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## Research Report

# Evolution of the ECB's analytical framework

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EUROPEAN CENTRAL BANK  
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### Evolution of the ECB's analytical framework

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# ECB STRATEGY REVIEW

**Disclaimer:** This paper constitutes staff input into the Governing Council's deliberation in the context of the ECB's monetary policy strategy review. This paper should not be reported as representing the views of the Eurosystem. The views expressed are those of the authors and do not necessarily reflect those of the Eurosystem.

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#### **Set of Occasional Papers related to the ECB's Strategy review 2020-21**

- No 263, "The implications of globalisation for the ECB monetary policy strategy".
- No 264, "Inflation expectations and their role in Eurosystem forecasting".
- No 265, "Inflation measurement and its assessment in the ECB's monetary policy strategy review".
- No 266, "Digitalisation: channels, impacts and implications for monetary policy in the euro area".
- No 267, "Review of macroeconomic modelling in the Eurosystem: current practices and scope for improvement".
- No 268, "Key factors behind productivity trends in EU countries".
- No 269, "The ECB's price stability framework: past experience, and current and future challenges".
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- No 276, "The mandate of the ECB: Legal considerations in the ECB's monetary policy strategy review".
- No 277, "Evolution of the ECB's analytical framework".
- No 278, "Assessing the efficacy, efficiency and potential side effects of the ECB's monetary policy instruments since 2014".
- No 279, "The need for an inflation buffer in the ECB's price stability objective – the role of nominal rigidities and inflation differentials".
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# Abstract

This paper discusses the role of economic and monetary analysis in the monetary policy strategy of the European Central Bank (ECB). Both areas of analysis have evolved since the 2003 strategy review. Economic analysis has assigned an increasingly relevant role to the Eurosystem and ECB staff macroeconomic projections in forming a view on the medium-term outlook for economic activity and inflation. Furthermore, its focus has strengthened with regard to structural trends in shaping key economic relationships. Similarly, monetary analysis has shifted in focus: while the 2003 review emphasised the information value of monetary dynamics for detecting risks to price stability over medium-term to longer-term horizons, the focus of monetary analysis has increasingly been redirected to the assessment of monetary policy transmission. This evolution has opened a gap between the formal description of the strategy following the 2003 review and the practice of economic and monetary analysis in informing the ECB's policy deliberations. This paper concludes by presenting options for closing this gap and aligning the strategy formulation with the evolved role of economic and monetary analysis.

**JEL Codes:** E32, E37, E44, E47, E51, E52, E58.

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## Executive summary

The monetary policy strategy of the European Central Bank (ECB), adopted in 1998 and reviewed in 2003, has established economic analysis and monetary analysis as the two pillars that inform the Governing Council's policy deliberations. Both areas of analysis have evolved since the 2003 review, driven by structural shifts in the economic and financial landscape, new analytical insights, and the experience gathered in the conduct of monetary policy over time.

This paper first reviews how the practice of economic and monetary analysis has changed over time. It then highlights the key trends that are likely to shape the future evolution of these areas of analysis. Finally, it discusses relevant options for reflecting these insights in a revised ECB monetary policy strategy.

A key change in the economic analysis is the increased role of the staff macroeconomic projections as a way of translating the wealth of economic information into a shared Eurosystem medium-term outlook for activity and inflation and the related risk assessment. This focus on the macroeconomic projections as a key product of economic analysis has been complemented by an increasingly broad and granular analysis of the longer-term structural factors affecting key economic relationships – both on the demand side and on the supply side and covering short-term, medium-term and longer-term horizons. These factors notably include globalisation, demographic transition issues, climate change and digitalisation trends, as well as their implications for productivity developments.

As these factors will continue to profoundly affect the economy in the future, they are also a key focus for enhancing economic analysis. Among the areas deserving particular attention are: (i) the economic implications of climate change; and (ii) the increased recognition that heterogeneity across different parts of an economy matters for aggregate outcomes. Moreover, the further development of advanced analytics methodologies and the continuous upgrading of modelling infrastructures act as key avenues for enhancing economic analysis. Finally, important data and measurement issues – such as the inclusion of owner-occupied housing in inflation metrics and the enhanced knowledge of how agents' expectations are formed at a granular level – will constitute important aspects in deepening economic analysis.

On monetary analysis, an important shift in focus has taken place since the ECB's strategy was reviewed in 2003. Its initial role, as codified in the 2003 review, emphasised the information value of monetary dynamics in detecting risks to price stability over medium-term to longer-term horizons. Whereas, the practice of monetary analysis, especially since the global financial crisis, has increasingly focused on assessing the state of monetary policy transmission. This shift in focus was partly driven by a weakening of the empirical link between money and inflation, which reduced the former's information value for detecting risks to price stability; but, most importantly, it has originated from impairments in the monetary policy transmission process and the broadening of the ECB's monetary policy toolkit following the global financial crisis. Both factors have placed increasing demands on



monetary analysis to provide real-time assessments of the complex processes linking the ECB's policy instruments to ultimate economic and financial outcomes, while also placing increasing demands on monetary analysis to inform the appropriate design of these instruments.

Looking forward, with regard to monetary analysis, a strong focus on transmission aspects continues to appear warranted, as the drivers that have motivated this focus are likely to remain relevant for the foreseeable future. Furthermore, the scope of analysis should be broadened to: reflect changes in euro area financial and economic structures, including an increasingly relevant role of non-bank finance; benefit from the increased availability of granular data; deepen the links between monetary and financial stability analysis; and exploit the information content of monetary and broader financial conditions in identifying risks surrounding the central outlook for growth and inflation.

The evolution of economic and monetary analysis has led to a gap between the formal description of the strategy following the 2003 review and the practice of monetary policy preparation at the ECB. To eliminate this gap and incorporate the aforementioned avenues for improving the information value of economic and monetary analysis, three options are worth considering. The first option is to abandon the two-pillar framework and replace it with a unified framework that integrates economic and monetary analysis in one consolidated assessment. The second is to preserve the existing two-pillar framework but codify the enhanced role of transmission as the focal point of monetary analysis in the strategy formulation. The third option, which sits somewhere between the other two options, is to combine the benefits of a more integrated framework, while explicitly retaining economic analysis and monetary analysis as two specialised analytical branches. This paper discusses the relative merits and strategic implications of these options in detail.

# 1 Introduction

**The formulation of the ECB’s monetary policy strategy in October 1998 centred on two key elements.**<sup>1</sup> The first was the quantitative definition of price stability as positive headline Harmonised Index of Consumer Prices (HICP) inflation rates below 2% to be maintained over the medium term. The second was what came to be referred to as the two-pillar framework, consisting of a “prominent role for money” and “a broadly based assessment of the outlook for future price developments”. The prominent role for money was operationalised via a quantitative reference value for broad money growth and deviations from this reference value “under normal circumstances” were seen as a signal of risks to price stability. The broadly based assessment of the outlook for future price developments relied on a wide range of indicators, inter alia wages and other labour market variables, commodity prices and exchange rates, asset prices, wealth, external demand, fiscal policy, and domestic financing conditions and costs. The two pillars provided complementary assessments of risks to price stability.

**With the evaluation of the strategy in May 2003, the Governing Council of the ECB further clarified these elements.** First, the Governing Council announced that, within the definition of price stability as positive headline HICP inflation rates below 2%, it aimed to maintain these rates “below but close to 2% over the medium term”. Second, it de-emphasised the reference value for money growth, and, for the first time, referred to the two pillars as “economic analysis” and “monetary analysis”. The revised strategy reconfigured the economic analysis and the monetary analysis as two separate elements of the policy-relevant information set. The information content of the economic analysis for risks to price stability was seen as mainly pertaining to a short-term to medium-term horizon. The information content of the monetary analysis was seen as being more relevant for a medium-term to long-term horizon. The Governing Council’s act of reconciling the signals from the two areas of analysis was formalised via the “cross-checking” function introduced in the 2003 reformulation of the strategy. To further bolster the information value of monetary analysis, the 2003 review also broadened its scope to capture more adequately the processes and sources of money creation, including credit dynamics. These adjustments were also reflected in communication. In particular, the ordering of the two pillars was reversed in the Introductory Statement, which from then on has always started with the economic analysis followed by the monetary analysis.

**After the 2003 review, the economic and monetary analyses, as well as the role they play in the Governing Council’s deliberations, has continued to evolve.** New analytical insights, structural shifts in the economic and financial landscape, and the experience gathered in running monetary policy for the euro area economy, require continuous adaptation. The remainder of the paper reviews this evolution, presents further possible enhancements to the economic and monetary analysis,

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<sup>1</sup> See European Central Bank (1998).

and discusses options for codifying the evolved role of these analyses in the formulation of the strategy.

## 2 Revisiting the ECB's economic analysis

**The 2003 review of the ECB monetary policy strategy had a strong focus on issues pertaining to the definition of price stability.** In particular, within the definition of price stability an inflation target of “below but close to 2%” was adopted. In that context, a number of relevant issues were evaluated, such as the best index to measure consumer price inflation and the costs and benefits of choosing a specific level or range for the inflation target. This included assessing the costs related to the probability of hitting the effective lower bound for nominal interest rates and an examination of measurement biases in the Harmonised Index of Consumer Prices (HICP) (Issing, 2003).

**The 2003 review did not systematically take stock of the elements comprising its economic analysis.** At the time those analyses were quickly developing but they remained constrained by considerable data limitations. For example, in 2003 aggregate data and time series were limited to about 20 quarterly observations – following the large structural change in 1998-99 generated by the launch of the euro itself. Meanwhile, microeconomic data, which are typically less timely, usually reflected developments broadly up to year 2000 or earlier, which limited their value for euro area analysis.

**The current strategy review takes place more than 20 years after the adoption of the euro – two important changes have occurred that call for an in-depth evaluation of the ECB's economic analysis.** First, since the 2003 strategy review, the global and euro area economies have undergone pervasive structural changes with implications for, among other things, the growth potential of the euro economy, the equilibrium real interest rate and the inflation process. The ongoing clustering of deep structural transformations has been affecting most economies at the global level since the mid-1990s and has become increasingly relevant over recent years. Structural trends shaping the long-term landscape relate to globalisation, demographic ageing, digitalisation, climate change, and the degree of economic and technological efficiency as a driver of productivity growth. These trends are poised to have fundamental implications for longer-term growth performance, supply structures and nominal trends. The ECB's economic analysis therefore needs to continuously adapt and integrate these structural trends in its regular assessments and in the policy preparation process.

**As for the second change, over the last two decades the data and analytical base for policy preparation has developed continuously and intensely, underlining the increasing role played by staff projections in summarising the high volume of data required for an agreed Eurosystem medium-term outlook on economic activity and inflation.** The data situation has improved dramatically as historic data have been accruing but also in a context of the strong investments made by the Eurosystem, the European System of Central Banks (ESCB) and the European Statistical System (ESS), leading to the development of new indicators, surveys and data sources and novel modelling and econometric methods. These

innovations have enabled substantive gains in terms of the timeliness, accuracy and overall richness of analysis. This is particularly the case for the short-term analyses of economic developments and price developments, which can now use a battery of indicators to assess: demand and supply conditions; sectoral developments; price and cost formation, including via the Corporate Telephone Survey (CTS); households' and companies' sentiment and expectations on current economic, financial and price developments, notably via the Survey on the Access to Finance of Enterprises (SAFE) in the euro area which provides a unique overview of the conditions and situation of small and medium-sized enterprises, and more recently, via the Consumer Expectations Survey (CES); and item-by-item timely data of posted consumer prices.

**While the economic analysis encompasses many elements, most of them ultimately feature in, or are integrated into, the quarterly staff macroeconomic projection exercises.** Since 1999 the quarterly staff macroeconomic projection exercises have played a central role in the economic analysis of the ECB's monetary policy strategy. They help to structure and synthesise a large amount of economic data and ensure consistency across different sources of information. In this respect, they are a key element in sharpening the assessment of economic prospects and the short-term to medium-term fluctuations of inflation around its trend. As such they strongly support the ECB Governing Council's assessment of medium-term risks to price stability.

**The processes and tools used for producing the Eurosystem/ECB staff macroeconomic projections have been under permanent development and review under the auspices of the Working Group on Forecasting over the last two decades.**<sup>2</sup> An important change was implemented in 2006, when the approach to setting the assumptions for the future path of short-term interest rates was revised. Instead of assuming that interest rates would stay constant over the projection horizon, their future path was determined by market expectations. Other elements in the staff projections that have evolved and developed over time relate to the comprehensive risk analysis around the baseline and the scenario analysis, especially at times of more elevated uncertainty.

**A substantial review of the process behind the staff projections at the ECB was conducted in 2017.** Although the mandate for the review was to focus on the ECB's internal processes, it also led to several changes to the projections prepared by Eurosystem staff. A particularly important enhancement of the projections process over recent years was the launch of the Annual Supply Side Review (ASSR). In each year since 2017, the ASSR has fed into analysis in the December internal staff projections report.<sup>3</sup> The scope of the ASSR is twofold. First, to review and scrutinise national central bank (NCB) supply side variables (e.g. potential output and its contributions). Second, to discuss analytical issues related to the supply side of the

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<sup>2</sup> The projections are published four times a year: in March and September they are produced by ECB staff while in June and December they are produced jointly by Eurosystem and ECB staff. For further information on the staff macroeconomic projections see ECB (2016).

<sup>3</sup> The internal staff macroeconomic projections report and the internal ASSR report are inputs to the Governing Council discussions. Neither report is published, rather a more concise report on the staff projections is published each quarter on the [ECB website](#).

economy. Beyond this, since the last strategy review in 2003, opportunities to reflect on more fundamental aspects of the economic analysis, in particular the staff projections process and their broad data and analytical base, have been limited.

**The current strategy review calls for systematic, in-depth evaluation and stock-taking of the analytical basis of policy preparation in the context of the economic analysis.** The rest of this section builds on a number of background notes, reviewing the experience with each of the elements of the economic analysis with regard to substance and processes. It starts by briefly recalling the conclusions of the work stream on inflation measurement (2021). It then reports on the analysis of long-term economic trends. Finally, it examines the practice with the short-term analysis and the models for the macroeconomic projections exercises. For most of the examined elements, specific improvements are proposed.

## 2.1 Inflation measurement and expectations

**The report prepared by the Monetary Policy Committee (MPC) and the Statistics Committee (STC) work stream on inflation measurement<sup>4</sup> concluded that HICP continues to fulfil the prerequisites for the index underlying the ECB's definition of price stability.** Nonetheless, the report also recommended that there was scope for enhancing the HICP, especially by including owner-occupied housing (OOH) using the net acquisitions approach, which relies on transaction prices rather than imputed rents. Filling this long-standing gap was seen of utmost importance to increase the coverage and cross-country comparability of the HICP. In addition to integrating OOH into the HICP, the report recommended further improvements in harmonisation, especially regarding the treatment of product replacement and quality adjustment. Such measures may also help reduce the measurement bias that still exists in the HICP. Overall, the report identified a remaining knowledge gap concerning the exact size of the measurement bias of the HICP, which called for further research. More generally, the report also found that auxiliary inflation measures can play an important role in the ECB's economic and monetary analyses. This applied not only to analytical series including OOH, but also to measures of underlying inflation or a cost of living index.

**The work stream on inflation expectations assessed the role of inflation expectations in the inflation process and the inflation outlook,<sup>5</sup> endorsing the ECB's current practice of using economic analysis and monetary analysis to benefit from relative advantages to look at (i) both survey-based and market-based expectations and (ii) both short-term and long-term expectations for different analytical purposes.** The analysis of the work stream on inflation expectations (2021) showed that, in a context of a declining trend in actual inflation during the low inflation period, longer-term inflation expectations had become less well anchored and took longer to adjust after temporary shocks. Monetary policy can play an important role in anchoring expectations about inflation, which confirms the

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<sup>4</sup> For more details see workstream on inflation measurement (2021).

<sup>5</sup> See work stream on inflation expectations (2021).

importance of their role in forward guidance. The review addressed the need for a comprehensive framework to assess the degree of inflation expectations anchoring with different metrics and the benefits of incorporating observed measures of inflation expectations in forecasting models. It also identified remaining knowledge gaps. Among these, the current data gap on household and firm expectations stands out. In particular, there is currently an imbalance in the cross-sectoral representativeness of the data on inflation expectations, where the financial sector dominates the origin of available inflation expectations data via the information content derived from inflation-indexed financial products and the large weight of financial sector participants in forecaster surveys. This contrasts with the rather limited information stemming from the household and non-financial corporate sector. The ECB's recently launched pilot of the Consumer Expectations Survey (CES) together with some household and firm surveys launched by euro area national central Banks highlight the types of initiatives that may help to effectively address remaining knowledge gaps.<sup>6</sup>

## 2.2 Assessing long-term economic trends and structural change

**The ongoing clustering of deep-seated structural transformations has been affecting most economies at the global level at least since the mid-1990s but various structural changes have accelerated in recent years and therefore they have become increasingly relevant for central bank analysis.** Structural trends shaping the long-term economic landscape relate to climate change, globalisation, demographic ageing, digitalisation and the degree of economic and technological efficiency as a driver of productivity growth. These processes have significant implications for all policy areas, including monetary policy. This means they need to be closely monitored. They shape the outlook of variables that play a key role in monetary policy, inter alia the potential growth of the euro area economy, the equilibrium real interest rate and the overall evolution of supply conditions, ultimately with implications for nominal trends and the inflation process. Underlining the increased relevance of large-scale structural change, the rest of this section first reviews the analysis of the impact of structural factors on inflation trends. It then takes stock of the main policy implications from each of the main structural change processes mentioned above, concluding with suggestions for further enhancing the ECB's economic analysis to better take into account structural change processes for policy preparation.

**In the context of the strategy review, ECB staff members have also reviewed the role of structural factors, such as globalisation, digitalisation and demographic change, in subdued inflation dynamics.**<sup>7</sup> The interaction of these structural trends with considerable slack in the economy and less well anchored inflation expectations in the region of the effective lower bound may explain a

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<sup>6</sup> For more information on the ECB's Consumer Expectations survey, see the [ECB's webpage](#). A similar initiative measuring French firms' inflation expectations has been undertaken by Bouche et al. (2021).

<sup>7</sup> See Koester et al. (eds.) (2021).

somewhat stronger contribution to the recent period of low inflation. In particular, in a low equilibrium interest rate environment, it may have become more difficult for central banks to fully accommodate the positive supply impact of these factors, resulting in demand lagging behind supply. This also should be seen against the background of the chronic euro area current account surplus.

Further work on these factors has been pursued inter alia in the Monetary Policy Committee work streams on globalisation, digitalisation and climate change.

