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BUNDESBANK
EUROSYSTEM

Research Programme 2021

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Introduction

The Bundesbank's research activities are directed towards developing and strengthening academic expertise in order to support decision-making and policy implementation in its core business areas. To meet high academic standards, Bundesbank research is peer-reviewed and is aimed at publication in top-ranking journals.

This research programme provides a detailed overview of the current topics of Bundesbank research. The areas covered comprise existing research with a longer-term perspective as well as new projects inspired by recent academic literature and the novel challenges that policy-makers are facing. All ongoing and planned research is organised into three broad areas in this programme.

Research area 1: Monetary policy in times of crisis and structural change

The COVID-19 pandemic has posed serious challenges to societies worldwide. In response to the severe economic disruptions caused by the pandemic, governments, central banks and supervisory authorities have provided unparalleled support to households, firms, and financial markets. When the pandemic hit, monetary policy in the euro area was already operating in a challenging environment characterised by historically low policy rates and a strongly expanded Eurosystem balance sheet.

In July 2021, the Eurosystem concluded a review of its monetary policy framework, which culminated in the approval of a new monetary policy strategy featuring, amongst other things, a symmetric 2% inflation target over the medium term. The Eurosystem also published an ambitious action plan to include climate risks in its new monetary policy strategy. This plan recognises that climate change and climate policies will have long-lasting effects on financial markets and the broader economy, which central banks need to better understand and incorporate into their modelling and forecasting toolkit. Digitalisation is another important driver of structural change worldwide, with implications for financial markets and the real economy. Digitalisation has also led to significant innovations in money and payments systems. The Eurosystem has itself recently started to evaluate the costs and benefits of a digital euro.

Research area 2: The role of heterogeneities in an integrated global economy

The global economy is characterised by substantial regional and sectoral heterogeneities, many of which were further amplified by the COVID-19 pandemic. In the European Union, the pandemic and policy responses by governments have led to sharp increases in public debt levels, renewing questions concerning debt sustainability and the fiscal framework. New tariffs and trade barriers have the potential to disrupt global value chains and risk the disintegration of international trade.

As well as differences between countries, heterogeneities among households and firms are important for central banks. Understanding the granular microeconomic response to monetary, fiscal and macroprudential policies can support their proper calibration. Household and firm heterogeneities are also important for assessing the macroeconomic impact of climate change and climate policies as well as the COVID-19 pandemic.

Research area 3: Safeguarding financial stability in an era of transformation

Structural change in the banking sector, accompanied by the emergence of new business models and digital technologies in financial services, poses new challenges for banking supervision and financial stability policies. The COVID-19 pandemic has put further pressure on the financial services industry. Climate change and the policies that address it will also have a profound impact on financial intermediaries and markets. As part of their

