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No 263, "The implications of globalisation for the ECB monetary policy strategy".
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Contents

Abstract

Since the European Central Bank's (ECB's) 2003 strategy review, the importance of macro-financial amplification channels for monetary policy has increasingly gained recognition. This paper takes stock of this evolution and discusses the desirability of further incremental enhancements in the role of financial stability considerations in the ECB's monetary policy strategy. The paper starts with the premise that macroprudential policy, along with microprudential supervision, is the first line of defence against the build-up of financial imbalances. It also recognises that the pursuit of price stability through monetary policy, and of financial stability through macroprudential policy, are to a large extent complementary. Nevertheless, macroprudential policy may not be able to ensure financial stability independently of monetary policy, because of spillovers originating from the common transmission channels through which the two policies produce their effects. For example, a low interest rate environment can create incentives to engage in more risk-taking, or can adversely impact the profitability of financial intermediaries and hence their capacity to absorb shocks. The paper argues that the existence of such spillovers creates a conceptual case for monetary policy to take financial stability considerations into account. It then goes on to discuss what this conclusion might imply in practice for the ECB. One option would be to exploit the flexible length of the medium-term horizon over which price stability is to be achieved. Longer deviations from price stability could occasionally be tolerated, if they resulted in materially lower risks for financial stability and, ultimately, for future price stability. However, model-based quantitative analysis suggests that this approach may require impractically drawn-out periods of deviation from price stability and potentially result in a de-anchoring of inflation expectations. An alternative option is to take financial stability into account by broadening the indicators and tools considered in monetary policy deliberations. An enhanced financial stability analysis of this nature would include two main elements: first, monitoring the build-up of financial vulnerabilities that can have adverse consequences for output and inflation in the not just medium term but also the longer run; and second, assessing the role of macroprudential measures in addressing those vulnerabilities and their interaction with the monetary policy stance.

JEL Codes: E3, E44, G01, G21.

Keywords: Monetary policy, financial stability, macroprudential policy, financial frictions, systemic risk.

Executive summary

Since the European Central Bank's (ECB's) 2003 strategy review, the importance of macro-financial amplification channels for monetary policy has increasingly gained recognition. This paper takes stock of this evolution and discusses the desirability of further incremental enhancements of the role of financial stability considerations in the ECB's monetary policy strategy.

From the legal perspective, a role for ECB monetary policy in financial stability can be justified to the extent that financial stability is a precondition for the primary objective of price stability. A further role can be envisaged in the context of the Eurosystem's duty to contribute to the smooth conduct of policies relating to the stability of the financial system.

From the economic viewpoint, any discussion of financial stability considerations in monetary policy must start from a recognition of the central role of the macroprudential policy framework that was introduced after the global financial crisis with the aim of addressing systemic risk. Macroprudential policy, along with microprudential supervision, is the first line of defence against the build-up of financial imbalances, because it is specifically designed to address the market imperfections and externalities which cause them. This is especially true in a monetary union, if financial cycles are not fully synchronised across countries and financial imbalances can develop within national borders.

The pursuit of price stability through monetary policy, and of financial stability through macroprudential policy, are to a large extent complementary. Financial stability is a precondition for price stability, as financial crises result in impairments in the monetary transmission mechanism and excessive deleveraging and de-risking, with adverse implications for the economic growth and inflation outlooks. By building resilience in the financial system and reducing the likelihood of financial crises, macroprudential policy can strengthen the role of monetary policy in ensuring price stability. By the same token, monetary policy can, in some circumstances, support financial stability. It does this by stabilising the economy and inflation during slowdowns. This also helps contain debt burdens in real terms, thus mitigating the risk of Fisherian debt-deflationary spirals and the losses that the financial sector would otherwise face. In periods of outright financial stress, the backstop role of monetary policy is crucial for financial stability as it can eradicate or contain the materialisation of uncoordinated equilibria such as fire sales or bank runs.

In specific circumstances, monetary policy and macroprudential policy may, however, be at odds, for instance when the build-up of systemic risk occurs in a situation of subdued inflation. In these circumstances, the issue arising is whether monetary policy should take the financial stability outlook into account. In principle, if macroprudential policy were able, independently of monetary policy, to maintain financial stability in all circumstances, there would be no grounds for this to happen. However, it is not possible to ensure that the conditions whereby price stability and financial stability can be pursued independently of each other are met in practice.

Macroprudential policy may not be able to pursue financial stability independently of monetary policy, given the possible limitations of the macroprudential framework and spillovers between the two policies. While the evidence suggests that, despite some uncertainty concerning their transmission mechanism, macroprudential policy instruments work in the intended direction, there is reason to believe that the macroprudential framework in the euro area is not yet complete. Moreover, spillovers between the two policies are material since they operate through common transmission mechanisms, with each having an impact on the objectives of the other. By limiting the build-up of leverage in the economy, macroprudential policy can slow down monetary policy transmission, with adverse implications for the price stability objective.

The literature has recently focused on mechanisms whereby monetary policy, through both conventional and unconventional measures, can in principle also adversely influence financial stability. The presence of a monetary policy risk-taking channel in the run-up to the global financial crisis is well established. A low interest rate environment creates incentives to engage in more risk-taking; this can become excessive and lead to the build-up of systemic risk. More recently, the debate has also focused on the possible adverse implications of low interest rates on the profitability of financial intermediaries and hence on their capacity to absorb shocks. The evidence suggests that these adverse effects have been material for some categories of non-banks and that for banks they have been allayed by general equilibrium offsetting factors; these originate from the economic stimulus provided by monetary accommodation and by an effective prudential framework that has mitigated excessive risk-taking. The outlook for bank profitability can be expected to worsen, to the extent that the savings/investment imbalances that have driven the real equilibrium rate to a low level persist. Indeed, the adverse side effects of low rates can be expected to increase over time; this implies that the overall balance, including offsetting factors, could progressively worsen in future if they are not alleviated by structural adjustments in the financial sector.

There is, therefore, a conceptual case for monetary policy to take financial stability considerations into account. When the conduct of monetary policy can contribute to the accumulation of financial imbalances, a first important response is to design and calibrate its instrument mix with a view to minimising the possible negative impact on financial stability. A notable case in point is the ECB’s targeted long-term refinancing operations (TLTROs). These entail a lending target that excludes housing loans, the aim being to avoid contributing to the formation of real estate bubbles. More broadly, monetary policy could also take financial stability into account by acting symmetrically over the financial cycle and by tightening to “lean against the wind” when systemic risk builds up and loosening to “clean” when systemic risk is realised. There is broad consensus on the need for aggressive monetary actions to restore financial stability and the functioning of the monetary policy transmission mechanism in the midst of a financial crisis, with possible distortions in ex ante incentives to be addressed by an effective macroprudential framework. After some time, however, aggressive monetary easing, especially in the form of unconventional measures, can produce side effects that affect financial stability. Mechanically leaning against the wind (hereinafter also referred to as “leaning”) is more controversial, since it may impose significant costs in terms of economic activity and inflation. The experience of other leading central banks in recent years has shown that interest rate hikes to lean against the wind have been rare and, in some instances, problematic.

A possible option for the ECB to take financial stability considerations into account is to exploit the flexible length of the medium-term horizon over which price stability is to be achieved. This would mean that longer deviations from price stability could occasionally be tolerated if they resulted in materially lower risks for financial stability and, ultimately, for future price stability. Model-based quantitative analysis suggests that adjusting the length of the medium term would require impractically lengthy periods of deviation from price stability. Moreover, lengthening the medium term would backfire if it led to a de-anchoring of inflation expectations. A careful analysis of the costs and benefits of this policy, which balances current versus future price stability risks, would therefore be needed, not least in view of the high degree of uncertainty surrounding a trade-off of this nature.

One practical approach would be to take financial stability into account by broadening monetary policy indicators and tools in order to monitor the build-up of financial imbalances. An enhanced monetary policy-oriented financial stability analysis would aim to improve policy outcomes by considering the above-mentioned interactions between objectives and policies. It could also reduce the uncertainty connected with the intertemporal trade-off that might arise in pursuing price stability when financial stability risks are high. The input currently produced for the Governing Council could be usefully enhanced in two main directions, which would also require a sustained research effort to develop the necessary quantitative tools: first, watching over the build-up of financial vulnerabilities that can have adverse consequences for output and inflation in the not just medium term but also the longer run; and second, assessing the role of readily enacted and planned macroprudential measures in addressing those vulnerabilities and their interaction with the monetary policy stance.

This analysis could be an important factor in fostering a deeper understanding of the possible side effects of monetary policy, enhancing the cost-benefit analysis of calibrating a given combination of conventional and unconventional monetary policy instruments, and fostering better outcomes across the two policy domains while respecting their mandates. It would also allow the ECB to fulfil its duty of contributing to the smooth conduct of policies relating to the stability of the financial system. The analysis could be presented as part of the Governing Council’s monetary policy meetings, in the same way as staff presentations on conjunctural and financial market developments. In view of the slower-moving nature of the underlying developments, the presentation could be less frequent, for example every six months.

1 Introduction

Our appreciation of the importance of conditions in the financial sphere of the economy for monetary policy and their practical incorporation in policy deliberations has undergone profound changes since the ECB's monetary policy strategy review of 2003. While the comprehensive analysis of a wide range of economic and financial variables has always been part of the ECB's strategy, the assessment of financial conditions has become increasingly important over time. The global financial crisis was a sharp reminder of the importance of a well-functioning financial sector for the real economy and inflation. On the analyses front the macroeconomic models used by all central banks, including the ECB, have been enhanced to acknowledge the importance of the financial sector for the transmission of monetary policy. Economic analyses devote more space to financing conditions, the monitoring of impairments in the transmission mechanism and macro-financial amplification channels. In parallel with monetary policy, the institutional framework governing the regulation of the financial sector has also evolved. Macroprudential frameworks have been introduced and banking supervision has been intensified and standardised across countries.

Taking stock of the significant changes in the way that financial stability considerations affect the conduct of monetary policy, this paper endeavours to shed light on open issues that may call for incremental changes in the ECB's strategy. These include the role of financial stability considerations in crisis periods and in normal times; and the general desirability of further enhancements in the analysis of financial impairments and financial stability with respect to monetary policy, including the assessment of its interactions with macroprudential policies.

1.1 What is the legal basis for the ECB taking financial stability into account when conducting monetary policy?

The role of the ECB with regard to financial stability can be examined from three different perspectives. First, Article 127(5) of the consolidated version of the Treaty on the Functioning of the European Union (TFEU)[1] sets out the duty of the European System of Central Banks (Eurosystem or ESCB) to contribute to the smooth conduct of policies pursued by competent authorities relating to the stability of the financial system. Article 127(5) thus establishes a separate task of the Eurosystem, with two characteristics: (a) it cannot interfere with or jeopardise the attainment of the primary objective of maintaining price stability; and (b) it has a contributory scope in that the Eurosystem does not bear the primary responsibility for financial stability and has no exclusive powers relating to it. However, in terms of its own contribution, the ECB acts independently.

1 Consolidated version of the Treaty on the Functioning of the European Union (OJ C 326, 26.10.2012, p. 7)

Second, under Article 127(1) of the TFEU financial stability might be a necessary means of pursuing price stability. Thus, financial stability would not itself be the objective but rather a means to attain another objective (price stability). Addressing financial stability issues in order to promote price stability would only be possible under certain conditions. Financial stability-oriented measures need to pertain to the primary objective laid down in Article 127(1) of the TFEU: they must be necessary to preserve the transmission mechanism and thus the singleness and effectiveness of monetary policy, and they must respect the principle of proportionality. In any case, Article 127(1) of the TFEU cannot be used to circumvent the solely contributory competence ascribed to the Eurosystem by the *lex specialis* of Article 127(5) by indirectly transferring direct responsibility for financial stability to the Eurosystem.

Third, financial stability is significant in the prudential supervision context, on the basis of the Single Supervisory Mechanism (SSM) Regulation[2] adopted under Article 127(6) of the TFEU. The SSM Regulation establishes that the stability of the financial system within the Union and within each Member State is one of the objectives of prudential supervision. Article 5 confers certain macroprudential tasks and the use of certain tools upon the ECB. The Regulation does not grant the ECB a general competence with regard to financial stability. When acting in the financial stability context the Eurosystem must, as in every action it undertakes, respect the principles of institutional balance and open market economy, the prohibition of monetary financing and the principle of conferral. In addition, and in line with Article 296 of the TFEU, the ECB must justify its decisions by explaining and confirming its careful and impartial examination of all relevant elements of the situation in question and stating in an adequate and transparent manner the grounds for its decision. The detailed observations on these rules contained in ECB (2021a) also apply with regard to financial stability.

1.2 What is the economic case for using monetary policy to address financial stability concerns, given the presence of macroprudential policy?

In the aftermath of the global financial crisis, lawmakers introduced new macroprudential tools and established new authorities with the aim of addressing systemic risk. Typically, systemic risk tends to accumulate during economic upswings and to materialise during the downswing. This process is not necessarily synchronised with the alternation of standard economic expansions and recessions: it has therefore been defined as the “financial cycle”. A stylised characterisation of the financial cycle is the repetition of (i) “boom” periods, marked by the formation of macro-financial imbalances such as rising indebtedness, increasing prices of financial assets and higher risk-taking; and (ii) “bust” periods during which the systemic risk materialises, leading to falls in credit and asset prices

2 Council Regulation (EU) No 1024/2013 of 15 October 2013 conferring specific tasks on the European Central Bank concerning policies relating to the prudential supervision of credit institutions (OJ L 287, 29.10.2013, p. 63).

and recessionary effects on the real economy. This inherent pro-cyclicality of the financial system is the reason behind the introduction of macroprudential policy, which is designed to increase the overall resilience of the financial sector and to act countercyclically over the financial cycle – i.e. to tighten ex ante during the build-up phase and relax ex post after the materialisation of systemic risk.

Macroprudential policy, along with microprudential supervision, is the first line of defence against the build-up of financial imbalances because it is specifically designed to address the market imperfections and externalities which cause them. The pro-cyclicality of the financial system can be traced back to the distortions inherent in financial relationships. These stem from the existence of asymmetric information (e.g. between banks and their borrowers), which results in adverse selection and moral hazard problems, and from limited enforcement technologies, which lead to collateral constraints. Moreover, individual risk management decisions impose costly externalities on the financial system. Macroprudential policy instruments can be directly mapped to these market imperfections and externalities and can thus be tailored to address them without having broad-based, unintended repercussions on the wider economy. As financial stability risks can in part be addressed through microprudential supervision, the coordination of micro and macroprudential policies poses additional challenges which are not discussed in this paper.

Macroprudential policy is especially beneficial in a monetary union if financial cycles are not fully synchronised across countries. Macroprudential policies targeting country-specific developments will often be more effective and appropriate than area-wide measures in reacting to asynchronous financial cycles.

For this reason, the macroprudential set-up in the euro area is both unique and complex as macroprudential responsibilities are shared among multiple institutions. National macroprudential authorities are the first line of defence in dealing with localised financial stability risks. Supranational authorities such as the ECB at the euro area level and the European Systemic Risk Board (ESRB) at the European Union (EU) level play an important role in addressing risks that are common to the different jurisdictions, including in relation to potential cross-border spillovers arising from insufficient action to counter financial imbalances or adopt macroprudential measures. The ECB has macroprudential top-up powers, which means that it can only be more, rather than less, stringent than national authorities in imposing macroprudential policies. The scope of its macroprudential policy encompasses the banking system, not the financial sector as a whole. In addition, certain instruments – for example borrower-based instruments – lie outside the scope of the ECB’s mandate and can be applied only at the national level.

While macroprudential policy tools have been activated within this set-up in the euro area, the countercyclical component has so far been limited. Macroprudential policies focused initially on measures tackling risks to the residential real estate sector. After the experience of the global financial crisis, many euro area countries started to implement borrower-based macroprudential instruments such as loan-to-value (LTV) or debt service-to-income limits, often in a structural manner as a backstop against the excessive build-up of imbalances in this sector. In line with the phase-in of post-crisis regulatory reforms, macroprudential capital buffers for the banking system have also been activated in recent years. In an environment of increasing capital ratios, structurally low profitability and modest credit growth, however, further capital increases addressing cyclical risks have been difficult to justify.

The institutional design of macroprudential policy prompts new questions regarding its relationship with monetary policy. The scope for interaction between these two policy domains is wide because they operate through common transmission mechanisms, with each potentially having an impact on the objectives of the other. For example, lower monetary policy interest rates (also referred to as policy rates) aiming to restore price stability after a disinflationary shock will tend to stimulate credit demand. The ensuing expansion of banks' balance sheets may be accompanied by an increase in leverage and in financial stability risks. Conversely, increases in banks' capital requirements or in macroprudential capital buffers will increase the resilience of the financial system by triggering a reduction in bank leverage when this is deemed to be high. In so doing, however, if capital requirements are binding at the system level, they may also lead to a tightening of the bank lending channel, with an impact on the transmission of monetary policy and on inflation.

In many cases, particularly in the long run, the spillovers between monetary and macroprudential policy are positive, and there is complementarity between financial stability and price stability. Price stability, on the one hand, contributes to financial stability by eliminating inflation-related distortions in financial markets, containing the propagation of shocks via well-anchored inflation expectations and mitigating pro-cyclicality in the economy. The complementarity between price stability and financial stability is especially apparent after financial crises. In these situations, maintaining stable inflation also stabilises real debt burdens, thus averting the risk of Fisherian debt deflation and reducing financial stability risks. The other case where the complementarities come to the fore is when the shock comes from the financial sector itself (for example in the form of market runs, asset fire sales, etc.) and impairs the transmission mechanism. Targeted interventions by the central bank in the face of financial market runs or asset fire sales can not only repair impairments in the monetary policy transmission mechanism, but also stabilise the financial system. And financial stability, on the other hand, is a prerequisite for price stability as it supports the smooth transmission of monetary policy through the financial sector. Macroprudential policies can help monetary policy achieve its price stability objective by ensuring a resilient financial sector and mitigating the procyclical reinforcing loop between real and financial variables. Complementarities are particularly strong in a monetary union, where macroprudential policies targeting country-specific developments will not only contribute to maintaining financial stability in the countries where financial cycles are not synchronised, but also produce positive spillovers on price stability.

In other cases, the spillovers between monetary and macroprudential policy can be negative over short horizons. This may happen, for example, when tighter macroprudential measures weaken the transmission of expansionary monetary policy, or when monetary policy accommodation increases the risk of financial instability.

Even if these multiple interactions in principle provide scope for synergies between monetary and macroprudential policy, the associated gains are not always material. Under two conditions, these gains could be negligible: if the spillovers were quantitatively unimportant, or if macroprudential policy were always able to perfectly and costlessly undo the impact of monetary policy on the macroprudential policy stance, and vice versa for monetary policy. In this situation, the Tinbergen principle could be applied, i.e. a one-to-one mapping of instruments to objectives. Accordingly, monetary policy would focus solely on price stability while macroprudential policy would focus solely on financial stability. In this case too, however, to determine its own stance each policy would need to take the stance of the other into account. Conversely, if the side effects were sizeable or the two policies were only imperfectly able to undo them, the benefits of taking the spillover effects on the other policy into account could occasionally be substantial. While remaining predominantly focused on its own objective, neither policy should ignore its effects on the goals of the other. The next two sections discuss in more detail whether the aforementioned two conditions which would justify the application of the Tinbergen principle apply in recent euro area experience.

There are clearly identified mechanisms through which monetary policy can adversely influence financial stability. The impact of low interest rates on financial stability, through two channels in particular, has received considerable attention recently. The first channel refers to the potential impact of low rates on the shock-absorption capacity of financial intermediaries that stems from the effect on their profitability and by extension their internal capital generation capacity. The second, related, channel refers to the incentives that may be created for intermediaries to engage in excessive risk-taking in a low interest rate environment, ultimately leading to the build-up of systemic risk and potential asset price misalignments.

There is abundant empirical evidence that declines in interest rates reduce banks' lending margins. This relation is ascribable to the sluggish and incomplete pass-through of the policy rate to the cost of deposits in a low-rate environment due to the presence of a zero lower bound (ZLB).

While there is evidence that the banking sector has to some extent been able to adjust to the low-rate environment, its ability to continue to do so is not guaranteed. Since negative policy rates were first adopted in 2014, the share of deposits carrying negative rates has been gradually increasing. This is particularly true for overnight corporate deposits, where negative-rate deposits currently stand at about one-third of the total. Even in those segments where the pass-through into negative territory has been material, the largest share is still represented by deposits whose rate is stuck at zero. Empirical evidence indicates that the adverse implications of low rates on margins are exacerbated when they persist for extended periods of time. This may reflect the fact that the mitigation provided by the stock of seasoned long-term fixed-rate loans which are unaffected by changes in market conditions and mature only gradually is eventually depleted.

The overall impact of very low rates on bank profitability has so far been broadly neutral, given the presence of offsetting effects on provisions. When low rates reflect accommodative monetary policy, whether conventional or unconventional, they are associated with a more positive impact on the outlook for the economy and ultimately with lower default risk. Bank provisioning costs are therefore reduced. The overall net impact on bank profitability is ultimately an empirical question, the answer to which also depends on the characteristics of the banking system and the duration of the spell of low rates engineered by monetary policy. As shown in ECB (2021b), the lower required provisions and larger lending volumes induced by monetary policy accommodation have so far broadly offset the adverse impact of low rates on profitability resulting from lower lending margins. The outlook for bank profitability can be expected to worsen for as long as the savings/investment imbalances driving the real equilibrium rate to a low level persist. Indeed, the adverse side effects of low rates can be expected to increase over time; this implies that the overall balance, including offsetting factors, could in the future progressively worsen. Empirical studies seeking to identify the impact of monetary policy-induced rate cuts by examining their effect on stock prices, a more forward-looking measure of bank performance than accounting profitability, reach mixed conclusions. Some do, however, point to the presence of non-linearity, with the impact of a given rate cut becoming less benign or more adverse when rates are low to begin with.

Lower interest rates increase banks' risk-taking incentives. A large body of empirical analyses has produced evidence that low rates further incentivise risk-taking by financial intermediaries trying to make up for reduced margins. In the banking sector, mortgage portfolios with higher debt-to-income (DTI) and LTV ratios and exposure to higher-yielding assets tend to feature higher risk-taking. In some countries these developments are associated with very high valuation levels in residential real estate and other asset markets. Evidence has emerged in recent years that the risk-taking channel is also affected by the configuration of interest rates along the entire term structure, which in turn is influenced by unconventional monetary policy. For example, a flatter yield curve induced by quantitative easing (QE) will, on the one hand, reduce incentives for risky maturity transformation and, on the other, lead to more risk-taking along other dimensions, including additional loan creation. Indeed, risk-taking is to some extent also an intended effect of monetary policy and isolating the extent to which it is excessive presents clear methodological challenges. For the banking sector, signals consistent with excessive risk-taking have been documented for consumer loans, where risk premia seem inadequate compared with the level of risk embedded in this business line. The relationship between rates and risk-taking also presents possible non-linearities in terms of profitability, with risk-taking behaviour being especially encouraged in a low-for-long interest rate environment.

Low rates are relatively more detrimental to the stability of non-banks. Insurance corporations and pension funds, unlike banks, are mainly exposed to relatively safe assets. They do not therefore benefit to the same extent from offsetting factors related to the macroeconomic general equilibrium effects associated with lower rates, when these reflect a more accommodative monetary policy, or from the corresponding reduction in credit risk. This is particularly relevant in the light of the significant changes in the shape of the financial system since the last monetary policy strategy review, with the greater role played by non-bank financial intermediation and the resulting diversification of financing sources in the economy.

Some of the side effects of monetary interventions can be mitigated by ensuring that monetary policy instruments are appropriately designed and, most importantly, that an adequate prudential framework is in place; the latter is currently missing for non-banks. Monetary policy has evolved with a view to mitigating its financial stability spillovers. One example of this is TLTROs, which entail a lending target that excludes housing loans, the aim being to avoid contributing to the formation of real estate bubbles. Moreover, the favourable rates at which banks can finance themselves through TLTROs, provided they meet their lending targets, supported their margins, thereby offsetting some of the pressure on their profitability. Likewise, the introduction of the tiering system has exempted part of banks' excess reserves from negative rates, thereby mitigating some of the side effects of negative interest rate policies on bank profitability. In this respect, financial stability analysis can help inform the design and calibration of the different monetary policy instruments. Most importantly, while the macroprudential framework has already proved its effectiveness in alleviating excessive risk-taking by banks, in a low-rate environment increasing credit and liquidity risk-taking by non-bank financial intermediaries is not tamed by the current macroprudential framework. The possibility of procyclical risk-taking, risks associated with fund leverage and excessive liquidity mismatches in parts of the non-bank sector are key sources of vulnerability.

Some of the already identified vulnerabilities of non-banks crystallised in March 2020, especially for money market funds and open-ended funds structurally exposed to liquidity risk. This posed material risks for the monetary policy transmission mechanism, ultimately calling for central bank interventions. A properly developed and calibrated macroprudential framework for the non-bank financial sector could mitigate such risks and thus support monetary policy in fulfilling its price stability mandate. Against this background, more work on how to enhance the macroprudential framework for non-bank financial intermediaries may be warranted, including the analysis of potential costs.[3]

Monetary policy, both conventional and unconventional, can also have a positive impact on financial stability. This is especially true ex post, once risk has materialised, and accommodative monetary policy can help improve the economic outlook. By boosting employment and income, monetary policy actions strengthen borrowers' financial positions, thus mitigating defaults. The ECB has adopted specific instruments to prevent inefficient equilibria, with resulting fire sales in sovereign debt markets and retail and wholesale deposit runs. However, even considering their important backstop role, these monetary policy interventions could also entail adverse financial stability side effects. When agents anticipate that the central bank is willing to step in whenever it is necessary, ex ante incentives may be

[3] See ECB (2021d).

distorted, leading investors to engage in excessive levels of risk-taking. This can lead to a trade-off between ex ante and ex post efficiency that can be mitigated by adequate macroprudential policies.

In the euro area the spillovers, both adverse and beneficial, of low rates and monetary policy can be heterogeneous across jurisdictions. Differing positions in the business and financial cycles and the differing structural characteristics of the financial sector are important factors in the transmission of monetary policy shocks to key financial variables.

The spillovers outlined above could in principle be offset by appropriate and effective macroprudential policies. In this case the optimal policy mix would most likely still be one in which monetary policy focuses exclusively on price stability. Solid direct empirical evidence on the effectiveness of macroprudential policies is still relatively scarce compared with that available for monetary policy, owing to their relatively recent introduction in the euro area and in most advanced economies. Nevertheless, the evidence is growing quickly and a number of results already suggest that macroprudential policy instruments, when available and activated, do work in the intended direction.

There are two main reasons, however, to believe that the macroprudential framework in the euro area is not yet complete. The first is that it has insufficient powers over non-bank financial intermediaries, which make up a substantial proportion of the financial system. The second refers to the design of the existing macroprudential framework for banks. This may entail limitations in the ability to act countercyclically, for example by releasing macroprudential capital buffers to deal with exogenous shocks affecting the financial system and, ultimately, the real economy. This increases the need to resort to aggressive monetary policy when facing severe negative shocks.

If the macroprudential policy framework is not fully effective, there is a conceptual case for monetary policy to take financial stability into account. Monetary policy would act symmetrically throughout the financial cycle, by tightening to lean against the wind when systemic risk builds up and loosening to clean when systemic risk is realised. In practice, leaning implies that monetary policy would respond not only to the usual indicators of price/output stability, but also to key indicators of the build-up of financial imbalances such as leverage, credit, or the net worth of financial intermediaries.[4] Conversely, cleaning would involve a response to indicators of financial instability/crisis, such as an unwarranted increase in market spreads or, more generally, impairments in the transmission of monetary policy.

The potency of monetary policy in addressing financial imbalances derives from its capacity to "get in all the cracks" and thus reach all corners of the financial system, regardless of the regulatory and supervisory framework. Recent models show that monetary policy can in principle support financial stability, especially when the latter is endangered by excessive credit or leverage, which can

[4] Other indicators could be considered, including the private sector's debt service ratio, i.e. households' and non-financial companies' ratio of interest payments plus amortisations to their income (see Juselius et al., 2017).

be affected by the conventional instruments of monetary policy. In such instances, the combined implementation of leaning and cleaning may also be beneficial from the price stability perspective, because a state of generalised financial exuberance can often coincide with a situation of mounting inflationary pressure. Indeed, a monetary policy reaction that ignored financial conditions would risk being too expansionary in normal times and too contractionary in crisis times.