**The review of these processes points to remaining knowledge gaps within the economic analysis.** The review, in particular, underlines the importance of setting up regular in-depth analyses of how ongoing fundamental transformations ultimately shape the long-term outlook for productivity growth, the natural rate of interest and supply structures – notably the labour markets – which are in turn a determining factor underpinning the assessment of inflation over more extended horizons. Suggestions for specific action to enhance the economic analysis and address knowledge gaps, are provided in Section 2.3.3. below, in the context of the ASSR. The rest of this subsection takes stock of the main messages from other reports that examine structural trends.

**Globalisation has changed the landscape in which monetary policy operates.**<sup>8</sup> Foreign demand has increased in importance as a driver of the euro area economy, given that the rest of the world is now so much larger as a share of the world economy. The global economy is also more integrated now than at the time of the 2003 strategy review. Both global and euro area trade and financial integration are significantly stronger, even if the pace of integration has slowed since the global financial crisis.

**While the impact of globalisation on the level of natural interest rate and inflation trends in the euro area is found to be overall contained, it has considerable influence on the growth trend, the amplitude and volatility of cyclical fluctuations and the overall financial landscape.** Globalisation has facilitated global risk-sharing and diversification, yet there is ample evidence that domestic financial cycles are driven, at least in part, by a “global financial cycle”, characterised by large common movements in asset prices, gross capital flows and leverage. The dominant role of the dollar in the global financial system means that the Federal Reserve and the US economy play a critical role in driving the global financial cycle. Globalisation has also rendered more complex the role of the exchange rate by introducing new mechanisms through which the exchange rate affects financial conditions, real activity and price dynamics.

**The new landscape has implications for the ECB’s economic analysis and monetary analysis.** The changes in the economic landscape, and the enhanced role of the external environment, have already largely been incorporated into Eurosystem analysis. Nonetheless, in some cases, existing models could benefit

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<sup>8</sup> This sub-section draws on Work Stream on Globalisation (2021), “The implications of globalisation for the ECB monetary policy strategy”, Occasional Paper Series, No 263, ECB, September.



from further adaptation in this context; in several cases additional research may be needed.

**Overall, macroeconomic modelling and projections exercises need to account better for the global dimension.** This would include the ability to anticipate and evaluate the impact of tail events that have a foreign origin. Models also need to better explain large co-movement of macroeconomic developments and encompass the role of spillovers and spillbacks.

**The ongoing trend of population ageing in the euro area is contributing to the slowing down of the real GDP growth trend, in addition to adverse fiscal and financial implications.** Labour supply and, to some extent, productivity growth are expected to be negatively hit by the demographic transition, posing risks to the potential growth outlook. Population ageing is also associated with higher precautionary savings to prepare for a longer period of retirement, capital deepening, lower intensity of technological innovation and a higher demand for safe assets – all of which have a potentially dampening impact on the natural rate of interest.

**The demographic change is likely to reinforce the existing downward trend of the natural rate of interest, at least until the sizeable cohort of baby boomers have retired (by around 2035), and then to gradually reverse the trend thereafter, although substantial uncertainty remains.** Until 2035, population ageing is expected to continue having a disinflationary impact, mainly through downward pressure on wage dynamics – a trend which may be reversed thereafter. Population ageing is putting a burden on public finances. Debt sustainability challenges may arise from higher ageing-related spending, eroding tax bases and if the interest rate-growth differential environment turns less favourable.

**Macroeconomic stabilisation may become more complicated, as population ageing limits the available policy space and contributes to larger cross-country heterogeneity in the euro area.** It is therefore important to deepen the analysis of the economic, financial and fiscal consequences of population ageing, namely with respect to the natural rate of interest, potential growth, debt sustainability and the impact on monetary policy transmission channels. Box 1 provides an analysis of the channels through which population ageing affects macroeconomic trends and the conditions for fiscal sustainability.

## Box 1

### The macroeconomic and fiscal impact of population ageing

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Population in the euro area is ageing and its growth rate is expected to turn negative from 2035 onwards, with adverse macroeconomic, fiscal and financial consequences. This box sketches the main demographic trends for the euro area and provides an overview on how these trends may affect the economy and diminish the available policy space for macroeconomic stabilisation.

The euro area, like many other advanced economies, has entered an era of drastic demographic change. Being a slow-moving process, the demographic transition was mainly driven by low birth rates, which were well below the natural recovery level, and rising life expectancy. Strong net migration inflows have prevented an even sharper slowdown in population growth. As a result of

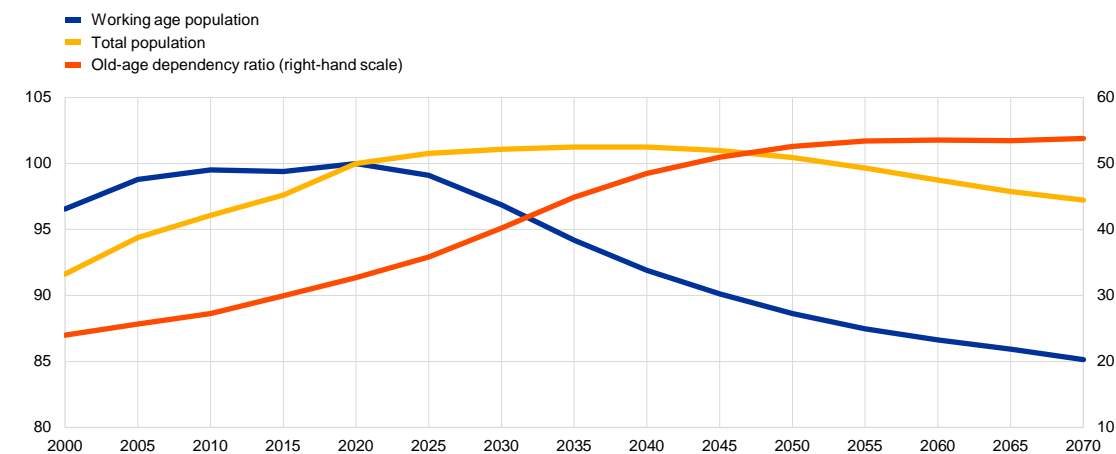
these forces, the cohort of the older population has increased considerably in the past decades and at a much stronger pace than the cohort of the working age population (defined as those aged between 15 and 64 years). These changes in the age composition are captured by a rising old-age dependency ratio – which sets the number of those above 65 in relation to that of the working age population – from 24% in 2000 to almost 33% in 2020.

Looking ahead, population ageing in the euro area will intensify in the next 15 years, as the sizeable cohort of the baby boom generation, i.e. those cohorts born between 1950-70, will gradually enter retirement. Total population in the euro area is expected to start declining from 2035 onwards, while working age population will shrink as of 2021, according to Eurostat projections (Chart A). The old-age dependency ratio is projected to reach almost 54% by 2070. The demographic trend in the euro area aggregate is broadly comparable to that of Japan, which is ahead of the euro area by around 15-20 years, while for the US population challenges are much more contained. These differences are linked primarily to the different migration patterns and differences in terms of the baby boom phenomenon.

### Chart A

#### Euro area population developments and projections

(left-hand scale: total and working age population, indices, 2020 = 100; right-hand scale: old age cohort as a share of the 15-64 age group, in percentage)



Sources: Eurostat (EU labour force survey and population projections – EUROPOP2019) and own calculations.  
 Note: Working age population is defined as the population aged 15-64 years.

The demographic transition will affect the euro area in various ways over the coming decades. In particular, population ageing is expected to hold back potential output growth, primarily through a shrinking labour contribution but it may also have an impact on other components of potential growth. As the working age population is projected to decline from 2021 onwards, labour supply growth will be dragged down. This will differ from the improvement in labour supply observed during the past two decades, which was mainly attributable to structural reforms, especially those aimed at raising the statutory and early retirement ages. Yet, the potential for further improvements appears limited going forward. Workforce ageing is also expected to depress investment, which would have a negative impact on capital formation. Moreover, productivity may decline as the workforce ages. Although empirically not fully conclusive, the relationship between age and productivity is thought to be hump-shaped. However, factors such as higher education levels and improving health conditions may help to widen the hump-shaped relationship between age and productivity, while structural policies and innovation may support productivity on the aggregate level.

Population ageing, alongside other secular trends, is widely seen to contribute to the decline in the natural rate of interest in the euro area.<sup>9</sup> Higher precautionary savings to prepare for longer periods of retirement, capital deepening due to lower labour supply, less innovation activity reflecting a shrinking share of young and prime-age workers and a higher demand for safe assets due to older people being more risk-averse are channels through which population ageing potentially dampens the natural rate of interest. Counterbalancing forces relate to a decline in national savings and may gain in importance once the proportion of older citizens, i.e. those who dissave, will start exceeding those who accumulate savings. Assuming that the relative importance of these different channels may change for the euro area going forward, the demographic transition is expected to reinforce the existing downward trend of the natural rate of interest at least until 2030, mainly on account of a shrinking labour force. This trend may reverse somewhat thereafter, as the relative share of those who dissave may become a dominant factor. Yet, uncertainties surrounding this outlook are substantial.

The link between population ageing and inflation is less established. There is strong empirical evidence that population ageing will cause relative price changes resulting from shifts in consumption baskets, while it is less obvious to what extent changes in the age structure may drive trend inflation. With the baby boom generation entering retirement, a possible scenario could be stronger upward pressure on wage inflation and higher wage premia, on account of compositional effects and assuming an inverse relation between cohort size and wages.<sup>10</sup>

The demographic transition may affect the structure of financial asset holdings, as older people are found to be more risk-averse. Although the demand for financial assets and housing may be depressed in the long run, risks of an asset price meltdown seem contained. Together with shrinking credit demand, this may have adverse repercussions for banks' profitability and influence monetary policy transmission, namely through the wealth and credit channels.

If left unaddressed, population ageing will pose a burden on public finances in the euro area, given the relatively strong role of publicly financed pension and health care systems. Debt sustainability challenges might arise from mounting ageing-related public spending, which will be particularly of concern in high-debt countries. In addition, an ageing euro area economy may be confronted with eroding tax bases, mainly reflecting a shrinking labour force, while the structure of public revenue may change as well. Furthermore, debt dynamics will crucially hinge on how the interest rate-growth differential will evolve, as population ageing will affect potential growth as well as the natural rate of interest.

In the euro area, macroeconomic stabilisation will most likely become more complicated, as population ageing may limit the available policy space and contribute to larger heterogeneity. Monetary policy may be more often constrained at the effective lower bound for nominal interest rates, while the available fiscal space will be bound by higher ageing-related public spending costs. At the same time, automatic stabilisers may become less effective, and the quality of public finances may worsen due to cuts in public investment in an ageing society.

To safeguard against the adverse economic and fiscal consequences of population ageing, it is necessary to build-up fiscal buffers during good economic times, to improve the quality of public

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<sup>9</sup> For an overview of the channels, see Brand, Bielecki and Penalver (2018), Krueger and Ludwig (2007), Carvalho, Ferrero and Nechio (2016), Ferreira and Shousha (2020), and Rachel and Summers (2019).

<sup>10</sup> Papadopoulos, Patria and Triest (2017) account for changes in the age distribution of workers and find that the baby boomers are putting a downward pressure on overall wages changes in the US.

finance and to implement growth-enhancing structural reforms. The latter should help to expand the productivity outlook (through more innovation and labour-saving technological progress) and to foster investment in human capital. To mitigate the adverse impact on labour supply, well-targeted structural improvements are needed, namely through labour market reforms tailored towards older workers and increasing female participation rates. Further pension reforms are needed that encourage workers to postpone their retirement. Also, national governments in the euro area may need to consider providing incentives to encourage immigration, while also considering how to ensure migrant workers are integrated into the euro area labour market.

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**Digitalisation is one of the major structural changes transforming the functioning of the both the euro area and the global economies, as it interacts with globalisation and demographic trends.**<sup>11</sup> Digitalisation is a long-duration technology shock that has been accelerating since the 2003 strategy review and particularly since the coronavirus (COVID-19) pandemic. Digitalisation may significantly affect the incidence of shocks and their transmission, with heterogeneity across the euro area and the EU, via its impact on key variables – such as productivity, potential output and inflation – and their measurement. It adds to the uncertainty and complexity faced by policymakers. Over the past two decades, the mechanical contribution to euro area inflation of the decline in information and communications technology product prices amounted to around minus 0.15 percentage points per year (while annual HICP inflation averaged 1.7% over this period).<sup>12</sup> The inflation effects via indirect channels, such as firms' pricing behaviour, market power and concentration, as well as firms' productivity and marginal costs are ambiguous. However, empirical evidence suggests that increased e-commerce may have a small, albeit insignificant, downward impact. On one hand, in a technology-optimistic scenario, productivity growth will increase if digitalisation accelerates, raising the natural rate and giving monetary policy more room to manoeuvre. On the other hand, if the expected productivity gains from digitalisation do not materialise at the aggregate level, and rising inequality is associated with digitalisation and higher savings, then the natural rate may remain subdued.

**Climate change affects monetary policy in a profound manner, in particular over longer horizons.**<sup>13</sup> Climate change is one of the greatest challenges of this century, and its impact is becoming increasingly evident (IPCC, 2018). Governments have the primary responsibility for addressing climate change and they have the appropriate tools to do so. However, central banks also need to confront climate change, both because it will affect the conduct of monetary policy and because monetary policy implementation can affect climate change.

**Climate change may have implications for the conduct of the ECB monetary policy.** Empirical studies suggest that, so far, climate change has mainly had an

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<sup>11</sup> This sub-section draws on work stream on digitalisation (2021).

<sup>12</sup> In other words, *ceteris paribus*, HICP inflation would have averaged 1.85% over this period without this direct downward impact from digitalisation (in principle, any disinflationary impact from digitalisation would be zero if monetary policy is sufficiently responsive to neutralise this effect).

<sup>13</sup> For a detailed analysis on the link between climate change and monetary policy, see work stream on climate change (2021).

impact on relative prices but it has had limited aggregate impact on inflation in advanced countries (Parker 2018, Faccia, Parker and Stracca 2020). However, the transition to a low-carbon economy, and the need for much higher carbon prices, may in the future imply a more sustained impact on inflation. In a disorderly scenario, this could call for a greater emphasis on core inflation as a gauge of price pressures. However, should the transition be orderly and spread over decades, the challenges for monetary policy would be more contained (see Allen et al., 2020 and NGFS 2020). In addition, climate change could complicate the assessment of the monetary policy stance. This is because climate change is potentially a source of more frequent, intense and persistent shocks to the economy whose nature (supply and demand) will be hard to identify. As a consequence, climate change may increase the prevalence of output and price stabilisation trade-offs, also as uncertainty about the magnitude of the effects of climate change and the horizon over which they will play out on the economy may compound these effects.

**Against this backdrop, the strategy review concluded that it is essential to better understand the impact of climate-related risks and policies on, inter alia, economic activity, the natural rate and inflation.** There is therefore a need to strengthen economic analysis on climate change, develop new statistical indicators and improve central banks' macroeconomic models and risk management models. Specific enhancements of the modelling infrastructure to integrate climate change considerations are presented in Section 2.3.4.

**Aggregate productivity growth has been on a declining trend in the euro area since the early 1970s, starting earlier than in the United States.**<sup>14</sup> For the euro area, slow total factor productivity (TFP) growth and muted capital intensity growth over the more recent period have been identified as the main drivers of this trend.

**Evidence suggests that the broad-based productivity growth slowdown also reflects aforementioned global trends, such as ageing or (de-)globalisation.** These trends have played an important role in shaping technology creation, diffusion and resource reallocation and thereby the pace and path of aggregate productivity growth over the last decades.

**Going forward, the COVID-19 shock is expected to interact with the dynamics of innovation and productivity-enhancing resource reallocation, with uncertain effects in terms of magnitude, speed and direction of future aggregate productivity growth.** First, if the currently observed slowdown in globalisation persists it could weigh on productivity growth via reduced technology transfer, input quality and reduced scope of productive firms to expand. Second, in a context of high uncertainty and heightened corporate indebtedness, investment required to adapt new technologies could slow down even further, particularly in the services sector. Third, the massive policy support of the corporate sector, if not well targeted and if maintained for too long, could impair the efficient reallocation of resources by setting wrong incentives, with adverse effects on the medium-term growth outlook.

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<sup>14</sup> This sub-section draws on work stream on productivity, innovation and technological progress (2021).

Hence the proper design of the exit strategy, and its credible communication, will partly determine the impact of the pandemic shock on aggregate productivity growth.

**The investment in green technology and acceleration of digital uptake could be a silver lining.** Large investment in green technologies, as a result of both demand and supply factors, could significantly push outwards the technological frontier and thereby accelerate environmental protection efforts. The big acceleration of digital uptake already taking place could also be fundamental to improving technology adoption of laggards, particularly with regard to (very) small and medium-sized enterprises that play an important role in many EU countries. Box 2 provides a detailed analysis of the implications of productivity trends from a policy perspective.

## Box 2

### Key productivity trends in the euro area

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**This box presents the main findings of a recent report on key productivity trends in the euro area.**<sup>15</sup> Productivity plays a key role not only in determining the welfare of countries but also in providing room for manoeuvre for monetary policy and its transmission to the economy, especially at times of low equilibrium rates of interest.

**A declining trend in productivity has been a striking feature over the past few decades, both in the euro area and other major regions (see panel (a) of Chart A).** This declining trend has been mainly driven by weak total factor productivity (TFP) growth and, to a lesser extent, weak capital deepening<sup>16</sup> after the global financial crisis (GFC) (see panel (b) of Chart A).

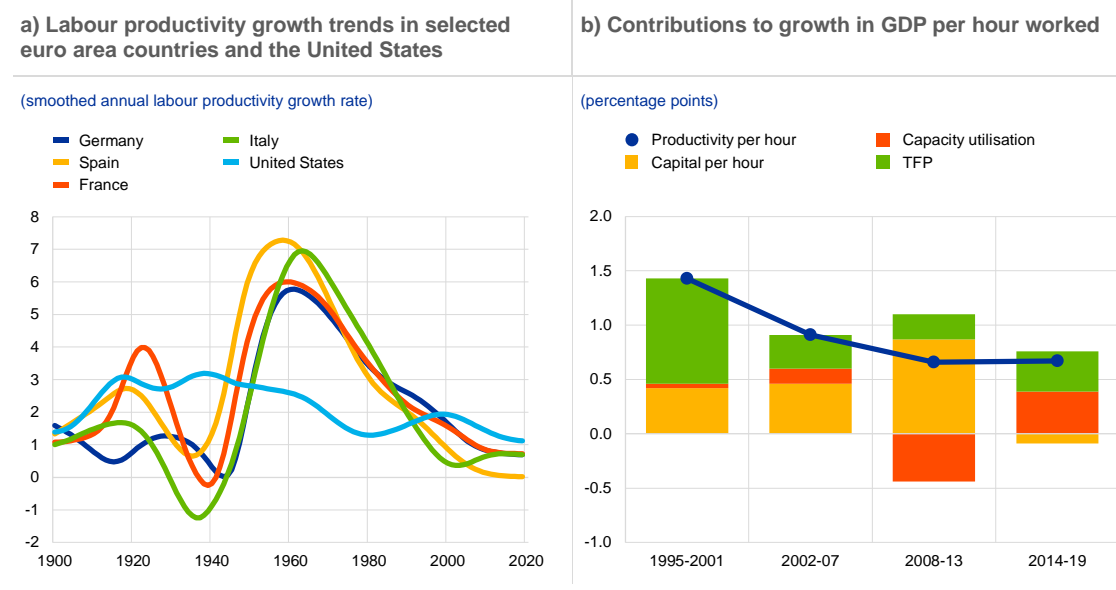
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<sup>15</sup> See work stream on productivity, innovation and technological progress (2021).