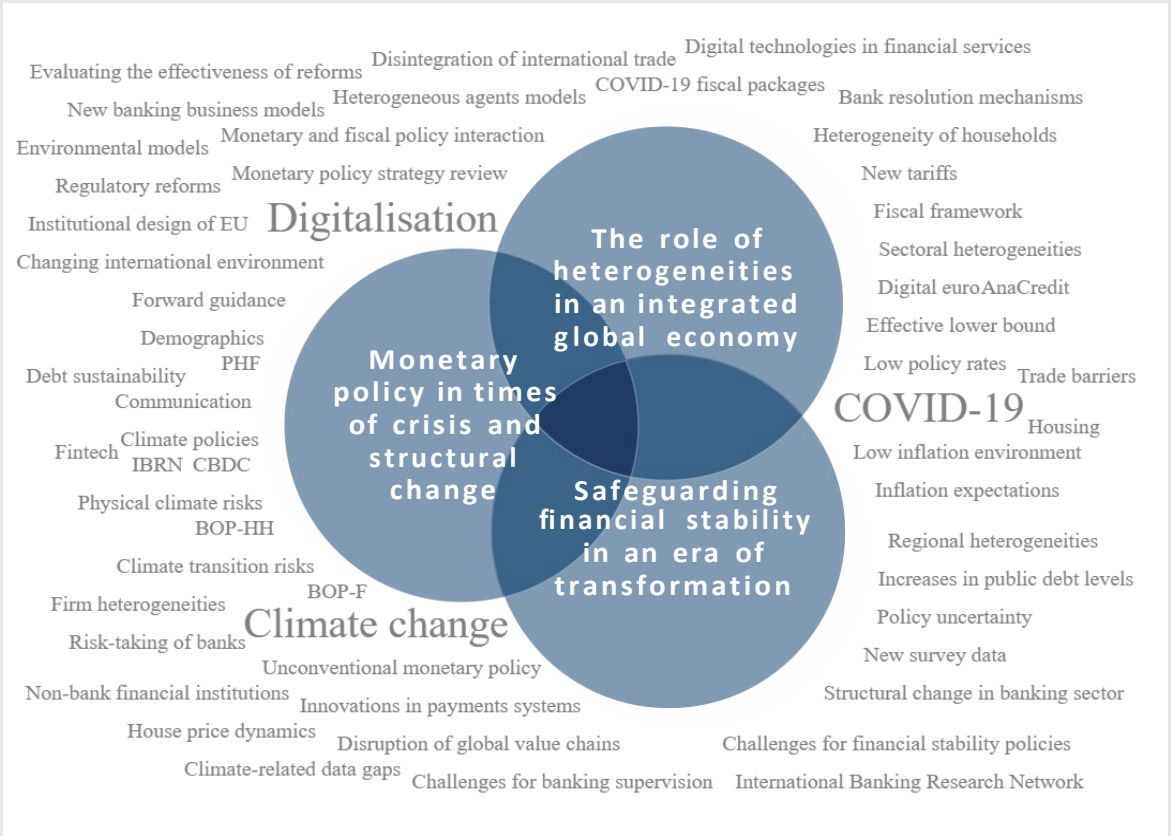
financial stability and banking supervision mandates, central banks need to understand the implications of these trends.

In response to the global financial crisis, policymakers have passed wide-ranging regulatory reforms and expanded their set of instruments, strengthening existing regulations and introducing new macro and microprudential requirements and supervisory practices. Further research is needed to evaluate the effectiveness of these measures as well as their potential side effects and interactions with monetary policy in a low interest rate environment.

The figure below visualises the topics covered by the three research areas of the Bundesbank Research Programme. Some of the topics shown have an overarching nature, as they inspire research projects in more than one research area. The figure emphasises the COVID-19 pandemic, climate change, and digitalisation as particularly prominent issues, which influence the three research areas as outlined in the overview sections above.

The following sections provide more information on the topics addressed in the three research areas. For additional information on research at the Bundesbank, readers are encouraged to contact us. The Research Centre's website provides contact details for individual researchers at the Bundesbank and contains information about the wide range of seminars, academic workshops and conferences that the Bundesbank organises throughout the year, as well as the various opportunities for cooperation and interaction.

Note that the Research Programme reflects a current snapshot of research topics, which are relevant to the Bundesbank. New academic trends or changes in demand for research-based policy advice may lead to updates of the Research Programme in the future.



Research area 1: Monetary policy in times of crisis and structural change

In the aftermath of the global financial crisis and the European sovereign debt crisis, policy rates in the euro area have remained at exceptionally low levels. Moreover, the ECB has introduced an extended toolkit of unconventional measures, which have sharply increased the size of the Eurosystem's balance sheet. The COVID-19 pandemic required further exceptional monetary support and has also contributed to unprecedented levels of public debt, with potential consequences for the interaction of monetary and fiscal policies. Moreover, structural economic shifts related to climate change, the digitalisation of the economy, demographic change and a changing international environment will continue to affect inflation dynamics and the conduct of monetary policy in coming years. Bundesbank research focuses on analysing these developments and their consequences for central banks.