The two phases of build-up and realisation of systemic risk may in practice be intertwined. Since financial crises can have persistent adverse effects on the economy, it is easy to argue that the cleaning phase of monetary policy should be correspondingly long. However, a prolonged period of monetary policy easing motivated by the adverse inflation outlook could at some point trigger the build-up of excessive risk, which would call for a switch to leaning. The appropriate timing of this switch is particularly difficult to determine. On the one hand, a delayed realisation that imbalances are again building up could expose the economy to the risk of financial dominance further down the line. This could potentially force a delayed monetary policy response to upward price pressures for fear of instigating debt servicing problems for overstretched borrowers and losses for financial entities. On the other hand, a hasty transition to leaning would lead to unnecessarily high unemployment, possibly reducing the debt-bearing capacity of the private sector and triggering a de-anchoring of inflation expectations.

There is broad consensus on the need for resolute monetary actions to restore financial stability and the functioning of the monetary policy transmission mechanism in the midst of a financial crisis. Moreover, in the recovery phase impaired financial conditions could impose a trade-off between inflation and output stabilisation. In these circumstances a looser monetary policy than needed to restore short-term inflation dynamics may speed up the recovery by helping relax financial conditions and thereby protect medium-term inflation dynamics. Any such interventions in crisis times, however, should take into account potential moral hazard concerns.

The desirability of a very prolonged monetary policy expansion after a financial crisis, especially through unconventional measures, is more debatable. While in the aftermath of a crisis asset purchase programmes are likely to speed up the recovery, with time they may also produce increasingly adverse side effects on the financial sector. As discussed above, an environment of persistently low long-term rates can be expected to have negative consequences on banks' interest rate margins, as it leads to a progressive reduction of the return on their assets to levels close to the cost of lower-duration liabilities.[5] In the absence of a sustained economic recovery, lower interest rate margins would translate into low profitability, which affects banks' ability to generate capital and could thus hamper their provision of credit to the economy. These possible side effects need to be weighed against the risk of an early withdrawal of unconventional measures, and the ensuing increase in long-term rates, stifling the demand for credit and choking the

[5] See also ECB (2021b).

recovery. This would also have adverse implications for lenders' balance sheets and profitability.

Leaning against the wind is more controversial. The main criticism of leaning against the wind with monetary policy is that it may be too blunt an approach to deal with financial stability effectively. Both empirical evidence and quantitative simulations suggest that the use of interest rates to lean may impose significant costs in terms of economic activity. Indeed, existing estimates, calibrated on the euro area economy, of the costs and benefits associated with using monetary policy to rein in financial imbalances suggest that the cumulative net benefit remains negative. Moreover, the lack of a single generally accepted measure of financial stability risks raises significant communication and accountability challenges, which are compounded by the fact that the length of the financial cycle is typically estimated to far exceed that of the business cycle. The experience of other leading central banks in recent years shows that the application of an explicit leaning approach is rare and, in some instances, has proven problematic. In the euro area the potential lack of synchronicity in the build-up of financial stability risks across Member States places an additional premium on the use of country-specific macroprudential policies to address these risks with respect to area-wide monetary policy.

While opinion remains divided, financial stability is an even greater concern in a world of persistently low "natural" interest rates where monetary policy is likely to be more frequently constrained by the effective lower bound (ELB). This strengthens the rationale for adopting preventive policies to limit the ex ante build-up of systemic risk. An effective macroprudential framework that extends beyond banks becomes essential to minimise the risk of financial crises destabilising the economy when monetary policy space is limited. If the macroprudential framework is not fully effective, the case for monetary policy to lean against the wind is also reinforced.

A possible option for the ECB to take financial stability into account is to exploit the flexible length of the medium-term horizon over which price stability is to be achieved. In the current formulation the horizon is dependent on the nature of the shocks buffeting the economy. Certain macroeconomic shocks risk generating large volatility in GDP and employment. To avert this outcome, they warrant a short-term deviation from price stability, provided it is restored over the medium term. A similar reasoning could conceivably apply to financial stability. If, in specific circumstances, averting the risk of financial instability called for a temporary deviation from price stability, a monetary policy oriented to the medium term might resolve this tension by extending the horizon over which price stability is to be achieved.

Conflicts between price and financial stability do not appear to be frequent but can be consequential. Such conflicts arise when expected inflation is below the level viewed as consistent with price stability at the same time as indications of financial stability risks are present. In such cases monetary policy may seek to attenuate this conflict by allowing a more patient return of inflation to the target level to avoid triggering a further build-up of financial stability risks.

Model-based quantitative analysis suggests that adjusting the length of the medium term would be a blunt tool to address financial stability concerns, in that it would require particularly drawn-out periods of inflation undershooting. An adjustment of the monetary policy horizon will be necessary if the degree of monetary policy tightening required to contain financial instability risks is, from a price stability perspective, large. Since phases of financial exuberance can be long-lived, however, the medium term may need to be extended considerably in these cases, as a period of disinflation may be necessary before price stability can be restored. For instance, simulations based on a medium-scale quantitative macroeconomic model that builds on well-established frameworks show that in a boom arising from a long-lived asset price bubble, a tighter monetary policy to curb the bubble would entail an undershooting of inflation that persists for more than ten years. A considerable extension of the period of undershooting is also entailed in a scenario where the bubble eventually bursts, leading to the overall conclusion that in cases where a prolongation of the horizon can indeed curb financial stability risks, the necessary extension is possibly too long to be considered as a plausible horizon for monetary policy.

Keeping inflation expectations well anchored is critical in assessing whether to adjust the length of the monetary policy horizon to address financial stability risks. If the monetary policy reaction to financial conditions requires undershooting inflation for an extended period and inflation expectations are formed in a backward-looking manner, risks of de-anchoring loom large. If inflation expectations do move downwards then real rates will be higher, as will the costs in terms of inflation undershooting. Simulations based on a simple framework suggest that if inflation expectations are backward looking, the optimal policy response to average credit growth rates would be essentially identical to the case where monetary policy has no impact on the probability of a crisis. Even for higher levels of credit growth the implied policy response would be only marginally higher if expectations were backward looking. These findings also suggest that the assessment of whether it is advisable to extend the horizon in the face of financial stability risks is state dependent. The net benefits are larger if the starting point for inflation is not very far from the target. Conversely, if it is well below the target the risk of inflation expectations becoming de-anchored is more sizeable if they are backward looking, which raises the cost of further spells of undershooting the target.

1.3 What concrete steps can be taken going forward?

A more explicit role for enhanced financial stability analysis in the monetary policy decision-making process seems advisable. Such a strategy can be justified for at least one fundamental reason: as the Eurosystem's current toolkit consists of a wide range of monetary policy instruments, the Governing Council should continue to prioritise the use of tools that have the least adverse impact on financial stability, assuming identical effects on price stability. Consequently, to better inform and guide the Governing Council in its choice of monetary policy instruments, an enhanced role for financial stability analysis would appear to be desirable. Although monetary policy decision-making already takes financial stability risks, mainly in relation to the monetary transmission mechanism, largely into account through the Quarterly Monetary Assessment (QMA) and the Financial Stability Review (FSR), this input could be usefully enhanced in two main dimensions. First, by looking deeper into the longer-term build-up of financial vulnerabilities that can have adverse consequences for output and inflation as well as for the monetary transmission mechanism over the longer horizon than typically considered by the QMA. This analysis should go beyond the traditional monetary policy horizon and should also be disaggregated, at sector and jurisdiction level. Second, an enhanced analysis of financial stability risks should include an appraisal of the role of readily planned and implemented macroprudential measures in addressing those factors which pose longer-term risks from a monetary policy perspective. In general, adding a systematic, monetary policy-oriented discussion on the build-up of financial imbalances and the impact of macroprudential policies might prove useful. It could be an important additional factor in eliciting a deeper understanding of the potential side effects of monetary policy, in enhancing the proportionality analysis of a given combination of conventional and unconventional monetary policy instruments and in fostering a more efficient policy mix across the two policy domains while respecting their respective mandates.

The enhanced financial stability analysis for monetary policy should be embedded in the monetary policy decision-making process. As regards its delivery to the Governing Council, the analysis described above could be presented during monetary policy meetings, as is done with staff presentations on conjunctural and financial market developments. Another option, in view of the slower-moving nature of the underlying developments, could be for this presentation to be delivered less frequently (for example biannually). Flexibility for updates outside this cycle should be retained for cases in which the financial stability environment evolves rapidly.

To be effective, the integration of financial stability considerations in the monetary policy debate also requires a sustained research effort to develop the necessary quantitative tools. Developing such tools is desirable given the considerable practical difficulties involved in the possible implementation of the leaning approach, or of carefully calibrated adjustments to the medium-term orientation. A specific area where advances should be made is the design of a unified framework for the cost/benefit analysis of different monetary policy tools and in particular their financial stability implications. This framework would also benefit from specifying an operational definition of financial stability, as in the case of price stability.

2 Interactions between monetary policy and macroprudential policy

2.1 Background and institutional set-up

The global financial crisis illustrated that financial imbalances can have significant real economic effects when they unravel.[6] In addition, the unravelling of financial imbalances (e.g. freezes in bank funding markets, excessive deleveraging) can impair the transmission of monetary policy.[7]

It also became evident that microprudential supervision was not necessarily enough to ensure a safe and resilient financial system. In particular, the presence of externalities and endogenous behaviour could lead to the development of vulnerabilities, thereby leading to pronounced levels of systemic risk.[8]

These insights were also rooted in the recognition that financial systems are inherently procyclical and that the resulting financial cycles are in general longer than business cycles (see, for example, Drehmann et al., 2012). The pro-cyclicality of the financial system can be traced to the various distortions inherent in financial relationships. These stem from the existence of asymmetric information (for example between banks and their borrowers), which results in adverse selection and moral hazard problems, from imperfect enforcement technologies which lead to collateral constraints, and from explicit or implicit access to the public safety net. This combination can result in distortions in individual behaviour, where intermediaries or households do not internalise the impact of their individual decisions (e.g. default or deleveraging) on the system, thus potentially giving rise to excessive risk-taking and pro-cyclicality.[9]

Conceptually, therefore, macroprudential policy is motivated by market imperfections. These distortions create externalities that have an aggregate impact on the level of output and also on its composition over time and across different sectors (Cúrdia and Woodford, 2010; Carlstom and Fuerst, 2010). According to De Nicoló et al. (2012), we can group these externalities into: (i) externalities that arise from strategic interactions of banks and other financial institutions that may lead to the build-up of vulnerabilities in the expansion phase of the financial cycle;[10] (ii) externalities related to interconnectedness, caused by the propagation of shocks

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6 See ESRB (2014), Lo Duca et al. (2017), Aikman et al. (2019), Laeven and Valencia (2020) and Kashyap and Siegert (2020).

7 See Abbassi et al. (2015), Pelzl and Valderama (2019) and Acharya et al. (2020b).

8 According to the ECB, systemic risk is "*the risk that financial instability will become so widespread that it impairs the functioning of the financial system to such an extent that growth and welfare suffer materially".* For some early contributions on the concept of systemic risk, see de Bandt and Hartmann (2000) and de Bandt et al. (2009).

9 Important contributions include those of Lorenzoni (2008), Mendoza (2010), Bianchi (2010) and Adrian and Shin (2014).

10 See Brunnermeier and Sannikov (2014a) and Boissay et al. (2016).

from systemic institutions;[11] and (iii) externalities related to fire sales of assets, mainly during the downward phase of the cycle, leading to a generalised fall in asset prices and an amplification of the shock.[12] Hence, there is a risk of financial developments becoming detached from fundamental real economic developments, which may lead to the build-up of unsustainable financial imbalances whose unravelling ("sudden busts") could have detrimental short and long-run implications for economic growth (see Hanson et al., 2011). This provides a role for both monetary policy and macroprudential policy to mitigate the risks of such divergences between the real and financial cycles.

As a result, in the aftermath of the global financial crisis regulators introduced new macroprudential authorities and tools with the aim of addressing systemic risks pre-emptively by increasing the resilience of the financial system.[13] Systemic risk tends to accumulate during the upswing of the financial cycle and materialise during the downswing. In a stylised characterisation, the financial cycle can thus be defined as the alternation of (i) "boom" periods, characterised by the formation of macro-financial imbalances such as the rise in indebtedness and in the prices of financial assets; and (ii) "bust" periods during which the systemic risk materialises, leading to sharp falls in asset prices and credit and to recessionary effects on the real economy. In its time-varying dimension, macroprudential policy was designed to act countercyclically over the financial cycle – i.e. to tighten ex ante during the build-up phase and relax ex post after the materialisation of systemic risk.

Macroprudential policy deals with these market failures through a broad and granular toolkit that can be mapped to externalities. Structural and countercyclical capital buffers play a central role in the macroprudential toolkit, since by strengthening the resilience of the banking system they are a suitable means of dealing with the three types of externalities mentioned above. Countercyclical capital buffers should be increased in the build-up phase of systemic risk and released once the risk materialises, while structural buffers are designed to deal with slower-moving structural risk posed by, for example, systemically important institutions. Liquidity requirements may be the most effective means of tackling fire sale externalities. In contrast, the application of restrictions on specific activities, assets classes or types of liability would probably be a more appropriate way of addressing strategic complementarities and interconnected sources of externalities. As systemic risk is an elusive and multi-faceted concept there is no one macroprudential tool that counterbalances the systemic risk stemming from the financial sector consistently and effectively. Depending on the nature of the systemic risk, the phase of the financial cycle, the potential unintended effects of the instruments, their complementarity and the reinforcing effects that some tools may have upon others, policymakers might deem it appropriate to use a combination of different instruments to tackle the same source of systemic risk (Leal and Lima, 2018). This has been the case with borrower-based measures that are often used intentionally in combination

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11 See Delli Gatti et al. (2012) and Acemoglu et al. (2015).

12 See, for example, Shleifer and Vishny (2010) and Diamond and Rajan (2011).

13 See ESRB Handbook (2018), Constâncio et al., (2019) and Cassola et al. (2019).

with the aim of targeting different elements of systemic risk or avoiding circumvention.

These recent developments in the institutional design of policymaking have introduced new questions regarding the relationship between macroprudential and monetary policies. The scope for interaction between these two policy domains is large, for three reasons: first, by each pursuing their own objectives they can each have an impact – intended or unintended – on the other's policy target; second, they work through common transmission channels, thereby affecting the same outcome variables; and third, some of the instruments used by both policies are very similar (Smets, 2014).

Macroprudential tools are more tailored to specific financial stability risks than standard monetary policy tools could be. In principle, macroprudential instruments can mostly be tailored to address risks concentrated in specific market segments and regions without having broad-based, unintended side effects on the wider economy.[14]

The relationship between macroprudential and monetary policies is particularly intricate in the EU and especially in the euro area, where the institutional set-up is both unique and complex. This intricacy can be explained by the fact that macroprudential responsibilities are shared among multiple institutions. At the EU level, the ESRB is responsible for the macroprudential oversight of the EU financial system and the prevention and mitigation of systemic risk. At the euro area level, the ECB has macroprudential top-up powers, i.e. it can only be more, rather than less, stringent than national authorities in imposing macroprudential policies, as envisaged in the SSM Regulation (Article 5). Its macroprudential policy remit applies only to euro area Member States and includes the banking system but not the other financial sectors. In addition, the ECB's toolkit is not complete, as some instruments – for example, borrower-based instruments – lie outside its scope and can be applied only at the national level.[15]

At the national level, authorities have the power to establish and implement macroprudential policy in their own jurisdictions, taking country specificities into account and in close coordination with the ESRB and the ECB (if the country is a member of the euro area). The various layers of macroprudential policy intervention in the EU – at national, euro area and Union levels – entail overlaps between these institutions which justify the need for appropriate coordination mechanisms to prevent inaction bias and minimise cross-border spillover effects (see ESRB handbook, 2018, and ECB, 2020a).

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14 See, for example, Angelini et al. (2012), Angelini et al. (2014), Gerke et al. (2017), Burlon et al. (2018), Darracq Pariès et al. (2019b), Aikman et al. (2019) and Van der Ghote (2019). While the literature suggests that the benefits of targeted macroprudential measures tend to outweigh the costs to the real economy, there could be redistributional effects through portfolio rebalancing by banks (see, for example, Acharya et al., 2020a). In addition, net benefits can differ considerably across different macroprudential instruments (see, for example, Chen et al., 2020).

15 Even at the national level, legal systems do not always include provisions for all types of borrower-based tools.

2.2 Complementarities and trade-offs between monetary and macroprudential policy

In principle, price stability and financial stability are complementary and can be mutually reinforcing. Price stability contributes to financial stability by eliminating inflation-related distortions in financial markets, by containing the propagation of shocks via well-anchored inflation expectations and by mitigating pro-cyclicality in the economy. Financial stability, on the other hand, is a prerequisite for price stability in that it supports the smooth transmission of monetary policy through the financial sector. Hence, macroprudential policies can help monetary policy achieve its price stability objective by containing the excessive accumulation of credit, limiting unsustainable developments in asset prices and mitigating the procyclical reinforcing loop between real and financial variables.[16]

While monetary and macroprudential policies should generally be seen as complementary, they may also have undesirable side effects on each other's domains. By addressing financial stability risks, macroprudential policy can stabilise the economy. In low interest rate environments this can reduce the risk of monetary policy becoming constrained by the ELB.[17] Conversely, the potentially negative effects of macroprudential policy on output during the build-up phase can be offset by accommodative monetary policy. Conflicts may also arise under specific economic and financial circumstances, since both policies work through common transmission mechanisms. These interactions may also depend on the stage of the financial cycle and its desynchronisation with the business cycle, and on the type of shock hitting the economy.

Monetary policy may have side effects on financial stability, which thus affect the conduct of macroprudential policy. Currently, these concerns are focused on the potential of low-for-long interest rates to contribute to the build-up of financial imbalances. However, monetary policy can have multiple effects on financial stability. The sign and size of these side effects are uncertain and depend on the phase of the financial cycle. They are interlinked with the transmission channels of monetary policy and work through the behaviour of borrowers, the risk-seeking behaviour of banks, and asset prices and exchange rates. Lower interest rates lead borrowers to take on more debt (the balance sheet channel) and banks to expand their balance sheets and increase leverage (the risk-taking channel). They induce asset price increases (in real estate prices, for example) that can trigger – and be exacerbated by – further increases in leverage (the asset price channel). An increase in interest rates in turn lowers the value of collateral and reduces the availability of new loans to borrowers (the borrower balance sheet channel). It also leads to an increase in default rates by negatively affecting borrowers' credit quality (the default channel), and to carry trades and capital inflows, mainly in emerging markets and small open economies, thus appreciating the currency (the exchange

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16 Bergant et al. (2020) show how, in an open economy, monetary policy could gain more room for manoeuvre for stabilising the domestic economy if macroprudential policies were able to insulate it from external shocks.

17 See, for example, Van der Ghote (2020) and Darracq Pariès et al. (2020b).

rate channel). Some of these effects are desirable from the monetary policy perspective, but they could pose financial stability risks if they became excessive.

Conversely, macroprudential policies may also run counter to the price stability goal. Acharya et al. (2020b) suggest that increasing banks' capital requirements at a time when monetary policy is easing poses a challenge to the effectiveness of the bank lending channel and the central bank's lender-of-last-resort function. Eickmeier et al. (2020) and Imbierowicz et al. (2020) also find that increases in capital requirements attenuate the general effects of monetary policy on interest rates and thus weaken the bank lending channel.[18] Loose macroprudential policy in times of financial distress may in turn run counter to a tight monetary policy stance when inflation is above target.

The intensity of these side effects can vary with the financial cycle. As financial imbalances build up, low policy rates can induce banks to take more risky loans and increase leverage. But if interest rates are tightened close to the peak of the financial cycle, they may induce risk-shifting and borrower defaults.

Complementarity between monetary and macroprudential policy occurs when the financial and business cycles are synchronised. If they are not, a trade-off may arise. If a financial boom (bust) coincides with high (low) inflation, tight (loose) policies reinforce one another.[19] As we discuss below, however, temporary conflicts may arise because financial cycles are distinct from business cycles and are, typically, longer in duration and greater in magnitude.[20] For instance, a situation in which the business cycle is in a contractionary phase may call for a decline in interest rates from a price-stability perspective, but such a decline may further fuel financial imbalances if the financial cycle is in an expansionary phase (Fahr and Fell, 2017). Naturally, this conflict could also arise in reverse (e.g. Lewis and Roth, 2019, van den End, 2015, and Agur and Demertzis, 2010).

The source of the shocks having an impact on the economy also influences the interaction of monetary and macroprudential policies. The optimal way to address a financial shock that leads to a build-up of financial imbalances is to focus on macroprudential policies that can be targeted at the financial sector distortion concerned. Conventional monetary policy is usually too blunt to deal with this sort of shock, since it also affects all other macroeconomic variables. This applies even if macroprudential and monetary policies are set non-cooperatively.[21] In the case of productivity shocks and how best to respond to them, research shows that the optimal policy mix depends on the nature of the financial distortion that is embedded

[18] At the same time, in the steady state a better capitalised banking sector can improve the bank lending channel; see, for example, Gambacorta and Shin (2016), Schmitz et al. (2017) and Darracq Pariès et al. (2019b). Clearly, these effects are weaker if part of the banking system holds capital buffers in excess of the minimum requirements.

[19] See Angelini et al. (2012). Some additional complementarities are detailed in Eickmeier et al. (2018), showing that monetary policy can lower the transitional costs of increasing capital requirements by lowering policy rates in a timely manner.

[20] Borio and Drehmann (2009a); Claessens et al. (2012, 2013); Schüler et al. (2015).

[21] Angelini et al. (2014); De Paoli and Paustian (2017).

in the modelling framework.[22] Monetary policy can be used on its own to counteract the effects of aggregate demand shocks as long as it is able to stabilise both inflation and output. In cases where lending imposes a systemic risk externality such as higher leverage, there is some scope for using macroprudential policy alongside monetary policy to mitigate the build-up of systemic risk.

Given these multiple interactions, in principle there is scope for interaction between both types of policy. Indeed, the optimal response of monetary and macroprudential policies to shocks will typically differ depending on whether the two types of policy are set in a cooperative or non-cooperative fashion.[23] As long as both policy types are unrestricted, however, the gains from cooperation in quantitative models turn out to be relatively small.[24] This is because monetary policy can undo the undesirable effects of macroprudential policy on price stability, and macroprudential policy can undo the side effects of monetary policy on financial stability.

If both policies are unconstrained, therefore, the optimal policy mix is one in which each policy domain focuses on effectively tackling its own distortions. If macroprudential policy is able to address the effects of financial distortions and monetary policy is able to counteract the effects of nominal rigidities, there is no need to substantially modify the conduct of each policy (IMF, 2013; Fahr and Fell, 2017). Monetary policy can primarily focus on price stability, which amounts to maximising welfare if nominal rigidities are the only distortions (Woodford, 2003). Macroprudential policy can in turn focus on financial stability. This is reminiscent of the Tinbergen rule, according to which each instrument should be paired with a specific objective. This allocation of responsibilities also follows the Mundell (1962) principle of effective market classification, which states that the optimal assignment of policies can be achieved by pairing instruments with the objectives they influence the most.

In the euro area, national macroprudential authorities are the first line of defence in dealing with localised financial stability risks, while supranational authorities have a coordinating role at the area-wide level. Monetary policy is common to all euro area countries and conducted in a “one-size-fits-all” manner. It may therefore have side effects on smaller countries, given their lower weight in determining euro area output and inflation (Cozzi et al., 2020), or on countries that are not in the same phase of the financial cycle as the majority. Against this background, targeted national macroprudential policies may be necessary in a monetary union to address asymmetric financial developments or shocks outside the scope of single monetary or macroprudential policy (Darracq Pariès et al., 2019b). The governance of macroprudential policy, based on shared responsibilities between the ECB and the national competent authorities, differs from the single monetary

[22] For instance, when there is only a borrowing collateral constraint, the literature suggests that monetary policy should be used alone, since credit restrictions imposed by macroprudential policy may counteract the stimulus provided by monetary policy. When the model incorporates endogenous financial distortions, the optimal policy mix will vary depending on both the strength and expected persistence of the productivity shock and the riskiness of balance sheets, including capital buffers and leverage.

[23] Angelini et al. (2014); De Paoli and Paustian (2017); Silvo (2019).

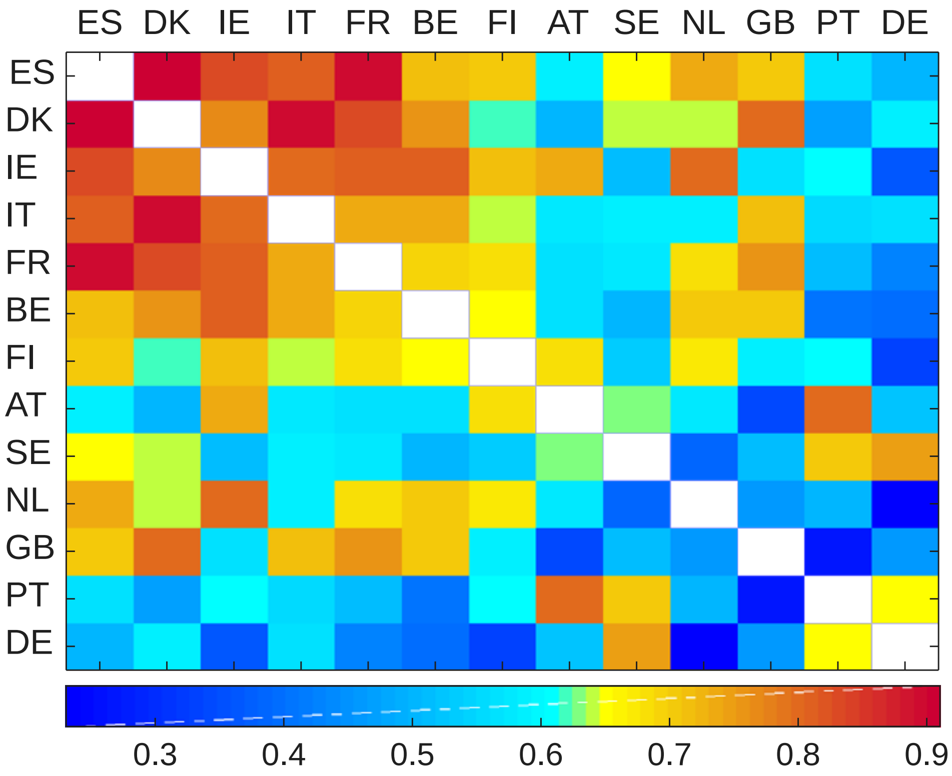
[24] See Martin et al. (2021) for a discussion of these results.

policy and/or single supervision, which are both much more centralised (see Cassola et al., 2019).

This shared responsibility reflects the fact that financial imbalances often build up along national boundaries as a consequence of national regulations or persistent fragmentation in the European banking sector and/or specific financial/asset markets (for example residential real estate), or that financial cycles remain significantly de-synchronised across the euro area.[25] This is illustrated in Chart 1, which depicts the low degree of synchronisation in financial conditions within various EU countries. Given this de-synchronisation, macroprudential policies targeting country-specific developments and/or using specific national macroprudential instruments (not available in EU regulations) will often be more effective and appropriate than area-wide measures (see Darracq Pariès et al., 2015, and Constâncio, 2018). This warrants a strong role for national authorities in identifying systemic risk and calibrating appropriate policy measures. At the same time, supranational authorities (such as the ECB at the euro area level and the ESRB at the EU level) play an important role in mitigating any cross-border spillover effects among closely integrated countries that may arise as a result either of insufficient action against financial imbalances or the macroprudential measures adopted (see Kok and Reinhardt, 2020). Against this background, cooperation and coordination by national and euro area authorities are crucial, especially given the euro area's unique institutional model for monetary policy and macroprudential policy, in which responsibility for financial stability is shared among several institutions.

25 See, for example, Schüler et al. (2015), Rünstler and Vlekke (2018) and Kunovac et al. (2018).

Chart 1
Concordance of financial conditions



Source: Schüler et al. (2015).
Notes: "Concordance" measures the degree to which financial cycles are synchronised across countries. The index is computed over the maximum available common sample across countries, i.e. from the first quarter of 1988 to the second quarter of 2020.

2.3 What changes if the macroprudential policy framework is only partially effective?

Our previous discussion suggests that macroprudential policy instruments should be considered the first line of defence against emerging or evolving financial stability risks. This implies that an effective macroprudential policy enables monetary policy to focus primarily on price stability (see, for example, Kashyap and Siegert, 2020).