<sup>16</sup> Capital deepening refers to the growth of capital intensity which is measured by capital per hour worked.

## Chart A

### Labour productivity growth trends in the euro area



Source: Own calculations using the Annual Macro-Economic database of the European Commission (AMECO).

Notes: Labour productivity is measured as GDP at constant 2010 prices per hour worked. Panel (b) shows weighted averages across countries with available data, including Belgium, Germany, Ireland, Spain, France, Italy, Luxembourg, Netherlands, Portugal and Finland. TFP growth is computed in a production function framework as the wedge between output and input growth and it captures, among other things, efficiency in the use of inputs in production.

**Aggregate productivity growth depends on within-firm productivity growth and on the evolution of market shares of each firm.** “Within-firm” productivity growth is driven by managerial ability, the quality of labour and capital, internal organisational decisions and investment in productivity-enhancing activities leading to technology creation and the adoption of already existing technologies.<sup>17</sup> Regarding resource reallocation, the literature confirms that there are massive flows of capital and labour across firms, predominantly operating in the same sector, as a result of firm expansion and contraction and also of firm entry and exit. If resources are reallocated to relatively more productive firms, aggregate productivity growth will increase even if average productivity does not vary. However, distortions related to the design of taxes and tariffs, the regulation of input and output markets, financial frictions or imperfect information have the potential to impair the allocation of production inputs across firms. The distinction between these two components of aggregate productivity growth, i.e. within-firm productivity growth and resource reallocation across firms, facilitates the discussion of past and future productivity drivers.

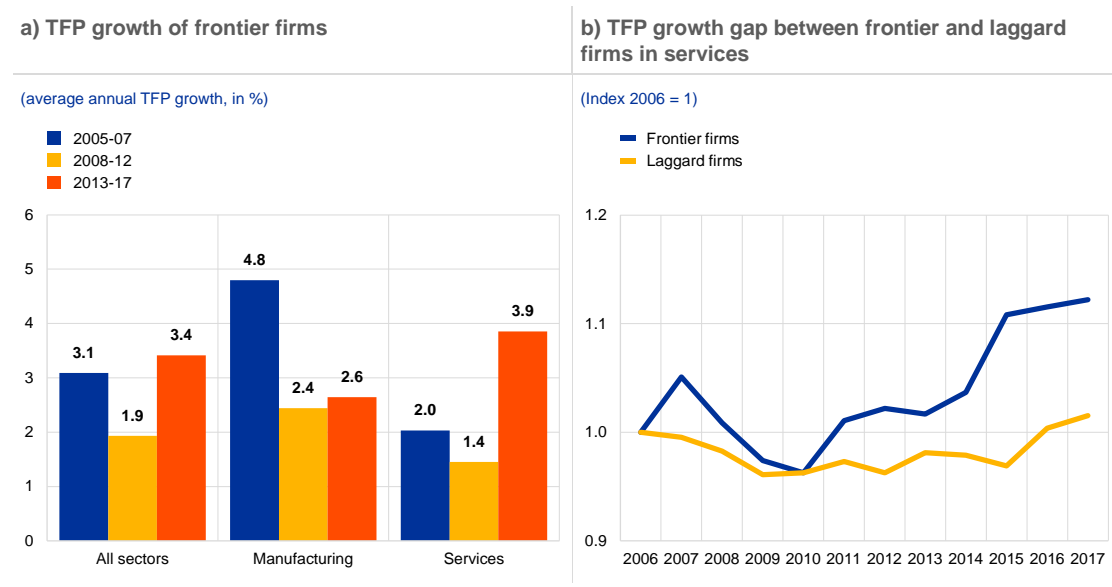
**Within-firm productivity growth in the euro area has been slowing down as a result of muted innovation in manufacturing and slow diffusion of technologies across firms in services.**

TFP growth of euro area frontier manufacturing firms – which represents a good proxy for innovative activity in manufacturing – has halved in the post-GFC period relative to before the crisis (see panel (a) of Chart B). Moreover, this slowdown has taken place entirely in high-technology manufacturing sectors. In contrast, technology creation has accelerated in services but seems to be benefiting only few firms so far. This is captured by the diverging TFP growth dynamics of frontier firms in services relative to the median service firm, referred as “laggard” (see panel (b) of Chart B).

<sup>17</sup> For a literature overview see Syverson (2011).

## Chart B

### Technology creation and diffusion in the euro area



Source: ECB, iBACH, Orbis and authors' calculations.

Note: Panel (a) shows average annual TFP growth rates of frontier firms, which are defined as the most productive 5% of firms in a given year within a four-digit industry across six euro area countries (Belgium, Germany, Spain, France, Italy and Portugal). Industry value-added weights are used to aggregate up to the corresponding broad sector. In Panel (b) Laggard firms or "laggards" are defined as the median firm in the sector.

### The contribution to aggregate productivity growth from resource reallocation is declining over time.

There is evidence of increasing resource misallocation since the early 2000s, that is, since before the GFC, which points to structural factors as well as cyclical ones (see Gamberoni et al., 2016). One of the possible factors discussed in the literature leading to resource misallocation and the emergence of what are sometimes referred to as "zombies" or "zombie firms" is the existence of financial frictions at the time of a protracted period of an accommodative monetary policy stance (see Gopinath et al., 2017). However, more recent work<sup>18</sup> finds that the prevalence rate of zombie firms<sup>19</sup> has been declining since the end of the GFC (Chart C, panel (a)) and is driven by the entry of firms into financial distress rather than by delayed exit of low productive/non-viable firms (or zombies) (Chart C, panel (b)). Moreover, that recent work does not find compelling evidence of a deterioration of the lending channel in times of accommodative monetary policy.

Turning to the process of creative destruction, ECB research shows that the short-term contribution of firm entry and exit is relatively small in the euro area, as a result of the low productivity level of most new firms. However, a process of firm selection and learning increases the productivity contribution of new firms over time.<sup>20</sup> The fact that business dynamism – which includes business churning but also the prevalence rate of high-growth young firms – is declining over time in the United States and also in the euro area could also diminish the contribution of resource reallocation to productivity growth.<sup>21</sup>

<sup>18</sup> Published in work stream on productivity, innovation and technological progress (2021).

<sup>19</sup> Defined as firms with an interest coverage ratio below one for three consecutive years. The analysis covers five euro area countries: Belgium, Netherlands, Italy, Portugal and Finland.

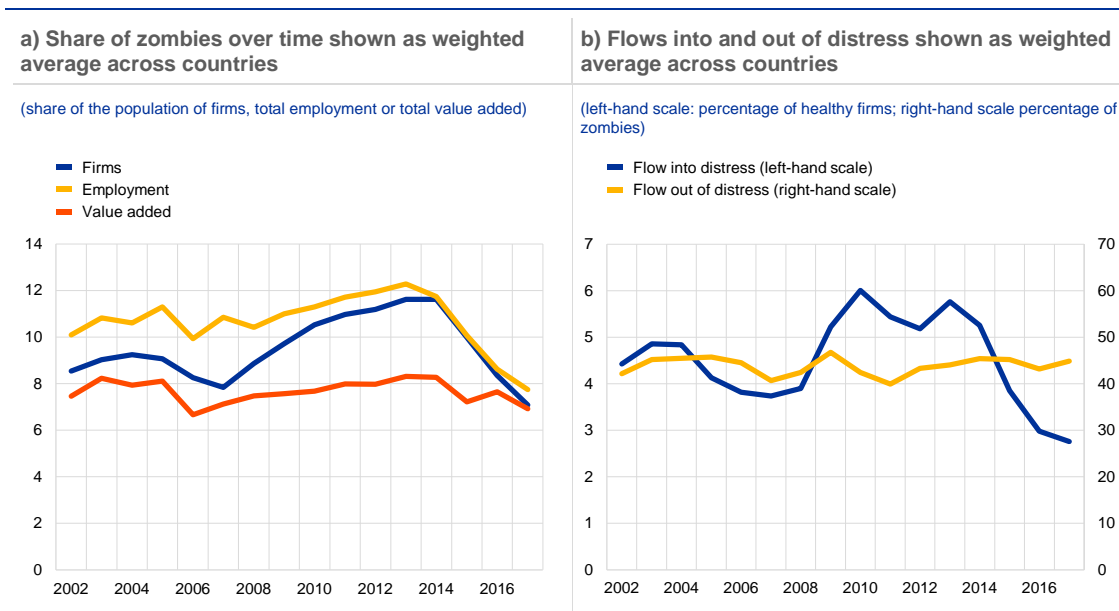
<sup>20</sup> For further details on this new research refer to work stream on productivity, innovation and technological progress (2021).

<sup>21</sup> See Calvino et al. (2015).



## Chart C

### The evolution of “zombie” firms



Sources: Central Balance Sheet Database, Cerved Centrale dei Bilanci, Istituto Nazionale Previdenza Sociale, Nationale Bank van België/Banque Nationale de Belgique Central Balance Sheet Office, Statistics Finland, Statistics Netherlands and authors' calculations.

Notes: Panel (a) shows the weighted average of the relative importance of zombies in terms of number of firms, employment and value added in five euro area countries (Belgium, Italy, Netherlands, Portugal and Finland). Zombies are defined as firms with the ratio of earnings before interest and taxes (EBIT) and the interest paid + financial charges being less than one ( $EBIT / (\text{interest} + \text{financial charges}) < 1$ ) for three consecutive years. Manufacturing includes NACE Rev. 2 sectors 10-33 and private services includes sectors 45-63 and 69-82. Panel (b) shows the share of healthy firms becoming zombies every year (inflows) and the share of zombies exiting the zombie status every year (outflows).

**Other factors may also play a role in explaining the trend decline in productivity, such as the slowdown in the pace of globalisation and an ageing population.** Both global trends may have negatively affected within-firm productivity growth and resource reallocation.

**These trends may also interact with the impact of the COVID-19 pandemic and policy responses to it.** First, despite recent encouraging signs there remain some threats to the trade outlook, for instance, stemming from potential restructuring of global value chains after the pandemic and a further rise in trade barriers. These developments could weigh on productivity growth as a result of reduced technology transfer, input quality deterioration and reduced scope for productive firms to expand. Second, productivity-enhancing investments by corporates might slow down the COVID-19 crisis. This is because firms affected by the shock might have to resort to debt to cover their liquidity shortfalls. In an environment of high levels of uncertainty and indebtedness, the investments required to innovate and/or to adopt new technologies could be postponed. On the other hand, the COVID-19 crisis has forced lagging firms to accelerate their digitalisation which could be positive for productivity growth going forward, as discussed below. Third, the massive policy support for the corporate sector in response to the COVID-19 crisis has been crucial in mitigating the initial impact of the shock. However, looking ahead, once the economic recovery takes hold on a more sustainable basis, policy support needs to be lifted gradually to allow for the necessary reallocation of resources by setting the right incentives. Hence the magnitude, design and timing of the exit strategies are expected to determine further (lagged) effects of the pandemic crisis on aggregate productivity growth.

**Finally, the investment in green technologies and the acceleration of the digital uptake could be a silver lining of the COVID-19 crisis.** Large investment in green technologies could

significantly push the technological frontier outwards. The acceleration of the digital uptake resulting from the COVID-19 pandemic could be a fundamental push to reap the benefits of new technologies.

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## 2.3 Review of tools and models underlying the economic analysis

This section reviews the practice of the short and medium-term economic analyses. It also examines the central role played by the quarterly macroeconomic projection exercises and the challenges of real-time assessment of supply versus demand conditions by means of the output and unemployment gap measures. Finally, it also reviews the state of play with the modelling infrastructure. In all cases, main directions for enhancing the analyses are identified.

### 2.3.1 Information, tools and models for the short-term assessment of the economic outlook

**A reliable and robust real-time assessment of the nature of shocks affecting the economy and how they condition the economic outlook is key for conducting monetary policy.** Conjunctural analysis is the starting point for the economic narrative that enables policy makers to understand and explain the analysis of medium-term risks to price stability to the public; this requires a broad set of analytical approaches. Experience has shown how the qualitative discussions (or “narratives”) surrounding the macroeconomic projections typically contain incremental information about the state of the economy; it is information that otherwise seems hard to convey as point estimates.

**Sound and robust short-term analysis is essential for distinguishing “news” from “noise” and it requires a multitude of models, tools and data sources.** Conducting a real-time assessment is challenging due to data limitations and the difficulty in identifying and quantifying the real-time transmission of macroeconomic shocks and policies. To achieve robustness the ECB and Eurosystem staff have over time developed a wide range of tools and approaches. These developments have largely mirrored advances in macroeconomic research, such as (i) combining quantitative and qualitative information, using state-of-the-art models and tools (Dynamic Stochastic General Equilibrium models, Structural Vector Autoregressions, including non-linear frameworks) and (ii) using high-frequency indicators and their applications, including household and corporate surveys.

**The short-term economic assessment has evolved significantly since the 2003 strategy review, spurred in particular by the episodes subject to higher uncertainty.** Three major economic crises in particular have challenged the status quo of internal analysis and led to innovative responses. Specifically, new frameworks (e.g. new specifications for estimated Phillips curves) have been

introduced, the analysis of short-term risks has been enhanced both at the euro area aggregate and the country-specific level, and a much larger wealth of data, including surveys and high-frequency indicators is now being used. The global financial crisis and the sovereign debt crisis demonstrated the importance of real-financial interactions and country heterogeneity for the real-time assessment of economic activity. The COVID-19 crisis led to an increase in the use of high-frequency indicators (both structured and unstructured), consumers and firms' surveys, and non-linear models for understanding the overall impact of the crisis and to better inform the short-term risk assessment. The additional information of high-frequency indicators, partly capturing real-time developments in the two GDP components that are more severely affected by the pandemic (i.e. production in the services sector on the supply side and private consumption on the expenditure side), has improved the forecast performance of the standard short-term forecasting models. Nonetheless, there are several problems when working with such data, resulting from data accessibility issues, in general low signal to noise ratio, challenges with seasonality and possible instability of the (sometimes non-linear) relationship between high-frequency indicators and economic activity.

**The short-term assessment of the economic outlook has also been increasingly informed by studying the heterogeneous behaviour of households and firms.**

In this respect, key insights have been provided by new data sets, such as information provided by the Survey on the Access to Finance of Enterprises (SAFE) in the euro area and the Corporate Telephone Survey (CTS). The ECB has stepped up its efforts to systematically use microdata to better understand aggregate consumption, investment, trade and labour market developments, and to bring distributional aspects into the conjunctural analysis. On the firms' side, the analysis of standard data is complemented by SAFE, which provides timely firm-level information on a large, representative sample of enterprises, including small and medium enterprises (SMEs). It includes qualitative information on a number of otherwise difficult to observe phenomena, such as loan applications and rejections and expectations on internal and external sources of finance. Since 2009 SAFE has proven to be an invaluable source of information, particularly during turning points of the business cycle. Analysis of business conditions has also been supported by contacts with non-financial companies in the context of the CTS, which focuses on larger companies. These contacts are used to gather qualitative insights to supplement the more quantitative information gathered in statistical data and surveys. They are also used to judge and understand business sentiment and anticipate trends which may only become evident in economic data with a lag. While these contacts were first set up more than a decade ago, it is only very recently that the main findings of the survey have been published (starting in Issue 1 of the Economic Bulletin in 2021). On the household side, the Consumer Expectations Survey (CES) has helped to fill core knowledge gaps across key topical areas by providing granular data on household economic behaviour and expectations. The key features of the CES are its timeliness (in collecting and delivering data); its harmonisation (in collecting comparable and synchronised information across the euro area) and its high frequency. These features have proven particularly valuable during the COVID-19 pandemic, in particular in building

a narrative for the pandemic-related shock and the effectiveness of monetary and fiscal stabilisation policies.

**Ensuring thorough and robust short-term assessment in the future will require further investments.** After more than 20 years of common monetary policy, the availability of granular (level of detail) and long-time series statistics to assess the euro area economic outlook is, in several cases, still lower than is the case for the United States. These data gaps need to be addressed in the near future. Prominent examples of priority areas for further enhancing the framework for short-term analysis relate to the following points.

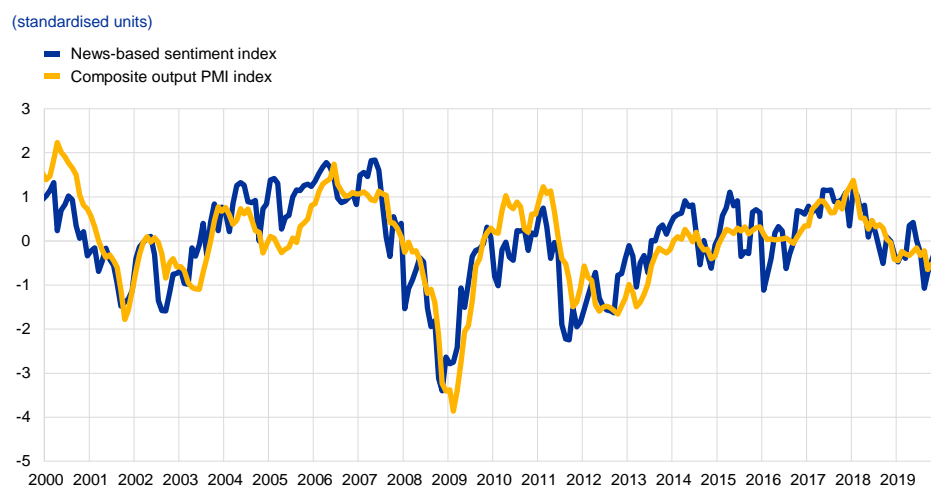
- Continuing to improve the level of detail and certain methodological aspects of the National Accounts framework: this would include improving granular breakdowns across sectors, asset classes and expenditure components, while also, where possible, shortening the time it takes for these data to become available. Some of the methodical challenges to overcome include measurement issues related to digitisation and globalisation. These improvements would lead to more comprehensive and higher quality data.
- Strengthening the use of high-frequency indicators and big data techniques (e.g. payments data, textual information) and investing in new avenues of forecasting with machine learning techniques, including via a more systematic use of textual analysis. For example, the COVID-19 pandemic has shown that alternative data sources can provide more timely signals on the state of the economy and help to track economic activity (see also Chart 1).<sup>22</sup>
- More intensely and regularly using the CES, the CTS, and the Survey of Professional Forecasters, leveraging as much as possible on established microdata sources (e.g. SAFE and the Household Finance and Consumption Survey).