The exceptionally low inflation rates in the euro area and many other developed countries in recent years raise questions concerning our understanding of the drivers and dynamics of inflation, particularly over the longer term. The Bundesbank's research therefore examines potential structural factors for long-lasting low inflation. Among these, researchers investigate the contribution of global versus domestic inflation drivers, the role of product markets for price setting by exploring micro price data, and the implications of demographic developments for productivity and therefore the inflation process.

In addition to structural factors, Bundesbank research analyses the cyclical determinants of inflation. Amongst other drivers, the recent literature highlights the relevance of economic uncertainty. Bundesbank research contributes to this literature by studying the effects of uncertainty during the COVID-19 pandemic, for example. While uncertainty was also elevated during the global financial crisis, this episode primarily highlighted the importance of frictions in the financial system for macroeconomic dynamics. The Bundesbank's research analyses the implications of such frictions for the monetary transmission process and for the efficacy of unconventional monetary policy measures – for example quantitative easing and negative interest rates – and for households' and firms' investment and savings decisions.

Like other major central banks, the Eurosystem has recently engaged in a review of its monetary policy framework. The aim of this review was to ensure that the monetary policy strategy remains fit for purpose in order to maintain price stability in a world undergoing substantial structural change and also to incorporate the lessons learned during the recent crises. Although the strategic review was completed in July 2021, several of the aspects it considered will remain important for Bundesbank research in the coming years. For example, the constraints imposed by effective lower bounds (ELB) on interest rates have made the management of inflation expectations via forward guidance and other forms of communication a key tool for many central banks.

Alternative monetary policy strategies, such as average inflation targeting, also heavily rely on the management of inflation expectations. By making monetary policy history-dependent, such strategies prescribe an automatic stabiliser role for inflation expectations and thus real interest rates. While the theoretical advantages of history-dependent monetary policy strategies are relatively well understood, many questions remain unanswered concerning their implementation. Research at the Bundesbank investigates from a theoretical standpoint how belief formation by households and firms may affect the efficacy of the monetary policy

transmission at and away from the ELB. Moreover, Bundesbank research assesses to what extent history-dependent monetary policy rules ensure unique macroeconomic equilibrium conditions when the ELB is expected to be binding occasionally.

Whereas most topics in research area 1 have a macroeconomic perspective, several research projects also incorporate a microeconomic view so as to shed more light on the impact of microeconomic decisions on macroeconomic policy. For example, monetary policy strategies that strongly rely on the management of expectations require a deep understanding of how the expectation formation of households and firms works in practice. This includes the availability of reliable empirical measures of inflation expectations and evidence on their reaction to monetary policy communication. In this context, Bundesbank research analyses the following questions, inter alia: does central bank communication affect households' and firms' expectation formation and would households understand the logic behind make-up strategies such as average inflation targeting? To what extent do households and firms respond to changes in their inflation expectations by adjusting economic and financial decisions? To address these questions and to gain a better understanding of households' and firms' expectation formation process, Bundesbank research explores the granular information from the newly established "Bundesbank Online Panel Households" (BOP-HH) and "Bundesbank Online Panel Firms" (BOP-F), which will be discussed further in research area 2.

In addition to relying on survey-based expectations of households and firms, market-based measures of inflation and interest rate expectations are an important tool for central banks to assess the stance of monetary policy. Bundesbank research therefore develops novel approaches to measuring inflation and interest rate expectations in the euro area based on financial data. Those approaches facilitate an explicit decomposition of asset prices into expectation and risk premium components, which is particularly important at the ELB. Moreover, using high-frequency asset price information, Bundesbank research analyses whether the expectations and trading behaviour of investors change after monetary policy announcements and if these announcements convey information not only about monetary policy, but also about economic fundamentals.