As structured macroprudential frameworks have only been in place for a relatively short time (especially in advanced economies, including the euro area), solid empirical evidence on the effectiveness of macroprudential policies is still relatively scarce. The prevailing empirical evidence suggests that macroprudential policy instruments do seem to work as intended (see, for example, Galan, 2020). Numerous studies indicate that measures that restrict lending are generally effective in curbing house prices and credit.[26] Recent evidence also

[26] For a comprehensive survey, see Galati and Moessner (2018); see also Cerutti et al. (2017) and Eller et al. (2020).

suggests that these measures tend to have little effect on output and inflation.[27] However, there appear to be notable transmission lags, with a delayed impact that reaches its peak only after three years, and implementation lags.[28,29] Empirical evidence on the effects on the credit cycle of macroprudential policies applicable at financial institution level is less conclusive and more mixed (see, for example, Galati and Moessner, 2018).

There is evidence, moreover, that the effectiveness of macroprudential measures depends on the state of the economy. The effect of such measures on credit growth, for instance, is affected by monetary policy conditions. In particular, macroprudential tools that were adjusted to reinforce monetary policy (i.e. pushed in the same direction, when both types of policy were tightened or eased) were relatively more effective.[30] While macroprudential policies can in principle help manage financial cycles, they appear to work less well in bust periods (Cerutti et al., 2017).

Part of the evidence on the lack of effectiveness of macroprudential measures could be affected by measurement and/or methodological issues. Measures may be endogenous and partly anticipated by market participants, making it difficult to properly identify and gauge their effects. Additionally, the measurement of macroprudential policy is still quite rudimentary: most databases use discrete measures of macroprudential tightening or loosening, as opposed to continuous measures of the various macroprudential instruments. Furthermore, empirical studies do not typically allow for time or state-contingent parameters, which could be useful to capture the varying effectiveness of macroprudential policy. Lastly, given that the institutional macroprudential policy frameworks in Europe have only been in place for slightly less than a decade, empirical evidence regarding their effectiveness is still highly tentative. In the absence of conclusive evidence, there are also compelling reasons to believe that the macroprudential policy framework may not be fully effective.

2.3.1 Why the macroprudential policy framework may not be fully effective

A first reason for which the macroprudential policy framework may not be fully effective is that its scope does not sufficiently encompass non-bank financial intermediaries, which make up a substantial share of the financial system. Since the global financial crisis, the macroprudential framework has applied primarily to risks within the banking sector; banks are, after all, the main focus of the dedicated powers of the macroprudential authorities. However, critical services to the real economy, including the payment system, insurance services, risk-sharing

27 See, for example, Richter et al. (2019).

28 See Poghosyan (2019).

29 The implementation of macroprudential measures needs time and hinges on indicators that warrant their use. Given their construction, these instruments tend to be activated rather late in the risk build-up phase, which further delays their impact.

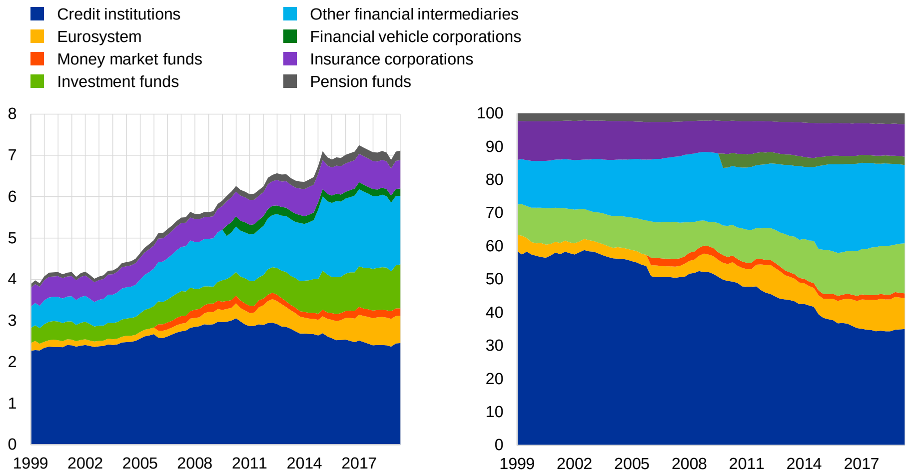
30 See, for example, Altunbas et al. (2017), Eickmeier et al. (2018), Everett et al. (2020) and Budnik (2020).

opportunities and the provision of liquidity are provided not just by banks but by the overall financial system (Chart 2). Moreover, interconnections between financial entities, including banks and non-banks, play a significant role when financial stability is at risk. The COVID-19 crisis has shown that the financing of non-financial corporations (NFCs) may be dependent on the services provided by non-banks (such as money market funds). Therefore market impairments in these sectors need to be addressed by central bank policies (like those implemented, for example, by the Federal Reserve System and the ECB) when the powers envisaged by macroprudential policy are not sufficient to prevent such risks from materialising.[31]

Chart 2

Euro area financial sector assets broken down by sub-sector

(left panel: percentages of GDP; right panel: percentages of total assets)



Source: ECB.
Note: In the first panel the financial sector assets belonging to different sub-sectors are shown as percentages of GDP. In the second panel, instead, the different assets are shown as percentages of the total amount of financial sector assets.

Second, the optimality of the macroprudential framework for banks has also been questioned since the start of the COVID-19 crisis, which has opened a debate on the optimal mix of releasable and structural buffers. Macroprudential policy addresses financial frictions that ultimately impair the financing of the economy, and in the euro area banks still play the key role in this respect. Even if it is designed to be more effective in addressing endogenous shocks stemming from the financial system (as discussed in Clerc et al., 2015), macroprudential policy could also be deployed to address exogenous shocks affecting the financial system and/or, ultimately, the real economy. The COVID-19 pandemic, for instance, has opened a debate regarding the optimality of the partition between releasable bank buffers (i.e. buffers that when released reduce the threshold for restrictions on dividend payments, given by the maximum distributable amount (MDA)) and non-releasable buffers in the current framework. The scarcity of releasable buffers has incentivised the release of buffers designed primarily for bank-specific vulnerabilities (microprudential), but not for use in the face of macro-financial shocks (for which

[31] Indeed, empirical evidence suggests that the effectiveness of macroprudential policies targeting financial risks is weakened if bank-like activities are conducted by non-banks (e.g. Cizel et al., 2016; Gebauer and Mazelis, 2020).

macroprudential buffers would be used). Thus far, in fact, euro area banks have only made limited use of the relaxation of buffer requirements introduced by European banking supervision and national competent authorities as a response to the COVID-19 pandemic.[32] It can be argued that the overall very limited build-up of releasable capital buffers in the euro area before the COVID-19 crisis (as opposed to non-releasable buffers that keep MDA thresholds in place) has constrained the ability of macroprudential authorities to foster banks' use of capital to support lending and thus help underpin economic activity.[33] Further lessons may be drawn post-COVID to better reinforce the share of releasable macroprudential buffers, without necessarily increasing the total amount of bank capital, in order to strengthen the response of macroprudential policy during crises.

A third reason for the only partial effectiveness of the macroprudential policy framework is the presence of spillovers and/or cross-border activities, which are particularly significant at EU level. Macroprudential policy, designed at the national level, usually addresses specific, systemic, financial stability risks in national jurisdictions (cf. ESRB handbook, 2018, Chapter 11). In the EU, financial integration means that any citizen can request financial services from any EU provider. Macroprudential policies could therefore be less effective in countries that receive a substantial share of their financing from abroad or are dependent on the cross-border activities of financial service providers that are out of macroprudential reach: the ability to avoid bubbles or excessive leverage is then limited. From a dynamic perspective, leakages may also occur if cross-border activities or the entry of foreign financial service providers are encouraged by the activation of macroprudential hurdles. However, this risk is in part limited when effective reciprocity arrangements are in place.[34]

A fourth factor that limits the effectiveness of the macroprudential policy framework is the potential presence of inaction bias, linked for instance to political considerations. Inaction bias can appear for several reasons, which can be mutually reinforcing. First, the costs of macroprudential action are usually concrete and immediately visible, while the benefits are difficult to quantify and/or are only likely to materialise in the future. For example, when the macroprudential authority decides to increase capital requirements, the costs are immediate and obvious – the need for banks to finance a larger part of their balance sheet with capital. The benefits, however, for example less vulnerability during crises, may not be visible. Second, responsibilities may be diluted when the macroprudential policy mandate is shared between several institutions. Third, the macroprudential authority may be subject to lobbying or political pressure or be constrained by election cycles.

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[32] There could be several reasons for banks' reluctance to draw down capital buffers. Apart from the MDA triggers that restrict dividend payments, banks may be concerned about stigma effects from falling capital ratios, with negative implications for funding costs or market valuations. Furthermore, uncertainty regarding future losses might induce banks to keep capital ratios well above the combined buffer requirement to avoid unintended breaches. Uncertainty about supervisory follow up in the event of breaches of the requirement and in relation to the time given to replenish buffers could further discourage buffer use. At the same time, pandemic-related losses have so far been relatively muted (partly because of mitigating policy measures) and thus have generally not required banks to use their capital buffers. This could change in the coming quarters if further losses were to materialise.

[33] See, for example, Darracq Pariès et al. (2020a).

[34] For recent literature surveys and meta analyses on the importance of cross-border spillovers of macroprudential policies, see, for example, Buch and Goldberg (2017) and Kok and Reinhardt (2020).

This would apply particularly to borrower-based measures (such as limits on LTV), which can have direct distributional effects. Fourth, the authority in charge of macroprudential policy may have a combination of mandates that have poorly defined boundaries. In this case, failure in one of its missions can damage the credibility or effectiveness of the whole: the resulting reputational risk decreases the incentive to act. Many of these factors do not apply solely to macroprudential policy, and they can be addressed through an appropriate institutional design and/or state-contingent policy rules. For instance, the attribution of some macroprudential powers to the ECB was intended, inter alia, to mitigate the risk of inaction bias. There is no pervasive evidence that inaction bias has materially affected the intensity of macroprudential policy actions in the euro area – by the end of 2019, for example, many national authorities had activated one or more macroprudential policies. In principle, however, the possibility of such bias resulting in limited macroprudential policy space when crises hit cannot be ruled out.

2.3.2 Partial effectiveness of the macroprudential policy framework: implications for monetary policy

If the macroprudential policy framework is not fully effective in containing systemic risk, it may be welfare-enhancing for monetary policy to take financial stability considerations into account.[35] This means that, in principle, it would be optimal for monetary policy to focus not just on price stability but also on financial stability. This is especially true when the risks to financial stability arise from excessive credit or leverage, which can be affected by the conventional instruments of monetary policy. To describe the role of monetary policy in this regard, it is useful to return to our stylised characterisation of the financial cycle as being composed of an “ex ante” or build-up phase and an “ex post” or crisis phase.[36]

Monetary policy can help address financial stability by adopting a leaning against the wind approach ex ante and a cleaning approach ex post. With respect to the benchmark policy, which has price stability as a single objective, this entails tightening ex ante, i.e. during the build-up phase, and loosening ex post, i.e. during the crisis phase (see, for example, Caballero and Simsek, 2020, and Van der Ghote, 2020). By tightening ex ante, monetary policy contributes during the build-up phase to reducing credit and, more specifically, leverage, thereby reducing the likelihood and/or severity of crises. By loosening ex post, monetary policy contributes to the relaxation of financial conditions and so to speeding up the recovery.

Monetary policy can thus help support financial stability by leaning and cleaning, but doing so incurs costs. To perform this role, monetary policy may temporarily have to deviate from price stability; this, in the presence of nominal rigidities, is costly. The exact nature of these costs depends on the model

35 See, for example, Farhi and Werning (2016), Caballero and Simsek (2019) and Stein (2021).

36 This section draws heavily on the work of the Research Task Force on Macroprudential Policy, Monetary Policy and Financial Stability; in particular, on the Discussion Paper produced by the Directorate General Research on the interaction between both types of policies (Martin et al., 2021).

considered. Where nominal rigidities take the form of Calvo pricing, for instance, they are convex: the costs of deviating from price stability for financial stability purposes escalate quickly and this limits the desired extent of the deviations. According to some of the models developed by the ECB, for instance, monetary policy can only reap about one-third of the gains of an effective macroprudential policy.[37]

Locally, however, the use of monetary policy to lean against the wind entails second-order losses in terms of price stability, but first-order gains in terms of financial stability. This implies that, at least conceptually, it is always optimal for monetary policy to adjust – even if only slightly – for financial stability considerations.[38] In practice, however, the potential use of monetary policy for financial stability reasons is questioned on the grounds of its being an inadequate or blunt tool for this purpose; by this reasoning, any practical attempt to use it in this manner is likely to be detrimental to social welfare.

The main argument against using monetary policy for macroprudential purposes is, perhaps, that monetary policy instruments may be inadequate or limited with respect to the task at hand. Monetary policy typically controls the short-term interest rate, which may be a poor substitute for macroprudential regulation. This is especially true when optimal macroprudential regulation is targeted to specific types of assets of economic agents. Macroprudential policies can target the behaviour of subsets of financial market participants (such as systemically important financial institutions) and tackle risks stemming from specific sectors, such as the residential and commercial real estate sectors, and countries.

In a currency union like the euro area, this argument becomes more pressing as countries' exposures to systemic risk are likely to be heterogeneous over time. There is strong empirical evidence that this is indeed the case in the euro area. Although this argument does not fully invalidate a potential macroprudential role for monetary policy, it does call into question the practical relevance of such a role. In particular, it implies that any practical attempt to significantly alter monetary policy for macroprudential purposes could be ineffective and potentially counterproductive. To put it bluntly, monetary policy will get very little bang for its buck if it tries to play a macroprudential role.

One strand of support for this view comes from empirical evidence that directly measures the relative effectiveness of monetary policy in dealing with credit, leverage, and/or asset prices. In this regard, value at risk (VaR) evidence suggests that – relative to monetary policy – a tightening of LTV ratios seems to have a small effect on output and a large effect on credit. Thus, to achieve the desired reduction in credit, conventional (i.e. interest rate-based) monetary policy would require substantially larger output losses than macroprudential policy (see, for example, Richter et al., 2019). This empirical evidence is subject to important caveats, however, in view of measurement and endogeneity problems.

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[37] See Van der Ghote (2019) and Martin et al. (2021) for a broader discussion of this point.

[38] For a formal development of this argument, see Caballero and Simsek (2020). Some authors argue that a systematic monetary policy response to financial developments can help dampen the financial cycle with only small effects on inflation (see Juselius et al., 2017).

A second strand of support for the view that monetary policy is too blunt a macroprudential tool is based on quantitative models. As discussed in Chapter 4, for instance, Svensson (2018) uses a stylised framework to quantify the costs and benefits of leaning against the wind. His framework acknowledges that raising the policy rate ex ante, i.e. before a crisis materialises, has benefits in terms of both the likelihood of crises and their severity in terms of rising unemployment. But such an increase in the policy rate is also costly – both ex ante, because it reduces economic activity and raises unemployment before the crisis, and ex post, because once it has materialised, the economy is found to have been in worse shape to begin with. Kockerols and Kok (2019) adapt Svensson's model framework to the euro area, where they find that his results also hold. Like all calculations of this type, Svensson's are highly sensitive to alternative assumptions. At the time of writing, this debate still rages.

The logic outlined above also applies to non-conventional monetary policies such as long-term refinancing operations (LTROs) and asset purchase programmes. Ex post, through their effect on asset prices and on the profitability of financial institutions, non-conventional policies can be instrumental in helping financial institutions rebuild their balance sheets in the aftermath of financial crises. Darracq Pariès et al. (2019a) suggest a connection between central bank asset purchases and financial/prudential policies. Asset purchases may be particularly important in situations of weakly capitalised banks (i.e. in crisis situations) where they have the potential to reinforce the bank lending channel of monetary policy transmission.[39] A similar point is made by Karadi and Nakov (2021), who show how, in the wake of a crisis, asset purchases can speed up the recovery by providing capital relief for banks. In a related vein, D'Avernas et al. (2020) demonstrate the beneficial role of liquidity provision and/or asset purchases in supporting both bank and non-bank financial intermediaries.

At the same time, there is concern that asset purchase programmes affect risk-taking and can thus fuel the build-up of financial imbalances.[40] Although this is in principle possible, it is not a priori obvious from existing research why non-conventional policies would lead to excessive risk-taking relative, for example, to conventional policies. It is conceivable that the anticipation of both types of intervention – conventional and non-conventional stimulus – generates moral hazard and fuels risk-taking ex ante. However, recent models suggest that these fears can be partly allayed if policies are targeted to the aggregate state of the economy and not to the individual portfolios of market participants (i.e. if policies take the form of market-wide stimulus as opposed to agent-specific bailouts).[41]

In addition, the diversity of monetary policy instruments can provide an opportunity to take financial stability risks into account. Since the global financial crisis, the ECB has shown that the number of monetary policy instruments

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39 In a related paper, Darracq Pariès et al. (2016) show how asset purchases, by affecting banks' risk-return optimisation, can enhance the credit channel of monetary policy transmission.

40 See, for example, Piergiorgio et al. (2017) and Hudepohl et al. (2019).

41 See, for example, Bornstein and Lorenzoni (2018) and Jeanne and Korinek (2020). The main idea is that ex post interventions that reduce the severity of crises also mitigate the inefficiencies that they entail (e.g. fire sales), which also reduces the need for prudential action ex ante.

can be greatly expanded within the remit of its mandate. It has mobilised and designed monetary policy programmes, including: (i) liquidity provisions at various maturity horizons or currencies; these are in some cases targeted as the amount that banks can borrow is linked to their loans to NFCs and households (excluding those for housing); (ii) asset purchase programmes involving a variety of assets, from sovereign to corporate bond markets; (iii) extending collateral requirements by including a variety of different asset classes satisfying adequate risk criteria; (iv) negative rates; and (v) communication tools such as forward guidance. More specifically, TLTROs and tiering – two monetary policy instruments used to strengthen the monetary impulse – were also specifically designed in such a way as to minimise their impact on financial stability and on housing markets and bank profitability respectively. This diversity of instruments gives more flexibility in the conduct of monetary policy with a view to limiting undesirable side effects on financial stability. It could also mean, in practice, that for a given price stability objective certain monetary policy tools might be preferred over others in order to maximise their positive impact on financial stability.

2.4 What changes if monetary policy instruments are constrained?

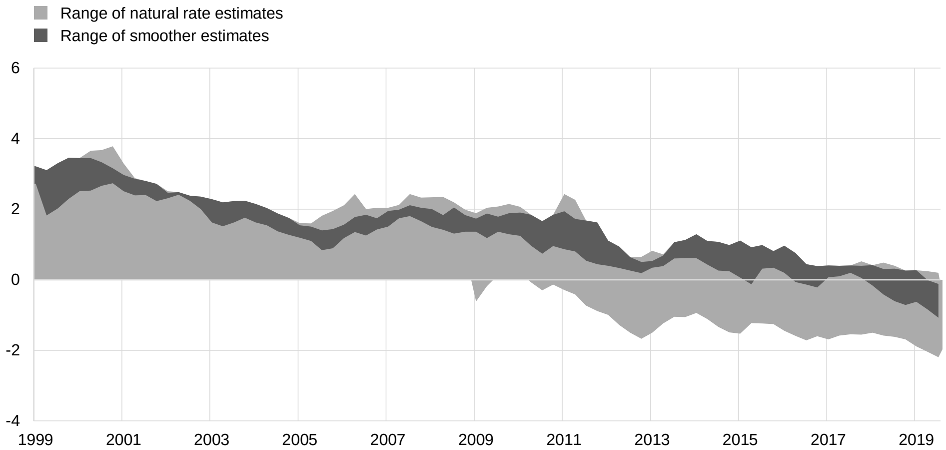
The risk of policy instruments being constrained by the ELB is one of the arguments underlying the objective of a moderately positive rate of inflation. In 2003 the Governing Council clarified its definition of price stability (as part of the evaluation of its monetary policy strategy at that time) as being, in target terms, annual Harmonised Index of Consumer Prices (HICP) inflation below, but close to, 2%. The three factors considered in this definition were: the lower bound on nominal interest rates, a possible measurement bias in the HICP, and downward nominal rigidities. The risk of monetary policy becoming constrained by the lower bound on interest rates was seen as stemming primarily from a sustained deflationary shock (ECB, 2003). The decline in real yields, as previously observed in the 1990s, could not have been anticipated to continue. Therefore, while the risk of interest rates bumping up against their ELB was considered material in principle, for practical purposes it appeared remote in 2003.

The recent decline in the natural rate of interest has increased the lower-bound risk. The global financial crisis has caused sustained disinflationary trends and precipitated a further significant fall in real yields. This development has been widely associated with a decline in the natural rate of interest (the real rate of interest consistent with the economy operating at its potential and with price stability). Chart 3 shows that estimates of low-frequency components in real yields (econometric estimates of the euro area natural rate of interest) fell from over 2% at the beginning of EMU to levels below zero prior to the current Covid-19 crisis. As a consequence the level of real interest rates that defines a neutral monetary policy stance (i.e. the natural rate of interest) has recently been so low that the risk of nominal interest rates being constrained by their ELB has risen significantly with respect to 20 years ago.

Chart 3

Long-term trends in real interest rates from econometric estimates of the euro area natural rate of interest

(percentages per annum)



Sources: Brand et al. (2018), Ajevskis (2021), Brand et al. (2020), Brand and Mazelis (2019), Fiorentini et al. (2018), Geiger and Schupp (2018), Holston et al. (2017), Jarociński (2017) and Johannsen and Mertens (2020).
Notes: Ranges span point estimates across models to reflect model uncertainty and no other source of r* uncertainty. The dark shaded area highlights smoother r* estimates that are statistically less affected by cyclical movements in the real rate of interest than the other estimates depicted in the chart.

This decline in the real interest rate appears to be largely driven by a fall in productivity growth, population ageing, and a high safe-asset premium (Brand et al., 2018). The importance of long-established macroeconomic trends for real yields emerges in standard growth models (for example Ramsey, 1928, and Solow, 1957), where the real rate of interest depends positively on the growth of per capita income, on population growth, and on a risk-adjusted discount factor.[42] Building on this, the literature widely attributes the decline in real interest rates to lower productivity growth, which has depressed the growth of income; to demographics and ageing, which boost savings for retirement; and to a rising risk premium associated with a scarcity of safe assets that depresses their return below the return on capital.

Reversing the impact of these long-standing trends appears to be extremely challenging. The forces behind total factor productivity trends are difficult to understand and predict. Ageing and the stagnation of population growth will reinforce the existing downtrend at least until 2030. To achieve a reversal in the risk factor would likely require a fundamental reform of the EMU architecture and effective measures to redress financial vulnerabilities in emerging market economies (as these incentivise the accumulation of foreign reserves as an insurance device against sudden stops).

Overall, there is a high likelihood of monetary policy becoming constrained by the ELB. Unlike the situation two decades ago, even deploying unconventional policy instruments cannot always fully ensure the effectiveness of monetary policy. And even if monetary policy were able to extricate itself from the lower bound on

42 This approach is taken by Laubach and Williams (2003), in the widely used econometric workhorse approach, to estimate the natural rate of interest.

nominal interest rates, as was the case for the Federal Reserve System in 2016-19, we can expect the risk of policy space – especially on the conventional interest rate – being exhausted to be significantly higher than before the global financial crisis. ECB (2021d) reports results from an extensive analysis of this issue. It concludes that, averaging across models and stipulating a 2% inflation objective and a decline in the natural rate from 2% to 0%, the risk of the interest rate instrument being constrained by the lower bound roughly triples, from around 10% to about 30%. Deploying asset purchases at the ELB to ease the monetary policy stance can mitigate this risk by a significant margin.

The higher likelihood of a binding ELB in the near future reinforces the need to safeguard financial stability. Intuitively, the ability of monetary policy to contain the adverse effects of financial crises on price stability and economic activity is likely to be constrained. In such a scenario, it becomes especially important to adopt preventive policies to limit the build-up of systemic risk ex ante. In this light, the clearest policy recommendation is to strengthen the macroprudential framework to increase its effectiveness as fully as possible. This should be a major focus of the euro area going forward, especially as regards the extension of the macroprudential framework to other financial intermediaries than banks and the strengthening of efforts to build up more releasable capital buffers in good times.

The case for monetary policy to lean against the wind becomes stronger in a low interest rate environment of this nature, where there is a high likelihood of monetary policy becoming constrained by the lower bound on interest rates. Accommodative monetary policy to stabilise output and inflation may be associated with high risk-taking and consequently with an increase in future volatility. This could lead to the paradoxical situation described in Adrian et al. (2020), where monetary policy attenuating short-term downside risk to growth via the impact on risk-taking could face higher risk costs in the medium term. It could be argued in this case that accommodative policy might contribute to reducing monetary policy space in the future. This dilemma can in principle be addressed through appropriate macroprudential policies. However, if these are not effective a leaning approach could make the economic and financial system more stable. By contributing to the expansion of monetary policy space in the future, leaning against the wind might thus be optimal even if monetary policy focuses only on price stability.[43]

The limited effectiveness of monetary policy at the lower bound can also contribute to propagating potentially adverse effects of macroprudential policies on output and inflation – and in turn undermine their effectiveness. Away from the lower bound, monetary policy can mitigate the adverse impact of macroprudential instruments geared to increase the resilience of the financial system with respect to output and inflation. But such stabilising effects can no longer be achieved if monetary policy is constrained. Chen et al. (2020) have recently shown that, in a model with long-term debt and collateral constraints, the short-term costs of macroprudential policy can be high when debt is high and the support of monetary

[43] The argument that leaning against the wind could increase monetary policy space in the future should not be misconstrued as suggesting that persistently low yields over the past decade can be accounted for by cyclical financial factors alone or could have been addressed by monetary policy.

policy is constrained by the lower bound. The costs of macroprudential policy, moreover, depend on the tool that is used: caps on LTV ratios lead to higher costs than caps on loan-to-income or debt-service-to-income ratios. Similarly, Mendicino et al. (2020) find that lower-bound constraints increase the macroeconomic transition costs resulting from raising bank capital requirements. The inability of monetary policy to be sufficiently accommodative as a result of the lower-bound constraint depresses the inflation rate, raises the real interest rate and leads to a larger fall in aggregate demand and output than would otherwise be the case. Thus, when monetary policy is constrained by the ELB, the short-run negative effects of a rise in capital requirements on real activity can be quite sizeable. In turn, such macroeconomic costs arising from macroprudential tools can undermine their effectiveness (for instance by inducing inaction bias).

Conversely, moderating the pace of phasing in macroprudential requirements can mitigate the ineffectiveness of monetary policy at the lower bound. As the risk-taking channel can be affected by both monetary and macroprudential policies, macroprudential policies can be used to support monetary policy objectives. If monetary policy is constrained by the lower bound, macroprudential policies can be phased in at a slower pace or even reversed to support monetary policy (for example through releasing countercyclical capital buffers built up during boom times).

Obstacles to monetary policy transmission from low equilibrium interest rates may also be mitigated by macroprudential policies. The persistence of the low real interest rate environment poses challenges for monetary policy transmission through banks: deposits are usually a financially attractive and stable source of funding for banks. However, the existence of banknotes means that retail deposit interest rates in particular may not fall below zero, even if the interest on reserves or the nominal return on safe and liquid assets has dropped into negative territory. This contributes to a compression of net interest margins and places a drag on bank profitability (Eggertsson et al., 2020). On account of this effect, Brunnermeier and Koby (2019) have coined the term “reversal rate”, suggesting that low policy interest rates can become ineffective in stimulating demand or may even lead to restraining financial conditions. In this situation, macroprudential policies can be used to mitigate the impairment of bank-based transmission in a low real-yield environment, for example by releasing countercyclical capital buffers previously built up to support bank profitability (Darracq Pariès et al., 2020b). Yet while this approach may be effective in counteracting the effects of low rates over the business cycle, it is not effective if monetary policy is constrained by the lower bound for a very long period of time on account of long-standing factors.

2.5 Conclusions

In the aftermath of the global financial crisis regulators introduced new macroprudential tools and authorities with the aims of addressing systemic risk in a pre-emptive manner and increasing the resilience of the financial system. This development raises new questions regarding the relationship between macroprudential and monetary policies.

The scope for interaction between these two policy domains is broad, because they work through common transmission channels and thus affect the same outcome variables. While in most circumstances price stability and financial stability are complementary and mutually reinforcing, they may also have undesirable side effects on each other's domains.