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<sup>22</sup> See European Central Bank (2021).

**Chart 1**

**Monthly news-based sentiment and PMI in the euro area**



Sources: HIS Markit, Factiva and ECB calculations.

Note: The news-based sentiment index is calculated as the sum of positive and negative words using the financial stability dictionary (in Correa et al. 2017) on newspaper articles in the four largest euro area countries (Ashwin et al, 2021).

### 2.3.2 Review of the processes and tools behind the Eurosystem/ECB staff macroeconomic projections

**The quarterly staff macroeconomic projections take centre-stage in the economic analysis.** They provide a consistent narrative for the outlook for economic activity and inflation. There is internal consistency in that the conjunctural analysis is linked to the medium-term outlook in accordance with tested modelling frameworks agreed at Eurosystem level and with respect to harmonisation and consistency across euro area country projections. There is consistency over time in that they integrate a large amount of continuously arriving new data that are assessed against the stable analytical framework of the projection models.

**The review of the past experience yields a positive picture on the role played by the quarterly projections.** In particular, the key elements of the projections' design and organisation are assessed as having served well, while some areas of further improvement have been identified.

**Staff ownership of the macroeconomic projections and conditioning the projections on market expectations for short-term interest rates are still seen as the most appropriate approaches.** The projections are currently produced by Eurosystem/ECB staff without involvement of the Governing Council. This approach provides flexibility to the Governing Council to deviate from staff's assessment of the baseline and risks surrounding it, especially when important information arrives after the projections cut-off date. It also avoids the challenging operational issues, especially in the context of the Eurosystem, that would arise from the Governing Council's close involvement in the projection exercises. Since 2006 the baseline projections have been conditioned on market expectations regarding the monetary

policy stance.<sup>23</sup> Such an assumption is straightforward, easy to communicate and produces plausible projections which are overall internally consistent, especially with market-based expectations on long-term interest rates. Projections conditioned on market interest rates can play an advisory role in the Governing Council's deliberations with respect to the need to close any gap between inflation projections and the inflation aim. Alternative approaches, such as endogenous interest rates either based on monetary policy rules or optimal monetary policy, would require an iterative process between the euro area-wide models and national projection models, which would require an agreement on the rules and harmonisation of the modelling frameworks and would introduce considerable further complexity to the process. The publication of such a path may lead to communication difficulties unless it was endorsed by the Governing Council which would significantly complicate the process. Nevertheless, the scope for internal scenario analysis of alternative monetary policy paths could be investigated further.

**The review also confirms other key aspects of the process for producing the staff projections.** One aspect given particular attention is the alternation in responsibility for the projections between Eurosystem and ECB staff. In June and December ECB and NCB staff produce the projections and form a consensus view on the economic outlook, while in March and September the projections are produced primarily by ECB staff.<sup>24</sup> This set-up is designed so that the projections benefit from regular exchanges between ECB and national experts, while avoiding an overly burdensome process. So far, the alternation between Eurosystem and ECB staff projections has been generally smooth but issues of consistency occasionally arise due to different models and judgement. Switching to four Eurosystem staff projections per year would impose a strong burden on NCB and ECB staff while one could consider enhancing the interaction between NCBs and ECB staff during the March and September projections. A further aspect to consider is the approach to producing inflation projections, especially in the light of persistent over-prediction of inflation in recent years. In this regard, the use of a highly disaggregated approach for forecasting inflation in the short term should be maintained, as the additional granularity at the HICP components level and higher frequency of the current approach allows for a richer narrative and alternative approaches have not been shown to outperform the disaggregated approach at short horizons. Nevertheless, the approach adopted over recent years of cross-checking short-term inflation projections with alternative tools which take account of the degree of economic slack is considered as essential. Last but not least, the transparency of the staff projections has significantly improved over time by publishing point forecasts in addition to projection ranges as well as quarterly data for real GDP growth and HICP inflation projections and gradually extending the publication of projections of macroeconomic variables and country projections. Although this level of transparency compares favourably with publication practices of many other central banks, it could be further enhanced.

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<sup>23</sup> Before 2006 the projections were conditioned on constant short-term interest rates; however, this could imply notable deviations from the most likely course of monetary policy which affected the quality and therefore usefulness of the projections.

<sup>24</sup> In the March and September projections, national central banks remain responsible for the short-term inflation projections.

**An area where staff identified more margin for improvement in the short term is the staff risk analysis.**

The assessment of risks in terms of asymmetry and overall uncertainty surrounding the baseline macroeconomic projections is an important ingredient into the monetary policy decisions of the Governing Council. The Quantitative Risk Analysis (QRA) is a crucial element in the decision-making process, which is supplemented by a sensitivity analysis using alternative paths for important technical conditioning assumptions, such as oil prices, and regular scenario analysis related to key issues in the staff projections. The QRA is an internal process through which the staff provide their quantitative assessment regarding the risks and the uncertainty surrounding the projections baseline for real GDP and HICP inflation. It mainly summarises staff views with respect to several sources of risk and uncertainty – notably those stemming from future shocks and potential behavioural changes in the economy which are in general difficult to derive. This assessment of risks is not necessarily that of the Governing Council, which is based on a broader assessment and communicated by the President of the ECB in the Introductory Statement (which has been turned into the “Monetary Policy Statement”) at the press conferences following the Governing Council meetings.

**There are various dimensions in which the staff risk analysis, including the QRA, could be further enhanced.**

An extension of the risk analysis to include variables such as the HICP excluding food and energy could be considered alongside other characterisations of risk such as measures of tail risks following, for instance, the Macro-at-Risk approach (see, for example, Adrian et al. 2019). Those risk measures could be derived from different approaches, in particular from well specified econometric models. Such an extension of the risk analysis could include reviewing a range of admissible models (including projection models), designing a model validation protocol to derive the best performing models also in terms of the overall predictive distribution and then to derive risk indicators from the predictive distribution of these models, which could be either of time-series or structural nature.

**The communication (both internal and external) related to the risk analysis is an additional key layer that can also be enhanced.**

An analysis of the various risks and uncertainty sources (e.g. conditioning assumptions, models features and judgement) and their respective contributions to the overall staff risk assessments could be considered as a regular input to the internal staff projections report. To enhance the comprehensiveness and the transparency regarding the distribution of the projections and to improve on the illustration of the uncertainty, a more active use of fan charts could be considered for both internal and external communication purposes, similar to practices employed by other central banks. The fan chart shows abundant information about the projections, summarising in one chart the point forecast considered as the most likely outcome, the degree of uncertainty surrounding this point forecast and the skewness and tail risks that are related to the whole predictive distribution.

### 2.3.3 Review of the role of potential output and the output gap in the staff macroeconomic projections

**Potential output estimates and their narrative enter monetary policy analyses and the assessment of the monetary policy stance.** Specifically, potential output and output gaps might be useful indicators for a central bank because: the output gap might help in forecasting inflation developments; potential output could play a role in estimating the natural rate of interest; and the potential output and output gap could play an important role if there were a need to separate the cyclical component of a time series, such as for budget balances or current account balances. Ideally, potential output estimates can be linked to an economic narrative, allowing policy makers to understand when and why these estimates change.

**Since potential output estimates indicate the economic capacity of an economy, they need to encompass the effects of relevant long-term structural developments and trends that ultimately drive the overall supply conditions.**

The more prominent and policy-relevant of such long-run trends relate to those examined in Section 2.2, i.e. population aging, digitalisation, climate change (and policies to contain it), globalisation and productivity growth stemming from technological development, and firm-level managerial and organisational capital. Against this background, there is a need for a regular in-depth Eurosystem analysis and reporting on the impact of structural trends on potential output – these also derive from implications for the long-term outlook for the natural rate of interest. To address this need, the analytical basis of the ECB strategy could be enhanced by putting more emphasis in the ASSR on the analysis of how these structural trends affect the outlook for supply side developments, including an assessment of how euro area countries may be affected differently.

**A second dimension in which the analysis of potential output and the output gap could be enhanced relates to embracing the various and considerable uncertainties that inevitably surround the relevant estimates.** Most estimates of potential output and the output gap are prone to ex post revisions and, at times, exhibit notable cyclicity. Estimates of international institutions for potential growth and the output gap were revised considerably between 2006 and 2019, and the largest revisions occurred around turning points in the business cycle. Moreover, potential output estimates are often criticised for moving too strongly together with the business cycle, i.e. showing an excess degree of cyclicity. The degree of cyclicity is related to the properties of the de-trending method used and – from an economic point of view – may be justified by hysteresis or the cyclicity of the development and adoption of new technologies. The COVID-19 crisis has made the estimation of potential growth even more challenging than usual, requiring adaptation of existing models and consideration of additional measures of slack (for more on this, see European Central Bank, 2020a). It is likely that the COVID-19 crisis is negatively affecting potential output. Furthermore, the impact of the shock on components of potential output may depend on which sectors are hit permanently.

**The output and unemployment gap estimates remain a driving factor of inflation over the short to medium term.** In addition, output and unemployment



gaps continue to be a cornerstone for the conceptual framework on which contemporary economic macroeconomic models are built. At the same time, uncertainty of various types (e.g. data, estimation and model uncertainty) relating to potential output estimates is endemic and has even increased as a consequence of the main crisis episodes since 2008. Slack estimates remain important inputs for forecasting inflation, including with Phillips curve models. However, the way output and unemployment gaps are derived, and the associated uncertainties, also have implications for the interpretation of the inflation process, as they can affect estimates of the responsiveness of inflation to economic slack, and thus also views about whether inflation is driven more by business cycle fluctuations captured by slack or by other cost-push factors. Against this background, the enhancement of the analysis and reporting of output and unemployment gaps may require policy makers to regularly be provided with a range of estimates with regard to slack in addition to the estimates underlying staff projections. These would need to be based on explicit and transparent assumptions. Policy makers may also need a regular analysis of the advantages and disadvantages of each of the measures comprising the range of estimates.

#### 2.3.4 Review of the role of models and assessment of model development needs

**Maintaining the strong performance of the quarterly projection exercises and the other elements of the economic analysis hinges on the development and maintenance of high-quality models.** This subsection draws on the work done by the work stream on Eurosystem modelling (2021), which has critically reviewed the main macro models developed at the ECB (or more generally across the Eurosystem) that are used for both the projection exercises and policy analysis. The current macroeconomic modelling strategies across the Eurosystem typically feature a suite-of-model approach which achieves a good balance between model diversity and specialisation across different functions. Even if modelling practices can vary somewhat across the Eurosystem, large-scale semi-structural models turn out to be generally the main projection models whereas Dynamic Stochastic General Equilibrium models are used for dedicated policy analysis. In many respects, Eurosystem models are close to being at the frontier of their field by academic and institutional standards. These models appear well-adapted to the monetary policy preparation process.

**At the same time, the work stream on Eurosystem modelling has identified some model development needs.** They concern both the adaptation and enhancement of the main projection or policy models as well as the development of new models to complement the existing modelling portfolio. For the main macroeconomic models, development priorities relate to the specification of the expectation formation process and the transmission mechanism and side effects of non-standard monetary policy measures. Other analytical gaps refer to the role of changing real long-term trends or the treatment of relevant non-linear features of macroeconomic dynamics in the euro area.

**Regarding the recommendations for the development of new (satellite) models, the last generation of macro-finance models, estimated Heterogenous Agent New Keynesian models or structural business cycle models with endogenous growth features would constitute promising avenues.** The work stream on Eurosystem modelling also puts forward suggestions to improve the use models in the policy process, notably related to model-based economic narrative and risk analysis for projections as well as increasing the transparency and the selection of models regularly used to assess the monetary policy stance.

**Another important gap identified both by the work stream on Eurosystem modelling and the work stream on climate change, relates to the need for the main macroeconomic models to account for the climate change-related features relevant for forecasting and monetary policy analysis, and possibly to develop new models dedicated to climate change-related risks and policies.**

According to a recent survey, several NCBs recognise that this is an area that needs developing. Climate change affects the macroeconomy and can have an impact on the conduct of monetary policy. Physical risks entailed by extreme weather events and global warming and transition effects related to government policies (e.g. an increase in carbon tax) and technological developments can alter firms' production costs and therefore affect price dynamics and economic activity, potentially posing relevant stabilisation trade-offs for monetary policy. Yet, uncertainty about the persistence, breadth, magnitude and even transmission mechanism of climate-related shocks to the economy is overwhelming.

**The staff review has made number of specific recommendations on adapting current models' climate change implications and on developing new models.**

There is a need to accommodate selected climate change transmission channels at business cycle frequency in the projection models to account for the effects that climate-related shocks and policies can have on the economy. This primarily concerns the sectoral dimensions (with specific energy sectors), the transition policies (notably fiscal instruments affecting energy costs), the impact on financial intermediation, and changes in long-run anchors. New satellite models (Dynamic Stochastic General Equilibrium (DSGE)-type notably) could focus on specific aspects, such as the technology structure and the specification of the energy sector, the micro-foundations of the relevant externalities, the nature of disturbances and their implications for financial intermediation, the global dimension, or the role of mitigation policies.

## 3 Revisiting the ECB's monetary analysis

This section first provides an overview of how monetary analysis has evolved over time, stressing its gradual shift in emphasis towards the assessment of monetary policy transmission. Subsequently, it discusses the prospects for monetary analysis, including the case for a continued focus on transmission, upgrades in its information value for economic tail risks, and a deepening of links with financial stability analysis.<sup>25</sup>

### 3.1 The evolution of monetary analysis

**The role of money in the ECB's monetary policy strategy has evolved since its initial formulation in 1998.** The strategy, from the outset, assigned a prominent role to monetary dynamics in informing the conduct of monetary policy. In its 1998 formulation, the strategy embedded the concept of a reference value for broad money (M3) growth that was consistent with price stability. Deviations from this reference value were treated as a timely guide for policy conduct. While clarifying that “The concept of a reference value does not imply a commitment to mechanistically correct deviations over the short term” (ECB, 1998), the direct link between the reference value and risks to price stability “under normal circumstances” implied that money acquired the status of a policy-reaction variable (Masuch et al. 2003). However, the initial years after the introduction of the euro revealed the normal-circumstances qualifier as a frequently binding constraint, as money growth often underwent pronounced shifts that were unrelated to the transactions motives underlying its link to nominal spending and, ultimately, the inflation pressures building up in the economy.<sup>26</sup>

**Reflecting this experience, the 2003 review of the ECB's monetary policy strategy redefined the role of money in two directions.** First, it assigned to it the status of an information variable, rather than a policy-reaction variable. The status as an information variable was motivated by the quantity-theoretic notion that monetary dynamics provide a particularly informative signal for medium-term to longer-term risks to price stability. As such, it was established as an alternative analytical perspective on the inflation process, which was to complement the signals, at short to medium-term horizons, deriving from the assessment of current economic developments. This notion was institutionalised by the conceptual distinction between economic analysis and the monetary analysis that was communicated in the context of the 2003 review. And a textual analysis of past external

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<sup>25</sup> The input from the monetary analysis to the policy preparation process is conveyed through internal reports delivered to the ECB's Governing Council on a regular basis. Selected elements of this analysis feature in the ECB's Economic Bulletin, notably in the section on Money and Credit or in dedicated boxes and articles.

<sup>26</sup> A salient example is the period of uncertainty and turmoil triggered by the September 11 terrorist attacks in 2001, which led to a strong accumulation of monetary assets in the private sector due to precautionary motives that were not seen as signalling increased risks to price stability. Other episodes, as well as more secular drivers of shifts in money demand, are reviewed in Papademos and Stark (2010).

communication indicates that the two areas have conveyed separate signals on the risk to price stability (see Box 3). Second, the assessment of monetary dynamics broadened in scope to more adequately capture the processes and sources of money creation – with credit developments as one prominent element – and to further depart from the notion of a stable link between money and inflation that could be exploited in setting policy at a high frequency. As a result of these changes, the role of the reference value for M3 was de-emphasised with the 2003 review, and the ECB Governing Council decided to discontinue its earlier practice of reviewing it on an annual basis and referring to it in the Introductory Statement.

### Box 3

#### The communication role of the monetary analysis within the two-pillar strategy

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**This box provides a textual analysis of past external communication by the ECB to examine the role of the monetary analysis in communicating risks to price stability.** Ordinal indicators on the risks to price stability have been coded based on the wording of the Introductory Statement with ranges from -2 (clear downside risks to price stability) to +2 (clear upside risks to price stability), where 0 means balanced risks, in line with Gerlach (2004). The risk indications provided in the Introductory Statement are split between the public signal on the overall risks from both pillars and that which is implied exclusively by the monetary analysis. The analysis shows that the signal on risks to price stability of the Introductory Statement based solely on the monetary analysis has at times not fully mirrored the one that emerged from the economic analysis or indeed the overall signal (Chart A). First, between mid-2001 and mid-2003, the monetary analysis pointed to broadly balanced risks to price stability, whereas overall risks saw substantial fluctuations between the positive and negative territory. Second, between 2009 and end-2012, risks were again balanced according to the monetary analysis, while the economic analysis signalled shifting risks from the downside to the upside. Third, between end-2013 and end-2014, the monetary analysis pointed to downside risks to price stability, whereas according to the economic analysis risks were still balanced. To conclude, the analysis suggests that the ECB's monetary analysis has made a separate contribution to the communication of the risks to price stability in the past.<sup>27</sup>

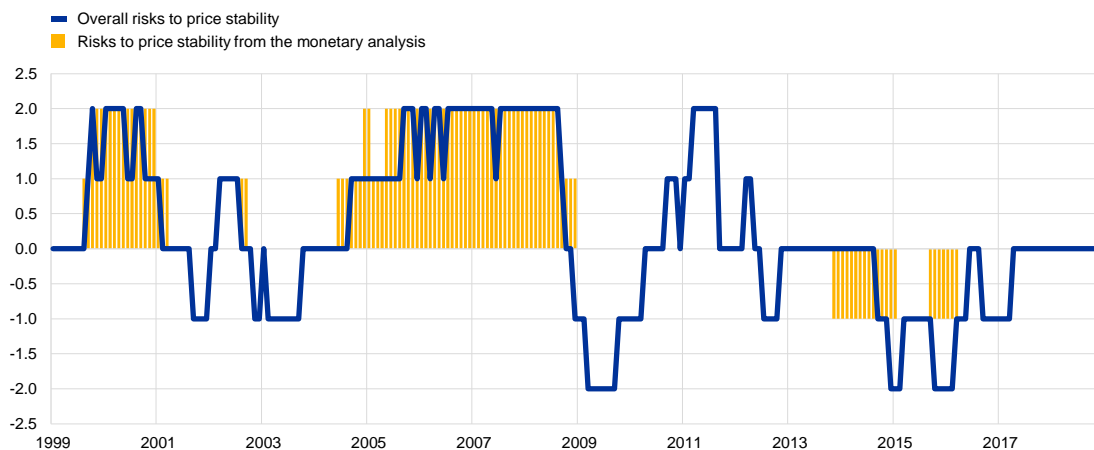
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<sup>27</sup> This insight is also supported by more formal empirical analysis, see Cour-Thimann and Jung (2021).