In recent years, the ongoing trend towards digitalisation has led to numerous innovations in financial services, challenging traditional paradigms of the monetary system. The rapid development of privately issued digital assets and new means of payments has triggered a discussion about whether central banks should themselves issue digital currencies. Besides understanding their conceptual underpinnings, Bundesbank research empirically analyses the importance of these trends. Amongst others, ongoing work assesses the impact of monetary policy and its communication on cryptocurrency markets and prices. Moreover, research at the Bundesbank focuses on theoretical studies of consumer behaviour and demand for cryptocurrencies. These research topics complement those concerning regulatory and financial stability implications of digital currencies investigated in research area 3.

Climate change and the policies addressing it will contribute to the ongoing structural change in the euro area and the global economy. This will also have implications for the conduct of monetary policy. Increased climate-related physical risks implied by extreme weather events will likely give rise to more frequent and larger shocks, with repercussions for inflation dynamics. Additionally, policy responses that tackle climate change and aim to reduce carbon emissions will likely constitute transition risks for many sectors of the economy. This has implications for the conduct of monetary policy operations, for instance in the collateral framework or in purchase programmes. Therefore, Bundesbank research will consider the feedback effects of climate-related physical externalities and risks, but also of technological change, the transition to a net-zero carbon economy, green growth, and scarce resources on the effectiveness and implementation of monetary policy. Against this background, one major task is the extension and evolution of macroeconomic and credit risk assessment models suited to investigating these questions. This also includes the development of environmental general equilibrium models or integrated assessment models, but also a deeper analysis of the involved heterogeneities across countries and sectors.

The quick and comprehensive responses by monetary and fiscal authorities to contain the effects of the COVID-19 pandemic have once again illustrated how intertwined both policies are. Although the policy

measures have averted a protracted economic crisis, they may result in unintended side effects. The fiscal policy responses to tackling the COVID-19 pandemic have given rise to unprecedented levels of public debt. Combined with monetary policy programmes that have further increased central banks' holdings of public sector debt, this raises concerns about fiscal dominance and more broadly about the interaction of fiscal and monetary stabilisation policies. Bundesbank research therefore investigates the effectiveness of crisis measures, but also their potential side effects, especially against the background of the euro area's fiscal framework, and their consequences for monetary and financial stability.

State-of-the-art quantitative methods are needed in order to answer the research questions above. Bundesbank research contributes to advancing the macroeconomic modelling toolkit along several dimensions. First, computationally efficient, higher-order solution and estimation techniques for dynamic stochastic general equilibrium (DSGE) models are being developed and used to quantify the impact of uncertainty on risk premiums in the economy. Second, accounting for the effects of the ELB on policy rates, or for large shocks due to the pandemic or climate change, requires non-linear, global solution methods. Third, Bundesbank research contributes to the development of econometric approaches which explicitly incorporate the ELB, are robust to outliers from the COVID-19 pandemic and account for state-dependent transitory or permanent structural changes. Finally, Bundesbank researchers advance estimation and solution techniques, applicable to large-scale models, in order to evaluate interdependencies between countries, sectors, regions and heterogeneous agents. These methods also help to link microeconomic data to macroeconomic aggregates, thus improving the micro-foundation of the models used within the Bundesbank.

Research area 2: The role of heterogeneities in an integrated global economy

The COVID-19 pandemic, climate change and advances in digital technology all add to already existing heterogeneities in the world economy and pose new challenges to central banks around the world. In Europe, the institutional design of the European economic and monetary union is still incomplete and is characterised by considerable heterogeneities between Member States. At the international level, current account balances, capital flows, exchange rate dynamics and trade barriers play an important role for the global transmission of shocks. Moreover, heterogeneities among households and firms are increasingly viewed as important for macroeconomic dynamics. Bundesbank research accounts for both a micro- and macroeconomic perspective and investigates all of these issues based on a range of data and methods, in order to contribute to a better understanding of the role of heterogeneities in an integrated world economy.