Given these multiple interactions, there is in principle scope for cooperation between both policies. The gains from cooperation are especially large if policy instruments are constrained or not yet fully developed. More specifically, while macroprudential policy instruments are the first line of defence against emerging or evolving financial stability risks, it may occasionally be welfare-enhancing for monetary policy to take financial stability considerations into account. This case is stronger in a low interest rate environment, when there is a high likelihood of monetary policy becoming constrained by the lower bound on interest rates.

3 The side effects of low rates and monetary policy on financial stability

3.1 Introduction

This Chapter explores the different mechanisms through which low rates and monetary policy can affect financial stability. While the low interest rate environment is related primarily to structural factors, the global financial crisis, and now the COVID-19 crisis, have pushed policy rates to unprecedentedly low levels. They have created the need to adopt unconventional monetary policy measures such as negative rates, large asset purchase programmes, forward guidance, and targeted liquidity provision measures. This chapter will take stock of the large body of literature and policy analyses on this topic and also update some specific exercises with a view to providing a comprehensive assessment of the financial stability implications of low rates.[44] In terms of coverage, Chapter 3 will look only incidentally at the non-banking sector. Its emphasis in this respect will be on the substantial spillovers of low rates to non-bank intermediaries and the importance of enhancing the macroprudential framework in order to address imbalances originating in this sector more effectively.[45] Chapter 3 will therefore focus on the banking sector but will also delve into the financial stability implications of low rates occurring via the real sector, considering both households and firms.[46]

Section 3.2 will first review the channels through which low rates might affect the shock-absorbing capacity of the banking sector. The role played by the zero lower bound (ZLB) on deposit rates for the compression of lending margins in a low-rate environment will be extensively discussed, as will the presence of offsetting factors acting for the most part indirectly through general equilibrium effects. As low profitability tends to be associated with incentives to undertake relatively risky investments, the implications of low rates for risk-taking will be assessed on the basis of a growing body of empirical evidence. Section 3.2 will emphasise the crucial distinction that should be made between intended risk-taking and unintended (excess) risk-taking. It will consider how the conclusions might change depending on whether rates are low as a result of secular stagnation or of monetary policy. The section concludes with a discussion of the circumstances under which monetary policy plays a crucial role in underpinning financial stability and whether the related interventions in turn entail distortions in incentives.

Section 3.3 will examine how financial stability side effects have been mitigated by the appropriate design of monetary policy instruments and by the prudential framework. The design of some of the instruments implemented since

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44 A detailed analysis of the financial stability spillovers of monetary policy, looking specifically at individual instruments, is included in ECB (2021b). This Chapter recalls some of the conclusions from that analysis while delving more deeply into those aspects deemed most relevant to the discussion on the interlinkages between macroprudential policy, monetary policy and financial stability.

45 See ECB (2021b) and the work stream report on Non-bank Financial Intermediation (2021).

46 See ECB (2021b).

the outbreak of the global financial crisis has been inspired mainly by the objective of mitigating possible adverse side effects on financial stability. These innovations in the monetary policy framework led, notably, to the series of targeted longer-term refinancing operations (TLTROs) and the two-tier system for reserve remuneration. The section will also discuss whether the intensity of financial stability spillovers is affected by the stance of prudential regulation or by the supervisory regime.

Section 3.4 will investigate whether the financial stability side effects of monetary policy depend on the position of the economy vis-à-vis the financial and business cycles or the financial position of the non-financial sector. Assessing whether monetary policy side effects are heterogeneous along these dimensions is of particular interest in the euro area, given its institutional framework. This is characterised by a common monetary policy regime and asynchronous national financial and business cycles, including in relation to the heterogeneous structural characteristics of the real and financial sectors in the different countries concerned.

3.2 Side effects of low rates and monetary policy on financial stability

3.2.1 Low rates, margins, profits and the valuation of banks

The standard conceptual framework in considering the link between policy rates, bank profitability and bank lending decisions is the bank capital channel. The bank capital channel focuses on the presence of a binding constraint for external financing.[47] The argument has two elements. First, capital has a bearing on banks' ability to attract outside funding and hence to supply credit to the economy. Capital matters because it provides "skin in the game" and mitigates the problem of asymmetric information between bank outsiders, who provide funds, and bank insiders, who use funds.[48] Second, monetary policy affects banks' profitability, which has an impact on their capital position and ultimately on their ability to attract outside funding.

The empirical evidence regarding the positive relation between short-term and long-term rates and net interest margins is abundant. As one of the main functions of banks is the "maturity transformation", the presence of a flat term structure tends to penalise the profitability of their business model. In addition, in

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47 A bank capital channel of monetary policy transmission was first proposed by Van Den Heuvel (2002) and then by Bolton and Freixas (2006). A binding external financing constraint for banks is central in the macro-finance literature; see, for example, Gertler and Kiyotaki (2010, 2015), Gertler and Karadi (2011), He and Krishnamurthy (2012, 2013) and Brunnermeier and Sannikov (2014a).

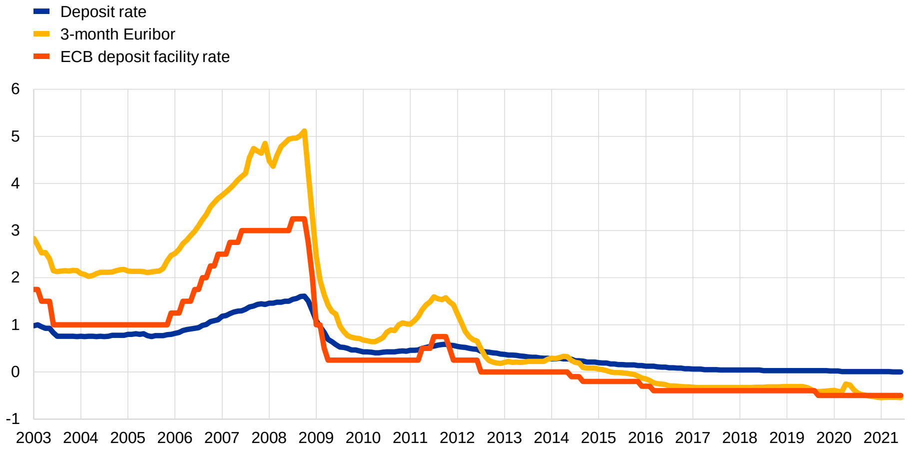
48 The importance of an external-financing and regulatory constraint for banks and the role of bank capital and profitability for lending are well documented. Negative shocks to banks' balance sheets force them to lend less, with adverse consequences for the real economy (Peek and Rosengren, 1997 and 2000). Better capitalised banks lend more while bank equity itself does not vary much over the business cycle. The variation in banks' liabilities drives variation in lending, and better capitalised banks have lower funding costs (Gambacorta and Shin, 2018). The capital position of banks is in turn closely linked to changes in bank profitability.

those situations where deposit rates are constrained by the presence of a ZLB, the interest rate level also has a bearing on lending margins. This may be the case irrespective of the steepness of the term structure and particularly when short-term rates are negative, as a larger share of deposits will tend to have rates constrained by the ZLB. Developments in the average cost of overnight deposits indicate the presence of a sluggish policy rate pass-through in a low-rate environment (Chart 4).[49] For euro area banks, on aggregate, a gradual decline in net interest margins has been observed in recent years (ECB, 2019). Econometric quantifications are provided in, among others, Claessens et al. (2018), who quantify that a 1-percentage point decrease in the interest rate implies a decrease of 8 basis points in banks' net interest margin, with this effect being greater (20 basis points) at low rates. The evidence in Coleman and Stebunovs (2019) is broadly consistent with these findings, although they also suggest that unobserved structural factors appear to play a relatively more important role in explaining the weakness of euro area bank profitability compared with that of their US counterparts.

Chart 4

Evolution of ECB deposit facility rate, 3-month Euribor, and overnight deposit rate (average across euro area banks)

(percentage points)



Source: ECB.

Lower rates squeeze margins more when rates are low to begin with. Bank deposits provide for liquidity and payment services, as in the standard framework described by Diamond and Dybvig (1983). For this reason, in the absence of other constraints their rates tend to be below those prevailing in the money market for corresponding maturities (mark-down). As rates decline, the rates of more and more deposits hit the ZLB while lending rates keep moving more closely with market conditions and the impact on the margin of an additional rate decline grows

49 The most common explanation of the ZLB rests on the notion that the presence of cash, an asset providing zero nominal rates, keeps banks from charging negative rates on their deposits. A bank trying to do so would experience withdrawals, with possible non-linear run-type dynamics. At the same time, the presence of transaction costs from carrying cash does not remove the presence of a lower bound but shifts it to a negative level (effective lower bound).

stronger.[50] Recent updates of the exercises conducted by Kerbl and Sigmund (2017) corroborate the presence of a convex relation between the level of rates and bank net margins (ECB, 2020c). A relationship between margins and the level of short-term rates already exists for rates below 5% and its magnitude increases as rates decrease. Ampudia and Van den Heuvel (2019) corroborate the interpretation of this convexity by showing that the positive relationship between policy rate changes and banks' stock prices that they document is more pronounced for intermediaries that rely more on deposit funding than on market-based, wholesale debt. Relatedly, in a low-rate environment the expansion of lending in reaction to a rate cut is smaller than it would be in times of higher rates; this also depends on the intensity of competition in the banking sector (Heider et al., 2019; Ulate, 2020; Eggertsson et al., 2020). In the extreme case, there could be a "reversal", i.e. banks could contract lending in response to lower policy rates (Brunnermeier and Koby, 2019).[51]

The overall impact of low rates on profitability is more ambiguous given the presence of offsetting factors, namely provisions. Bank profitability depends on the level of lending margins but also on the macroeconomic environment. When low rates reflect the accommodation provided by conventional or unconventional monetary policy, they boost the level of economic activity, generating higher lending volumes and lower default risk. Moreover, as rates fall so does the cost of servicing debt, mechanically reducing default rates. According to Altavilla et al. (2018), considering both conventional and unconventional monetary policy measures, the benign impact of low interest rates on loan loss provisions and lending volumes is estimated to be substantial and to fully compensate for the adverse impact on net interest income. Consistent findings are presented in Lopéz et al. (2018), while an overall adverse impact is reported in Borio et al. (2017). A synopsis of the most recent literature on bank profitability is provided in Table 1.

Analyses of the impact of low rates on banks' stock prices also suggest significant heterogeneity across studies on the effects on overall profitability.[52] The market value of a bank is a useful statistic to gauge the impact of policy rates on its overall current and future profitability; it considers not just net interest income and provisions but all of the items that might be affected by the level of interest rates (such as fees and commission). Market valuations also play a role, regardless of their being a signal of future profitability: bank (inside) equity holders might hesitate to issue low-priced new shares as this would dilute their control rights, with diverse implications for incentives and efficiency.[53] Looking at euro area banks, Ampudia and Van den Heuvel (2019) conduct a high-frequency event study to disentangle the effect of a policy rate announcement on banks' stock prices from other economic news. In normal times, with high rates, a policy-rate cut increases

50 Banks are instead forced to reduce lending rates as they would otherwise suffer from competition with other intermediaries who could divest sovereign bonds, whose yields move more closely with market rates.

51 Even though outright reversal appears to be only a theoretical possibility so far, there are mild signs of contractionary behavior by banks in some segments (Amzallag et al., 2019; Bittner et al., 2020). Repullo (2020) elaborates on the conditions under which a reversal rate might actually exist.

52 These are all based on an identification approach using high frequency market data and all seek explicitly to identify causal effects of monetary policy shocks.

bank stock prices, including through changes in the discount factor. This positive relationship weakens and eventually changes sign as rates become lower. A policy-rate cut in negative territory, however, decreases bank stock prices, suggesting that the adverse impact on overall profitability more than compensates for the impact of the change in the discount factor. Consistent findings are provided in Hong and Kandrac (2018) and Eggertsson et al. (2020). At the same time, Altavilla et al. (2018) show that after each policy rate cut into negative territory banks' stock prices increased markedly and that surprises arising from monetary policy easing during the low interest rate period also improve their credit default swap spreads. This is consistent with the findings of English et al. (2018). First, the stock prices of euro area banks improved over the day of the official policy communication. Second, regressing the daily stock market returns of individual banks on high-frequency policy surprises (controlling for concomitant macroeconomic data releases) shows that policy easing tends to improve banks' market valuation.

Table 1

Impact of low/negative interest rates on banks' profitability and its components

Direction of the impact	Outcome variable	Paper(s)	Geographic coverage
⇩	Net interest income	Claessens et al. (2018), Coleman and Stebunovs (2019), Urbschat (2018), Borio et al. (2017), Deutsche Bundesbank (2018), Lopéz et al. (2020), Altavilla et al. (2018)	Advanced economies, Europe, Germany, Japan, euro area
⇩	Deposit expenses	Lopéz et al. (2020)	Europe and Japan
⇧	Non-interest income	Borio et al. (2017), Lopéz et al. (2020)	Advanced economies
⇧	Non-interest income	Altavilla et al. (2018), Urbschat (2018)	Euro area, Germany
⇩	Loan loss provisions and non-performing loans	Borio et al. (2017), Altavilla et al. (2018), Urbschat (2018)	Advanced economies, euro area, Germany
⇩	Overall profitability	Coleman and Stebunovs (2019), Borio et al. (2017)	Europe, advanced economies
⇩⇧	Overall profitability	Lopéz et al. (2020), Claessens et al. (2018), Altavilla et al. (2018)	Europe and Japan, advanced economies, euro area

Low long-term rates are relatively more detrimental to the stability of non-banks. Insurance corporations and pension funds, unlike banks, are mainly exposed to very long-term and relatively safe assets. As such, they are adversely affected by low rates, particularly at the long end of the term structure. Moreover, they do not benefit to the same extent from the offsetting factors related to the general equilibrium macroeconomic effects of low rates and the related reduction in credit risk. This is particularly relevant given that the shape of the financial system has changed significantly since the last monetary policy strategy review, with a greater role for non-bank financial intermediation.[54]

Despite the ambiguous evidence on the causal effects of monetary policy on bank profitability, a low-rate environment remains challenging for banks and

[54] See ECB (2021b).

non-banks as well. While the available analyses may differ on the size and even sign of the net effect of monetary policy on profitability, all the available evidence emphasises the crucial role exerted by its indirect effects, via the stimulus, on economic growth. Importantly, when rates are driven down by factors other than monetary policy accommodation, the adverse impact on net interest income is not offset by these indirect effects.[55] A low-rate environment driven by a decline in real rates unambiguously poses challenges to banks' profitability. In addition, non-banks such as insurance corporations and pension funds benefit to only a limited extent from the economic stimulus provided by monetary policy leading to a compression of yields, as these institutions are primarily exposed to long-term and relatively safe assets.

The level of inflation expectations embedded in nominal interest rates is found to be the main driver of lending margins. The current low-rate environment is largely due to the long-standing declining trend in the level of real rates.[56] At the same time, most frictions underlying the financial stability spillovers of the low-rate environment refer to the level of nominal rates (for example, the ZLB is a constraint on nominal deposit rates). It is therefore important to empirically test the extent to which the adverse side effects are truly dependent on nominal rates alone. Recent analyses (ECB, 2020b) corroborate this interpretation by suggesting that part of bank profits is essentially akin to seigniorage, i.e. income obtained thanks to the possibility of issuing cash-like liabilities.

The adverse implications of low rates for margins are exacerbated when they persist over time. On the one hand, banks' intermediation capacity could deteriorate in an environment of persistently low profitability; this may also reflect the transitional mitigation provided by the stock of seasoned long-term fixed-rate loans which are not affected by changes in market conditions and which mature only gradually. On the other hand, as time goes by banks may find it easier to adjust their business model and start charging negative interest rates on their deposits, particularly if they expect this environment to last (ECB, 2020b).[57] The available evidence indicates that the impact of low rates on margins is exacerbated by their persistence over time (Chart 5).

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[55] However, the long-standing stagnation hypothesis suggests that the decline in real rates is actually a reflection of the low growth environment. Brand and Mazelis (2019) suggest that the natural rate of interest in the euro area has been around zero or negative in recent years. Similar estimates are reported in analyses of the global natural real interest rate (Gourinchas and Rey, 2016; Jorda and Taylor, 2019; Rachel and Summers, 2019). It should also be noted that low rates also directly affect provisions and debt-servicing costs irrespective of their possible implications for economic growth. This last channel is closely related to the financial duration of the outstanding loan portfolio.

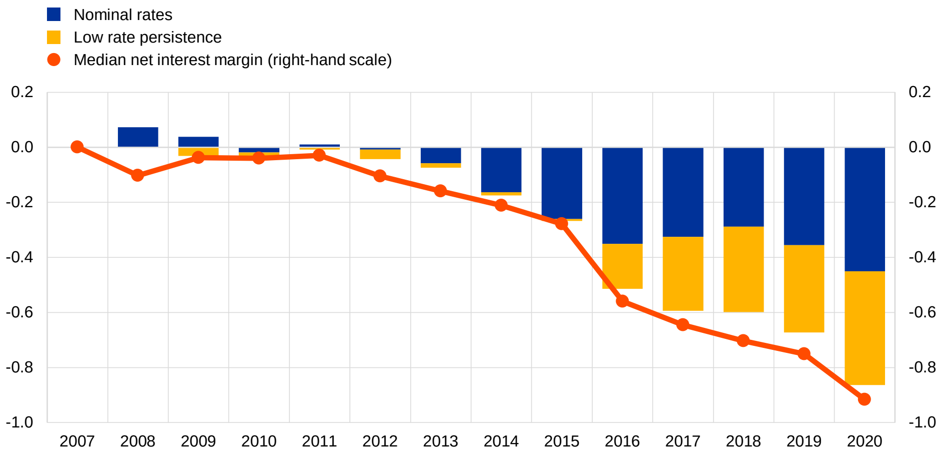
[56] See Expert group on productivity, innovation and technological progress (2021).

[57] The business model adjustment may be more difficult in banks relying heavily on retail deposits and long-term relationships with their customers, since the introduction of negative rates may be seen as a deteriorating factor in this relationship. It could also compromise the ability of banks to generate earnings in the future (Drechsler et al., 2017; Basten and Mariathasan, 2018). Moreover, the introduction of regulatory requirements such as the net stable funding ratio has increased the importance of deposits as a funding source for banks (Eisenschmidt and Smets, 2019). In some countries there are legal restrictions on the application of negative interest rates (e.g. Portugal).

Chart 5

Low-for-long and the net interest margin of euro area banks

(changes from 2007; percentage points)



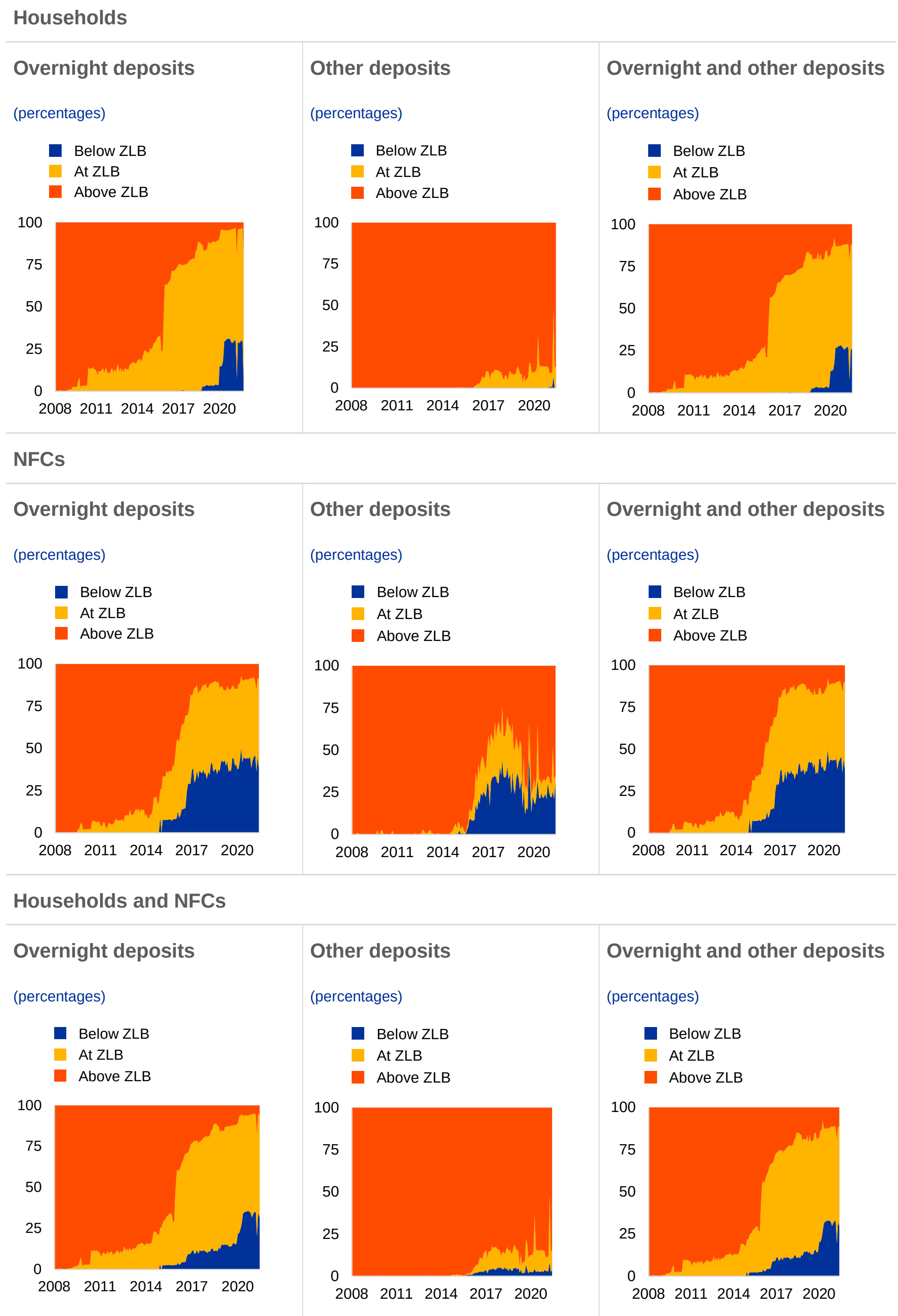
Sources: ECB (2020c).
Notes: Based on Special feature B of the November 2020 edition of the ECB's Financial Stability Review. The estimated contribution of nominal rates includes that of: real short-term interest rate (three-month overnight index swap net of current inflation); current inflation (consumer price index inflation rate); real long-term interest rate (nominal ten-year domestic sovereign bond yield net of inflation expectations); inflation expectations (obtained from inflation-linked swaps). The contribution of the persistence of low rates refers to a set of dummies denoting the number of consecutive years with nominal short-term rates below the sample median (1.25%). The net interest margin is the ratio of net interest income to total interest-earning assets. Controls included: real GDP growth, bank equity over total assets, liquid assets over total assets and deposits over total assets, bank fixed effects. The yearly estimation sample covers 3,629 banks located in 18 euro area countries over the period 2000-18.

The stacking at exactly zero and the subsequent gradual pass-through of deposit rates into negative territory observed so far indicate that the pass-through at the ZLB is sluggish, more so for household deposits than for corporate deposits. Since 2014, two main patterns have emerged. First, euro area banks have been able to charge negative interest rates on a gradually increasing but still limited share of customer deposits. Notably, for overnight corporate deposits this share currently stands at about one-third of the total, while for other segments it is significantly lower (Chart 6). Second, even where the pass-through has been substantial, as for corporate overnight deposits, the shape of the cross-bank rate distribution indicates a progressive and visible concentration of the mass of the distribution at exactly zero (Chart 7). Structural features appear to affect the pass-through into negative territory. These include, for instance, the size of a bank's clientele, as proxied by the share of large loans over total loans, which displays a positive correlation with the share of deposits with negative rates (Chart 8). However, the temporary nature of the ZLB could also reflect behavioural patterns.[58]

[58] As for structural features, NFCs' overnight deposits with negative rates tend to be those held by larger clients, possibly reflecting the size of the deposit and the complexity of the payment services required (Chart 8). Negative rates are also more likely to be passed through by stronger banks (Altavilla at al., 2019b). Experimental evidence on the presence of behavioural patterns is instead provided in Corneille et al. (2021).

Chart 6

Share of deposits with negative rates by holding sector and deposit type



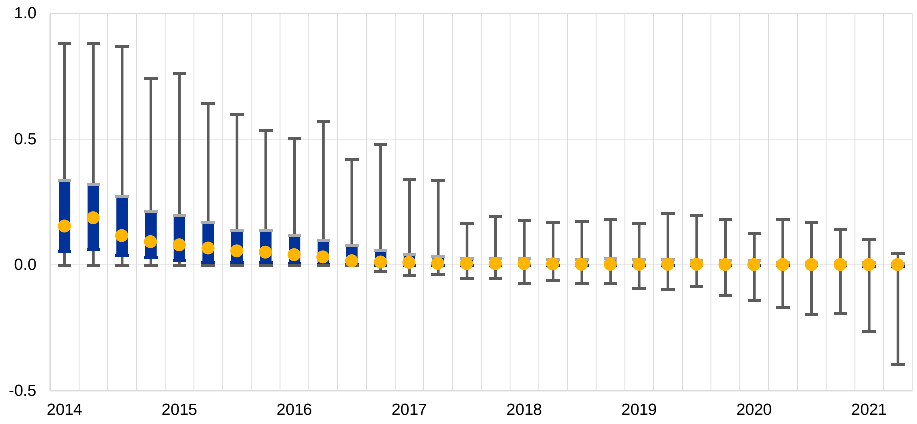
Source: ECB (IBSI and IMIR datasets).
Notes: Deposits at the ZLB are defined as those with an interest rate of between 0 and 5 basis points. The latest observation is for April 2021.

Empirical estimates indicate that the transition into negative territory tends to be very gradual, especially with "more negative" rates. A hazard model for the transition into negative territory from the moment in which a given deposit rate hits the ZLB has been estimated on the basis of bank-level information on deposit rates for a sample of euro area banks.[59] Regarding the level of policy rates, two opposing factors could be at play. On the one hand, when rates descend deeper into negative territory the transition is associated with more compressed margins, which creates an incentive for banks to accelerate the adoption of negative deposit rates. And on the other, the costlier transition can reduce their ability to charge negative rates (which depends on their balance sheet strength). The estimates indicate that the latter effect tends to dominate, as lower policy rates are associated with longer spells of stacking at the ZLB (Chart 9).

Chart 7

Distribution of overnight NFC deposit rates over time and across banks

(percentage points)



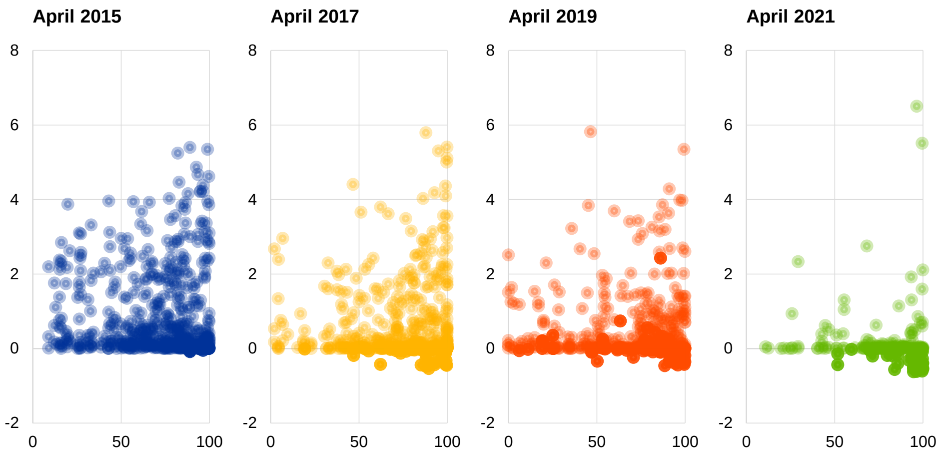
Sources: ECB (IBSI and IMIR datasets and ECB calculations.
Notes: Time series of box plots representing the distribution of deposit rates across banks in euro area countries. For each period, the box plots represent the 5th, 25th, 50th, 75th and 95th percentile of the distribution. Quarterly frequency based on the distribution in the last month of each quarter considered. The latest observation is for March 2021.

[59] Recourse to this family of models is necessary in this context given that, as mentioned above and despite the relatively long time-series available, a large share of deposits is currently still stuck at the ZLB. Failure to take this source of censoring into account would lead to downwardbiased estimates of the speed of the transition. The controls embedded in the model include time-varying country-specific fixed effects (distinguishing between periods on the basis of the level of the deposit facility rate), with the inclusion of "shared frailty" controls. On the reasonable assumption that country-level conditions are also taken into account when setting the policy rate, including in relation to the stacking at the ZLB, this control is useful in addressing a potential source of endogeneity. All covariates display statistical significance.