## Chart A

### Risks to price stability in the euro area (1999 to 2018)

(ordinal scale)



Sources: ECB and authors' calculations.

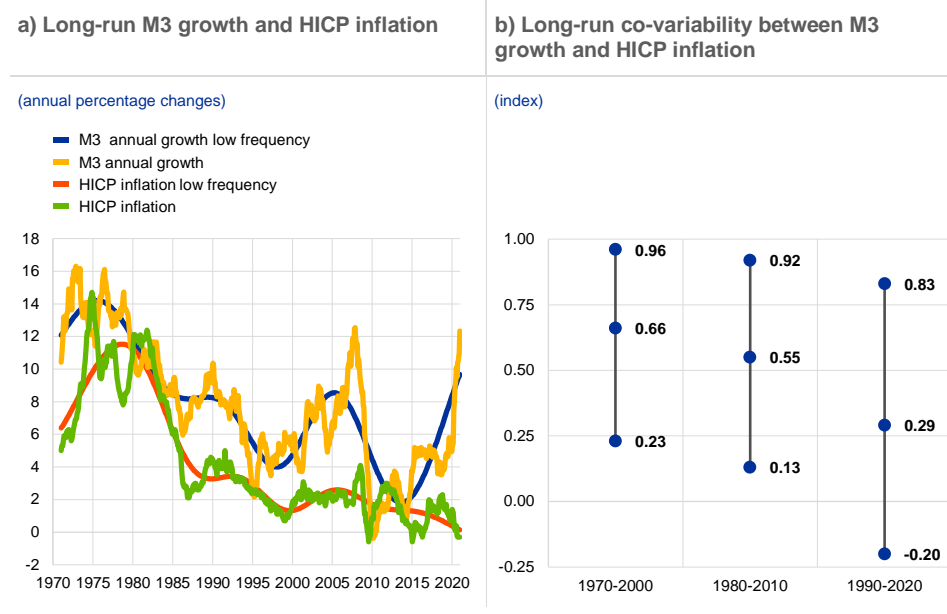
Note: The risk indications were obtained from ECB introductory statements.

**Since the 2003 review of the ECB's monetary policy strategy, three major changes have resulted in a strengthened focus of monetary analysis on monetary policy transmission.** First, the basic long-run empirical link between money and inflation has weakened over recent decades (Chart 2), partly reflecting the historically low level and volatility of inflation during that time. Second, the global financial and sovereign debt crises have revealed the fragility of the monetary policy transmission process and placed increasing demands on monetary analysis to help policymakers navigate the resultant challenges. These challenges are visible, for instance, in a major shift in the contributions of the main components of bank lending rates to non-financial corporations (NFCs) since 2009 (Chart 3), implying an increased complexity in the analysis of transmission channels operating via financial intermediaries (Rostagno et al., 2019).<sup>28</sup> Third, the ECB's monetary policy toolkit has become more complex, again requiring an upgrading of monetary analysis to shed light on the transmission patterns and potential side effects of hitherto untested measures (see below). As such, the shift in focus of monetary analysis towards transmission has been a natural adaptation to a changing monetary policy environment.

<sup>28</sup> The chart decomposes the rates that banks charge to their corporate borrowers into different factors: a proxy for the risk-free rate that banks take as a benchmark when setting NFC lending rates as well as various additional cost factors that banks incur when extending credit, including spreads in bank funding markets and their compensation for credit risk. It shows that the link between risk-free rates, which are rather tightly controlled by monetary policy, and bank lending rates, which also capture the other factors relevant to transmission, has become less stable. Moreover, it illustrates that the contribution of different lending rate components has fundamentally changed over time (see also European Central Bank, 2017a).

## Chart 2

### The long-run co-movement between M3 growth and HICP inflation

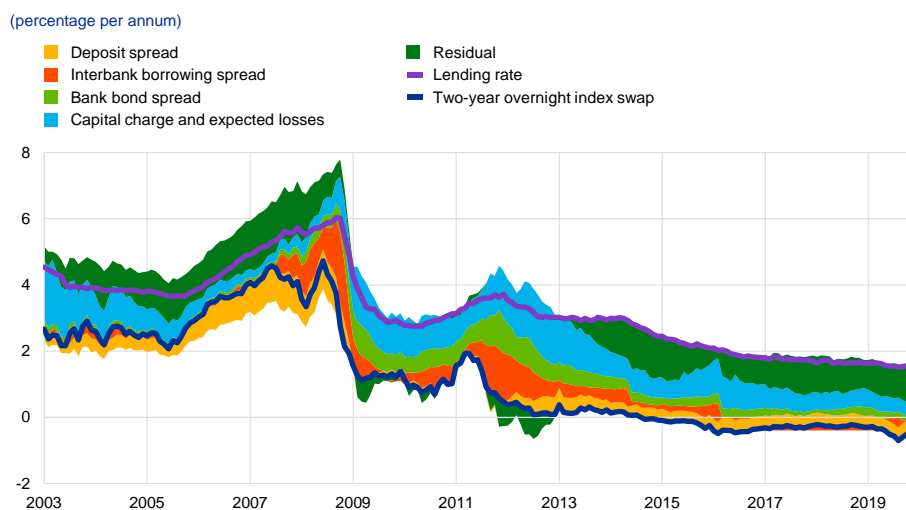


Sources: ECB calculations.

Notes: For panel (a), the low frequency component of M3 growth and HICP inflation is derived using the symmetric version of the band-pass filter as described in Christiano and Fitzgerald (2003). It captures movements with a cycle length of more than ten years and is computed as the difference between the observed series and the high-frequency and business cycle frequency components. The high-frequency component captures movements with a cycle length of up to two years. The business cycle-frequency component captures movements with a cycle length of more than two and up to ten years. The panel is based on data from January 1970 to December 2020. For panel (b), the maximum long-run co-variability measure (dots in the middle) and 90% confidence interval (delimited by the upper and lower dots) (based on Müller and Watson, 2018) is based on quarterly data for the annual growth rates of M3 and HICP inflation over the respective three-decade periods indicated. The maximum long-run co-variability over the period 1970-2000 is found for M3 growth leading HICP inflation by ten quarters, while that over both 1980-2010 and 1990-2020 is by four quarters.

## Chart 3

### Decomposition of the composite cost of borrowing for non-financial corporations



Sources: ECB (Monetary financial institutions Balance Sheet Items, Monetary financial institutions Interest Rate Statistics), Bloomberg, Moody's, Merrill Lynch Global Index and ECB calculations.

Notes: The base rate is the two-year overnight index swap, which is a proxy for the swap rate that banks in the euro area take as base when setting the lending rate granted by banks to NFCs. The red area shows the spread between the rate faced by banks in borrowing from other banks and the Eurosystem, and the swap rate. To proxy the most relevant borrowing rate, we consider the euro interbank offered rate (Euribor) before June 2014, the main refinancing operations (MRO) until March 2016, and subsequently the deposit facility rate. The yellow and green areas comprise bank deposit and bank bond spreads, respectively, both weighted by their share as funding sources on banks' balance sheets. The components of the light-blue area are based on Basel II risk weights, with probability of default proxied by Moody's expected default frequencies. The residual is a proxy of the margin, derived as the difference between observed lending rates and all other cost components.

### 3.1.1 Monetary analysis and the transmission mechanism

**Monetary analysis provides an essential contribution to the assessment of the monetary policy transmission mechanism.** The transmission of monetary policy operates via multiple channels.<sup>29</sup> Monetary analysis provides a particularly useful contribution to the assessment of the channels which operate via the banking sector and credit markets, ranging from the bank lending channel to the risk-taking channel and from the traditional interest rate channel to the broad credit channel. Here, the contribution of monetary analysis has been boosted by the availability of new granular data, the development of structural macroeconomic models with a detailed financial sector (see, for example, Christiano et al., 2014) and analytical tools allowing the modelling of nonlinear and time-varying effects in macro-finance interactions which became particularly important for the analysis of the recent crisis periods and the non-standard monetary policy measures adopted in response to these crises.

#### 3.1.1.1 Monetary analysis and the bank lending channel

**The bank lending channel is key for the transmission of monetary policy in the euro area, as bank lending remains the main source of financing of firms and households.** The bank lending channel refers to how banks' balance sheet conditions, together with leverage, liquidity and value-at-risk constraints, have an impact on their intermediation capacity and therefore on the transmission of monetary policy.<sup>30</sup> In this respect, variations in bank capitalisation and asset quality may contribute to either smoothing or amplifying financial shocks via their impact on bank lending policies.

**The analysis of bank health is informative for the pass-through of monetary policy measures and the supply of credit to firms and households.** When conducting monetary analysis, a rich array of aggregate and granular data on bank balance sheets, responses to the euro area bank lending survey (BLS) and financial market prices and volumes are assessed in order to form a view on bank intermediation capacity. Empirical evidence based on such data indicates that monetary policy can stimulate loan supply to a larger extent for more resilient banks (measured by the size of bank credit default swap spreads) (Altavilla et al., 2018). By contrast, less resilient banks may restrict their credit supply more when faced with adverse financial shocks. Moreover, there is evidence that bank capitalisation matters for banks' expansion of their loan supply in response to the ECB's asset purchases – this means there is a more muted expansion of lending volumes by less capitalised banks (see, for example, Albertazzi et al., 2020b). At the same time, there is evidence that the ECB's unconventional monetary policy measures introduced since June 2014 have helped banks with lower capital and higher non-

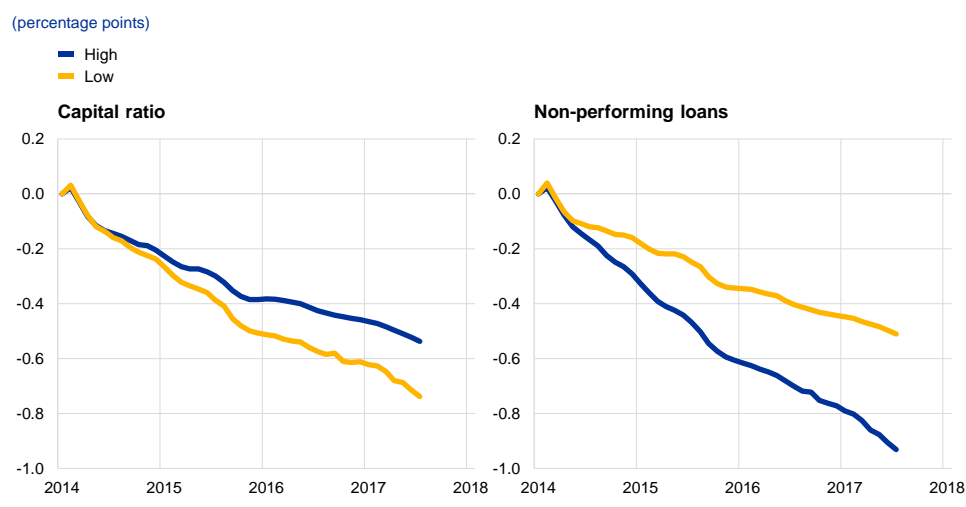
<sup>29</sup> For an overview of traditional channels of the monetary policy transmission mechanism, see Boivin et al., (2010). For a discussion of the monetary policy transmission mechanism in the euro area see Beyer et al. (2017) and Albertazzi et al. (2020a).

<sup>30</sup> For more detail, see Disyatat (2010). Note that this characterisation of the bank lending channel differs from the traditional perspective presented by Bernanke and Blinder (1988), which focuses on the special role of deposits in the funding of banks and their imperfect substitutability with bonds.

performing loan ratios catch up with regard to the pass-through of policy rates (Chart 4) (Altavilla et al., 2019a and Altavilla et al., 2020a). Finally, in the current low or negative interest rate environment, well-capitalised banks not only have larger capital buffers which they can use to smoothen credit supply over the cycle but they are also better able to pass through negative deposit rates to their customers than less well-capitalised banks, which also allows them to grant more loans (Altavilla et al., 2019b).

#### Chart 4

#### Decline in bank lending rates due to the ECB's non-standard monetary policy measures by bank characteristics



Source: Altavilla et al. (2020a).

#### Changes in supervisory and regulatory requirements have a significant impact on the bank lending channel.

An increase in capital buffers generates the necessary leeway for banks to bear more risk and expand their exposure towards the private sector. Similarly, a sudden drop in capital buffers bears the potential to prompt a large deleveraging. The impact of changes in capital requirements on bank lending activity therefore differs depending on the size of the bank's capital buffer before the change in requirements, as documented by the granular analysis conducted under the monetary analysis. For instance, banks with higher ex ante capital buffers react less to changes in capital requirements, as capital constraints are not binding for these banks. By contrast, if initial capital buffers are small, there is a detrimental impact on lending volumes associated with increases in capital requirements, as these likely force them to deleverage in order to address capital shortfalls.<sup>31</sup>

#### An important element in the analysis of the bank lending channel is the impact of the ECB's unconventional monetary policy on bank profitability.

While there have been concerns about a negative impact of low or negative interest rates on bank profitability, empirical evidence has highlighted their favourable impact on economic growth (leading to higher loan demand and lower credit risk), which has, thus far, compensated the negative impact on banks' net interest income (Altavilla et

<sup>31</sup> See Altavilla et al. (2020b).



al., 2017). At the same time, there may be adverse effects of negative rates on loan volumes and rates in the longer term, especially for low-capitalised banks and lending to risky firms (Arce et al., 2018).

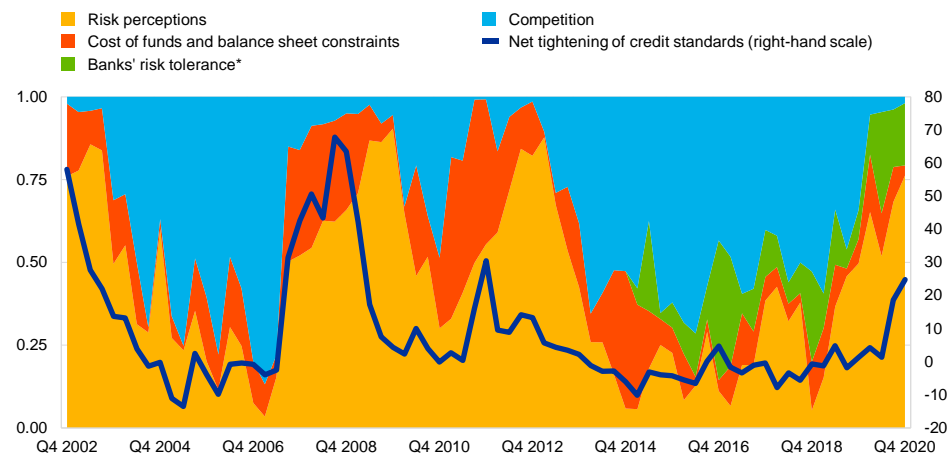
### 3.1.1.2 Monetary analysis and the risk-taking channel

**Banks' behaviour in the transmission of monetary policy also depends on their risk perceptions and risk tolerance, which may be interlinked with their own balance sheet situation and their ability to take on further risk.** Influencing the degree of risk-taking is part of the mechanism through which monetary policy ultimately exerts its influence on spending and aggregate demand. Monitoring the portfolio allocation patterns of various financial entities, it is possible to establish whether the portfolio rebalancing that is intended to be triggered by central bank asset purchases is taking place or whether there are impairments in this part of the transmission mechanism (Albertazzi et al., 2020b). At the same time, low interest rates and a related search for yield may breed excessive risk-taking and in this respect a component of the monetary analysis comprises investigating whether the additional risk-taking by banks is priced appropriately. Beyond this, banks regularly provide direct qualitative evidence in the BLS on their risk perceptions and risk tolerance and the impact these have on changes in their credit standards. In stressed periods, risk perceptions tend to be the dominant factor for the tightening of credit standards, while changes in banks' risk tolerance tend to play a more limited role according to the indications in the BLS (Chart 5).

**Chart 5**

Credit standards and relative importance of factors contributing to changes in credit standards for loans to firms

(left-hand scale: share in contribution to tightening; right-hand scale: net percentage of tightening)



Source: ECB (BLS).

Notes: \* "Banks' risk tolerance" was introduced in the first quarter of 2015. The latest observation is for the fourth quarter of 2020.

### 3.1.1.3 Monetary analysis, the interest rate channel and fragmentation

**The analysis of the pass-through of monetary policy measures to lending rates has been extended and adapted as a result of the increased complexity of the operation of this channel.** The monetary policy transmission mechanism via the interest rate channel, capturing the effects of monetary policy measures on money market rates, bank funding costs and lending rates, became more complex in the proximity of the effective lower bound and with the adoption of non-standard monetary policy measures, including negative interest rates on the deposit facility. The analysis of this channel needed to be extended and adapted to capture possible non-linear effects and to understand how it interacted with other important channels relevant for the transmission of non-standard measures, such as the portfolio rebalancing channel and the signalling channel (European Central Bank, 2017a). For this purpose, the tools to analyse the pass-through were extended to account for heterogeneous responses across banks (e.g. depending on business models), and cross-country heterogeneity in lending rates due to cyclical and structural differences.