Several research projects address heterogeneities at the macroeconomic, multi-country level. The institutional design of the European economic and monetary union aims to reduce the risk of a debt crisis, mitigate negative spillovers between Member States and ensure that member countries' debt remains sustainable, amongst other objectives. The COVID-19 pandemic and the ensuing economic policy responses have led to considerably higher public debt levels. This has further narrowed the margins for fiscal policy, which in some countries is still dealing with the fallout from previous crises. As a result, the efficacy of countercyclical policies may be impaired and existing imbalances amplified. As such, the COVID-19 pandemic laid bare that the institutional design of the euro area remains incomplete. Faced with the largest recession since the great depression, the sharp rise in public debt across euro area Member States led to renewed stress in sovereign debt markets to which the ECB responded with various unconventional policy measures.

To gain a better understanding of how the institutional design of the euro area could be improved, Bundesbank research examines its fiscal framework. For example, current research focuses on investigating the potential consequences of moving towards a fiscal union through increased risk sharing, and the design of sustainable fiscal rules and fiscal policies within the EMU. The Bundesbank also believes it is important to study how the construction of the European recovery fund, the advancement of the capital markets union and the introduction of a common deposit insurance scheme would have to be implemented to support the institutional design and, hence, resilience to large and possibly asymmetric shocks within the euro area.

The combination of high levels of public debt and low economic growth will likely have repercussions for some euro area member countries. Bundesbank research analyses how COVID-19 fiscal packages are affecting current account balances and labour market developments within the euro area. Moreover, current work investigates whether the access to refinancing facilities of the central banks and the redistribution of liquidity via TARGET mechanisms serve as a buffer against adverse shocks.

Possible strains in the euro area's sovereign debt markets have the potential to trigger capital flow reversals in the euro area. Those reversals are potentially more harmful to economic growth when frictions in goods and labour markets inhibit necessary adjustments across member states. Structural reforms can help to mitigate those negative effects. Bundesbank research investigates the implications of structural policies, such

as the German Hartz reforms, on the labour market and the current account.

Differences in competitiveness across countries and trade restrictions can also give rise to current account imbalances. Bundesbank research contributes to the debate on competitiveness in various ways. It analyses how increases in tariffs and trade policy uncertainty affect competitiveness, international capital movements across countries, and exchange rates. An important question in this context is whether and to what extent multinational companies are more productive than their national peers, and how this affects growth prospects and foreign direct investment flows across countries. Almost all sectors in the euro area economy engage in cross-border service trade, which has been less affected than trade in goods in the aftermath of the global financial crisis. Bundesbank research investigates countries' competitiveness by focusing not only on their export performance, but also on their ability to trade in services, making use of detailed Bundesbank firm-level data. However, competitiveness is difficult to measure. Bundesbank research therefore looks beyond conventional measures such as unit labour costs and acknowledges the importance of global value chains.

Identifying ex-ante whether capital flows are sustainable is no simple task. Bundesbank research seeks to analyse to what extent capital flows and, hence, current account dynamics are driven by fundamental factors such as relative growth expectations across countries. However, large capital flows are not only a source of distress. They also act as buffers against macroeconomic risk. Bundesbank research assesses whether fiscal measures taken to cushion the impact of the COVID-19 crisis led to private capital inflows, which may contribute to a dampening of business cycle fluctuations across countries.

Large capital movements across firms, sectors or countries may, in future, also result from the increasing demand for sustainable investment, aiming at supporting the transition to a carbon-free economy and reducing climate-related economic risks. Heterogeneities across firms and countries with respect to their exposure to climate-related physical and transition risks is likely to play an increasingly important role. In coming years, Bundesbank research will study the importance of these heterogeneities, inter alia by developing multi-sector, multi-country environmental DSGE models. Bundesbank research will further analyse how climate-related physical and transition risks propagate through global supply chains and how this affects firms' ability to compete.

The external capital structure is a key determinant of international capital flows. Research at the Bundesbank aims to better understand how income inequality within an economy affects the build-up of external liabilities and changes the external capital structure across countries. Bundesbank research also shows that innovations in payment technologies are important drivers of gross capital movements and exchange rates.