Chart 8

Deposit rates versus share of large loans to NFCs

(x-axis: percentage of total NFC loans; y-axis: percentage points)



Sources: ECB (IBSI and IMIR datasets and ECB calculations.
Notes: Bank-level scatter plots of rates for new business deposits (y-axis), average across all categories weighted by the corresponding outstanding amounts and share of new loans to NFCs above €1 million (x-axis). The x-axis is a proxy that indicates whether the banks deal with large clients. Observations with negative rates are highlighted by darker shaded points. Each panel reports data for the corresponding month only. Data as of April 2021.

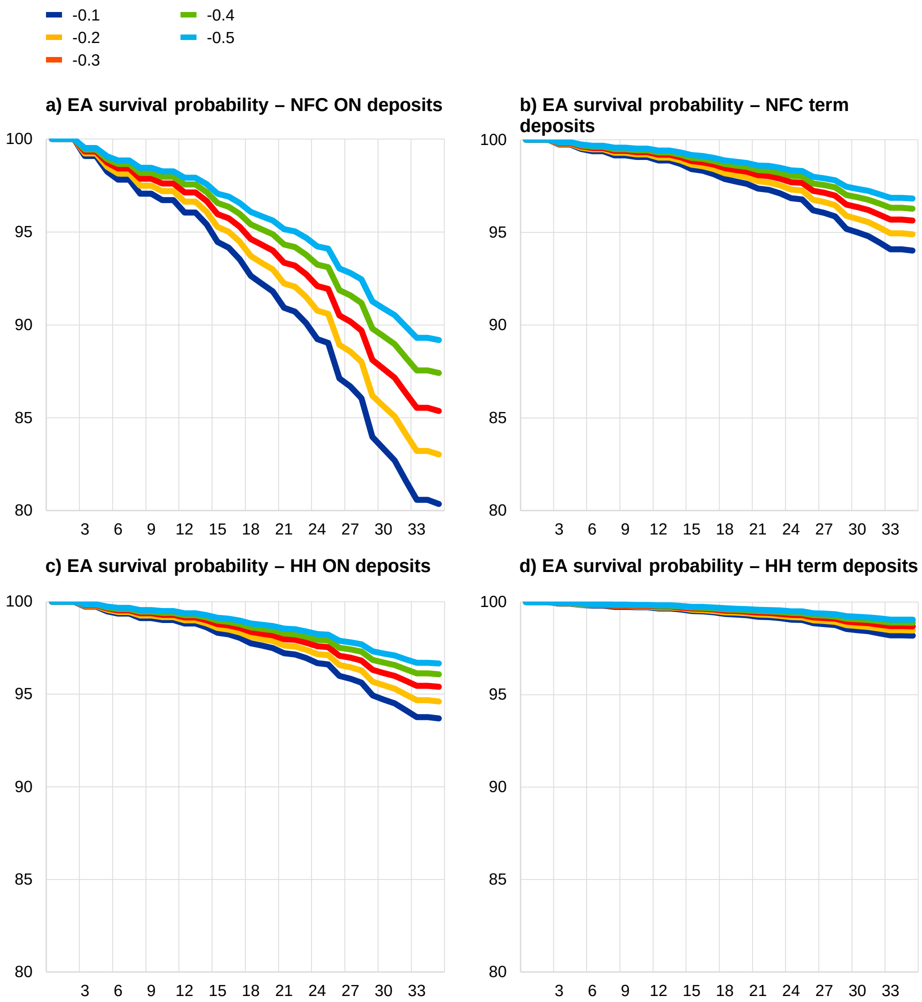
Lower interest rates can increase risk-taking incentives for banks. Portfolio allocation models predict that a reduction in short-term and long-term interest rates on safe assets will increase risk-taking by banks because investing in relatively safer asset classes becomes less attractive (Fishburn and Porter, 1976; Dell'Ariccia et al., 2014). Adrian and Shin (2010b) stress that weakly capitalised banks have high incentives to engage in riskier activities and to shift additional credit risk to debt holders when interest rates fall. Rajan (2006) argues that incentives or contractual imperfections mean that some financial intermediaries may search for yield when interest rates are low.[60]

[60] Rajan (2006) argues that insurance companies and pension funds enter into fixed-rate commitments and are therefore required to generate a minimum return on their assets. In a period of low interest rates on safe assets, their incentives to invest in riskier assets therefore increase. Alternatively, hedge fund managers' compensation contracts typically feature 1% of assets under management plus 20% of annual returns in excess of a minimum nominal return. This contractual feature increases the incentives for hedge fund managers to shift into riskier assets in low-rate environments.

Chart 9

Deposit rate sluggishness at the ZLB conditional upon different policy rate levels, by sector and deposit type

(probability of remaining stuck once hitting the ZLB; percentages)



Sources: ECB (IBSI and IMIR datasets) and ECB calculations.
Notes: The charts display the probability of deposit rates remaining stuck once they hit against the ZLB. The chart is based on a hazard model estimated for euro area (denoted as EA) bank deposit rates. The different colours indicate the estimated survival probabilities, over a three-year horizon, conditional upon the corresponding policy rate level. The underlying sample comprises bank-level information on the deposits placed with a representative sample of euro area banks and with a number of breakdowns capturing the counterparty (households (HH) and NFCs) and the type of deposits (overnight (ON) and term). The rates observed are monthly rates for new businesses since the introduction of the negative rate policy (June 2014 to September 2020). The sample comprises all observations related to any given deposit (bank/sector/type) for which the rate hits the ZLB (rate between 0 and 5 basis points) and all observations thereafter. The empirical set-up consists of the Cox proportional hazards model. This assumes that the time spent at the ZLB varies with deposit type, the size of the bank, the average size of its clients and the deposit facility rate, taken as the difference between it and the policy rate prevailing when the deposit hit the ZLB for the first time (this is because rates on different deposits have different starting levels and meet the ZLB at different times). The model also embeds time-varying country-specific fixed effects (distinguishing between periods on the basis of the deposit facility rate level), by including "shared frailty" controls. In the computation of the survival functions, all other characteristics are set at their sample average.

Yet not all theories imply that lower short-term rates go hand-in-hand with an increase in risk-taking. In Dell'Ariccia et al (2014), agency problems between banks and creditors become less severe the lower the short-term interest rates and thus banks' funding costs. In these models, a lower interest rate therefore reduces banks' incentives to engage in riskier activities. Lower interest rates also reduce the opportunity costs for banks to hold cash as an insurance against high deposit withdrawals (Smith, 2002). Lower interest rates can also increase banks' charter value, driving them away from "gambling for resurrection" strategies (Kane, 1989; Hellmann et al., 2000).

While the theory is ambiguous, a large body of empirical evidence has shown that a monetary policy that induces reductions in the short-term interest rate increases banks' risk-taking. Low policy rates are shown to increase banks' incentives to load up on riskier assets, step up their leveraging or increase their reliance on short-term funding. Mortgage portfolios with higher DTI and LTV ratios and the quest for higher-yielding assets point towards higher risk-taking. A number of studies assess the extent to which these patterns are caused by monetary policy. For the euro area, for instance, Maddaloni and Peydró (2011) show that the period between 2003 and 2006 was characterised by accommodative monetary policy shocks, as demonstrated by the persistent downward deviations of central bank interest rates from the Taylor rule. This period also saw more aggressive easing of credit standards for corporations and households. A considerable body of literature has emerged showing that part of the increase in risk-taking due to low interest rates can be causally linked to accommodative monetary policy.[61]

In recent years, evidence has emerged that the risk-taking channel is also present for monetary policy instruments other than short-term policy rates. The risk-taking channel is indeed affected by the configuration of interest rates along the whole term structure, which is in turn influenced by unconventional monetary policy. According to Bednarek et al. (2020), the Eurosystem's long-term liquidity provisions are associated with a higher supply of bank loans, especially to ex ante riskier firms. This shift in bank lending supply is associated with an ex post deterioration in banks' balance sheets. Long-term liquidity provision also tends to create incentives for banks to purchase high-yield eligible collateral securities (Crosignani et al., 2020). An active risk-taking channel specific to the negative interest rate policy has been documented, especially for those banks that rely heavily on customer deposits. Under this policy, the incentive for banks to expand their supply of loans is strengthened because additional reserves injected by the central bank entail a charge on them (Demiralp et al., 2021). However, the additional lending tends to be re-allocated towards ex ante riskier firms and higher-yielding securities, in particular by banks with a high share of retail deposit funding (Bubeck et al. (2020), Heider et al. (2019)). The risk-taking channel, in the form of portfolio rebalancing, is particularly significant for asset purchase programmes and may be the dominant component of their transmission to the real economy. By reducing the return on safe long-term securities, these policies make investors tilt their asset allocation towards higher-yielding and riskier assets (Albertazzi et al., 2020c).

More risk-taking is to some extent an intended effect of monetary policy and the evidence does not point to broadly based exuberance, although pockets of excessive risk in specific segments have been identified (e.g. consumer credit).[62] An

[61] See, for example, Altunbas et al. (2010), Buch et al. (2014a, 2014b), Delis and Kouretas (2011), Paligorova and Santos (2017), Dell'Ariccia et al. (2017) for the United States; Gaggl and Valderrama (2010) for Austria; López et al. (2010a, 2010b) for Colombia; Geršl et al. (2012) for the Czech Republic; Apel and Claussen (2012) for Sweden; Jimenez et al. (2014) for Spain; Morais et al. (2019) for Mexico.

[62] Disentangling intended from excessive risk-taking is obviously a complicated task. One approach that has been attempted consists in assessing the consistency of the pricing of the risk taken and its quantity (see Box 3 in Albertazzi et al., 2020a).

effective transmission of monetary policy to the real economy relies to some degree on banks and other investors' willingness to take additional risks. Lower policy rates stimulate loan growth to riskier borrowers too.[63] Increased risk-taking may therefore not translate into higher financial stability risks if monetary policy accommodation improves the balance sheet condition of existing borrowers and reduces the share of non-performing loans in banks' loan portfolios and the need for loan loss provisioning. Although higher risk-taking by banks and other financial intermediaries is partly warranted, these additional risks may become excessive and could pose a risk to financial stability. So far, however, most existing theoretical models or empirical evidence do not provide strong indications that the additional risk-taking associated with accommodative monetary policy has been excessive.[64] However, high uncertainty is embedded in the valuation of risks as the assessment of whether or not they are excessive may depend, for example, on the position of the business and interest rate cycle.

In certain circumstances, the risk-taking channel of monetary policy may even help underpin financial stability. Under adverse macroeconomic conditions, flight-to-quality episodes and procyclical movements in lending supply pose threats to financial stability. In the aftermath of negative shocks, flight-to-quality accelerates the transmission of shocks with potentially adverse side effects on financial stability itself (Bernanke et al., 1996). Moreover, investors' risk aversion increases under adverse macroeconomic conditions, with potential negative second-round effects (for example Vayanos, 2004).[65] The stabilising effects of monetary policy in the euro area in the aftermath of the global financial crisis have been documented in the literature.[66]

The relation between interest rates and risk-taking also presents possible non-linearities which risk being exacerbated in a low-for-long interest rate environment, potentially leading to excessive risk-taking, the build-up of systemic risk and asset price misalignments. The rigidity of deposit rates in low interest rate environments could suggest stronger incentives for banks to engage in riskier investment strategies (see Eisenschmidt and Smets, 2019). Indeed, some research suggests that the level of the short-term interest rate has a particularly strong effect on risk-taking incentives for financial intermediaries. Bianchi et al. (2021) show that the US economy may be characterised by longer-term regime shifts in asset values and risk premia that coincide with shifts in the interest rate environment.[67] They show that risk premia are systemically lower and asset valuations higher in such environments. Buch et al. (2014b) find that banks in the United States take on

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63 See Buch et al. (2014a).

64 The model provided in Stein (2012) is an exception. In this very simple model, banks engage in excessive money creation funded by short-term debt because they do not internalise the cost of fire sales. This externality provides a rationale for monetary policy to take financial stability into account.

65 Bekaert et al. (2013) find that expansionary monetary policy reduces risk aversion. At the same time, a large body of literature has emerged showing that in periods of real and financial volatility, the transmission of monetary policy shocks to the real economy and bank lending is significantly weaker than in normal or low volatility periods (Tenreyro and Thwaites, 2016; Eickmeier et al. 2020).

66 See, for example, Acharya et al. (2019), who document that at the height of the financial crisis, full allotment induced low-risk banks to increase credit supply and reduce loan spreads during the heights of the financial crisis.

67 These measure the interest rate environment as the real federal funds rate in excess of a measure of the natural rate of interest. This measure seems to be highly correlated with the real interest rate.

additional credit risk after expansionary monetary policy is introduced, especially in periods of relatively low nominal interest rates.[68] For other intermediaries, key sources of vulnerability stem from the possibility of excessive liquidity mismatches in parts of the non-bank sector, procyclical risk-taking, and risks associated with fund leverage.

For risk-taking, the implications of low rates change depending on whether these reflect monetary policy responding to adverse economic shocks (often associated with the financial sector's procyclical tendencies and excessive de-risking) or other factors. As mentioned, when the risk-taking channel operates the monetary-policy induced and intended extra dose of risk-taking tends endogenously to occur when the economy is in need of stimulus. This in turns tends to be associated with conditions of subdued risk appetite arising from the procyclical deleveraging and de-risking tendency of the financial sector. While disentangling intended from excessive risk-taking remains a daunting task, these simple considerations imply that a low interest rate environment resulting from secular stagnation are therefore more likely be associated with unintended and unwarranted increased risk-taking.

3.2.2 Beneficial financial stability spillovers of monetary policy

Under some circumstances monetary policy interventions play a fundamental role in sustaining financial stability. At a general level, the pursuit of a price stability mandate tends to be associated with a mitigation of business cycle fluctuations and of the related financial stability implications in circumstances where the financial sector tends to act pro-cyclically. In other circumstances, monetary policy exerts a key backstop role for financial stability. Notable examples are situations where central banks' interventions prevent the realisation of inefficient equilibria characterised by disordered deleveraging and de-risking (as with risk-taking, only excessive deleveraging and de-risking is unwarranted from a monetary policy viewpoint). These interventions refer to the lender-of-last-resort role of central banks, broadly defined.

The ECB has on several occasions adopted specific instruments to prevent the materialisation of inefficient equilibria that result in fire sales in sovereign debt markets. Measures such as the securities markets programme, outright monetary transactions (OMTs) and, more recently, the pandemic emergency purchase programme addressed dysfunctionalities in sovereign debt markets and preserved banks' intermediation capacity. Numerous papers estimate that the securities markets programme has had sizeable effects on the sovereign yields of stressed countries. OMTs, although never actually implemented, had smaller but

[68] Drechsler et al. (2017) show, in a dynamic asset pricing model with financial intermediaries, that the level of the nominal short-term rate is an important determinant of bank risk-taking. A central prediction of the model is that low nominal interest rates result in low risk premia due to lower risk aversion, which resembles a risk-taking channel in a low interest rate environment. In a low nominal rate environment the market price of risk, as well as the risk premium, are lower than in a high interest rate environment. The low price of risk leads banks to adopt greater leverage, which makes their net worth more volatile. Consequently, a low interest rate environment leads to higher volatility in the economy in the long run.

long-lasting effects which also restored funding flows to banks that had previously been shut out of the market for unsecured wholesale funding. They also re-activated investment flows in sovereign bonds by non-domestic banks, thereby mitigating the sovereign-bank nexus.[69]

A number of measures adopted by the ECB since the onset of the global financial crisis were conceived to avert retail and wholesale deposit runs and the ensuing dysfunctionalities in the transmission mechanism.[70] Throughout these operations the Eurosystem has provided considerable liquidity support and term funding to euro area banks (see ECB, 2021b), with the intent of mitigating the risk of outright credit crunches and their harmful consequences for the real economy.[71]

The backstop role of monetary policy has a material impact on bank default rates, as well as on other variables, by eradicating equilibria with runs. A micro-structural model of competition for euro area banks, including a central bank injecting liquidity at pre-determined conditions, has recently been designed (Albertazzi et al., 2020b). The model makes it possible to assess the role of monetary policy in averting uncoordinated run-type equilibria, even when these do not actually materialise. The analysis indicates that the quantitative relevance of non-fundamental risk, i.e. the risk associated with the presence of alternative equilibria with run-type features, is potentially large in the euro area banking sector. It also indicates, however, that central bank interventions exerted a crucial role in containing it. The counterfactuals show that a 1 percentage point reduction (increase) in the ECB lending rate for its refinancing operations reduces (increases) the median of banks' default risk across equilibria by around 50%, with substantial heterogeneity of this pass-through across time, banks and countries.

A number of studies have documented the presence of side effects that materialised in the aftermath of the liquidity injections implemented by the Eurosystem, including three-year longer-term refinancing operations (LTROs). There is evidence showing that banks borrowing more Eurosystem funds up to December 2011 tended to be weakly capitalised and use riskier collateral than other counterparts (Drechsler et al., 2017). Studies also showed that some banks invested disproportionately in government debt securities, particularly domestic bonds, leading to an aggravation of the bank-sovereign nexus (Acharya and Steffen, 2015). These side effects have inspired innovations in the design of future operations (see Section 3.3).

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69 See the synopsis of the papers quantifying the impact on bond yields provided in Albertazzi et al. (2020a) and Altavilla et al. (2020b). For the securities markets programme, this is based on Eser and Schwaab (2013); Krishnamurthy et al. (2018) and Ghysels et al. (2017); for OMTs, it is based on Altavilla et al. (2014) and Krishnamurthy et al. (2018). On OMTs and the sovereign-bank nexus, see Acharya et al. (2016).

70 See Cœuré (2014).

71 A number of studies use granular data to explore the effectiveness of long-term liquidity operations on lending supply, leading to somewhat diverse assessments. These include Carpinelli and Crosignani (2020);, Jasova et al., Mendicino, and Supera (2018),; Andrade et al., Cahn, Fraisse, and Mésonnier (2021); and García-Posada and Marchetti (2016).). these studies offer significant methodological advances in terms of the ability to disentangle shifts in credit demand from shifts in supply. They measure the impact of such operations via a funding cost relief channel, documenting a relatively mild impact on average. This differs from backstop role of these operations. To assess the latter one needs to construct a counterfactual of the economy if the (systemic) run had materialised.

A central bank that is perceived as always willing to accommodate liquidity dry-outs may induce distortions in ex ante incentives, leading banks to embark on higher levels of liquidity and credit risk. The "Greenspan put" has long been considered a cause of excessive exuberance in financial markets. Recent works by Cieslak et al. (2021) confirm, for the United States, that low stock returns tend to predict more accommodative policy, largely reflecting policymakers' reading of stock market development signals on the outlook for consumption.

Effective macroprudential policies may improve the trade-off between ex ante and ex post efficiency associated with central bank (ex post) interventions. As formally illustrated by Jeanne and Korinek (2020), the presence of a shadow banking sector not covered by the available prudential framework makes it optimal to partly limit ex post liquidity interventions and, as a consequence, distortions in ex ante risk-taking incentives. However, doing so may be extremely costly ex post, as systemic crises that are not adequately mitigated by central bank interventions could result in huge economic costs. Announced commitments not to intervene might therefore simply not be credible, leaving distortions on ex ante incentives unaffected (Dewatripont and Maskin, 1995). Enhancing the macroprudential framework to also make it effective with respect to the most significant non-bank institutions would therefore address ex ante incentives without requiring either costly or non-credible limits to ex post backstop operations.[72] An effective macroprudential framework not only relieves pressure on monetary policy ex ante, by making the central bank less compelled to lean against the wind in order to contain the build-up of financial stability risks, but also relieves pressure on monetary policy ex post, by making the central bank less compelled to limit its ex post interventions in order to limit moral hazard.[73]

3.3 How the design of instruments and other institutional factors mitigates the adverse side effects of monetary policy on financial stability

This section focuses on specific features of unconventional measures that might, directly or indirectly, have a substantial interaction with financial stability. More specifically, it presents an overview of how the design of liquidity provision measures, asset purchase programmes and negative interest rate policies might influence bank profitability and financial asset valuations and how policy-specific features might avoid or mitigate some of these side effects on financial stability.

72 A different perspective is provided in Bornstein and Lorenzoni (2018). According to their analysis the notion that ex post interventions necessarily lead to negative side effects in terms of moral hazard ex ante is not, from a theoretical viewpoint, general. Their reasoning is developed around an example envisaging monetary policy interventions ex post and the presence of an aggregate demand externality. Intuitively, the ex post inefficiency caused by the lack of a backstop, and amplified by the demand externality, has adverse consequences on ex ante choices, thus making the ex ante level of borrowing inefficient (more so than with ex post interventions).

73 A growing body of literature is assessing the effectiveness, but also the limits, of macroprudential tools. Overviews can be found in Galati and Moessner (2018), Cerutti et al. (2018) and Araujo et al. (2020).

LTROs

In December 2011 the ECB Governing Council announced additional liquidity provision measures to support bank lending and liquidity. These measures took the form of two three-year LTROs with the option of early repayment after one year. Empirical evidence (Crosignani et al., 2020; Altavilla et al., 2017) noted that, as a result of the three-year LTROs, banks increased their government bond holdings, consequently intensifying the negative feedback loop between banks and sovereigns. To address this unintended consequence of the three-year LTRO, the design of subsequent liquidity programmes has been strongly targeted to real economy outcomes.

In 2014 the ECB launched TLTROs to "enhance the functioning of the monetary policy transmission mechanism by supporting lending to the real economy." The rationale for TLTROs reflects both the predominantly bank-based financing structure of the euro area economy and the fact that the functioning of the bank lending channel is important for its economic growth. Unlike the three-year LTROs, these targeted operations embed an incentive scheme whereby borrowing banks obtain benefits if they lend more to the real economy. Moreover, the favourable rates at which banks can finance themselves through TLTROs, provided they meet the lending targets, support their margins, thereby offsetting some of the pressure on profitability.

The specific design of the TLTROs has changed over time to accommodate the different objectives of the measure. The design of TLTRO III (March 2019) responded to a variety of objectives related to the potential congestion of bank funding caused by the need to refinance sizeable amounts of bank bonds and maturing TLTRO funding, as well as the need to comply with various regulatory requirements.[74] The TLTRO III recalibrations of March and April 2020 were designed to support firms and households' continued access to bank credit.[75] They have provided a backstop against the risk of spiralling into an adverse feedback loop in the real and financial sectors, preserved the transmission of the monetary policy within the euro area, and supported the economic outlook during the pandemic.

The targeted nature of TLTROs has been effective in tilting banks' asset composition from purchasing securities to non-financial private sector lending, leading to a broad-based easing of bank-based financing conditions. Several studies highlight that the targeted nature of central bank liquidity operations has significantly incentivised banks' lending to the non-financial private sector, ultimately leading to a compression in bank exposure to domestic sovereign holdings (see Afonso and Sousa-Leite, 2019, Balfoussia and Gibson, 2016, Benetton and Fantino, 2018, Boeckx et al., 2020, Altavilla et al., 2020c, and Altavilla et al., 2020d). The increase in loan supply and the decrease in lending rates found in much of the research have also been instrumental in reducing the sovereign-bank nexus that was indirectly fuelled by untargeted liquidity operations (Altavilla et al., 2017).

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[74] These requirements include the net stable funding ratio, the minimum requirement for own funds and eligible liabilities and total loss-absorbing capacity.

[75] Excluding lending for house purchases.

In all TLTROs, the "eligible loans'' universe has remained unchanged and excludes loans to households for house purchases. Eligible loans are defined as loans to NFCs and households (including non-profit institutions serving households) resident in Member States whose currency is the euro. From the start of the TLTRO operations in 2014, the ECB has deliberately excluded loans to households for house purchases from "eligible loans", as the market segment was considered to be adequately served by the banking sector and its exclusion was intended to avoid financial imbalances in housing markets as an unwarranted side effect of accommodative monetary policy.[76]

Negative interest rate policy

Negative interest rate policy also has potential implications for bank profitability and intermediation capacity. Empirical evidence shows that the effect of the negative interest rate policies on the main components of bank profitability is asymmetric, with a positive impact on loan loss provisions offsetting the negative impact on net interest income. Importantly, a protracted period of negative policy rates has an adverse effect on bank profits that, however, only materialises over a long time horizon and is counterbalanced by improved macroeconomic conditions (Altavilla et al., 2019b).

Direct costs related to the remuneration of excess reserves at negative rates are mitigated by a number of factors. The direct charge associated with negative interest rate policy applies in particular in countries where most of the excess liquidity is concentrated (such as Germany and France). At the same time, before all asset and liabilities are repriced at the new rates, the indirect impact of negative interest rate policies on net interest margins is more significant in countries where a larger share of the loan portfolio is indexed to short-term rates. These include Italy and Spain, where loans are typically extended at a floating rate (albeit with a gradual shift towards larger shares of fixed rates on new loans). These charges are, however, mitigated by several factors, including: (i) non-interest income supported by one-off capital gains and potentially fee and commission income (substitution of lower negative interest income – de facto negative rates for households – and potentially increased trading activity); (ii) the intended macroeconomic impact leading to higher intermediation volumes and lower credit risk; and (iii) banks' trade at negative value in the interbank market partly recouping the charges.

Moreover, negative interest rate policies also provide stimulus to real economic activity through firms' asset rebalancing. Confidential information on more than 300 banks from the individual balance sheet item (IBSI) dataset, matched with information obtained from the Orbis database on more than three million firms operating in 19 euro area countries, shows that firms with ex ante high cash holdings that are associated with negative deposit rate banks increased their investment after the introduction of the negative interest rate policy. This is an independent channel of

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[76] While still representing a minor component of euro area banks' balance sheets, consumer loans have rapidly expanded in recent years. As mentioned above, this reflects possible excessive exuberance.

transmission that Altavilla et al. (2019b) label as the corporate channel of monetary policy.

A further concern is related to the effect of negative interest rate policies on banks' risk-taking behaviour. A number of recent studies investigate the risk-taking behaviour of banks in an environment of negative policy rates. Bubeck et al. (2020), for example, analyse how the negative interest rate policy influences banks' securities investment choices. The analysis finds that following the introduction of negative policy rates, banks with a larger share of deposits tend to increase their holdings of high-yield securities. A potential concern for financial stability emerges from the evidence that less capitalised banks seem to engage more in these search-for-yield activities. Based on a sample of syndicated loans, Heider et al. (2019) show that banks whose business model is particularly exposed to the low interest rate environment, such as those with a high share of retail deposits, may take systematically higher risks than their peers. At the same time, looking at loan-level credit register data for Italy, Bottero et al. (2019) present evidence that the higher ex ante risk of borrowers resulting from the broadening of credit supply did not translate into higher levels of non-performing loans. Boucinha and Burlon (2020) provide an overview of the transmission channels of negative interest rate policies to the real economy, noting that higher risk-taking by banks is part of the policy's transmission mechanism. While there may be pockets of excessive risk-taking, macro and microprudential authorities are best placed to address these potential side effects. In addition, Arce et al. (2018) document a positive relationship between capital ratios and risk-taking for those banks adversely affected by the negative interest rate policy. Their evidence suggests that the undercapitalised banks affected take less risk because of the lack of capital buffers to absorb losses and the need to meet capital requirements. This somewhat dispels worries of gambling-for-resurrection behaviour, while suggesting the importance of capital constraints for the transmission of monetary policy. Overall, the evidence of potential side effects of the negative interest rate policy is mixed.

Several central banks have exempted certain types of deposit from negative interest rates in order to mitigate some of their side effects, including their impact on bank profitability. The deposit tiers thus created are subject to different interest rates. At its meeting of 12 September 2019 the Governing Council of the ESCB decided to introduce a two-tier system for reserve remuneration, in which, for institutions subject to minimum reserve requirements, a part of the reserve holdings in excess of those requirements would be exempted from remuneration at the rate applicable to the deposit facility (the exempt tier).

The two-tier system for reserve remuneration is designed to preserve the accommodative impact of negative interest rate policies while alleviating some of the negative side effects for banks, i.e. those related to the direct costs of holding excess reserves. In addition, it has encouraged additional borrowing and lending activity in the interbank money market, including cross-border, which contributes positively to de-fragmentation. Looking ahead, if the negative interest rate policy extends over a long period of time, adjustments to the tiering multiplier could enable higher compensation for the increased direct costs resulting from the more negative remuneration on banks' excess liquidity holdings. This, in turn, would mitigate the risk of hampering bank profitability, especially in periods of distress, where negative shocks to capital would be more likely to result in deleveraging.