**Pass-through analysis was instrumental in motivating the credit easing package adopted in 2014 and has shed light on the transmission of negative rates.** An illustration of the pass-through in the context of non-standard monetary policy measures is shown in Chart 6, which reports changes in lending rates granted to NFCs over different periods for different countries. This analysis showed that the monetary policy easing before the summer of 2014 contributed to a significant compression of lending rates granted by banks to NFCs in less vulnerable countries such as Germany, France and the Netherlands but was not transmitted equally to other countries (European Central Bank, 2017a). This pointed to impairments in the interest rate channel. The credit easing package introduced in 2014, and further measures adopted after that, allowed for a stronger decline in NFC lending rates in more vulnerable countries such as Italy and Spain.<sup>32</sup> The pass-through analysis based on the monetary analysis toolbox was also important in identifying increased fragmentation in lending rates, which signalled rising risks of specific impairments in the monetary policy transmission mechanism. Some cross-country heterogeneity in credit markets is an intrinsic aspect of monetary union, reflecting, for example, different financial market structures resulting from the relative importance of capital market financing for firms and the different prevalence of fixed versus flexible mortgage rates. However, increased financial market heterogeneity across countries could also reflect impairments in transmission linked to problems specific to some segments of credit markets in some national or regional contexts, preventing a homogeneous transmission of monetary policy across the euro area and therefore leading to excessive fragmentation.<sup>33</sup>

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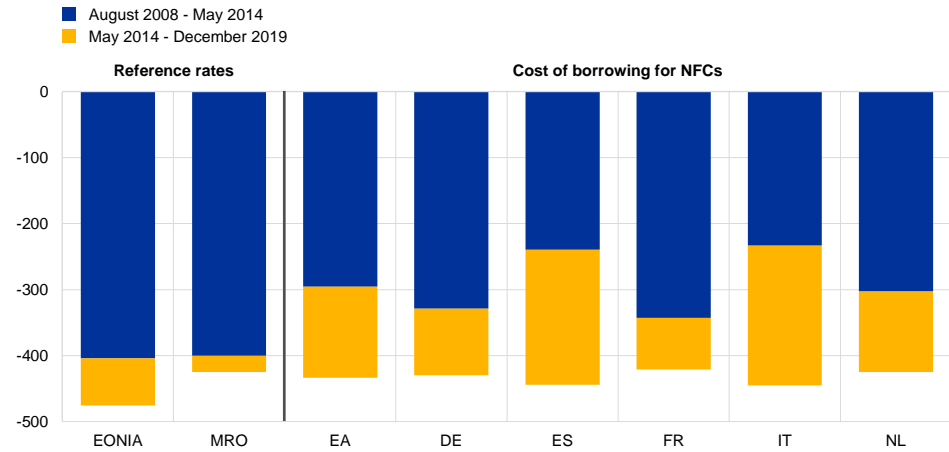
<sup>32</sup> Such analysis is regularly complemented by an assessment using granular data. For example, analysis of the pass-through of the ECB's negative interest rates to bank lending and deposit rates has shown that negative rates have been to some extent passed through to corporate depositors, and this has provided granular evidence that the monetary policy transmission mechanism continues to work also in a negative interest rate policy environment (see Altavilla et al., 2019b).

<sup>33</sup> For example, increased uncertainty with regard to the creditworthiness of potential borrowers exclusively on the basis of the country where they are located.

## Chart 6

### Interest rate pass-through from reference rates to the cost of borrowing for non-financial corporations across euro area countries

(basis points)



Source: ECB.

Notes: May 2014 was selected as it is a date that immediately precedes the ECB's announcement of some monetary policy measures taken to enhance the functioning of the monetary policy transmission mechanism on 5 June 2014 (announcement of the modalities of targeted longer-term refinancing operations (TLTROs) and intensification of preparatory work related to outright purchases of asset-backed securities). EONIA is the euro overnight index average, MRO is the main refinancing operations rate and EA is short for euro area. Reference rates are monthly averages.

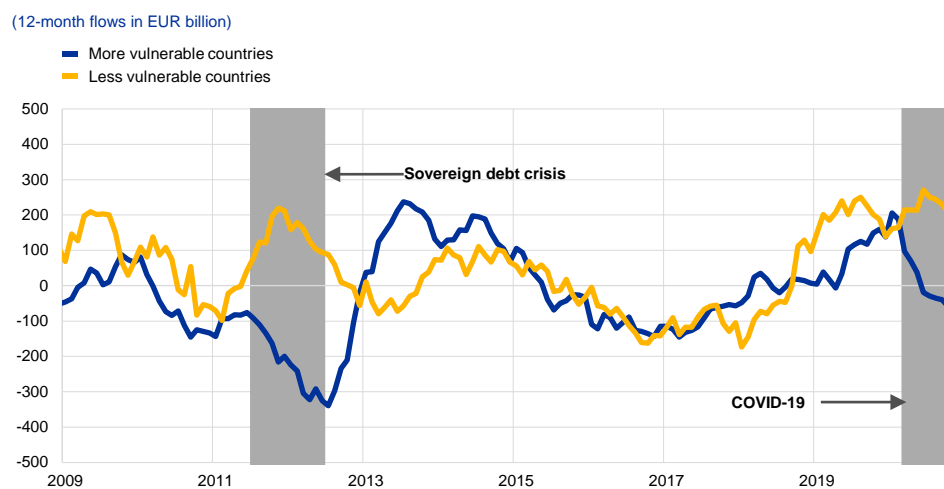
### **A complementary contribution of monetary analysis to the identification of impairments in transmission and excessive fragmentation in specific financial markets relates to the analysis of portfolio flows across sectors and countries.**

Cross-border monetary flows contain useful information for the analysis of fragmentation across euro area country groups. In this respect, monetary analysis was instrumental in documenting and analysing the large monetary outflows from more vulnerable countries and considerable inflows into less vulnerable countries during the sovereign debt crisis. Such analysis remains important for the assessment of the current economic and financial environment, as, for example, the initial stages of the COVID-19 crisis created strong cross-border monetary flows across euro area countries. Less vulnerable countries continued to receive inflows, while more vulnerable countries saw their previous inflows turn into outflows (Chart 7). In both episodes, dynamics in cross-border monetary flows of both country groups began to converge following monetary policy measures by the ECB. The comprehensive MA assessment of these dynamics enables light to be shed on the nature of these monetary flows through their correspondence with balance of payments items.<sup>34</sup>

<sup>34</sup> See Picón Aguilar et al. (2020) for more details.

**Chart 7**

**Cross-border monetary flows by country group**

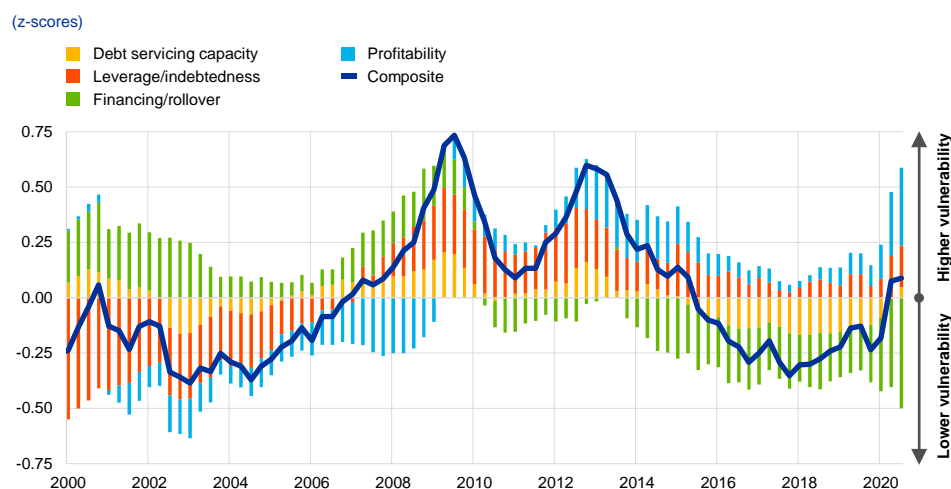


Source: ECB (Monetary financial institutions Balance Sheet Items).

Notes: Net cross-border monetary flows are measured as the change in the net external position of a country's MFIs (i.e. the central bank, commercial banks and money market funds considered together). More vulnerable countries include Greece, Spain, Italy and Portugal. Less vulnerable countries include Belgium, Germany, France, Netherlands, Austria and Finland. The latest observation is for October 2020.

### 3.1.1.4 Monetary analysis and the broad credit channel

**The monetary analysis is not limited to the analysis of balance sheets of financial entities but also assesses the financial position of borrowers, covered under the broad credit channel.** The broad credit channel, also known as (borrower) balance sheet channel or financial accelerator, operates via the impact of monetary policy measures on firm and household balance sheets, notably their net worth. Monetary policy changes affect borrowers' creditworthiness, their risk of default and external finance premia applied to their funding, thereby influencing their consumption and investment decisions (Bernanke and Gertler, 1995). Monetary analysis based on financial accounts data, featuring integrated sectoral accounts, offers a useful perspective for monitoring and analysing the operation of the broad credit channel. An illustration of such contribution is represented by indicators on different sources of vulnerabilities of NFCs, in relation to all sources of external financing, including from banks and from non-banks (Chart 8). Moreover, financial accounts data allows for an assessment of household vulnerability as well as the evolution of sectoral debt and liquid asset overhangs or shortfalls.

**Chart 8****Non-financial corporation composite vulnerability indicator**

Sources: Eurostat, ECB, Merrill Lynch, Refinitiv and ECB calculations.

Notes: The composite measure is based on a broad set of indicators along five dimensions: debt service capacity (measured by the interest coverage ratio, corporate savings and revenue generation), leverage/indebtedness (debt-to-equity, net debt-to-EBIT and gross debt-to-income ratios), financing/rollover (short-term debt-to-long-term debt ratio, quick ratio (defined as current financial assets/current liabilities), overall cost of debt financing and credit impulse (defined as the change in new credit issued as a percentage of GDP)), profitability (return on assets, profit margin and market-to-book value ratio) and activity (sales growth, trade creditors ratio and change in accounts receivable turnover). The indicators are standardised as z-scores, composite sub-indicators are computed by taking averages of the underlying z-scores and the overall composite indicator is obtained by equally weighting the composite z-scores of the four sub-categories. Positive values indicate higher vulnerability, whereas negative values indicate lower vulnerabilities. The latest observation is for the third quarter of 2020.

### 3.1.1.5 Monetary analysis and the relative importance of credit supply and credit demand factors

**Monetary analysis helps to quantify the role of credit supply and credit demand factors based on time series and structural models augmented with credit and monetary aggregates.** The aforementioned transmission channels operate, to a large extent, via the effects of monetary policy on credit markets. This means it is essential to understand to what extent credit flows are driven by credit supply versus credit demand factors, in order to, for example, assess if the smooth operation of the monetary policy transmission mechanism may be impaired by bank balance sheet constraints or enhanced by the loosening of credit terms and conditions.<sup>35</sup> The policy response to mitigate credit growth slowdowns driven mainly by a fall in credit demand (which under some conditions might take the form of measures to support the overall economy such as large-scale asset purchases) is likely to differ from the case of credit supply influences prevailing, which might be counteracted with more specific measures such as targeted longer-term refinancing operations (TLTROs). Monetary analysis contributes regularly to this assessment by, for example, providing estimates of the relative importance of credit supply and credit demand factors in driving NFC loans, including via time series models accounting for

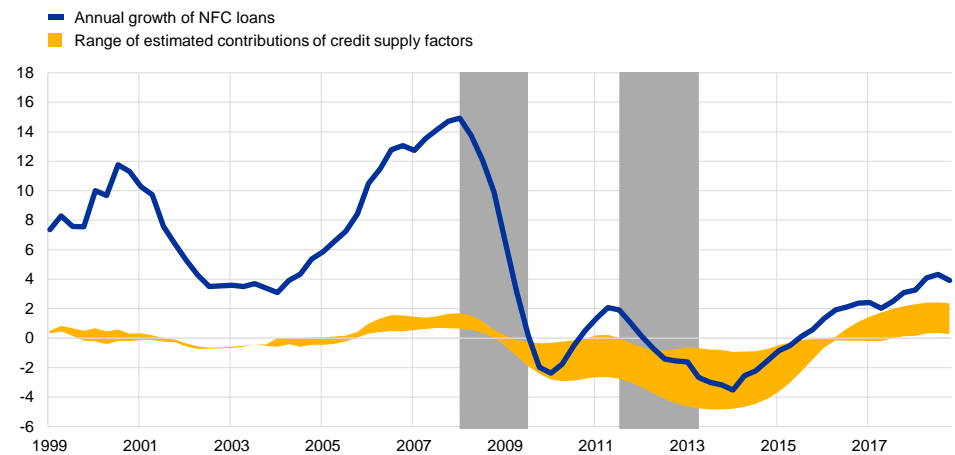
<sup>35</sup> In this context it is essential to capture both exogenous changes in credit supply, such as those driven by credit supply innovations linked, for example, to the expansion of specific new credit markets (as was the case with securitised loans) from endogenous changes, which reflect the transmission of monetary policy changes or the propagation of other structural disturbances. For this purpose, it is necessary to conduct the analysis of the effects of credit supply factors on the basis of structural models.

time variation and non-linearities as well as via structural models with a rich financial sector. These estimates indicate the important adverse contribution of credit supply factors in the aftermath of the global financial crisis, linked to the deterioration of financial intermediary balance sheets linked to increased non-performing loans, as well as during the sovereign debt crisis, due to the adverse bank-sovereign feedback loops (Chart 9). At the same time, credit demand played a larger role, especially as firms reduced their investment demand as is typical during recessions. These models are also regularly applied to estimate the impact of these factors on real GDP (European Central Bank, 2020b). These estimates are complemented by indications from the BLS and SAFE, which allow for an assessment of factors behind credit supply and credit demand developments (Chart 10). BLS indicators are also regularly used to derive model-based indicators of loan supply conditions (Altavilla et al., 2019c).

### Chart 9

#### Impact of credit supply shocks on the annual growth of loans to non-financial corporations

(annual percentage changes, percentage points)

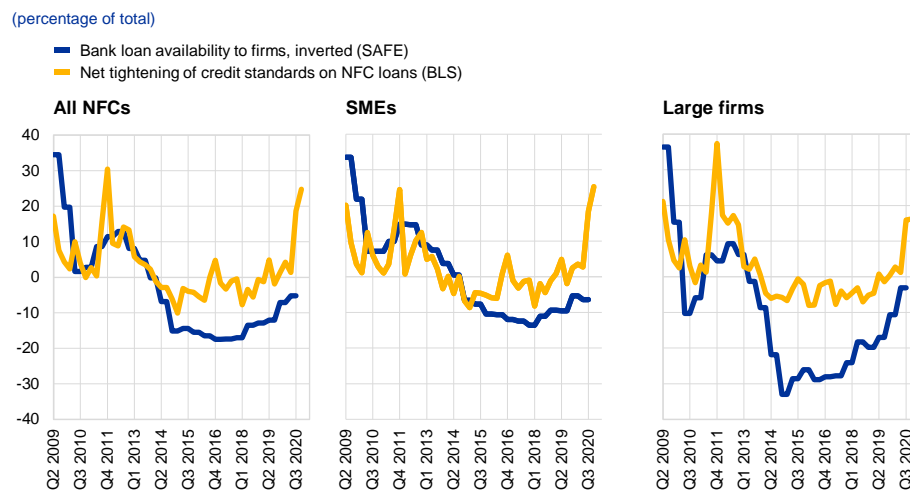


Sources: ECB and ECB calculations.

Notes: The range of estimated contributions of loan supply factors (orange range) to the annual growth rate of loans to NFCs is based on three different empirical models: a Bayesian vector autoregression (VAR), a proxy Bayesian VAR with BLS information (Altavilla et al., 2019c) and a time-varying parameters VAR (Gambetti and Musso, 2017). Shaded areas delimit recessions on the basis of peaks and troughs for the euro area business cycle established by the Centre for European Policy Research (CEPR) Euro Area Business Cycle Dating Committee.

**Chart 10**

Bank lending availability for euro area firms according to the bank lending survey and the Survey on the Access to Finance of Enterprises



Sources: ECB and European Commission.  
Notes: For more detail on this, see Köhler-Ulbrich et al. (2016). Net percentage changes have been inverted for SAFE. Latest observation: January 2021 BLS, April-September 2020 SAFE.

### 3.1.2 Monetary analysis and the design of monetary policy measures

**Monetary analysis has been instrumental in the calibration and analysis of the ECB’s unconventional monetary policy measures.** This particularly applies to the measures which aim to restore disrupted transmission channels and/or excessive fragmentation (transmission-oriented measures), such as the (targeted) longer-term refinancing operations ([T]LTROs).<sup>36</sup> Monetary analysis has also played an important role in the analysis of ECB measures affecting the monetary policy stance (stance-oriented measures), such as the ECB’s asset purchases.

#### 3.1.2.1 Monetary analysis and the design and analysis of transmission-oriented measures

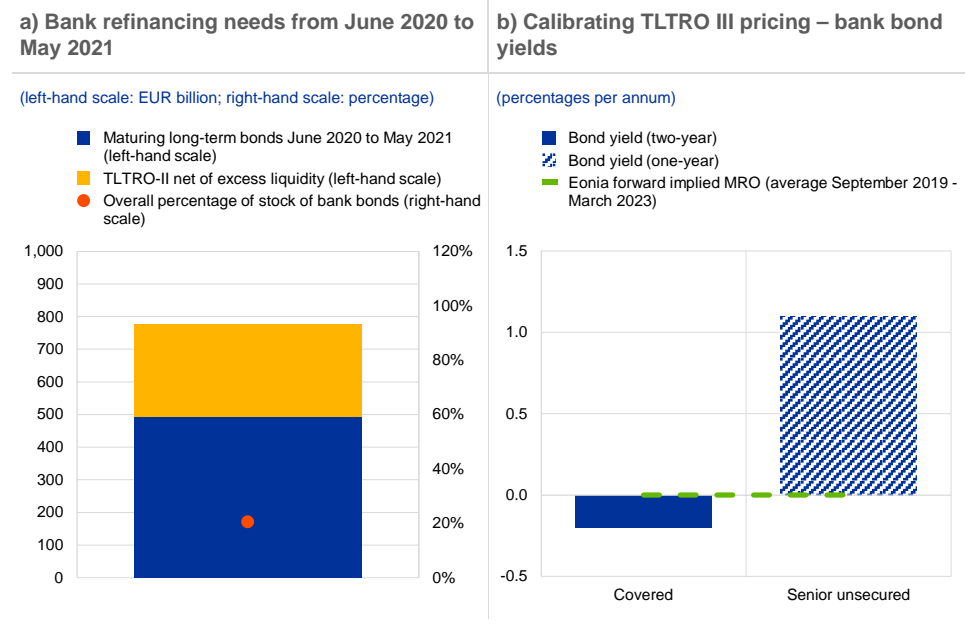
**Monetary analysis has played a crucial role not only in the analysis but also in the design of the technical features and calibration of (T)LTROs, which are a key example of a transmission-oriented measure.** In providing attractive funding conditions to banks, (T)LTROs have helped restore and preserve favourable financing conditions for borrowers. This is crucial in a bank-based financial system like the euro area, where SMEs and households are particularly dependent on bank lending.

**The design, calibration and adjustments of TLTROs were based on a variety of lending parameters.** The design of the original TLTRO in 2014 needed to carefully balance the objective of providing incentives to banks to lend to the economy, the

<sup>36</sup> See Altavilla et al. (eds.) (2021).

need to avoid stigma that could jeopardise the measure’s effectiveness and the importance of minimising distortions in the competitive landscape. Given the novelty of the measure, historical experience offered little guidance. Detailed bank-level simulations of eligible lending under alternative design parameters allowed policymakers to choose the combination of parameters that struck the desired balance. Similarly, the change in the design of the incentive structure in the second series of TLTROs in 2016 (TLTRO II), which entailed a switch from negative to positive incentives and a graduated pricing schedule, was guided by an in-depth, granular analysis of the effectiveness of the first programme. More recently, the decision to introduce the third series of TLTROs (TLTRO III) in March 2019 was driven by the assessment that banks were facing a very large volume of refinancing needs in close succession (see panel (a) of Chart 11), which would give rise to “congestion effects” in bank bond markets, thereby driving up their funding costs and exerting significant upward pressure on lending rates. Having established the need for a new series of operations, their pricing was calibrated so that incentives to divert funding to non-targeted activities would be minimised, while also ensuring that the operations remained attractive compared to market-based sources of funding (panel (b) of Chart 11).