At the microeconomic level, understanding the heterogeneity of households and firms is key to assessing the macroeconomic impact of shocks and supporting the calibration of monetary and other policy responses. To facilitate the analysis of micro-level heterogeneity, the Bundesbank recently complemented its existing survey on household finances with two monthly surveys on household and firm expectations. Bundesbank researchers use data from all three surveys to better understand households' consumption and firms' investment and employment decisions as well as their expectation formation process (see also research area 1 above). As an example, based on the "Bundesbank Online Panel Households" (BOP-HH), researchers analyse the short-term impact of the COVID-19 pandemic and (fiscal) policy measures, such as the temporary lowering of the VAT or child-related benefits, on households' financial conditions and consumption.

The BOP-HH survey data, along with granular consumption data from external sources, are also used to investigate how climate change and climate-related risks affect households' consumption behaviour and expectations. Specifically, Bundesbank research analyses how the cross-sectional dispersion of households' expectations interacts with heterogeneities in their exposure to climate-related risks.

The COVID-19 pandemic has revealed important data gaps related to the actual and expected situation of firms across industries, regions, and firm sizes. The

newly established "Bundesbank Online Panel Firms" (BOP-F) allows researchers to closely track firms' expectations regarding the economic impact of the pandemic and their access to credit. Future research aims at analysing the impact of the pandemic on firms' productivity and price setting behaviour and the role of macroeconomic uncertainty for firms' decisions, amongst other things.

The digitalisation of the global economy has further accelerated with the COVID-19 pandemic. Based on firm-level data, Bundesbank research assesses how digital technologies and their transformation affect firms' returns to scale and whether this leads to increasing market concentration across sectors. Bundesbank research also investigates the drivers behind German households' adoption of fintech products and new payment instruments.

To better understand the importance of heterogeneity for the transmission of monetary policy and to assess the impact of monetary policy on inequality, research at the Bundesbank continues to investigate the relation between households' consumption, savings and investment decisions. Several of the projects in this area use household-level data from the Bundesbank's wealth survey "Panel on Household Finances" (PHF), which is collected every three years and focuses on the wealth and income of households. Based on this unique granular dataset, Bundesbank research analyses, inter alia, the drivers of changes in wealth and income, and the impact of uncertainty on households' portfolio choice. Other topics addressed are the redistributive consequences of interest rate changes on households' balance sheets, time preferences over the life cycle, peer effects in evaluating the relative position in net wealth distribution, inequality at the top of the wealth and income distribution as well as gender differences with regard to labour market and financial decisions.

Demographic trends – first and foremost the rapid aging of the population – pose a number of challenges to the German economy and the other euro area economies. Bundesbank research analyses the implications of these trends for the fiscal stance, pension systems, households' labour force participation rates as well as their saving and investment decisions. The persistent low interest rate environment, demographic and other trends have contributed to strong demand for housing in some euro area countries. Yet our understanding of housing market dynamics is still limited. Therefore, Bundesbank research investigates how homeownership, savings, indebtedness and wealth accumulation are interlinked and why homeownership is relatively low in Germany.

Note that the BOP-HH, BOP-F, and PHF data are not only useful for studying heterogeneities. Their granular nature also provides important microeconomic information for research projects in other research areas, which are geared towards the macroeconomic perspective.

Research area 3: Safeguarding financial stability in an era of transformation

In response to the global financial crisis, policymakers enacted financial sector reforms and expanded their set of instruments, strengthening existing regulations and introducing new capital, leverage and liquidity requirements. The goal of these regulatory measures is to ensure the soundness of banks and ultimately the stability of the financial system. Macroprudential policy has been introduced as a new policy area, with new institutions at the national and European level. Bundesbank research contributes to the development of tools and methods for designing and evaluating microprudential and macroprudential regulations. Meanwhile, the financial industry is undergoing rapid structural change through the emergence of new business models and digital technologies. Moreover, climate change and policies addressing it are also giving rise to new challenges for the financial system. Not least because of its financial stability mandate and its role as a banking supervisor, the Bundesbank needs to understand the implications of these trends.