As for institutional factors, the architecture of banking supervision influences banks' risk-taking behaviour. Using granular information obtained from the credit registers of several European countries, Altavilla et al. (2020a) found in a recent study that supranational supervision reduces the credit supply to firms with very high ex ante and ex post credit risk, while stimulating credit supply to firms without loan delinquencies. The same study also finds crucial complementarities between supervision and both conventional and unconventional monetary policy. So far, centralised supervision has been able to offset excessive bank risk-taking induced by a more accommodative monetary policy stance but does not offset more productive risk-taking. Similar complementarities between monetary policy and national macroprudential policy are found in Altavilla et al. (2020d). Credit and liquidity risk-taking by non-bank financial intermediaries is, however, not tamed by an effective macroprudential framework. A properly developed macroprudential framework for the non-bank financial sector can mitigate such risks and thus support monetary policy in fulfilling its price stability mandate.

3.4 Potential focus on heterogeneous and distributional effects of monetary policy on financial stability

The euro area's monetary policy can have heterogeneous financial stability spillovers across jurisdictions. While monetary policy decisions are taken by the Governing Council for the euro area as a whole, the consequences in terms of fostering the build-up of financial vulnerabilities could differ across euro area countries. Indeed, the side effects of monetary policy on a country's financial stability can change, depending on whether the country is experiencing a peak or a trough in its business or financial cycle and on country-specific structural features. This leads to cross-country heterogeneity both in the transmission of monetary policy and in its possible financial stability implications.[77]

Positions in the business and financial cycles are significant factors in the transmission of monetary policy shocks to key financial variables. Alpanda et al. (2019) show that business, credit and interest rate cycles affect the monetary transmission mechanism in a non-linear and asymmetric manner. They find that the impacts of monetary policy shocks on the debt-to-GDP ratio and real house prices are less pronounced during periods of economic downturns, high household debt, or high prevailing interest rates.

Mortgage market structures can exacerbate the responses of house prices and residential investment after monetary policy shocks. Calza et al. (2013) document the significant degree of heterogeneity observed in the institutional characteristics (e.g. duration of mortgage contracts, the required levels of down-

[77] See Hauptmeier et al. (2020).

payment, the existence or lack of equity release products) of national residential mortgage markets across 19 industrialised countries (nine of which being euro area countries). They also show that the impact of monetary policy shocks to residential investment and house prices is significantly stronger in countries with more developed mortgage markets.

The role of heterogeneity across economic agents

Heterogeneity within the private non-financial sector, i.e. both households and firms, has a bearing on the transmission of monetary policy. Until recently, policy makers and academics had essentially analysed the effects of monetary policy on aggregate consumption, investment and GDP and, to a lesser extent, on financial variables such as aggregate debt-to-GDP ratio, house prices, and stock prices. Their focus was not on heterogeneity. However, a substantial and growing body of literature now departs from the usual assumption of "representative" households or firms.[78]

The heterogeneous forces whereby monetary policy affects the real economy through its various channels can have significant implications, not only on the effectiveness of monetary policy transmission per se, but also on financial stability. The levels of aggregate variables such as private sector indebtedness or financial asset prices reflect, in a significant manner, the individual decisions made at household or firm level. The impact of a monetary policy decision on the debt-to-GDP ratio of the private sector (households and firms), for instance, essentially depends on the heterogeneous individual and partial equilibrium effects of monetary policy on households' consumption and firms' investment. Most importantly, however, it depends on the initial wealth and leverage distribution of those households and firms. While we are beginning to understand more clearly the heterogeneous channels through which monetary policy affects households' consumption and firms' investments, the spillovers on financial stability remain mostly unexplored.

Monetary policy affects households through various channels in a heterogeneous way. Slacalek et al. (2020) document several dimensions (net liquid assets, net wealth, housing wealth and stock market wealth) of heterogeneity across euro area households. They also analyse several monetary policy transmission mechanisms operating on the household sector through direct partial equilibrium channels (e.g. intertemporal substitution and net interest rate exposure), and indirect general equilibrium channels (e.g. net nominal exposure, as well as wealth, collateral and labour income channels). They show that the magnitude of these effects varies across households, depending on their marginal propensity to consume, their balance sheet composition, the sensitivity of their earnings to fluctuations in

[78] See Challe et al. (2017), Kaplan et al. (2018), McKay et al. (2016), Luetticke (2021) and Auclert (2019).

aggregate labour income, and the responsiveness of aggregate earnings, asset prices and inflation to monetary policy shocks.[79]

Heterogeneous responses to monetary policy across firms

High leverage of non-financial firms affects the transmission of monetary policy. That said, however, the literature on this aspect provides mixed evidence. Jeenas (2018) shows that firms with higher leverage respond more to a monetary policy surprise shock. In contrast, Ottonello and Winberry (2020) find that the response to a monetary policy shock of US firms with high leverage and a low distance-to-default, classified as high-risk firms, is less marked than that of other firms. They also document that this difference is persistent, lasting up to three years. Looking at US firms, Anderson and Cesa-Bianchi (2020) document, instead, that after a monetary policy tightening firms with higher leverage experience a more pronounced increase in credit spreads and decrease their stock of debt to a greater degree than firms with low leverage. Auer et al. (2019) find for the euro area that higher leverage is generally associated with a more marked response by industrial production to monetary policy; however, this positive relation weakens significantly and eventually changes its sign when leverage is particularly high – and thus likely to be excessive.

The amount of liquid assets that a firm holds on its balance sheet, and its age, also play a key role in its responsiveness to monetary policy shocks. Jeenas (2018) finds that firms with higher leverage and lower liquid asset holdings at the time of a contractionary monetary surprise tend to experience lower fixed capital expenditure, inventories and sales growth. Cloyne et al. (2018) use firm-level investment data for both US and UK firms and find that younger firms paying no dividends exhibit the largest and most significant change in capital expenditure in response to monetary policy surprises.

In the euro area, the presence of spillovers between monetary policy and macroprudential policy matches the cross-country heterogeneity in their intensity and explains the need for an appropriate balance between the macroprudential competences available at the national level and those which are centralised. Cross-country heterogeneity in the transmission and financial side effects of monetary policy calls for the presence of mitigating tools available at the national level. Heterogeneity is driven by country-specific institutional factors, as well as by differences in average household and firms' characteristics, that have a bearing on monetary policy. Some national designated authorities have recognised this and have already resorted to various borrower-based measures (e.g. LTV, DTI and debt service-to-income caps) along with the flexibility package provided for in the Capital Requirements Regulation. The aim here is to curb the undesirable side effects that, by feeding into the build-up of financial vulnerabilities in some sub-sectors, monetary policy can have on financial stability. At the same, the widely

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[79] Using household survey data for the United States and the United Kingdom, Cloyne et al. (2020) show that the aggregate response of consumption to interest rate changes is driven by households with a mortgage.

documented spillovers of monetary policy on financial stability and, symmetrically, those of macroprudential policy on the monetary policy transmission mechanism, imply that some degree of coordination is warranted so as to achieve a consistent policy mix.

3.5 Conclusions

This chapter provided an assessment of the financial stability implications of low interest rates, distinguishing as far as possible between the consequences of the structurally low-rate environment and the causal effects of monetary accommodation. On the basis of a large body of empirical evidence it concluded that low rates have adverse implications for the profitability of financial intermediaries. When considering the causal effects of monetary policy, however, it is crucial to consider the presence of offsetting factors stemming from the improvement in the macroeconomic outlook produced by the monetary accommodation. The evidence, in this respect less conclusive, points to an overall broadly neutral impact on bank profitability. The outlook for non-banks is less benign, as many of these intermediaries are structurally exposed to relatively safe assets and do not benefit of such offsetting factors.

Low rates did encourage risk-taking in segments of the financial sector. However, it is difficult to assess empirically whether the increased level of risk-taking should be considered as excessive or unwarranted – and therefore whether low interest rates produced adverse effects on financial stability. Here again, the outlook is less benign for non-banks than for banks, largely reflecting the effective micro and macroprudential framework that is in place for euro are banks.

Chapter 3 also discussed how the design of some of the instruments implemented since the outbreak of the global financial crisis has been inspired by the objective of mitigating possible adverse side effects on financial stability. This was notably the case for TLTROs and for the two-tier system for reserve remuneration.

4 Medium-term orientation of the price stability objective and financial stability considerations

4.1 The medium-term horizon for price stability and financial stability considerations in a price stability-oriented monetary policy framework

Financial stability considerations can be significant in pursuing the primary objective of price stability assigned to the ECB by the Treaty on the Functioning of the European Union (TFEU). Financial stability is a prerequisite for monetary policy to be effective in pursuing its primary objective, as without it most transmission channels do not operate smoothly. If, for instance, the balance sheets of financial intermediaries, and of banks in particular, are impaired as a result of losses incurred during a crisis, these entities will be constrained in their ability to create inside money or to shape the price of risk in the economy.[80] They will not, therefore, be effective carriers of the monetary stimulus to the economy. Similarly, if the non-financial sectors in the economy are suffering from low net worth owing to a collapse in asset values and high levels of debt, their access to finance will be constrained and the reaction of investment and consumption to monetary stimulus will be muted.[81] Moreover, financial crises are in and of themselves deflationary and associated with left-tail materialisations of inflation outcomes, which are not consistent with price stability.[82]

In principle, macroprudential tools can be used to address the build-up of financial imbalances in a targeted fashion, but they may face limitations.[83] For example, leakages may occur through non-bank financial institutions within the domestic financial sector that are either unregulated or not given the same regulatory treatment as banks. In these circumstances, monetary policy itself would not be subject to the leakages as it famously “gets in all of the cracks” of the financial system (Stein, 2013). It can affect financial stability by influencing risk-taking and leveraging and in this way also affect the probability as well as the depth of potential crises. So a price stability-oriented monetary policy may want to step in to pre-empt the deflationary pressure that would be associated with a potential future financial crisis.

Ensuring financial stability can, however, appear to run counter to the active pursuit of price stability over short horizons. The above considerations create a rationale for a monetary policy oriented towards price stability to also take financial

80 See Adrian and Shin (2010a) and Brunnermeier and Sannikov (2014a).

81 See Gertler and Kiyotaki (2010).

82 See Reinhart and Rogoff (2009) and Jorda et al. (2013).

83 For a more in-depth discussion, see Chapter 2. For a literature review on the effectiveness of macroprudential policy, see, for example, Galati and Moessner (2018).

stability into account – at least for as long as financial stability cannot be ensured at all times through macroprudential tools. In the short run, however, there may seem to be a conflict between achieving price and financial stability if, for instance, in an environment where inflation is below the desired level, there is evidence that financial imbalances may be building up. This tension can potentially be resolved by extending the horizon over which price stability is to be achieved to an appropriate extent.

The ECB's monetary policy strategy already entails a flexible medium-term horizon over which it seeks to restore inflation to its target level. Since its inception in 1998 and as also confirmed in 2003, the ECB's monetary policy strategy envisages a medium-term orientation to maintain price stability, recognising the significant transmission lags with which monetary policy exerts its influence. Moreover, the length of the medium-term horizon is defined flexibly and is conditional upon the nature and size of the shocks buffeting the economy. Supply shocks move inflation and real economic activity in opposite directions and attempting to offset them at high frequency would generate unwanted volatility in output and employment.

The medium-term orientation also provides a possible way to take financial stability concerns that impinge on price stability into account over a longer horizon than that associated with standard transmission lags. While under the ECB's current strategy adjusting the length of the medium-term horizon for achieving price stability is subject to a specific conditionality, namely whether aggregate shocks are of a supply nature, this could be expanded to also accommodate financial stability considerations. Sections 4.2 and 4.3 discuss the theoretical desirability and practical feasibility of this expanded use of the medium term, taking into account that there is no generally accepted way to identify and measure financial stability risks. Clearly, an expanded role of the horizon to take financial stability concerns into account would entail significant communication challenges.

To illustrate the types of policy prescription that could be associated with such considerations, it is useful to distinguish between two stylised "states" that the economy may be in. The first state refers to an ex ante situation, when a financial crisis has not yet occurred (see Table 2). If, for example, financial exuberance is detected while inflation is expected to be below target over the standard horizon, then monetary policy can allow itself more time to restore price stability. The intention here would be to avoid a further build-up of financial stability risks that would be triggered by more forceful action to restore price stability, which would in turn pose challenges in meeting the inflation target further down the line. A second state refers to a situation where financial stability risks have materialised in an ex post state and the economy finds itself grappling with a financial crisis. In principle, financial crises are associated with deflationary pressures; therefore there is no immediate conflict between restoring price and financial stability. However, in the aftermath of a financial crisis the monetary accommodation required to achieve price stability might not be sufficient to also remove financial impairments arising, for instance, from large stocks of debt accumulated on balance sheets. In this case, the inflation target could be temporarily overshot to allow these impairments to be addressed, before returning to price stability over a longer horizon.

Table 2

Financial stability risks and the horizon for achieving price stability – the ex ante case (normal times)

		Expected inflation at the end of the horizon ($E(\pi)$) compared with the target (π^*)	
		$E(\pi) < \pi^*$	$E(\pi) > \pi^*$
State of financial stability risks	No exuberance detected	Maintain standard horizon	
	Exuberance detected	Extend horizon (and allow temporarily for a slightly tighter monetary policy than that required by price stability considerations alone)	Maintain or shorten standard horizon (and allow for a much tighter monetary policy than that required by price stability)

Applying an extended horizon to achieve price stability has in fact been fairly frequent over the ECB's history. An illustrative exercise to identify instances of an extended horizon for monetary policy can be designed on the basis of the inflation projections at the end of the horizon of Eurosystem staff's broad macroeconomic projection exercises (B)MPEs. (B)MPEs are a key input to the Governing Council's assessment of economic developments and risks to price stability. As such, for illustrative purposes their horizon can be understood as representing a benchmark for the reference horizon for monetary policy decisions.[84] If projected inflation at the end of the (B)MPE horizon is outside a range of values that can be understood as consistent with the definition of price stability and yet no monetary policy action is taken, then it can be inferred that the horizon adopted by the Governing Council in that instance extended beyond that of the (B)MPE.[85] Chart 10 depicts in grey the quarters since 2005 when the monetary policy horizon extended beyond that of the (B)MPE, focusing only on those cases where projected inflation was below a range consistent with price stability.[86]

[84] The precise length of the projection horizon is not fixed over time, since the end point is always at the end of a calendar year. As a result, depending on the quarter in which the projection is carried out the length of the horizon varies somewhat. In 2016 the horizon of the December exercise was extended from eight to 12 quarters.

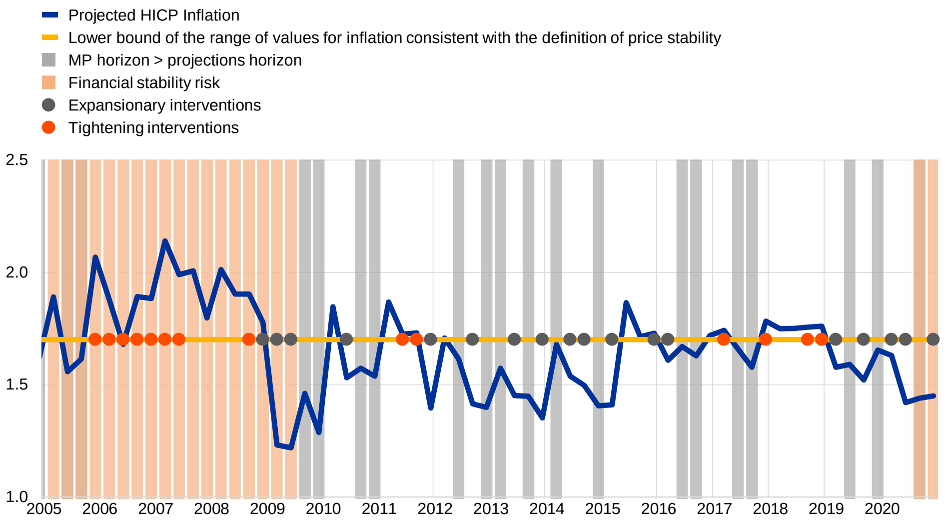
[85] One possible interpretation of this outcome is that the Governing Council did not share the Eurosystem staff's views on expected inflation at the end of the horizon. Another is that, especially during the financial and sovereign crisis, the effectiveness of the different monetary policy measures for achieving price stability needed to be iteratively assessed, thus generating a prolonged period of undershooting.

[86] For this exercise, an illustrative floor value of 1.7% is used, in line with the following, taken from ECB (2003): "longer-term inflation expectations have been firmly anchored at levels in line with the definition of price stability since January 1999, remaining in a range between 1.7% and 1.9%."

Chart 10

ECB medium-term and financial stability in the euro area

(percentages)



Sources: ECB and ECB calculations.
Notes: The blue line represents projected inflation at the last reference quarter of the Eurosystem staff's (B)MPE conducted at the quarter shown on the x-axis. The yellow line represents an illustrative lower bound of the range of values for inflation consistent with the definition of price stability (1.7%). Grey areas are quarters when the monetary policy horizon is longer than that of the (B)MPE. The light orange areas denote quarters where medium or high financial stability risk, as indicated by the systemic risk indicator of Lang et al. (2019), is greater than 0.1. Grey diamonds mark ECB expansionary interventions, including the introduction and extension of non-standard measures. Red diamonds mark ECB tightening interventions, including the scaling down or discontinuation of non-standard measures. The latest observation is for the fourth quarter of 2020.

Instances of conflict between price and financial stability have been fairly rare in the euro area but have had potentially significant implications for financial stability. The above discussion of potential short-run conflicts between price and financial stability and the situations described in Table 2 raise the question of how empirically significant such cases have been in the euro area. The exercise reported in Chart 10 can be extended to also provide a stylised answer to that question. Unlike price stability, which can be mapped onto a single, well-defined metric such as the rate of HICP inflation, codifying financial stability risks and concerns into a quantitative expression is notoriously difficult. In this exercise we use the domestic version of the cyclical systemic risk indicator (d-SRI),[87] which is a broad-based indicator capturing risks stemming from domestic credit, real estate markets and asset prices as well as external imbalances. It has good leading indicator properties for the materialisation and depth of systemic financial crises. The light orange areas in Chart 10 identify periods when the d-SRI signals medium or high risks for financial stability. Consistent with the notion that financial cycles are long (compared, for example, with business cycles),[88] the d-SRI identifies only one protracted period, from 2005 to mid-2009, in the available sample of medium or high financial stability risks.[89] During this period, there were two quarters in 2005 and another two in 2009 when projected inflation was below the range consistent with price stability.

87 Lang et al. (2019).

88 See Drehmann et al. (2012), Rünstler and Vlekke (2016) and Chapter 3 of this paper.

89 A medium risk has also been identified at the end of the sample period (since the third quarter of 2020).

In a situation where inflation was projected to be below a range consistent with price stability while signals of financial stability risk were also present, no expansionary monetary policy interventions in fact took place. While in the aftermath of the Lehman Brothers collapse in late 2008 and early 2009 the d-SRI was still indicating the presence of financial stability risks, the crisis had actually taken hold and monetary policy was reacting to address it. Only the 2005 case, when there was no injection of monetary policy accommodation, is therefore relevant. It is open to interpretation whether this case was at least in part caused by the Governing Council taking financial stability considerations into account. On the one hand, money and credit growth was buoyant in that period and narrative-based approaches make the case that this factor did indeed weigh on decision-making at the time.[90] On the other hand, actual inflation readings were also quite high in that period, possibly generating larger uncertainty regarding the level of staff projections. Taylor-rule estimates of the ECB's reaction function using only the standard arguments do not detect any significant anomaly in this period.[91]

4.2 Financial stability and the medium-term orientation: general aspects

This section discusses the extent to which the medium-term may have to be adjusted to allow monetary policy to counteract the build-up of financial imbalances. The section will mostly abstract from the question of whether central banks ought to respond to financial imbalances, which is addressed in Chapter 2. It will, assume a systematic monetary policy response to financial imbalances and assess whether, compared with a standard policy response: (a) it tends to dampen economic fluctuations in response to boom/bust cycles; and (b) it generates a change in the medium-term orientation. The response to financial imbalances will be captured through a leaning element.

Section 4.2 draws on selected models which are representative of different approaches, with the aim of providing an initial assessment of how the medium term may need to be adjusted to allow for a monetary policy response to financial imbalances.[92] It entertains two possible notions of financial stability. The first notion coincides with the absence of bubbles in asset prices, since bubbles, i.e. developments in asset prices that are unrelated to economic fundamentals, can create instability when they burst. The second can be understood more broadly as the absence of imbalances in the financial sector, i.e. a state of the world in which the banking system is well capitalised (whereas financial imbalances would be associated with low bank capital and increasingly binding financing constraints in the banking sector). Section 4.2 also uses different approaches to assess the implications of a monetary policy response, including some leaning elements. A first approach is scenario analysis, broadly along the lines of Bernanke and Gertler

90 See Neumann (2008) and Fischer et al. (2008).

91 See Hartmann and Smets (2018).

92 A number of papers discuss the properties of leaning against the wind, including Gourio et al. (2018), Adrian et al. (2020) and Cairo and Sim (2020). However, the available macro-finance models are arguably not yet sufficiently developed to provide robust, quantitative guidance on the medium term.

(1999). The advantage of this methodology is that it is feasible in suitably extended versions of standard, linearised macroeconomic models whose empirical properties are well understood. A second approach is to account explicitly for the non-linearities characterising financial crises triggered by shocks which reduce the capitalisation of financial intermediaries. This approach requires a less standard type of model, which is inevitably more stylised along certain dimensions. A third, and much simpler, approach will be used to gauge the implications of relaxing the assumption of rational expectations and full credibility of the central bank inflation target.

The discussion in this section focuses on an ex ante perspective for the medium term, i.e. the extent to which an adjustment in the medium-term orientation is warranted to address the risk of future financial instability. Nevertheless, the leaning against the wind policy rules used in the simulations are symmetric, i.e. they call for both leaning ex ante, that is, a tighter monetary policy stance during the build-up of financial imbalances, and cleaning ex post, that is, easier monetary policy once the financial imbalances unravel. Cleaning can be problematic if the policy rate reaches the ELB – see Appendix A3.

4.2.1 Adjusting the medium term in response to bubbles

The term "bubbles" is typically used to describe a situation in which asset prices are too high relative to fundamentals and risk falling and damaging financial stability in the future. The academic literature accounts for the possibility of bubbles in different ways, with sometimes radically different policy implications. A number of papers in the influential "rational bubbles" tradition stress that bubbles have positive as well as negative effects.[93] It is not therefore clear whether it would be desirable to deflate them. At least one influential paper has argued that trying to deflate bubbles with monetary policy may have the exact opposite effect.[94] But there are other approaches to modelling bubbles and their conclusions are more in line with the traditional view that higher interest rates can reduce the size of bubbles and that this is in principle desirable.[95,96]

To illustrate how the medium term should be modified to take into account a response to the risk of financial instability, we conduct simulations using a medium-scale quantitative macroeconomic model which builds on well-established frameworks.[97] In the model, banks lend to the real economy but are subject to a moral hazard problem which is alleviated by constraining their balance sheets to only a certain fraction of their market value. This gives rise to the possibility

93 See Martin and Ventura (2012) and Farhi and Tirole (2012).

94 See Galí (2014).

95 See Miao and Wang (2014) and Aoki and Nikolov (2015).

96 Appendix A.3 presents a variant of the exercise in this section, based on the model in Karadi and Nakov (2021), in which financial instability is captured through waves of optimism and pessimism in the private sector. The results are broadly in line with those in the section.

97 The banking block of the model is a variant of the Gertler and Karadi (2011) and Miao and Wang (2014) frameworks. To generate realistic dynamics in response to shocks, the model also includes a number of real rigidities such as consumption habits, investment adjustment costs and backward-looking indexation of prices within the Calvo framework. The response coefficients to inflation and output growth of the benchmark, Taylor-type rule are taken from the NAWM II (Coenen et al., 2018).

of rational asset price bubbles on banks' stock market valuations; these raise banks' ability to borrow and generate a boom in lending and economic activity. The model is calibrated on euro area data and its impulse responses to standard shocks (total factor productivity, monetary policy, etc.) are consistent with those of estimated models such as the New Area-Wide Model (NAWM) II (Coenen et al., 2018).

The bubble has beneficial effects while growing, but it creates bank vulnerability. As long as it persists over time, it gives a capital gain to investors and helps raise the bank's profitability by increasing leverage.[98] The bubble derives its value from its ability to relax the borrowing constraint. In so doing, it can increase aggregate economic activity. The downside is that the boom relies on positive investor sentiment and can quickly turn to a bust if sentiment becomes pessimistic. This is why a policy response to moderate the rise in bank leverage and bank vulnerability is appropriate.[99]

In this framework we consider a bubble-driven boom and ask how monetary and macroprudential policies can help mitigate the build-up of risk. The boom arises because investor sentiment improves, and this raises the value of the bubble on banks' share price. To shed light on the implications for the medium-term orientation of monetary policy leaning against the wind, we consider two different scenarios for the way the boom evolves. In one, which we term a "boom-bust scenario", investor sentiment turns quickly negative after two years, causing a sharp decline in asset prices, lending and output. In another, which we term "long-boom", the boom continues over a ten-year period and starts subsiding gradually of its own accord. We examine these two scenarios in the light of the difficulties of forecasting precisely when a boom might turn to bust. This is important when considering leaning policies: the central bank is unlikely to have an accurate idea of how long it will need to lean. And the evolution of inflation depends strongly on how long the positive sentiment endures, how strongly the central bank leans against the leverage build-up and the degree to which leverage responds to the central bank's reaction.

The boom-bust scenario is displayed in the first row of Chart 11. The blue line shows how the economy evolves when there are no macroprudential policies and monetary policy is governed by the standard Taylor rule, reacting only to inflation. The bubble raises bank equity prices, bank leverage, lending and investment. Inflation rises, but only modestly. This is because the bubble increases not only demand but also supply; therefore, the economy does not overheat, despite the

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98 The economy we consider is dynamically efficient in that the real interest rate is higher than the economy's growth rate. However, a bubble can exist because it relaxes credit constraints. The mechanism works as follows. When investors are optimistic about bank leverage and profitability, this raises the bank's share price and allows it to borrow more. If lending is profitable, this increases bank profits, thus making the optimism about the bank's share price into a self-fulfilling prophecy.

99 The bubble is affected by both temporary and persistent movements in real interest rates. Appendix A.1 shows that the bubble equilibrium is larger as real interest rates decline, since a relatively low increase in leverage is sufficient to compensate investors for their low required rate of return. This suggests that the financial stability risks from asset price bubbles increase significantly in a low real interest rate environment. In contrast, a temporary monetary tightening has a complex impact on the financial side of the economy. On the one hand, it increases the size of the bubble, because the higher real interest rate reduces the bank's net worth, thus tightening the supply of credit to the real economy. On the other hand, the monetary tightening reduces the bank's overall equity price as well as its access to credit. This means that monetary policy could be used to restrain the build-up of leverage during a period when the bubble is growing.