**Chart 11**  
The case for TLTRO III and pricing calibration



Sources: ECB (Centralised Securities Database, Monetary financial institutions Balance Sheet Items) and ECB calculations.  
Notes: For panel (a), long-term bond redemptions include bonds with an original maturity of more than a year which expire between June 2020 and May 2021, obtained from the Centralised Securities Database statistics extracted as of end-December 2018. Hybrid bonds, certificates and Genussscheine are not considered in the calculation. The stock of bank bonds is obtained from Monetary financial institutions Balance Sheet Items. In panel (b), EONIA is the euro overnight index rate. MRO is the main refinancing operations rate. EONIA-based projections do not account for (negative) term premia, which may reduce implied MRO rates. Bond yields are two-year forward rates in one year. The latest observation is for 31 May 2019.



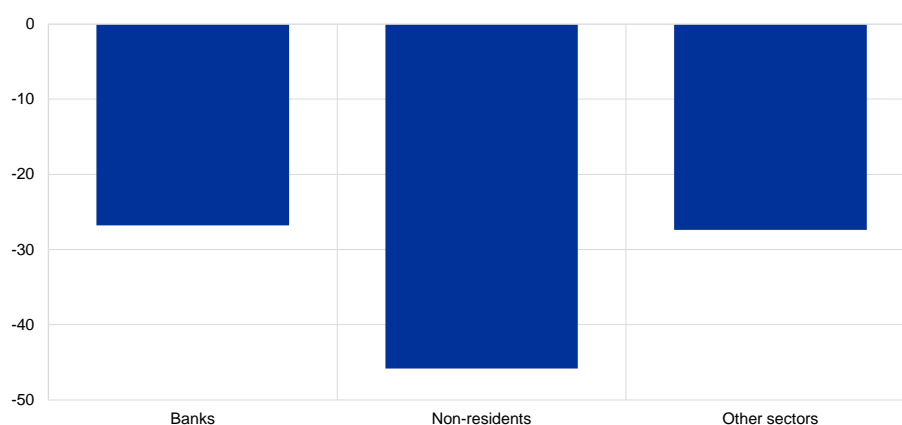
### 3.1.2.2 Monetary analysis and the analysis of stance-oriented measures

**Monetary analysis has provided useful insights for the assessment of the ECB's large-scale asset purchases.** The analysis of the sources of money creation provides an anchoring framework to study the transmission of the asset purchase programme (APP) and the pandemic emergency purchase programme (PEPP) and their impact on the portfolio choices of the various institutional sectors. The degree and speed with which large-scale Eurosystem purchases translate into broad money has a direct connection with the sectors from which such purchases are sourced (Chart 12). For instance, when the Eurosystem purchases securities held by a domestic resident other than a bank, a commensurate increase in the money balances in the hands of the public (M3) is observed. However, the monetary aggregate remains unchanged when the ultimate seller is a non-euro area resident, unless the latter re-invests proceeds in the euro area.<sup>37</sup>

#### Chart 12

Impact of the public sector purchase programmes on the net purchases of government securities across sectors

(percentage)



Sources: ECB and ECB calculations.

Notes: This chart shows the percentage of euro area government securities purchased by the Eurosystem between March 2015 and December 2018. For more details on the calculations see European Central Bank (2017b).

## 3.2 Prospects for the future evolution of monetary analysis

**There appears to still be justification for monetary analysis to retain a strong focus on analysing the transmission mechanism.** The deployment of a broad set of monetary policy instruments beyond interest rate adjustments seems very likely in the foreseeable future. As such, an ongoing assessment of their transmission is required, and this requirement will continue to arise in an analogous fashion during

<sup>37</sup> APP and PEPP remain effective in this case, as they continue to affect the term premium component of yields at the long end of the curve. Via the extraction of duration, asset purchases have contributed to ensuring favourable financing conditions for borrowers. See Altavilla et al. (eds.) (2021).

any eventual unwinding of some or all of these instruments.<sup>38</sup> Likewise, the fragilities in monetary policy transmission that were exposed by previous crises remain prevalent and, in some cases, may have been reinforced by the COVID-19 crisis. This means the factors that have motivated the intensified focus of monetary analysis on monetary policy transmission will continue to apply for the foreseeable future. It appears advisable to continue focusing the key channels for conveying analysis to the Governing Council on transmission-relevant aspects.<sup>39</sup>

**To further broaden its capacity to track monetary policy transmission in a comprehensive way, monetary analysis needs to factor in shifts in euro area financial structures, including the increasingly relevant role of non-bank finance.**

Since the global financial crisis, non-bank financial intermediaries have expanded their assets relative to banks and corporate debt securities have partly replaced bank loans in the financing structure of euro area firms. The analysis conducted for this review indicates that these developments matter for the transmission of monetary policy.<sup>40</sup> For instance, the shift from bank loans to corporate debt securities may weaken the transmission of standard policy-rate shocks to the economy; by contrast, it may strengthen the transmission of monetary policy shocks affecting longer-term yields, which tend to be particularly responsive to asset purchases (Chart 13). These findings, in turn, suggest that the effectiveness of different types of monetary policy measures may change over time and exhibit relevant heterogeneity across the euro area, given the pronounced cross-country differences in firm financing structures.<sup>41</sup> Accordingly, a priority for future follow-up work will be to assess potential sources of heterogeneity in transmission across geographies, sectors and borrower types. Such work could be complemented by the development of a normative framework that permits differentiation between natural differences in financial structures across countries and excessive fragmentation that may hamper transmission. Moreover, since corporate balance sheets in several sectors have been hard-hit by the current crisis and the resultant spike in indebtedness is likely to crystallise as a key legacy of the crisis, it will also be important to analyse the implications of heterogeneous corporate vulnerability on the strength of policy transmission.

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<sup>38</sup> The secular decline in the natural rate of interest also raises the likelihood that the policy space for standard interest rate adjustments may be limited, thus requiring more frequent use of other monetary policy tools in the future.

<sup>39</sup> In line with current practice, these include, for example: the impact of monetary policy on financing conditions; its reflection in the demand and supply for bank and non-bank credit; the intermediation capacity of banks and their ability to transmit monetary impulses to ultimate borrowers; portfolio flows inside and outside the euro area and their implications for the transmission of monetary policy to liquidity conditions in the economy; macro-finance feedbacks; and the interaction of policy with borrower balance sheets and asset pricing.

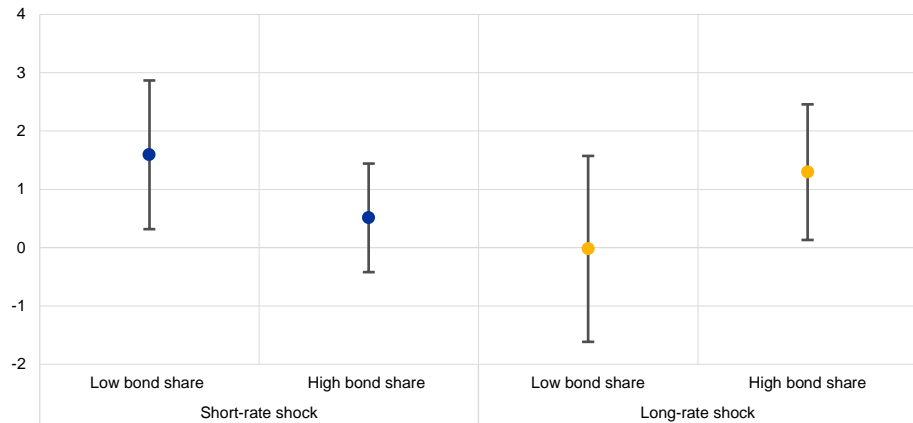
<sup>40</sup> See work stream on non-bank financial intermediation (2021) for details.

<sup>41</sup> Ongoing work also suggests that banks' and non-bank financial intermediaries' respond differently to monetary policy shocks. More specifically, while banks and investment funds show similar responses to policy shocks at the short end of yield curve, the latter tend to be more responsive to shocks at the longer yield curve segments (see work stream on non-bank financial intermediation (2021) for details). This provides indication that the relative importance of different types of financial intermediaries may also affect the relative effectiveness of different types of monetary policy measures.

### Chart 13

#### GDP response to expansionary monetary policy shocks (conditional on bond share)

(percentage)



Source: Holm-Hadulla and Thürwächter (2021).

Note: The chart shows effects of a monetary policy easing shock – identified via high-frequency surprises in a panel local projections model using monthly data for euro area countries. The impacts are calibrated to a 25-basis-point fall in rates. Short-rate (long-rate) shock refers to surprises in the one-month Overnight Index Swap rate (five-year Bund yield). The bond share is the ratio of bond volumes to the sum of bond and loan volumes in the NFC sector of each country. Low (high) bond share refers to the lower (upper) quintile of the cross-country bond share distribution. Dots (whiskers) are point estimates (90% confidence intervals) of the impact after approximately two years.

**The analysis of transmission also continues to be enhanced by the increased availability of granular information, for instance via the AnaCredit dataset.** The broadened availability of timely granular information on individual bank balance sheets and interest rates for euro area monetary financial institutions has offered increasingly detailed insights into bank-based transmission (Altavilla et al., 2019a). A promising avenue to further deepen these insights is the use of the AnaCredit dataset, which provides detailed and timely information on individual bank loans in the euro area on a monthly basis from September 2018 onwards.<sup>42</sup> This dataset complements other sources of granular information on banks and firms, and it has the potential to further enhance analysis of the monetary policy transmission mechanism along several dimensions, including: heterogeneity in the transmission of monetary policy across regions and sectors; potential side effects of monetary policy, for instance regarding bank risk-taking; and the sources of changes in credit developments (including the role of credit supply factors and the impact of prudential policies). Besides AnaCredit, an array of other newly available transaction-level and security-level datasets shed light on parts of the transmission mechanism that were not previously fully understood, referring, for instance, to bank hedging practices and derivatives exposures (EMIR), money market borrowing (MMSR) and securities holdings (SHS). Increased active use of these datasets provides a significant expansion of the analytical basis available to inform the design and calibration of standard and non-standard monetary policy measures and the assessment of their effectiveness and side effects. An area where granular data can contribute to enhancing the understanding of the transmission mechanism and the calibration of non-standard monetary policy measures includes refinements in the quantification of possible interest rate thresholds beyond which a qualitatively different transmission

<sup>42</sup> For more details see [AnaCredit](#).

of the negative rate policy through banks is likely (along the lines of the “reversal rate” concept).

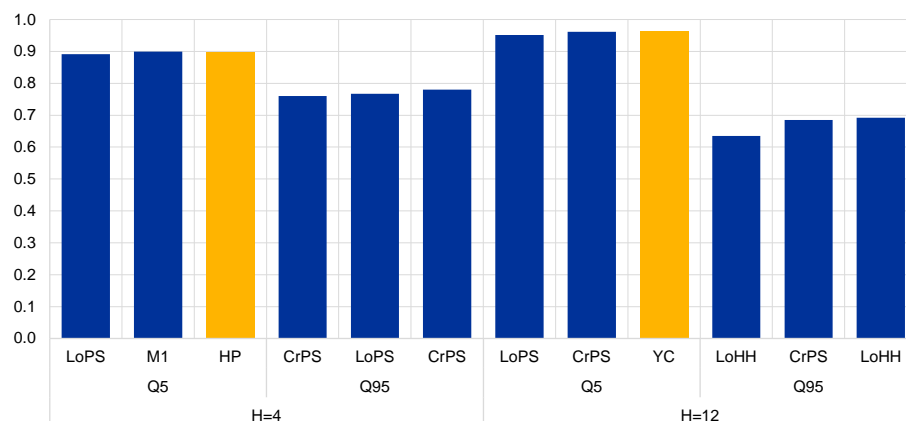
**Besides the focus on transmission, monetary analysis also remains a valuable source of information for assessing risks to price stability.** Indicators of money, credit and broader financial conditions are informative for identifying risks around the central outlook for inflation and growth. They emerge as relevant explanatory variables in inflation-at-risk and growth-at-risk models, which use quantile estimation techniques to gauge the link between monetary and financial variables and the entire distribution of projected inflation and growth outcomes. For instance, recent work based on forecasting horse races of several financial indicators in the context of standard expectations-augmented Phillips curves for euro area HICP excluding energy and food price inflation points to a number of credit aggregates (bank lending to the non-financial private sector, total credit to the non-financial private sector and bank lending to households) and monetary aggregates (M1) providing the largest significant marginal improvement in forecasts of lower (5th) and upper (95th) quantiles of inflation at both short (one year ahead) and medium (three year ahead) horizons (Korobilis et al., 2021) (Chart 14). Further, narrow money (M1) growth appears to be a reliable leading indicator for all past recessions in the euro area (European Central Bank, 2019) and strong growth of bank lending to the private sector has preceded most recessions in the euro area (Adalid et al., 2021).<sup>43</sup>

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<sup>43</sup> Conceptually, these new analytical tools depart in two ways from the original monetary analysis, which rested on the monetarist view of a stable long-run link between broad money growth and inflation: first, in identifying informative monetary variables, they consider a broader set of financial indicators that also includes credit volumes, asset prices and leverage; second, they do not treat the link between these variables and the economy as a separate monetarist paradigm, but integrate it into well-established economic frameworks, such as the Phillips curve or the various channels of the transmission mechanism. For a precursor of the latter, albeit based on a different methodological approach, see Gerlach (2004) and Assenmacher-Wesche and Gerlach (2008).

**Chart 14****Ranking of marginal value of specific variables for inflation forecasting**

(percentage)



Source: Korobilis, Landau, Musso and Phella (2021).

Notes: Relative predictive quantile scores (ratio of score of quantile regressions with a financial indicators to that of the benchmark AR(2) model) for euro area HICP excluding energy and food prices quarter-on-quarter growth rate for the best models for the prediction of the 5th quantile (Q5) and the 95th quantile (Q95) four quarters and twelve quarters ahead. A value below one signals an improvement of the forecast relative to the benchmark and the lower the value the larger is the improvement. LoPS is bank lending volumes to the non-financial private sector. HP is house prices. CrPS is total credit volumes to the non-financial private sector. YC is yield curve (ten-year government bond yield minus three-month euro interbank offered rate). LoHH is bank lending volumes to households.

**The implications of accelerating financial innovation have emerged as an additional important priority for further analysis.** Innovation in financial markets is likely to accelerate in the years ahead, for example, via an increased role of fintech solutions and the emergence of new forms of public and private money and money-like instruments, including central bank digital currencies (CBDC), stablecoins and crypto-assets. In this respect, it will be important to analyse the implications of these developments for monetary transmission, including an assessment of the impact of a potential introduction of a digital euro. Moreover, analytical efforts are warranted to assess how changes in financial structure and fintech may affect concepts and measures of money, credit and liquidity and their usefulness in providing signals of changes in the expected distribution of inflation and real economic activity.

**Further work is needed to deepen the links between monetary and financial stability analysis and to enhance the latter so that it can assume a more explicit role in the monetary policy decision-making process.**<sup>44</sup> There is a fundamental interrelation between macroeconomic and financial stability, as financial crisis episodes are associated with disinflationary pressures that threaten the achievement of price stability, while also debilitating the transmission mechanism. Moreover, the regular proportionality assessment that is part of monetary policy evaluation, needs to consider side effects that may arise in the transmission process, with financial stability featuring as a prominent area of potential concern. The modelling tools, datasets and techniques for monetary and financial stability analysis are highly complementary. At the same time, their respective perspectives remain

<sup>44</sup> For more details see work stream on macroprudential policy, monetary policy and financial stability (2021).

distinct: while typical financial stability shocks also affect the transmission mechanism, not all shocks to the transmission mechanism necessarily qualify as financial stability shocks. As discussed in Section 4, the complementarities and overlaps between monetary and financial stability analyses also have implications for their role in the monetary policy strategy.

## 4 The two-pillar framework, cross-checking and communication

**The above considerations confirm the continued relevance of the economic and monetary analysis but their evolved role has yet to be reflected in the formulation of the strategy.** The ECB's monetary policy strategy codifies the process by which the information content of economic and monetary analysis feeds into policy deliberations and communication. In the 2003 formulation of the strategy, this process was organised around the two-pillar framework and cross-checking the respective signals on risks to price stability. This set-up was still firmly rooted in the notion, established in the 2003 strategy review, that economic analysis and monetary analysis provide complementary analytical perspectives for understanding the inflation process, which in turn need to be reconciled at the level of the Governing Council of the ECB. As such, it is at odds with the evolution of monetary analysis in practice as it neither accounts for its increased role in assessing the transmission of monetary policy, nor does it allow for the reduced emphasis on bivariate reduced-form relationships between money and inflation in the Governing Council information set. Therefore, revamping the strategic roles of economic analysis and monetary analysis may be warranted to close the gap between their formal description in the 2003 formulation of the strategy and their analytical role in practice; furthermore, this could serve to accommodate the aforementioned avenues for upgrading monetary analysis and deepening the links between monetary analysis and financial stability analysis.<sup>45</sup>

**To this end, three main options appear worth considering.** The first option is to abandon the two-pillar framework and replace it with a unified framework that integrates the economic and monetary analysis in one consolidated assessment. The second is to preserve the existing two-pillar framework but codify the enhanced role of transmission as the focal point of monetary analysis in the strategy formulation. The third option, which sits somewhere between the other two options, is to combine the benefits of a more integrated framework, while explicitly retaining economic analysis and monetary analysis as two specialised analytical branches. While the relative merits of these options are discussed in detail below, it is worth noting that they all allow for a stronger reflection of financial stability analysis in the information set that is relevant to monetary policy.<sup>46</sup>

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<sup>45</sup> The issue of how to integrate financial stability considerations in the ECB's monetary policy framework is addressed in work stream on macroprudential policy, monetary policy and financial stability (2021).

<sup>46</sup> See work stream on macroprudential policy, monetary policy and financial stability (2021). On substance, this could further strengthen: (i) the analysis of the longer-term build-up of financial vulnerabilities and their possible implications for output, inflation and the monetary policy transmission mechanism; (ii) an appraisal of the role of readily enacted and planned macro-prudential measures in addressing the factors which pose longer-term risks from a monetary policy perspective; and (iii) the analysis of financial stability risks associated with monetary policy measures as part of the ongoing proportionality assessment.