In the euro area, and particularly in Germany, the banking sector provides the bulk of external financing for households and firms. Understanding banks' credit supply and risk-taking decisions is therefore of vital importance for banking supervision and ultimately for financial stability. Policymakers therefore need to understand which strategies banks choose and what this implies for bank performance in order to develop and adapt the supervisory framework, and to close potential regulatory gaps. An important element in accomplishing this task is the increased availability of granular data as provided, for example, by the recently developed AnaCredit database. Using such data sets, Bundesbank research identifies and analyses key factors that influence banks' credit supply decisions. Further research in this area studies the role of cross-border mergers and acquisitions and the consequences of bank opacity and complexity. Bundesbank research also investigates whether banks change their portfolio allocation when facing reforms that increase the relative cost of their debt by taxing bank leverage.

As they transform long-term loans into short-term deposits and illiquid assets into liquid liabilities, banks are affected by the monetary policy stance. Bundesbank researchers analyse the implications of persistently low or negative policy rates on the interest rates banks offer, their lending and risk-taking decisions, and their profitability. One potential consequence of sustained low interest rates is a decline in firm exits, which might lead to an increase in lending to "zombie firms", with potential implications for aggregate productivity. This research also sheds light on the relationship between monetary policy at the macroeconomic level to banks and firms at the microeconomic level.

Global banks continue to play a particularly important role in the international transmission of shocks and the spillover of regulatory policies to financial systems. The Bundesbank plays an active role in the International Banking Research Network (IBRN), in which central bank economists from around the world study issues pertaining to global banks. Since Germany is an open economy and a member of a currency union, almost all regulatory changes have potential international implications. Assessing these spillovers is an important task for Bundesbank research.

The footprint of non-bank financial institutions in the financial system has grown in recent years. Non-bank financial intermediaries have become an important funding source for households and firms. Bundesbank research aims to investigate drivers of this growth to

better understand the role of non-bank financial institutions in funding the real economy. The increasing degree of digitalisation in financial services such as deposit-taking, lending, and payment systems has a profound impact on financial intermediation. The market entry of new, technologically advanced intermediaries such as fintech and bigtech players poses a particular challenge to the banking sector. Bundesbank research analyses these trends, for example by studying the business models of new intermediaries, which often focus only on parts of the value chain of banks. Another important development over recent years has been the increasing use of blockchain technologies, which many digital currencies rely on. Bundesbank researchers contribute to the understanding of this development by studying the fundamental demand for crypto currencies, the driving forces of the market price of crypto assets and the role of cyber risks for financial stability.

Capital market financing has gained heightened importance for the German and euro area economies in recent years. Consequently, financial markets can be both a source of shocks, as became clear during the global financial crisis, but also mitigate or amplify macroeconomic shocks. Bundesbank researchers analyse how financial markets process information about major shocks such as the COVID-19 pandemic, and how the financial sector responds to cyclical changes in risk.

Monetary policy is transmitted to the real economy via its direct effects on interest rates, but also indirectly through other asset prices. Understanding price formation in financial markets, and especially price responses to central bank policy, is thus crucial for Bundesbank research. Issues currently being addressed in this area comprise the impact of unconventional policy measures, scarcity effects in collateralised funding markets, the determinants of investment fund flows, the consequences of synthetic leverage in this sector, the effects of low and negative short-term interest rates on the term structure, and the interaction between risk taking, the term structure and regulatory policy.

The careful design, calibration, and evaluation of microprudential and macroprudential regulatory measures are of the utmost importance in ensuring their success. Bundesbank research contributes to assessing the effectiveness and potential side effects of regulation. Questions currently being investigated include, for instance, how financial regulation affects bank market structure, merger and acquisition activity, competition and bank business models and how the regulation of bank holdings of sovereign debt affects default incentives of governments.