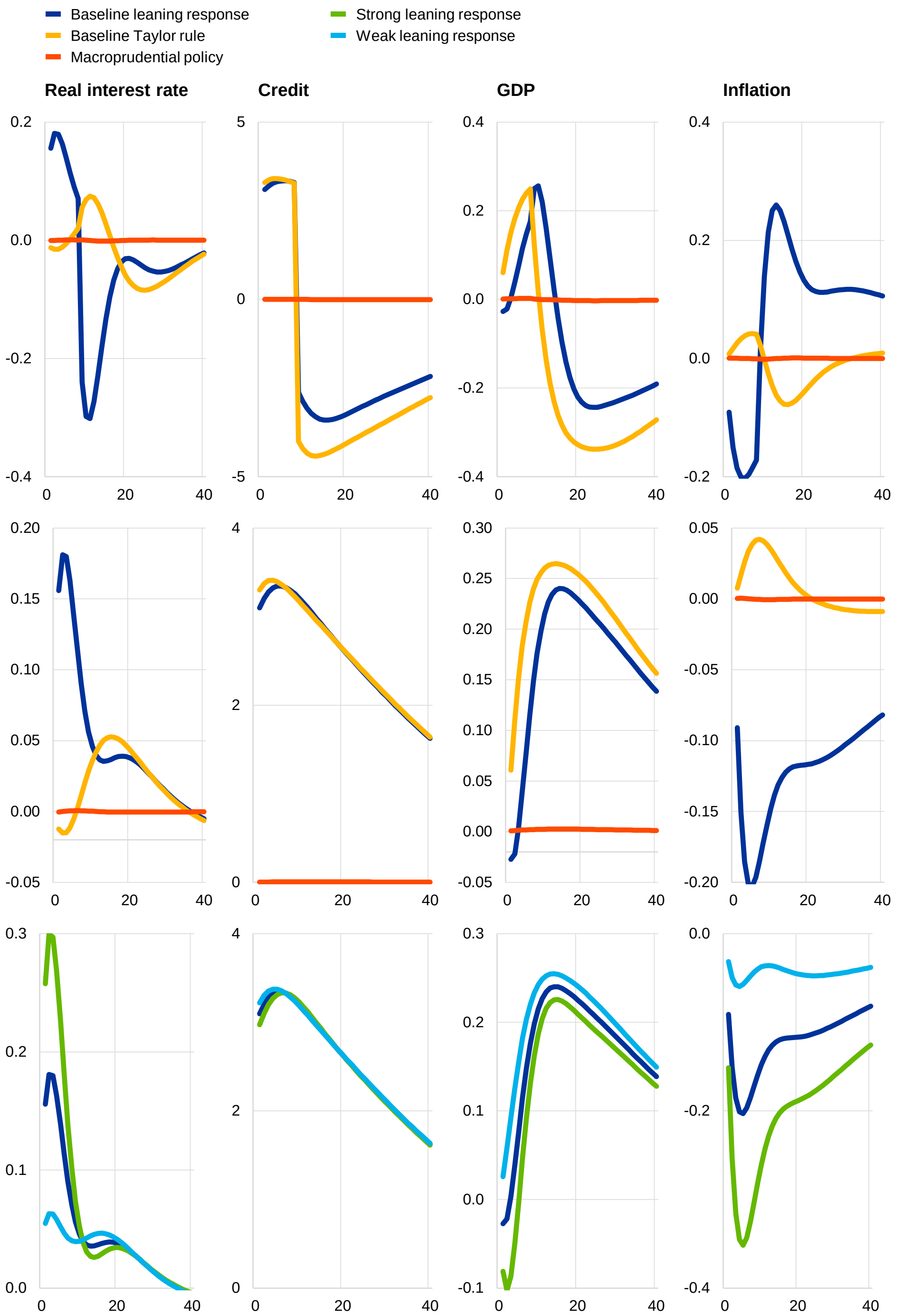
increase in GDP and investment. During the bust, sentiment turns, the size of the bubble drops and all the effects go into reverse.

A monetary policy approach leaning against the bubble is at least partially effective at restraining the boom and moderating the bust, but at the cost of greater inflation volatility. This scenario is shown by the orange line in Chart 11. Leaning against the bubble is represented by an additional term in the Taylor rule, which responds to deviations of total credit from its level in normal times. This term implies that the nominal interest rate increases by 1 percentage point when credit is 10 percentage points higher than in normal times. This leaning-type approach ensures that credit and GDP show slightly less pronounced fluctuations both during the boom and during the bust. But the approach creates a cost in terms of greater inflation volatility. As monetary policy leans against the lending boom and bust, inflation undershoots during the boom and overshoots during the bust. Inflation deviations from target are also more persistent. While the expected return to price stability after the boom-bust cycle is of about seven years (almost 30 quarters) under the standard policy rule, it increases to beyond ten years under the rule incorporating a leaning element.

Chart 11

Responses to a bubble-driven boom

(x-axis: time in quarters; y-axis: percentage deviations from steady state. The real interest rate and inflation are annualised.)



Source: ECB calculations.
Notes: The first row of the chart corresponds to a scenario where a bubble starts to inflate at t = 1. It continues for two years and then collapses at t = 8. The second row of the chart represents the same bubble shock as in the first row but without a collapse at t = 8. In the first two rows, the blue line is the baseline leaning response, the yellow line adds a leaning against the wind term to the Taylor rule (100-basis point increase in the interest rate when credit is 10% above the steady state) and the orange line adds a macroprudential policy response. The third row repeats the exercise in the second row but examines the model's sensitivity to the degree of leaning. For a 10% increase in credit above steady state, interest rates increase by 100 basis points under the baseline leaning response (blue line), 160 basis points under the strong leaning response (green line) and 40 basis points under the weak leaning response (light blue line).

As a benchmark for comparison, the yellow line in the figure shows that effective macroprudential policy restrictions would be much more suitable in offsetting the effect of the optimism/pessimism cycle. If timely macroprudential measures[100] restrict any increase in bank leverage, the growth of the bubble is immediately stopped. This is because the bubble's growth depends on higher expected profits which occur on the back of higher bank leverage. Lending and asset prices cannot rise as a result. Both inflation and the financial side of the model are fully stabilised.[101]

The second row of Chart 11 displays the alternative scenario in which the boom continues for a very long time without a bust. We see that the boom can gradually subside on its own accord even in the absence of macroprudential measures or monetary policy leaning against the wind. This is because investor optimism regarding banks' profitability prospects gradually adjusts downwards throughout the simulation. At the same time, the capital stock grows, creating a capital overhang that slows down investment. This scenario could be seen as the smooth unravelling of imbalances without a disruptive crisis event. A monetary policy response to the rise in the credit-to-GDP ratio (shown in the orange line) reduces the size of the lending boom (though to a much lesser extent than macroprudential policy, shown in yellow). Once again, however, there is a cost in terms of lower inflation, which undershoots the target for a period exceeding five years. This scenario would therefore require a considerable lengthening of the concept of the medium term. More generally, the length of the medium term will depend on how long credit exceeds long-run averages, thus eliciting a monetary policy response.

The final row in Chart 11 shows the implications of varying the degree to which monetary policy leans against the bubble in the long-boom scenario. The baseline response considers a 1-percentage point increase in nominal interest rates in response to a 10% increase in credit. The weak response considers 0.4 percentage points while the strong response considers 1.6 percentage points. The figure shows that leaning more strongly against the bubble reduces the boom in credit and investment at the cost of larger and more persistent inflation target undershoots.

All in all, this approach would require a considerable extension of the notion of medium term. Focusing on the example of a very long-lasting bubble, a standard Taylor rule would be accompanied by an inflationary period, but price stability would be restored after about five years. By contrast, a rule reacting to the bubble would be consistent with a medium-term horizon of over ten years. A limited degree of reaction to the bubble is beneficial, in the sense of reducing the credit boom (a little) while the bubble keeps growing, and mitigating the investment and output fallout once the bubble bursts. Over this period, the economy would go through mild inflation undershooting, rather than overshooting.

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[100] Macroprudential policy operates by restricting bank leverage.

[101] The extreme effectiveness of macroprudential policy in this example is to some extent an artefact of the framework. Restricting banks' ability to increase leverage tackles the root cause of the bubble.

4.2.2 Adjusting the medium term in response to financial imbalances

An alternative interpretation of financial instability is related to a broader emergence of financial imbalances in the banking sector. This considers the possibility that a sequence of shocks may reduce the capital of financial intermediaries and their risk-bearing capacity. Through occasionally binding capital constraints on the balance sheet of financial intermediaries, these developments would trigger an endogenous risk channel, eventually leading to a sudden increase in risk premia and a credit crunch. While unpredictable, the shocks are known to be within the realms of possibility. The economy will fluctuate between a typical, normal state and a rarer crisis state. The central bank may intervene in order to mitigate either the likelihood or the depth of the crises.

We again compare outcomes produced by a standard monetary policy rule with those generated by a monetary policy response with leaning elements. Compared with the standard Taylor rule, the rule augmented with leaning against the wind envisages somewhat tighter monetary policy in good times, when risk premia are low and financial intermediaries have abundant capital, and looser monetary policy in crisis times, when risk premia increase and financial intermediaries become capital-constrained. We report results based on the model in Dewachter and Wouters (2014), which is an example of a new class of models allowing for endogenous risk.[102]

When the policy rate reacts to financial conditions, financial variables and inflation are stabilised more effectively (see Table 3). Financial leverage, equity prices and risk premia are on average less volatile than under a standard Taylor rule, and this also reduces volatility in investment. The cost is a more activist monetary policy, which leads to more volatility in policy rates.[103] An additional benefit is a greater stabilisation of inflation in all contingencies. By contrast, the standard Taylor rule produces, on average, some inflation overshooting in normal times and undershooting during crises. It is therefore too expansionary in normal times and too contractionary in crisis times.

[102] Dewachter and Wouters (2014) embed the endogenous risk framework of He and Krishnamurthy (2012) in a standard macroeconomic model. See also Brunnermeier and Sannikov (2012) and Boissay, Collard and Smets (2016).

[103] A more activist monetary policy may be problematic if it results in a more frequently binding ELB constraint. However, using the method employed by Dewachter and Wouters (2014) it is not possible to study the implications of the ELB.

Table 3

Implications of leaning in a model with endogenous risk

	Taylor rule			Rule with leaning elements		
	Average	Crises	Normal times	Average	Crises	Normal times
Volume (investment)	8.40	8.87	8.18	8.37	8.87	8.14
Volume (output)	2.78	2.79	2.77	2.85	2.86	2.84
Volume (stock prices)	5.20	5.40	5.09	5.18	5.39	5.06
Volume (bank leverage)	0.36	0.46	0.07	0.33	0.44	0.06
Volume (nom. interest)	0.50	0.42	0.40	0.48	0.46	0.46
Volume (inflation)	0.34	0.28	0.28	0.32	0.32	0.32
Mean (nom. interest)	3.60	2.84	4.00	3.08	2.88	3.16
Mean (inflation)	0.28	-0.24	0.52	0.00	-0.04	0.00
Mean (Sharpe ratio)	29.79	35.57	26.90	29.44	34.80	26.77

Source: Dewachter and Wouters (2014).
Notes: For each variable listed in the first column of the table, "Average" denotes mean values obtained over a long, simulated sample including crises and normal times; "Crises" denotes mean values during crises; "Normal times" denotes mean values in the remaining periods. Crisis times are defined based on the Sharpe ratio to approximate a state of binding leverage constraints: they correspond to the 33% highest realisations of the Sharpe ratio.

The explanation is that in reacting to financial conditions the rule takes into account the risk channel of monetary policy. The model produces marked differences in the volatility of equity prices and financial leverage between crisis and normal times. In crisis times, equity prices are highly volatile, financial intermediaries are risk averse and risk premia increase quickly, with adverse effects on the market price of capital and aggregate investment. As a result, the risk channel is contractionary in crises: it depresses aggregate demand and creates deflationary pressure. Conversely, in normal times risk premia are low, the price of capital increases and aggregate investment booms. The risk channel becomes expansionary: it boosts aggregate demand and creates inflationary pressure.

The performance of the monetary policy rules depends on how well they take the risk channel into account. The rule augmented with leaning elements prescribes different policy reactions depending on financial conditions. In so doing, it implements a tighter monetary policy stance in normal times, when the risk channel generates an endogenous easing of monetary conditions, and a more accommodative stance in times of crisis, when the risk channel becomes contractionary. It thus produces greater inflation stabilisation than the standard Taylor rule, which abstracts from the risk channel.[104]

The augmented rule also leads to a reduction in financial stress during crises, though not a reduction of macroeconomic volatility. The reduction in financial stress is signalled by the lower values of the Sharpe Ratio, both on average and in crisis times. However, this outcome is accompanied by a negligible decrease in the

[104] The risk channel also produces effects on real interest rates that are sensitive to the specific features of this model. More specifically, the model includes a degree of substitutability between consumption and investment, because consumption is not subject to frictions. As a result, a policy rule which produces lower volatility of aggregate investment will also tend to generate higher consumption volatility. In turn, a higher volatility of consumption generates an increased precautionary savings motive and, in equilibrium, lower real rates. For roughly comparable inflation levels, this also implies lower nominal rates. A higher volatility of consumption tends to also outweigh the reduction in investment volatility: overall output volatility tends to increase.

volatility of investment. By contrast, the volatility of output increases as a result of the higher consumption variability associated with the more variable nominal and real interest rates.

It is important to note that the reaction to financial conditions must be carefully designed in order to produce the results in Table 3. All else being equal, the policy rule augmented to include leaning elements implies that a one standard deviation change in financial leverage leads to a change in the policy rate of 20 basis points. This reaction appears to be appropriate in the model. A milder reaction would produce smaller deviations from the benchmark policy rule and a stronger reaction could easily become excessive. For example, additional simulations not reported in the table consider the case of a monetary policy reaction coefficient to financial conditions that is twice as large. In this case the leaning rule would be excessively contractionary in normal times and overly expansionary during crises. On average, inflation would remain below target.

Overall, a carefully designed reaction to financial conditions could be beneficial in the context of this model, but it would not require an extension of the medium-term orientation because price stability and financial stability are mostly complementary. Through the risk channel, conditions of financial exuberance will tend to be accompanied by upward inflationary pressures. Conversely, periods of financial disruption will accompany disinflationary tendencies. In the model, therefore, the tighter monetary policy stance required by the leaning against the wind approach will be beneficial both in mitigating financial exuberance and in restoring price stability. In the absence of a short-term trade-off between financial and price stability, there is no need for adjustments in the medium term.

4.2.3 Ex ante perspective and the anchoring of inflation expectations

The discussion thus far assumes that inflation expectations always remain well anchored at the central bank's target (reflected in the monetary policy rule). It is, however, conceivable that persistent periods of target undershooting, which could accompany a leaning-type monetary policy approach, could lead to a de-anchoring of inflation expectations. This section analyses the implications of previous conclusions when assumptions on the expectation formation mechanism are modified. It is based on a much simpler framework, within which it is not possible to explore the dynamics of inflation over the short, medium and long term, but includes a stylised characterisation of the risk of financial crises – see Ajello et al. (2019).[105] The depth of the economic recession is exogenously given (and tailored to match the conditions extant at the time of the global financial crisis), but its probability depends on past credit growth.[106] In turn, credit growth is negatively affected by monetary policy interest rates. As a result, looser monetary policy produces two effects: it boosts aggregate demand, as in the standard New

[105] The model incorporates the risk of financial crises in a highly stylised New Keynesian framework.

[106] The grounds for this assumption are the results in Schularick and Taylor (2012).

Keynesian model; and it leads to an increase in credit growth and therefore in the probability of a crisis.[107] See Appendix A.2 for further details on the model.

Chart 12 highlights that the conclusions of this exercise are strongly affected by the sensitivity of the probability of financial crises to monetary policy, which is highly uncertain. The figure shows the output gap, inflation, the optimal policy rate and the quarterly probability of a financial crisis for different average values of past credit growth (L0). The policy rate would, by assumption, equal 2.5% and would be independent of the rate of credit growth, if monetary policy had no impact on the probability of a future crisis. Compared with this case, monetary policy would remain almost unchanged if credit growth were not greatly affected by changes in policy rates, as in the Ajello et al. (2019) calibration. Even if credit growth increased by 20% from its sample average (0.1), policy rates would increase by just a handful of basis points. By contrast, the benchmark calibration, tailored to euro area data, implies a stronger sensitivity of credit growth to policy rates. As a result, a 30-basis point increase in the policy rate would be warranted if credit growth equalled the sample average (0.1), and a 40-basis point increase if it reached its maximum sample value (0.3). Inflation would be just 1 basis point lower than the 2% target assumed in the analysis and the output gap would be somewhat negative.

Focusing on the euro area calibration, Chart 13 shows that these results are quite sensitive to the expectation formation mechanism. If inflation is partly backward looking, the lower inflation rate and output gap produced by the tighter monetary stance feed into expectations. More specifically, inflation expectations drift downwards as the monetary policy stance is tightened to reduce the probability of the crisis. For a given policy rate, real rates are higher than under rational expectations. Consequently, the output and inflation costs of the leaning approach increase. Taking the expectation formation mechanism into account, monetary policy should lean much less against the risk of a crisis. For average values of credit growth, the optimal policy interest rate almost reverts to the case where monetary policy does not internalise its impact on the probability of a crisis. Higher values of credit growth justify only marginal increases in the monetary policy interest rate.[108]

These results suggest that any implications for the medium term in models where inflation expectations are assumed to be well anchored are likely to be extreme. Unfortunately, the simple model cannot provide direct guidance on the medium-term orientation, but it suggests that its modification should in general be

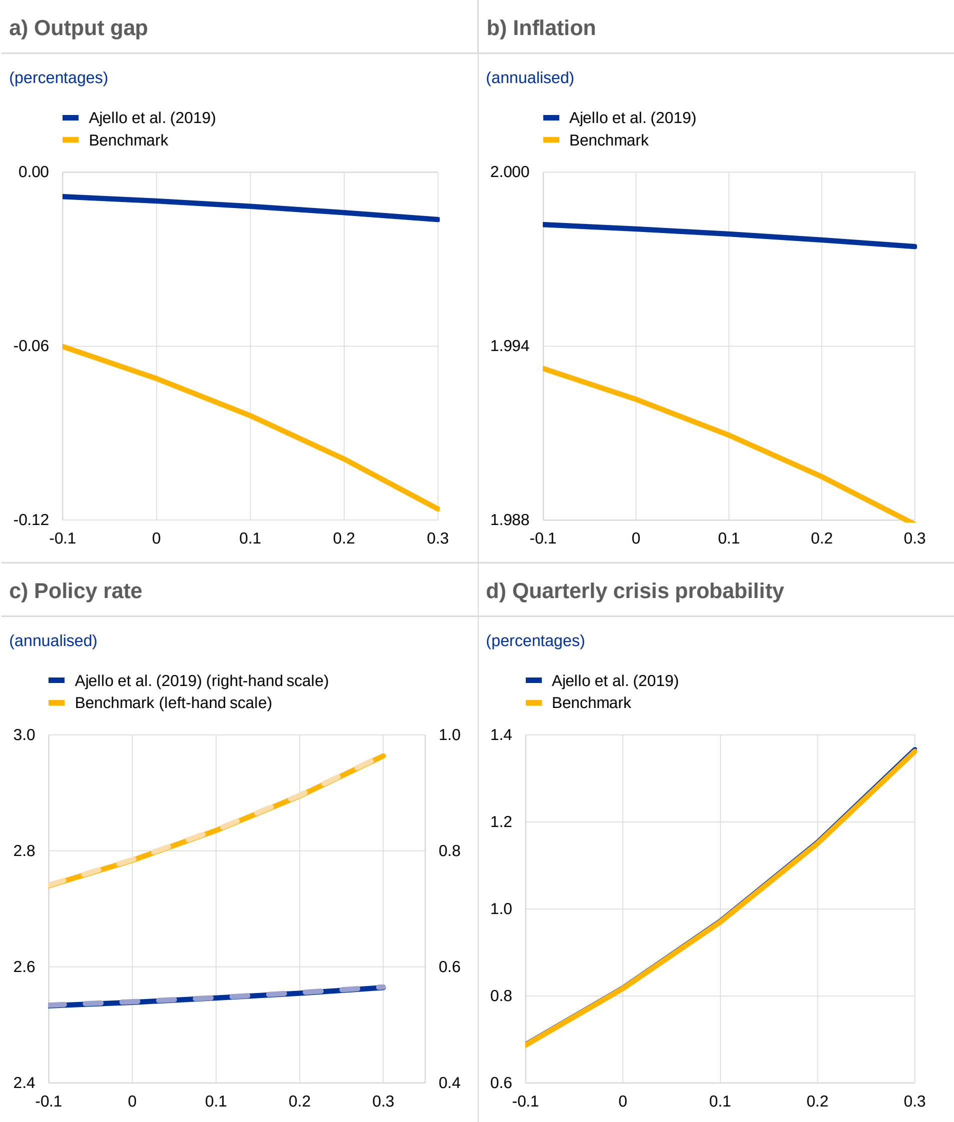
[107] We modify the original model along two dimensions. First, we allow for private sector expectations to incorporate a backward-looking component. More specifically, on the condition that no crisis occurs in period t+1, inflation expectations are assumed to be formed as follows: $\hat{E}_t\pi_{t+1} = (1-\zeta_\pi)E_t\pi_{t+1} + \zeta_\pi\pi_t$, where $E_t\pi_{t+1}$ denotes expectations under rational expectations and $0 < \zeta_\pi < 1$ is a parameter indexing the degree of “backward-lookingness”. Our second modification is to calibrate the sensitivity of credit growth to policy interest rates based on euro area data. Our estimates suggest that a 1-percentage point increase in the policy rate leads to a 0.8% fall in the quarterly rate of growth of credit. This sensitivity is estimated to be much higher than in the original calibration in Ajello et al. (2019), which is based on US data.

[108] These results should be interpreted as merely illustrative, given the simplicity of the model, even if some of the simplifying assumptions may be favourable to leaning against the wind. For example, the framework assumes that output and inflation losses are given in the case of crisis. In other words, there is nothing that the central bank can do to “mop up” ex post. To the extent that the central bank has the ability to intervene ex post, for example through unconventional policies, the benefits of leaning against the wind may be reduced.

more muted than recommended in models where expectations are always well anchored.

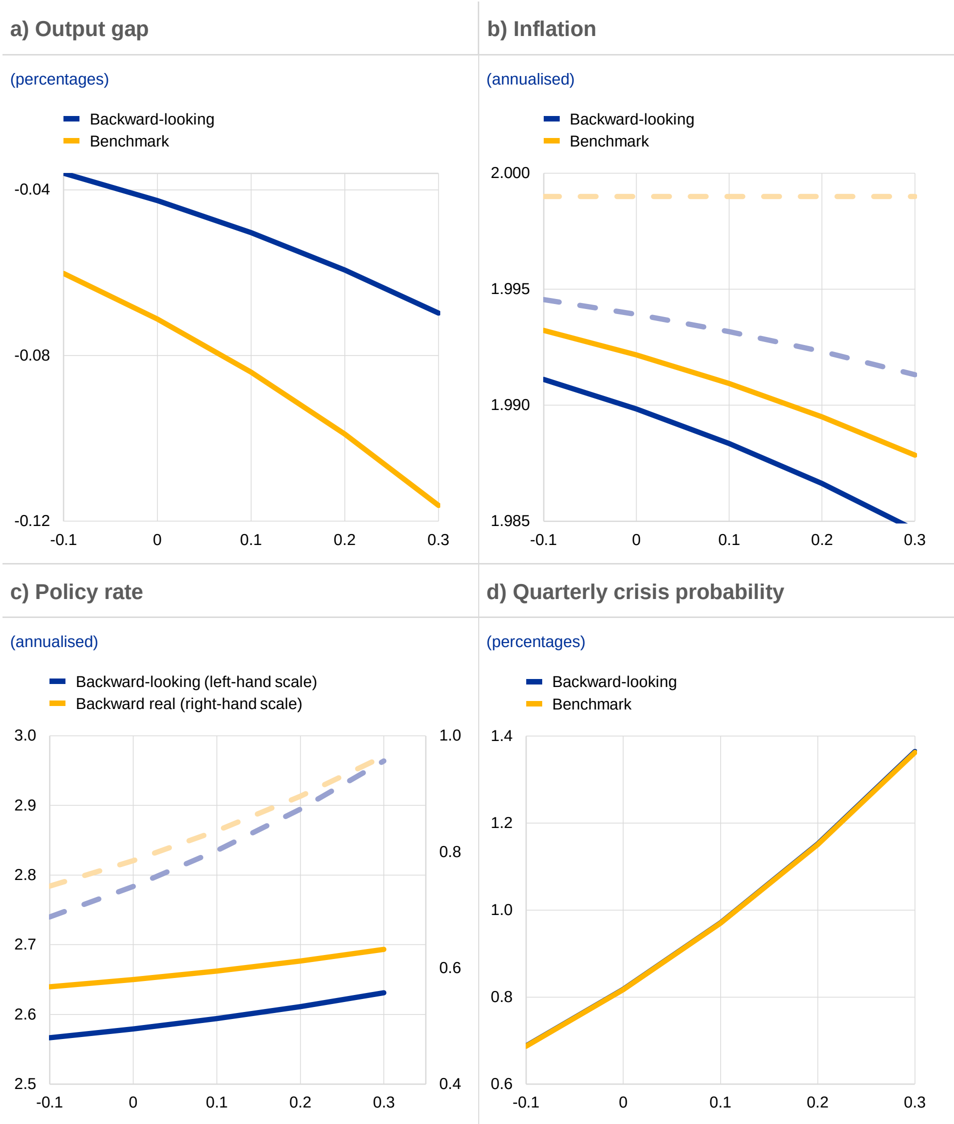
Chart 12

Leaning against the wind and sensitivity of crisis probability to monetary policy



Source: ECB calculations.
Note: The x-axis of each panel displays the different average values of past credit growth. In the third panel, the one devoted to optimal policy rate, the full lines represent the nominal rates while the dashed lines represent the real rates.

Chart 13
Leaning against the wind and expectations formation



Source: ECB calculations.
Note: In the second and third panel, the ones devoted respectively to inflation and optimal policy rate, the full lines represent the nominal rates while the dashed lines represent the real rates. The backward-looking case assumes $\zeta_\pi = 0.5$, where the ζ_π parameter denotes the degree of "backward-lookingness" of inflation expectations.

4.3 Financial stability and the medium-term orientation: implementation issues and euro area considerations

4.3.1 The medium term and the notion of "financial cycle"

The previous section illustrated adjustments to the medium-term horizon to address financial stability considerations in stylised settings, abstracting from operational challenges that arise in a real-time policy environment. This section discusses the operational challenges associated with the adjustment of the medium-term horizon to achieve the price stability objective.

A first important challenge is how to characterise and measure the build-up of financial imbalances in order to identify conditions that would warrant stabilisation policies to maintain financial stability. A concept widely used to do so the financial cycle, which although not amenable to a broadly agreed single definition, generally includes measures of credit aggregates and asset prices. Three definitions are commonly used within the ECB. First, Drehmann et al. (2012) have developed a cycle of joint fluctuations of credit and residential property prices.[109] The ECB itself has developed two metrics. The "financial cycle" developed by Schüler, Hiebert and Peltonen (2015) measures the degree of co-movement between credit and asset prices, including equity, bond and house prices. In turn, the SRI developed by Lang et al. (2019) is designed to signal the likelihood of future financial crises and has been used to calibrate cyclical macroprudential policy instruments.

The estimation of financial conditions in real time is particularly prone to uncertainty due to data lags, methodological issues and data revisions. For example, house price series tend to be released up to three quarters following the reference period. The transformation to extract the cyclical component emphasises some horizons relative to others. Lastly, many of the series are normalised using nominal GDP which, in itself, may be the cause of fluctuations in specific circumstances. As a result of these shortcomings, the thresholds to characterise excessive financial imbalances may be difficult to establish.

4.3.2 Operationalising the medium term in the euro area

The estimated financial cycle length from peak to peak across the different metrics and across euro area countries is between eight and 20 years.[110] The resulting range of cycle lengths is thus considerably broader than the two to eight years commonly assumed for the business cycle.[111] The estimated length of the ECB's financial cycle measure, based on Schüler et al. (2020), falls squarely within this range (Chart 14). The longer financial cycle begs the question of whether it is so long as to render a leaning-oriented monetary policy impractical, in terms of accountability, for a medium-term oriented monetary policy. In the following subsection, we illustrate that only specific sub-periods of the cycle are relevant for leaning considerations in the "ex ante" perspective. For euro area countries, however, the differing frequencies between business and financial cycles imply that

[109] The cycle is based on the band-pass filter of Christiano and Fitzgerald (2003) applied to the annual growth rates of the series in order to separate the typical business cycle length from medium-term cycles, which are significant for financial imbalances.

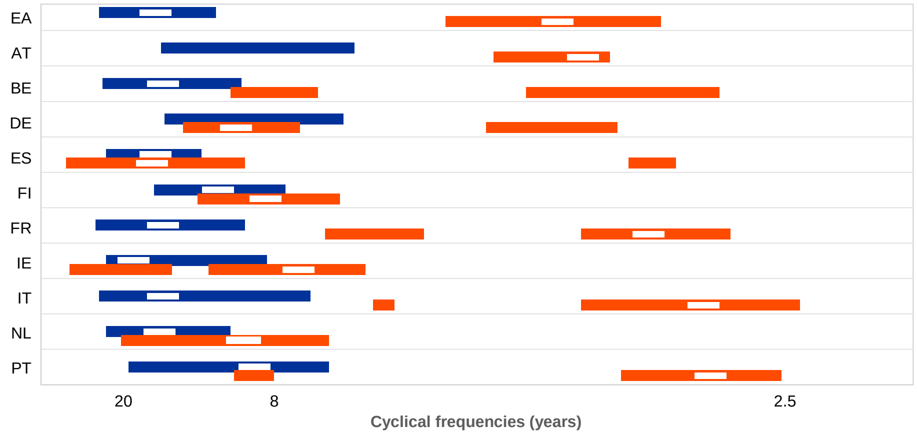
[110] The financial cycle metrics considered combine asset price and credit conditions to distinguish them from measures of pure price bubbles as these are linked more weakly to financial crises. The asset price and credit components may themselves have differing horizons that should be considered when using the cycle metrics for policy implementation.