## 4.1 Moving away from the two-pillar framework

**As one option, the economic analysis and monetary analysis could be integrated into a unified monitoring framework for diagnosing the state of, and predicting the likely evolution of, the macroeconomy.** As such, the conceptual distinction between economic analysis and monetary analysis would be abandoned in the formulation of the strategy and the traditional two-pillar framework would be replaced in the ECB's public communication. A key benefit of this option is that it formalises the inherent links between the underlying structures, shocks and adjustment processes covered by the two areas of analysis, as the cyclical state of the economy is co-determined by the strength of monetary policy transmission and the strength of transmission is sensitive to the economic environment in which it takes place. Furthermore, in this integrated framework, communication at a meeting-to-meeting frequency could be tailored more flexibly to focus on the elements of analysis that, from time to time, are deemed most relevant for a complete characterisation of the conjunctural environment and outlook within a single narrative.<sup>47</sup>

**While significantly streamlining the strategy formulation, the move to an integrated framework would also entail several disadvantages.** The abandonment of the distinction between economic analysis and monetary analysis could be wrongly perceived to be an outright rejection of the notion that monetary developments offer informative signals regarding risks to price stability, in particular over a medium-term to longer-term horizon. Especially in a scenario of shifts in inflation towards more buoyant price dynamics or towards intensified deflationary pressures, this misperception could complicate efforts to steer private sector expectations and to convey the conviction that monetary dynamics act as a nominal anchor in conditions of instability.

## 4.2 Revamping the two-pillar framework

**Alternatively, the two-pillar framework could be retained, while becoming more precise in its strategic conceptualisation with regard to the analytical focus of monetary analysis on transmission.** This would involve the ECB retaining the nature of the current economic pillar and clarifying that the monetary pillar has evolved towards a stronger focus on the analysis of monetary policy transmission. In the context of this revamped two-pillar framework, with the evolved role of monetary analysis being formally reasserted in the strategy statement, the Governing Council would continue to receive the analysis that currently forms part of their information set, complemented by an enhanced analysis of financial stability for monetary purposes (see above). In addition, the Governing Council would need to clarify the evolved framework as an outcome of the strategy review.

**This option would better align the formulation of the strategy with the evolved role of monetary analysis, while signalling some degree of continuity.** A

<sup>47</sup> For an early discussion of the possibility of integrating economic analysis and monetary analysis into a single pillar, see Papademos (2006).



codification and formalisation of the evolved role of monetary analysis under the monetary pillar would be important for re-establishing consistency between the actual practice by which policy decisions are informed and the way the strategy is presented. It would also provide a clear and tangible signal that the Eurosystem continues to draw on the information content of credit and monetary aggregates for medium-term to longer-term risks to price stability. While all central banks carefully monitor transmission, retaining a separate pillar oriented towards this analysis would signal the particular importance ascribed to and the unique complexities related to transmission in a monetary union set-up.

**However, the resultant continuity in the formulation of the strategy comes at a cost.** First, the sharp distinction between the two pillars would contrast with the notion that monetary policy transmission and economic processes are intertwined. Second, it may create the misperception that monetary analysis sticks to an outdated paradigm by which reduced-form relationships between monetary variables and inflation enter the policy-relevant information set on a similar footing as the staff macroeconomic projection exercises.

### 4.3 An intermediate solution

**To combine the relative merits of the previous two options, the third option would entail moving towards a more integrated framework, but explicitly retaining the economic analysis and monetary analysis as two specialised branches of analysis.** To this end, the Governing Council could communicate that it makes its monetary policy decisions on the basis of an encompassing assessment of economic, monetary and financial developments and that this assessment builds on the ECB's two analytical perspectives: (i) the economic analysis, which assesses real and nominal economic developments, and (ii) the monetary and financial analysis, which examines monetary and financial indicators to assess the operation of the monetary policy transmission mechanism and monitor possible risks to price stability from financial imbalances. To highlight the distinction of the new strategy formulation from that of 2003 and to emphasise the importance of financial factors in the analysis, the latter branch could be referred to as "monetary and financial analysis".

**This option would ensure that the joint interdependence of economic, monetary and financial developments is fully taken into account, while reinforcing the continued relevance of monetary analysis.** Compared to the option of a full integration of economic analysis and monetary analysis, this option would avoid the misperception that monetary analysis has been downgraded. Instead, it would explicitly signal continuing prominent role played by monetary analysis, also in fostering a medium-term to longer-term orientation of policy. Compared to the option of retaining the explicit reference to two separate pillars, it avoids the specific connotation that this term has acquired in the history of the euro area, namely: two alternative and independent paradigms for understanding inflation (rather than essential and interrelated ingredients of the same complex chain of

economic adjustment processes that link the actions of the central bank to the ultimate outcome variables it seeks to influence).

**All three options would call for adapting communication, including a removal of the cross-checking paragraph as a standalone recurrent element of the Introductory Statement.** Under all three options it would be beneficial to remove the outdated cross-checking paragraph in the Introductory Statement. Given the reorientation of the monetary analysis in practice, the current formulation of this paragraph appears too mechanical and rigid to reflect the nuanced and broadened conclusions emerging from the monetary analysis. Furthermore, it is still clearly rooted in the notion of two separate paradigms of the inflation process.<sup>48</sup> At the same time, to avoid the impression that a discontinuation of the cross-checking paragraph implies a joint assessment of the risks to price stability from economic and monetary perspectives no longer takes place, the meeting-to-meeting communication would have to be carefully redrafted by integrating all of the main elements of the evolved monetary analysis within a joint narrative based on both analytical perspectives.

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<sup>48</sup> For a more general discussion on communication aspects, see work stream on monetary policy communications (2021).

## References

- Adalid, R., Korobilis, D., and Musso, A. (2021), "Anatomy of Credit Cycles", ECB, forthcoming.
- Adrian, T., Boyarchenko, N. and Giannone, D. (2019), "Vulnerable Growth." *American Economic Review*, Vol 109, No 4, pp. 1263-89.
- Albertazzi, U., Barbiero, F., Marqués-Ibáñez, D., Popov, A., Rodriguez d'Acri, C. and Vlassopoulos, T. (2020a), "Monetary policy and bank stability: the analytical toolbox reviewed," *Working Paper Series*, No 2377, ECB, Frankfurt am Main.
- Albertazzi, U., Becker, B., Boucinha, M. (2020b), "Portfolio rebalancing and the transmission of large-scale asset programmes: evidence from the euro area", *Journal of Financial Intermediation*, forthcoming.
- Allen, T., Dees, S., Boissinot, J., Caicedo Graciano, C.M., Chouard, V., Clerc, L., de Gaye, A., Devulder, A., Diot, S., Lisack, E., Pegoraro, F., Rabaté, M., Svartzman, R. and Vernet, L. (2020), "Climate-Related Scenarios for Financial Stability Assessment: An Application to France", *Working Paper Series*, No 774, Banque de France.
- Altavilla, C., Boucinha, M., and Peydró, J.L. (2017), "Monetary policy and bank profitability in a low interest rate environment", Working Paper Series, No 2105, ECB, Frankfurt am Main, October.
- Altavilla, C., Boucinha, M., Holton, S. and Ongena, S. (2018), "Credit supply and demand in unconventional times", *Working Paper Series*, No 2202, ECB, Frankfurt am Main, November.
- Altavilla, C., Andreeva, D., Boucinha, M. and Holton, S. (2019a): "Monetary policy, credit institutions and the bank lending channel in the euro area", *Occasional Paper Series*, No 222, ECB, Frankfurt am Main.
- Altavilla, C., Burlon, L., Giannetti, M. and Holton, S. (2019b), "Is there a zero lower bound? The effects of negative policy rates on banks and firms", *Working Paper Series*, No 2289, ECB, Frankfurt am Main, June.
- Altavilla, C., M. Darracq Pariès and G. Nicoletti (2019c), "Loan supply, credit markets and the euro area financial crisis," *Journal of Banking & Finance*, Vol. 109, Issue C.
- Altavilla, C., Canova, F. and Ciccarelli, M. (2020a), "Mending the broken link: Heterogeneous bank lending rates and monetary policy pass-through", *Journal of Monetary Economics*, Vol. 110, April, pp. 81-98.
- Altavilla, C., Barbiero, F., Boucinha, M. and Burlon, L. (2020b), "The great lockdown: pandemic response policies and bank lending conditions", *Working Paper Series*, No 2465, ECB, Frankfurt am Main, September 2020.

Altavilla, C., Lemke, W., Linzert, T., Tapking, J. and von Landesberger, J. (2021), “Assessing the efficacy, efficiency and potential side effects of the ECB’s monetary policy instruments since 2014”, *Occasional Paper Series*, No 278, ECB, Frankfurt am Main, September.

Arce, Ó., García-Posada, M., Mayordomo, S. and Ongena, S. (2018), “Adapting lending policies in a “negative-for-long” scenario”, *Working Papers*, No 1832, Banco de España.

Assenmacher-Wesche, K., and Gerlach, S. (2008), “Interpreting euro area inflation at high and low frequencies”, *European Economic Review*, Vol. 52, No 6, pp 964-986.

Bernanke, B. and Blinder, A. (1988), “Credit, Money, and Aggregate Demand”, *American Economic Review*, Vol. 78, No 2, American Economic Association, pp. 435-439.

Bernanke, B. and Gertler, M. (1995), "Inside the Black Box: The Credit Channel of Monetary Policy Transmission", *Journal of Economic Perspectives*, Vol. 9, No 4, Fall, pp. 27-48.

Beyer, A., Nicoletti, G., Papadopoulou, N., Papsdorf, P., Rünstler, G., Schwarz, C., Sousa, J. and Vergote, O. (2017), “The transmission channels of monetary, macro- and microprudential policies and their interrelations,” *Occasional Paper Series*, No 191, ECB, Frankfurt am Main.

Boivin, J., Kiley, M. and Mishkin, F. (2010), “How Has the Monetary Transmission Mechanism Evolved Over Time?”, in *Handbook of Monetary Economics: Volume 3*, Friedman and Woodford (eds.), pp. 369-422.

Bouche, P., Gerardin, M., Gautier, E. and Savignac, F. (2021), “Mesurer les anticipations d’inflation des entreprises”, *Le Bulletin de la Banque de France*, n°236/6.

Brand, C, Bielecki, M. and Penalver, A. (2018), “The natural rate of interest: estimates, drivers and challenges to monetary policy”, *Occasional Paper Series*, No 217, ECB, Frankfurt am Main.

Calvino, F., Criscuolo, C. and Menon, C., (2015), “Cross-country evidence on start-up dynamics”, *Technology and Industry Working Papers*, OECD Science, OECD Publishing, Paris.

Carvalho, C., Ferrero, A. and Nechio, F. (2016), “Demographics and real interest rates: inspecting the mechanism”, *European Economic Review*, Vol 88, pp. 208-226.

Christiano, L. and Fitzgerald, T. (2003), "The Band Pass Filter", *International Economic Review*, Vol. 44, No 2, pp. 435-465.

Christiano, L., Motto, R., and Rostagno, M. (2014), "Risk Shocks", *American Economic Review*, Vol, 104, No 1, pp. 27-65.

Cour-Thimann, P. and Jung, A. (2021). "Interest-rate setting and communication at the ECB in its first twenty years", *European Journal of Political Economy*, forthcoming.

Disyatat, P. (2010), "The bank lending channel revisited", *BIS Working Papers*, No 297, Bank for International Settlements.

European Central Bank (1998), *A stability-oriented monetary policy strategy for the ESCB*, Press release by the Governing Council of the ECB, 13 October.

European Central Bank (2016), *A guide to the Eurosystem/ECB staff macroeconomic projection exercises*, ECB, Frankfurt am Main.

European Central Bank (2017a), "MFI lending rates: pass-through in the time of non-standard monetary policy", *Economic Bulletin*, Issue 1.

European Central Bank (2017b), "Which sectors sold the government securities purchased by the Eurosystem?", *Economic Bulletin*, Issue 4.

European Central Bank (2019), "The predictive power of real M1 for real economic activity in the euro area", *Economic Bulletin*, Issue 3.

European Central Bank (2020a), "The impact of COVID-19 on potential output in the euro area," *Economic Bulletin*, Issue 7.

European Central Bank (2020b), "Assessing bank lending to corporates in the euro area since 2014", *Economic Bulletin*, Issue 1.

European Central Bank (2021), "Using machine learning and big data to analyse the business cycle", *Economic Bulletin*, Issue 5.

Faccia, D., Parker, M. and Stracca, L. (2020), *Too hot for stable prices? International evidence on climate change and inflation*, mimeo, ECB.

Ferreira, T. and Shousha, S. (2020), "Scarcity of Safe Assets and Global Neutral Interest Rates", *International Finance Discussion Papers*, No 1293, Board of Governors of the Federal Reserve System, Washington, DC., July.

Gamberoni, E., Giordano, C. and Lopez-Garcia, P., (2016), "Capital and labour (mis)allocation in the euro area: some stylized facts and determinants", *Working Paper Series*, No 1981, ECB, Frankfurt am Main, November.

Gambetti L. and Musso, A. (2017), "Loan Supply Shocks and the Business Cycle", *Journal of Applied Econometrics*, Vol. 32, No 4, June, pp. 764-782.

Gerlach, S. (2004). "The two pillars of the European Central Bank", *Economic Policy*, Vol. 19, No 40, pp. 389-439.

Gopinath, G., Kalemli-Özcan, S., Karabarbounis, L. and Villegas-Sanchez, C., (2017), "Capital Allocation and Productivity in South Europe", *The Quarterly Journal of Economics*, Vol. 132, No 4, pp. 1915-1967.

Holm-Hadulla, F. and Thürwächter, C. (2021), "Heterogeneity in corporate debt structures and the transmission of monetary policy", *European Economic Review*, Vol. 136, July.

IPCC (2018), *Global Warming of 1.5°C.* IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, In Press.

Issing, O. (2003), "Foreword" in Issing, O. (ed.), *Background Studies for the ECB's Evaluation of its Monetary Policy Strategy*, ECB, Frankfurt am Main, November, pp. 5-9.

Korobilis, D., Landau, B., Musso, A. and Phella, A. (2021), "The time-varying evolution of inflation risks", *Working Paper Series*, ECB, forthcoming.

Köhler-Ulbrich, P., Hempell, H.S. and Scopel, S. (2016), "The euro area bank lending survey", *Occasional Paper Series*, No 179, ECB, Frankfurt am Main, September.

Koester, G., Lis, E., Nickel C., Osbat, C. and F. Smets (eds.) (2021): "Understanding Low Inflation in the Euro Area from 2013 to 2019: Cyclical and Structural Drivers", *Occasional Paper Series*, No. 280, Frankfurt am Main, September.

Krueger, D. and Ludwig, A. (2007), "On the consequences of demographic change for rates of returns to capital, and the distribution of wealth and welfare", *Journal of Monetary Economics*, Vol. 54, No 1.

Masuch K., Nicoletti-Altimari, S., Rostagno, M. and Pill, H. (2003), "The role of money in monetary policymaking", in Issing, O. (ed.), *Background Studies for the ECB's Evaluation of its Monetary Policy Strategy*, ECB, Frankfurt am Main, November, pp. 187-229.

Müller, U. and Watson, M. (2018), "Long-Run Covariability", *Econometrica*, Vol. 86, No 3, pp. 775-804.

NGFS (2020), *NGFS climate scenarios for central banks and supervisors*, Network for Greening the Financial System, Paris, France.

Papademos, L. (2006), *The role of money in the conduct of monetary policy*, Speech delivered at the Fourth ECB Central Banking Conference, Frankfurt am Main, 9 November.

Papademos, L. and Stark, J. (2010) (eds.), *Enhancing Monetary Analysis*, ECB, Frankfurt am Main.

Papadopoulos, M., Patria, M. and Triest, R. (2017), "Population aging, labor demand, and the structure of wages", Fed Boston, Working Paper 17-1.

Parker, M. (2018), "The Impact of Disasters on Inflation", *Economics of Disasters and Climate Change*, Vol. 2, Issue 1, pp. 21-48.

Picón Aguilar, C., Oliveira Soares, R. and Adalid, R. (2020), "Revisiting the monetary presentation of the euro area balance of payments", *Occasional Paper Series*, No 238, ECB, Frankfurt am Main.

Rachel, L. and Summers, L.H. (2019), "On falling neutral real rates, fiscal policy, and the risk of secular stagnation", *Brookings Papers on Economic Activity*, The Brookings Institution, Spring.

Rostagno, M., Altavilla, C., Carboni, G., Lemke, W., Motto, R., Saint-Guilhem, A., and Yiangou, J. (2019) "A tale of two decades: the ECB's monetary policy at 20", *Working Paper Series*, No 2346, ECB, Frankfurt am Main.

Syverson, C., (2011), "What Determines Productivity?", *Journal of Economic Literature*, Vol. 49, No 2, pp. 326-365.

Work stream on climate change (2021), "Climate change and monetary policy in the euro area", *Occasional Paper Series*, No 271, ECB, Frankfurt am Main, September.

Work stream on digitalisation (2021), "Digitalisation: channels, impacts and implications for monetary policy in the euro area", *Occasional Paper Series*, No 266, ECB, Frankfurt am Main, September.

Work stream on Eurosystem modelling (2021), "Review of macroeconomic modelling in the Eurosystem: current practices and scope for improvement", *Occasional Paper Series*, No 267, ECB, Frankfurt am Main, September.

Work stream on globalisation (2021), "The implications of globalisation for the ECB monetary policy strategy", *Occasional Paper Series*, No 263, ECB, Frankfurt am Main, September.

Work stream on inflation expectations (2021), "Inflation expectations and their role in Eurosystem forecasting", *Occasional Paper Series*, No 264, ECB, Frankfurt am Main, September.

Work stream on inflation measurement (2021), "Inflation measurement and its assessment in the ECB's monetary policy strategy review", *Occasional Paper Series*, No 265, ECB, Frankfurt am Main, September.

Work stream on macroprudential policy, monetary policy and financial stability (2021), "The role of financial stability considerations in monetary policy and the interaction with macroprudential policy in the euro area", *Occasional Paper Series*, No 272, ECB, Frankfurt am Main, September.

Work stream on monetary policy communications (2021), "Clear, consistent and engaging: ECB monetary policy communication in a changing world", *Occasional Paper Series*, No 274, ECB, Frankfurt am Main, September.

Work stream on non-bank financial intermediation (2021), “Non-bank financial intermediation in the euro area: implications for monetary policy transmission and key vulnerabilities”, *Occasional Paper Series*, No 270, ECB, Frankfurt am Main, September.

Work stream on productivity, innovation and technological progress (2021), “Key factors behind productivity trends in EU countries”, *Occasional Paper Series*, No 268, ECB, Frankfurt am Main, September.



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