Regulators continuously monitor whether financial sector regulations are effective in achieving their intended stabilisation role or whether they have unintended consequences. Bundesbank research contributes to these efforts by conducting evaluation studies of various regulatory measures. Prominent examples are the Bundesbank's contributions to the evaluation of financial regulatory reforms under the umbrella of the Financial Stability Board (FSB) and the Basel Committee on Banking Supervision (BCBS). In addition to assessing the effectiveness of regulations, Bundesbank research analyses the effect of financial stability communication on households and financial markets.

With effective regulation in place, banks should be able to withstand both idiosyncratic shocks and system-wide stress. Nevertheless, banks will always be subject to some degree of fragility, as the maturity transformation between long-term loans and short-term deposits exposes them to run risk. Bundesbank researchers analyse how to design bank resolution mechanisms that help to avoid bailouts by governments or disorderly liquidations via bank runs. Amongst other things, they analyse the conditions under which bail-out expectations lead to moral hazard by banks that are "too big to fail", putting other banks at a disadvantage and jeopardising financial stability.

In addition to the various trends and structural forces affecting the financial sector, cyclical build-ups of systemic vulnerabilities may pose threats to financial stability. To develop indicators that can guide macroprudential policy decisions, research at the Bundesbank contributes to the measurement and identification of financial cycles and systemic risk. Since financial market regulations ultimately affect lending to households and firms, Bundesbank research analyses the impact of various regulatory measures not only on the financial sector, but also on the real economy. An important aspect of this research is the development of several

short-term forecasting models that take macroeconomic and financial linkages at a disaggregated level into account.

House prices are important for financial stability; when they drop sharply, many borrowers face negative equity, resulting in foreclosures and bank losses. Banks may react with cuts in lending and fire sales, leading to a downward spiral in asset prices and yet more lending cuts. Indeed, financial crises are often accompanied by boom-and-bust cycles in housing markets. An understanding of house price dynamics is thus one of the key elements in successfully monitoring financial stability. Bundesbank researchers contribute to this understanding by investigating the driving forces behind house price developments and the effects of borrower-based and financial institution-based regulations.

Climate change and the policies required to mitigate it affect all parts of the financial system. Bundesbank research studies the impact of climate change on financial intermediaries and markets from various angles. For example, the continued growth of markets for sustainable investments like green bonds or sustainable mutual funds requires a deeper knowledge of the structure of demand and supply on these markets. Other recent Bundesbank work studies how transition risks arising from climate-related policy measures like carbon prices affect firm values, asset prices and portfolio allocations. Bundesbank research also analyses the importance of natural disasters for individual banks.

Economists at the Bundesbank are also developing a coupled economy and financial system-wide methodology for climate risk stress testing. The aim is to identify vulnerabilities and to assess the resilience of the financial system to physical as well as transition risks. This includes work on a set of models such as environmental DSGE models, disaggregated short-term macro-financial models, sectoral input-output-models and financial market models to analyse sensitivities and second-round effects for all financial intermediaries. The goal is to analyse transition risks stemming from environmental policy, technology or preference changes, worldwide CO2 prices and equivalent policies, and to analyse physical risks through channels likely to play a role in Germany. A particular emphasis is placed on second-round effects within and across different financial sectors, feedback with the real economy, and firm-level analysis.

The Bundesbank also tackles the challenge of closing climate-related data gaps, for example by integrating firm-level emissions data or granular weather and climate data into its analyses. Recent statistical Bundesbank work focuses on improving the measurement of the carbon footprint of products, firms and industries. Moreover, by incorporating requirements for the disclosure and measurement of climate-related risks in Eurosystem monetary policy operations and financial regulation, the Bundesbank also acts as a catalyst for various policy initiatives aiming at the production of such high-quality data, e.g. the EU Corporate Sustainability Reporting Directive, the FSB Task Force on Climate-Related Financial Disclosure, or the EU Taxonomy for Sustainable Activities.