and D. Thesmar (2015), Vulnerable Banks, Journal of Financial Economics, Vol. 115, No 3, pp. 471-485.
- Kablau, A. and M. Weiß (2014), How is the low-interest-rate environment affecting the solvency of German life insurers?, Deutsche Bundesbank Discussion Paper No 27/2014, October 2014.
- Lepore, C., M. Tanaka, D. Humphry and K. Sen (2018), An Elusive Panacea? The Impact of the Regulatory Valuation Regime on Insurers' Investment Behaviour, Bank of England Staff Working Paper No 710, February 2018.
- Macaulay, F. (1938), The Movements of Interest Rates, Bond Yields and Stock Prices in the United States since 1856, National Bureau of Economic Research (NBER), New York.
- Möhlmann, A. (2017), Interest rate risk of life insurers – evidence from accounting data, Deutsche Bundesbank Discussion Paper No 10/2017, May 2017.
- Shin, H. S. (2017), Is There a Risk of Snapback in Long-Dated Yields?, Panel Remarks at the Second ECB Annual Research Conference, 25 September 2017, available online at <https://www.bis.org/speeches/sp170925.htm>
- Sirri, E. R. and P. Tufano (1998), Costly Search and Mutual Fund Flows, Journal of Finance, Vol. 53, No 5, pp. 1589-1622.
- Tesar, L. L. and I. M. Werner (1995), Home Bias and High Turnover, Journal of International Money and Finance, Vol. 14, No 4, pp. 467-492.

Third Regulation Amending Regulations Under the Insurance Supervision Act (*Dritte Verordnung zur Änderung von Verordnungen nach dem Ver-* *sicherungsaufsichtsgesetz*) of 10 October 2018, Federal Law Gazette I, 2018, No 35, Bonn, 22 October 2018, pp. 1653-1654.

| Glossary

BaFin	Federal Financial Supervisory Authority
BCBS	Basel Committee on Banking Supervision
BIS	Bank for International Settlements
BLS	Bank Lending Survey
CCP	Central counterparty
CCyB	Countercyclical capital buffer
CDS	Credit default swap
DSTI	Debt-service-to-income ratio
DTI	Debt-to-income ratio
EBA	European Banking Authority
ECB	European Central Bank
EIOPA	European Insurance and Occupational Pensions Authority
ESRB	European Systemic Risk Board
EU	European Union
FOMC	Federal Open Market Committee
FSB	Financial Stability Board
FSOC	Financial Stability Oversight Council
GDP	Gross domestic product
G-SII	Global systemically important institution
IAIS	International Association of Insurance Supervisors
IMF	International Monetary Fund
IORP	Institutions for occupational retirement provision
IRBA	Internal ratings-based approach
LTI	Loan-to-income ratio
LTV	Loan-to-value ratio
MFI	Monetary financial institution
MiFID	Markets in Financial Instruments Directive
MiFIR	Markets in Financial Instruments Regulation
NIESR	National Institute of Economic and Social Research
OECD	Organisation for Economic Co-operation and Development
O-SII	Other systemically important institution
OTC	Over-the-counter
P/B	Price/book ratio
P/E	Price/earnings ratio
RWA	Risk-weighted assets
SME	Small and medium-sized enterprises
SREP	Supervisory review and evaluation process

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 most discussion papers are only 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 under this menu item.

The charts and tables in the report may also be found on the Bundesbank's website (under Tasks > Financial and monetary system > Financial Stability Review) along with a selection of underlying data as of the cut-off date. In addition, extensive data are available for various Bundesbank statistics, which are continuously updated (under Statistics, in particular in the time series databases).

■ Financial Stability Reviews

Financial Stability Reviews for the period 2005 to 2017; usually published once a year in November.

■ Articles from the Monthly Report

October 2018	The growing importance of exchange-traded funds in the financial markets
September 2018	The performance of German credit institutions in 2017
August 2018	Monetary policy and banking business
June 2018	Lower bound, inflation target and the anchoring of inflation expectations
May 2018	Monetary policy and banking business
April 2018	Current regulatory developments in the field of payments and in the settlement of securities and derivatives
March 2018	Contingent convertible bonds: design, regulation, usefulness
February 2018	Monetary policy and banking business
January 2018	The importance of bank profitability and bank capital for monetary policy
January 2018	Finalising Basel III
December 2017	The Eurosystem's financial market infrastructure – origin and future set-up
November 2017	Monetary policy and banking business

■ Discussion papers

43/2018	Implications of bank regulation for loan supply and bank stability: A dynamic perspective	Monika Bucher, Diemo Dietrich, Achim Hauck
42/2018	The pricing of FX forward contracts: micro evidence from banks' dollar hedging	Puriya Abbassi, Falk Bräuning
39/2018	Coordination failures, bank runs and asset prices	Monika Bucher, Diemo Dietrich, Mich Tvede
34/2018	What are the real effects of financial market liquidity? Evidence on bank lending from the euro area	Andreas R. Dombret, Daniel Foos, Kamil Pliszka, Alexander Schulz
29/2018	Interest rate rules under financial dominance	Vivien Lewis, Markus Roth
26/2018	Bank use of sovereign CDS in the eurozone crisis: hedging and risk incentives	Viral V. Acharya, Yalin Gündüz, Timothy C. Johnson
24/2018	Convertible bonds and bank risk-taking	Natalya Martynova, Enrico Perotti
22/2018	Unconventional monetary policy, bank lending, and security holdings: the yield-induced portfolio rebalancing channel	Karol Paludkiewicz
20/2018	Quantitative easing, portfolio rebalancing and credit growth: micro evidence from Germany	Johannes Tischer
18/2018	Time-varying capital requirements and disclosure rules: effects on capitalization and lending decisions	Björn Imbierowicz, Jonas Kragh, Jesper Rangvid
16/2018	The international transmission of monetary policy	Claudia M. Buch, Matthieu Bussiere, Linda Goldberg, Robert Hills
13/2018	International monetary policy spillovers through the bank funding channel	Peter Lindner, Axel Loeffler, Esther Segalla, Guzel Valitova, Ursula Vogel
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37/2017	A stress test framework for the German residential mortgage market – methodology and application	Thomas Siemsen, Johannes Vilsmeier
35/2017	Why do banks bear interest rate risk?	Christoph Memmel
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33/2017	Moral suasion in regional government bond markets	Jana Ohls