[111] See Drehmann et al. (2012), Rünstler and Vlekke (2018) and Galati et al. (2016).

key components, especially credit and house prices, tend to be only mildly correlated with the standard business cycle.[112]

Chart 14

Frequencies of financial and business cycle indicators



Source: Schüler et al. (2015).
Notes: The chart depicts the 25% highest density region of power cohesion (while excluding cycles lower than 5 quarters) for financial cycles (blue) and business cycles (red) separately in the frequency space (inverted to cycle length). For some countries the distribution of the business cycle is bimodal (e.g. Belgium). The white dash locates the global maximum to be used as reference for cycle length. Short to medium-term fluctuations are considered for 2.5 to 8 years (to the right) and medium to long-term frequencies as 8 to 20 years.

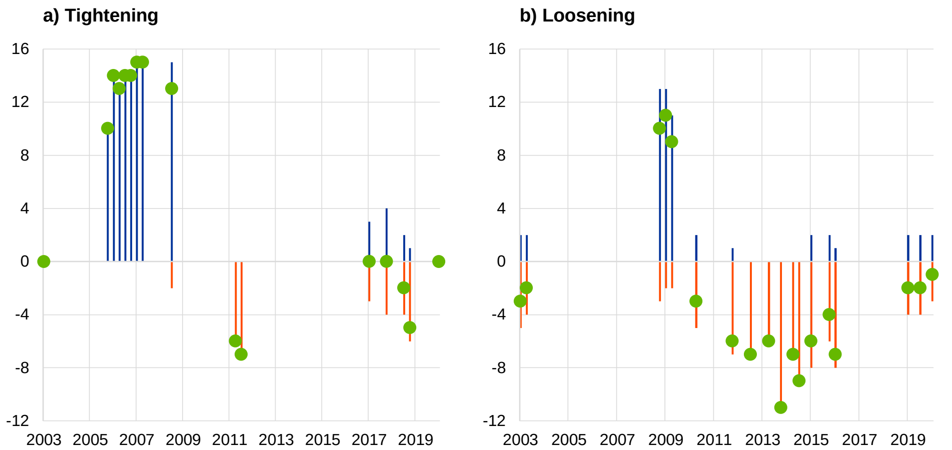
The differing lengths of the financial and business cycles imply that the ECB's monetary policy may face difficulties in taking financial stability considerations into account. Section 4.1 explicitly addressed the degree to which price stability and financial stability objectives at the euro area level have appeared sufficiently aligned as to warrant a joint tightening or loosening of monetary and macroprudential policy. Beyond the synchronisation of the two cycles, the large cyclical variations across euro area countries raise doubts over a leaning against the wind policy for the euro area as a whole. The average share of time over which country-specific financial cycles are in the same phase (e.g. expansion or contraction) as in other euro area countries can be measured through concordance, capturing the degree to which financial cycles are synchronised across countries. This ranges from an average value of 0.48 for Germany with respect to all other countries to an average value of 0.72 for Spain (Chart 1 in Chapter 2). When analysing the financial conditions captured by the SRI for the specific timings of monetary policy decisions it is found that tightening decisions in the period before the global financial crisis coincided not only with elevated values of the SRI for the euro area as a whole, but also with elevated values (top quartile of SRI by country) across a fairly large number of euro area countries (Chart 15, panel a). This reflects the relatively synchronised nature of the pre-global financial crisis conditions but may not carry over into other cases, where for instance localised property price exuberance may be driving the build-up of financial vulnerabilities. Yet monetary policy loosening

[112] A cross-country assessment reveals that longer cycles for total credit and house prices are observed in countries with higher home ownership rates (Rünstler, 2016).

in the last decade coincided with low SRI values in around one-third to one-half of euro area countries (within the bottom quartile, Chart 15, panel b).

Chart 15

Number of countries with exuberant and depressed financial conditions at moments of monetary tightening and loosening



Sources: Lang et al. (2019), ECB and ECB calculations.
Notes: The blue lines indicate the number of countries with exuberant financial conditions, the red lines countries with depressed financial condition. The green dots indicate the net number of countries with exuberant and depressed financial conditions, where exuberant/depressed conditions refer to SRI values within the top/bottom quartile. Bars are placed at the moments of monetary policy tightening (panel a) and loosening (panel b) decisions.

4.3.3 How effective is monetary policy in curbing systemic risk?

The fact that financial cycles tend to be asynchronous across euro area countries provides an important additional argument for using country-specific, as well as sector-specific, macroprudential instruments as a first line of defence before considering using monetary policy to address financial imbalances. To illustrate this point, the two-country dynamic stochastic general equilibrium model of Darracq Pariès et al. (2019b)[113] was used to simulate a region-specific gradual 10% rise in house prices over a two-year horizon, fuelled by positive housing demand factors and loose credit supply conditions on loans for house purchases in a low policy rate environment.[114] The baseline simulation assumes that monetary policy is unchanged for two years. Against this background, two situations are contrasted. In the first scenario, a countercyclical macroprudential intervention in the booming region imposes a limit on LTV ratios, while monetary policy is kept constant. In the second scenario, an early exit from accommodative monetary conditions implies an increase in the policy rate. The simulations are shown in Chart 16. The macroprudential measures are found to be able to contain the asset price increase in the booming region and to better shield the rest of the euro area. By comparison, the early tightening of monetary policy to mitigate house price growth in

113 See Darracq Pariès et al. (2019b).

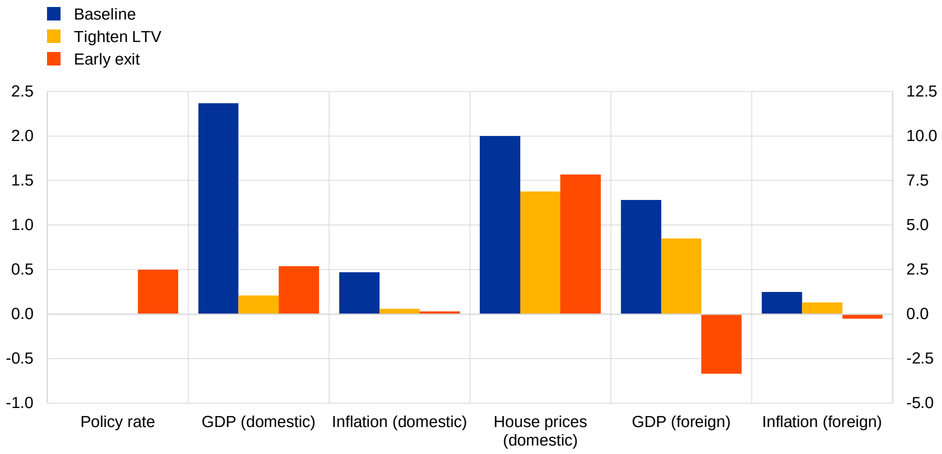
114 In the model, buoyant construction activity and the relaxation of financial constraints for the household sector support the momentum of growth and of consumer spending in the booming region.

the domestic economy delivers significantly more cross-country heterogeneity and negative cross-border spillovers.

Chart 16

Leaning against house price bubbles: LTV ratio measures vs. monetary policy

(cumulative percentage responses after two years)



Source: Simulations based on Darracq Pariès et al. (2019b).
Notes: "Baseline" refers to a scenario with unchanged monetary and macroprudential policies over the two-year horizon, assuming 10% growth in home-country house prices. "Tighter LTV" refers to a scenario where a cap on LTV ratios is introduced in the home country while monetary policy is assumed to be unchanged. "Early exit" refers to a scenario of increasing monetary policy rates while macroprudential policy is assumed to be unchanged. Real GDP is the percentage deviation from baseline while inflation and policy rates are percentage point deviations from baseline (all left-hand scale). House prices are percentage deviation from baseline (right-hand scale).

The illustration suggests that the more limited synchronisation of financial cycles across euro area countries could imply that in some of those countries a single monetary policy might run counter to the stabilisation of financial conditions.[115] Even if macroprudential policy is not fully effective, the fact that it can be targeted at sector and jurisdiction-specific financial stability risks may make it preferable to a "one-size-fits all" single monetary policy to address financial stability aspects.[116]

The remaining question is thus when a leaning response could in practice be deployed to address financial stability considerations. To answer this question, we resort to the d-SRI. This measure is more suitable than simple measures of credit growth as it is designed to signal crisis moments five to 12 quarters in advance and thus speaks to the objective of a leaning policy, namely to mitigate the likelihood and severity of such crises. While the overall cycle length of eight to 20 years may well exceed any practical definition of medium-term horizon for monetary policy, the leading indicator properties for financial crises focus on the late stages of the cyclical build-up and the turning point in the cycle. The average build-up time from trough to peak in euro area countries is between five and seven years (Chart 17). However, the median value of the indicator across those countries increases more strongly (i.e. above the value of 0.5) towards the late stage of the cycle (i.e. 12 quarters before historical financial crises) and peaks four to eight quarters before the onset of financial crises (Chart 18). This provides a window of two to three years for policies

115 See Smets (2014).

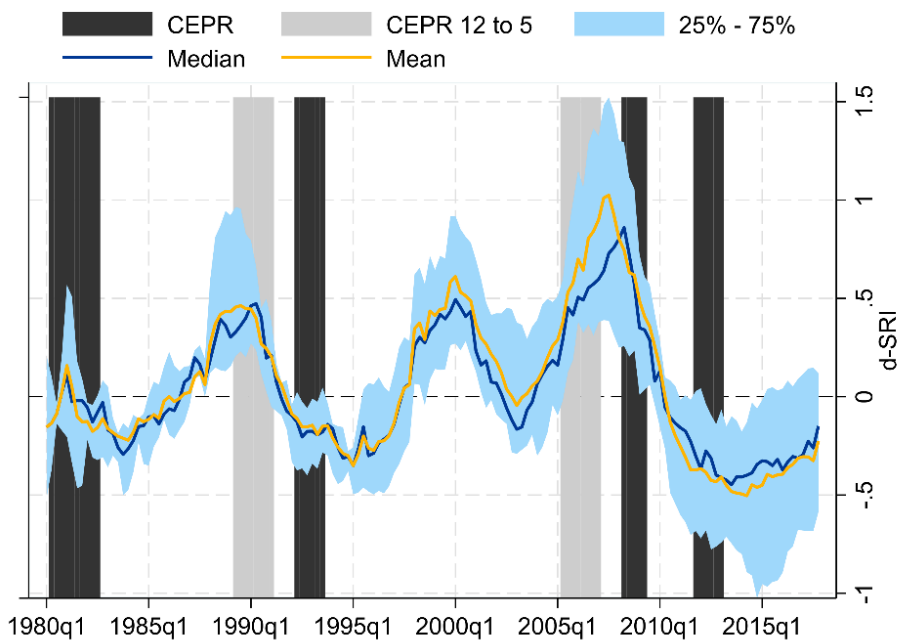
116 See Darracq Pariès et al. (2019b).

to counteract the build-up of imbalances. The movements of the d-SRI may thus provide pointers as to the use of a leaning policy.

Chart 17

Cross-country distribution of the SRI around crises

(x-axis: time; y-axis: deviation from median)

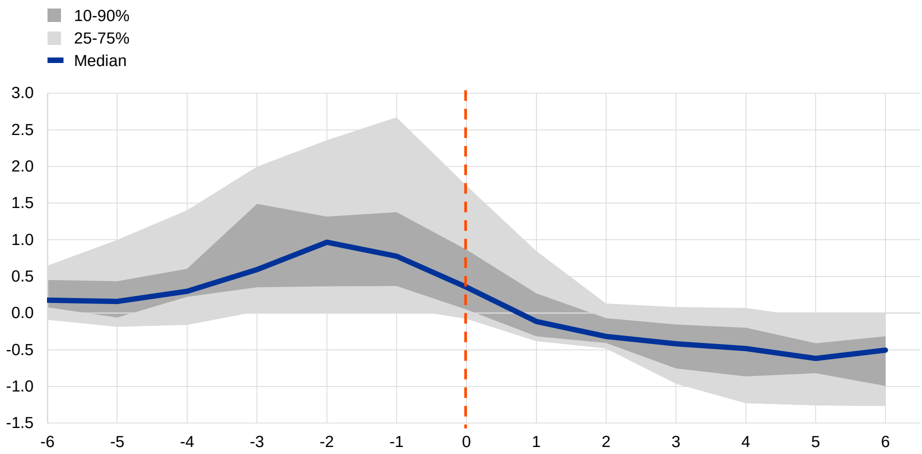


Source: Lang et al. (2019).
Notes: The blue shaded area indicates the interquartile range of the d-SRI across euro area countries, Denmark, Sweden, and the United Kingdom. Black shaded areas represent recession periods identified by the CEPR (Centre for Economic Policy Research) Euro Area Business Cycle Dating Committee, while grey areas represent the respective 12 to 5 quarter vulnerability periods.

Chart 18

SRI starts to increase on average around five years before financial crises

(x-axis: years before/after the start of a crisis; y-axis: deviation from median)



Source: Lang et al. (2019).
Notes: The light grey shaded area indicates the interquartile range of the d-SRI across euro area countries, Denmark, Sweden, and the United Kingdom during the years before and after systemic financial crises. The dark grey shaded area, instead, indicates the interdecile range of the d-SRI across the same countries and in the same years specified before. The orange dotted line denotes the start of a systemic crisis, whose dating is based on the ECB/ESRB EU crises database described in Lo Duca et al. (2017).

To assess the medium-term costs and benefits of leaning against the wind the theoretical framework of Kockerols and Kok (2019) is applied and augmented to consider the trade-offs with regard to inflation.[117] The cost-benefit framework includes an inflation-targeting central bank and also features the possibility of a financial crisis. Monetary policy can use leaning policies to prevent and mitigate crises but such policies will also impose costs in terms of higher unemployment in the event that the crisis does not occur. Even if a crisis does occur, leaning policies weaken the economy heading into the crisis. The analysis in Kockerols and Kok (2019) suggests that the costs of leaning outweigh the benefits.[118] Their study also finds that more targeted macroprudential policies achieve net benefits. The original Svensson (2017) framework is focused solely on unemployment but is here augmented by measuring costs and benefits in terms of the deviation of inflation from a target. To this end, a Phillips curve relationship between unemployment and inflation is assumed and the loss function is adapted to also include inflation. A parameter alpha in the loss function of the monetary policymaker reflects the relative weight on unemployment, and (1-alpha) the weight on inflation. The analysis of monetary policy leaning against the wind, given a weighted loss function of unemployment and inflation, confirms the previous findings. Even if policymakers only care about inflation (alpha = 0) then net benefits are still negative, albeit small. Chart 19 shows the cumulative net benefits across time and across different alpha weights. Even assuming a short-sighted policy and all the weight on inflation (alpha = 0) it is not advisable to adopt leaning policies. Essentially, the cumulative costs of lower inflation outweigh the benefits at all times, and especially in the medium term, as they also do for unemployment. Changing the weight on the inflation alpha does not therefore change the balance of costs and benefits, nor does extending the horizon.

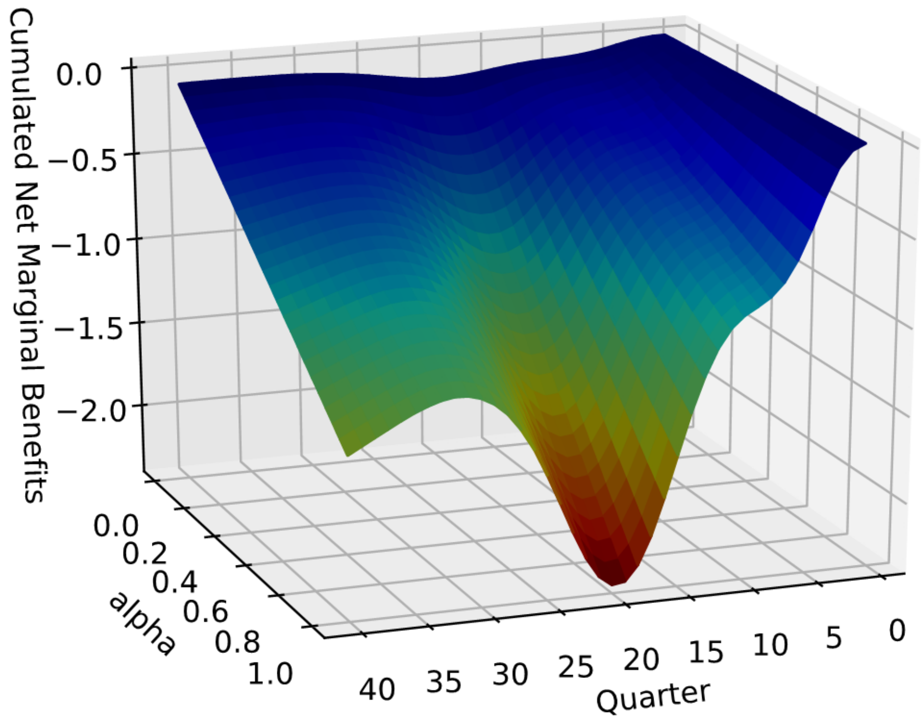
[117] The framework in Kockerols and Kok (2019) builds on the work of Svensson (2017).

[118] Notably, the analysis of Kockerols and Kok (2019) incorporates a financial cycle measure in the Svensson framework. This is to accommodate some of the criticism of Svensson's approach, to the effect that it does not properly account for systemic risks and the persistence of the financial cycle, which risks ignoring the possible long-lasting effects of financial crises on the real economy (see, for example, Adrian and Liang (2018), Filardo and Rungcharoenkitkul (2016) and Gourio et al. (2018)).

Chart 19

Costs and benefits of leaning across time: cumulative net marginal benefits of leaning for varying inflation rate weights in the loss function across time

(x-axis: quarters; y-axis: alpha parameter in the loss function; z-axis: net marginal benefit of leaning against the wind)



Source: Simulations based on Kockerols and Kok (2019).
Notes: The net marginal benefit is measured as the cumulative loss to inflation and unemployment, as deviating from the flexible inflation-targeting benchmark for changes to the policy rate.

4.4 Conclusions

The medium-term horizon for the achievement of price stability provides the Governing Council with the flexibility to tailor its monetary policy stance to the prevailing economic conditions. A simple, illustrative exercise suggests that the horizon has been extended fairly frequently over the ECB's history. It is however open to interpretation whether such extensions were, at least occasionally, a result of the Governing Council taking financial stability considerations into account. This chapter has discussed whether, in the event of heightened risks of financial instability, the medium term could be used more systematically to introduce a leaning element to monetary policy strategy.

In theory, the medium term appears to have limitations as a basis for monetary policy to deliver the potential benefits of leaning against the wind. In the face of asset price bubbles, leaning would be consistent with a considerable extension of the medium-term orientation. This approach would reduce credit and GDP fluctuations during the boom-bust cycle induced by the bubble, but at the cost of greater inflation volatility. By contrast, in reaction to financial imbalances resulting in alternating regimes of normal and crisis times, a carefully designed monetary policy reaction to financial conditions could be beneficial but would not necessarily require an extension of the medium-term orientation.

Additionally, the theory suggests that keeping inflation expectations well anchored is critical if an adjustment of the monetary policy horizon is to be effective. The benefits of taking financial conditions into account are strongly reduced if the monetary policy reaction to financial conditions requires undershooting inflation for an extended period and if inflation expectations are formed in a backward-looking manner. If anything, this argues for very muted extensions of the medium term to account for financial stability, and only when inflation is and remains sufficiently close to the target.

An all-encompassing assessment of the costs and benefits of leaning is difficult to perform and sensitive to the model used. Existing analyses calibrated on the euro area suggest that its costs, in terms of lower inflation, are likely to outweigh its benefits. More specifically, the net costs remain positive even if the horizon is extended.

In practice, considerable operational challenges are likely to be associated with an adjustment of the medium-term horizon to account for financial stability considerations. A key challenge is to identify and measure the build-up of financial imbalances. An obvious option is to apply the widely used concept of financial cycle, whose estimation in real time is, however, prone to uncertainty as a result of data lags, methodological issues and data revisions. In addition, there is limited synchronisation of financial cycles across euro area countries. ECB monetary policy tools would, therefore, be too blunt to stabilise financial conditions in only a subset of countries. A more promising alternative to identify and measure the build-up of financial imbalances may be the domestic version of the cyclical SRI, or d-SRI, which in the past has shown good leading indicator properties for the materialisation and depth of systemic financial crises. Nevertheless, the difficulties of identifying a generally accepted measure of financial stability risks underline the considerable communication challenges that would be entailed in attempting to extend the flexible medium-term orientation to take such risks into account.

5 Integrating financial stability considerations into monetary analysis

5.1 Introduction

The changing European financial and macroeconomic landscape and the recently created financial stability architecture in the euro area, as well as the experiences of central banks in the past ten years, have fed into a renewed discussion regarding the relationship between the ECB's monetary analysis and financial stability considerations. Against this background, Chapter 5 addresses two specific questions: is there a case for the Eurosystem's monetary analysis to be expanded to formally incorporate financial stability considerations? And if so, how could the monetary analysis be expanded?

A preliminary step in this chapter is to clarify what is meant by monetary analysis and financial stability. Monetary analysis has evolved significantly over the past ten years and now comprises the analysis of developments in monetary, credit and financial indicators. It uses not only aggregate time-series information but also detailed, granular data to assess the monetary transmission mechanism in real time and design monetary policy measures. The *aim*, ultimately, is to extract information on the likely evolution of future inflation and real economic activity at all relevant horizons for policy analysis. This broad scope is reflected in the Quarterly Monetary Assessment (QMA) – the central product of the monetary analysis process that is part of the preparation for the Governing Council's monetary policy meetings.[119] Financial stability can be seen as a condition in which the financial system is capable of withstanding both shocks and the unravelling of financial imbalances without major disruption and while continuing to provide its essential services to the economy; in its absence, most of the transmission channels do not operate smoothly.

This chapter is structured as follows. Section 5.2 provides an overview of the debate on interactions between monetary analysis and financial stability, both within the Eurosystem and on a broader scale. Section 5.3 summarises the pros and cons of formally integrating financial stability considerations into monetary analysis and recognises that under some conditions there might be scope for monetary policy to take additional financial stability considerations into account, albeit not in a mechanical fashion. The discussion is complemented by a survey of the empirical evidence on the growing importance of financial stability for monetary policy and by a review of the practices of other central banks. Section 5.4 discusses indicators and tools that can be used in an enhanced monetary analysis. These provide additional information on the monetary transmission mechanism and on the build-up of potential financial stability risks. They can inform the choice of a suitable monetary

[119] At the same time, the Macroprudential Report summarises financial stability risks for each euro area country. The Financial Stability Review analyses and communicates externally on the risks to financial stability in the euro area.

policy instrument mix and highlight the many interactions between monetary policy, financial stability and macroprudential policies. Section 5.5 offers some conclusions.

5.2 An overview of the debate on the relationship between monetary analysis and financial stability

When the ECB's monetary policy strategy was drawn up in 1998, financial considerations were not disregarded, although the contribution of monetary policy to financial stability has always been subordinated to the objective of price stability.[120] Monetary analysis, initially defined as the analysis of all risks to price stability from a medium to longer-term perspective based on the assessment of monetary and credit aggregates, was from the outset assigned a broader scope than that of assessing developments in asset prices. One important role of monetary analysis within the ECB's monetary policy strategy has been to contribute to the timely identification of imbalances in financial markets and the implied potential risks to long-term price stability, by exploiting the early warning properties of monetary and credit indicators for excess fluctuations in stock and house prices.[121] Monetary analysis has thus been instrumental in the assessment of such imbalances and the formulation of a monetary policy response, which under some circumstances might "lean against" accumulating asset price imbalances, to the extent that such imbalances are deemed to pose risks to price stability. In this way, elements of the leaning approach have been incorporated in the ECB's monetary policy strategy from the early stages of its formulation.

The past ten years have seen a renewed debate on the interactions between monetary policy and financial stability, triggered by the aftermath of the global financial crisis and the European sovereign debt crisis. Financial stability concerns were addressed by European institutions by setting up the European Systemic Risk Board at EU level, the Single Supervisory Mechanism at euro area level and the gradual development of macroprudential policies at national and euro area level. This established a framework enabling the Eurosystem to undertake both micro and macroprudential policies. The existence of multiple interactions between policies designed to maintain price stability and measures introduced to safeguard financial stability was also recognised.[122] Specifically, the interrelations between monetary, macro and microprudential policies are viewed as complex and variegated, ranging from situations characterised by conflicting objectives or trade-offs to situations where complementarities prevail, pointing to a significant scope for synergies.[123] In the discussions on the role of monetary policy in fostering financial stability in the euro area, a consensus emerged that "while the new macroprudential policy framework should be the main tool for maintaining financial stability, monetary policy authorities should also keep an eye on financial stability. This would allow the

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[120] See, for example, the discussion in Issing (2003), ECB (2005), Papademos (2006), Detken et al. (2010) and ECB (2011), especially Section 3.6.

[121] See, for example, Adalid and Detken (2007) and Gerdesmeier et al. (2010).

[122] For a detailed discussion of these interactions, see Chapter 2.

[123] See, for example, Beyer et al. (2017).

central bank to lean against the wind if necessary, while maintaining its primary focus on price stability over the medium term" (Smets, 2014, p. 263).

Nevertheless, in a rapidly changing financial landscape and within new institutional frameworks it is not surprising that a debate took place on the role of monetary analysis in presenting monetary policy decision-makers with relevant financial stability analysis. Various economists have offered discussions and analyses that explicitly or implicitly call for a more pronounced focus on financial stability objectives in monetary analysis.[124] For example, Galí (2012) stressed the importance of financial stability for monetary policy and argued that "many aspects of financial stability analysis are a natural evolution of the current monetary analysis" (p. 88). Brunnermeier and Sannikov (2014b) argue that credit and monetary quantities provide better signals of the build-up of vulnerabilities than financial prices. Accordingly, a monetary analysis aiming to analyse "the distribution of liquidity mismatch across sectors provides valuable information about the build-up of vulnerabilities in tranquil times and helps to identify balance sheet impaired sectors in volatile times" (p. 61). Other papers indirectly support the view that monetary analysis can play a key role in the design of financial stability policies. For example, Adrian and Shin (2010a) stress the role of financial intermediaries' balance sheets in the analysis of the financial cycle through fluctuations in the price of risk. Stein (2012) makes the case that financial stability considerations should be incorporated in the monetary policy framework and that central banking tools could usefully be directed to containing excessive private money creation from the regulated and shadow banking sectors.

Although most of these considerations are legitimate, analysts note that the transformation of the monetary pillar into a financial stability pillar on that basis poses significant risks. Specifically, formally integrating financial stability considerations into monetary analysis and more generally assigning financial stability objectives to monetary policy alongside price stability could risk undermining the credibility of the pursuit of inflation control. As summarised by Smets (2014), these risks could be associated with possible increased political pressures undermining the independence of the central bank and with potential time-inconsistency problems for monetary policy.[125]

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124 Proposals to turn the monetary pillar into a financial pillar had already been advocated in the early stages of the formulation of the ECB's monetary policy strategy. See Rostagno et al. (2021).

125 "First, the central bank's involvement in financial stability requires a stronger involvement in distributional policies (as highlighted by Brunnermeier and Sannikov 2013) … This requires a greater accountability and political involvement, which may undermine the independence of the central bank and increase political pressures. Second, involvement in financial stability risks creating important time-inconsistency problems for monetary policy. Central banks may get trapped in providing more liquidity than appropriate for long-run price stability if the fundamental problems of debt overhang following a financial crisis are not addressed" (p. 277).

5.3 Considerations on the idea of expanding current practice to integrate financial stability considerations into the monetary policy decision-making process

5.3.1 The pros and cons of formally integrating financial stability considerations into the monetary policy decision-making process

A traditional reference framework for many central banks is the Tinbergen principle, according to which any one policy instrument cannot be used to achieve more than one objective. According to Tinbergen, monetary policy should use the monetary policy tool of its choice to achieve price stability and react to the build-up of vulnerabilities only if they affect the outlook for inflation. Financial stability concerns that do not have a bearing on the primary objective should be addressed with other tools (i.e. prudential policies and regulation).[126] Thus, the consensus view among monetary policy experts until the global financial crisis was that monetary policy should concentrate mainly on maintaining price stability; pursuing financial stability in parallel would overburden monetary policy. To the extent that boom/bust cycles were perceived to be moderate until 2008, monetary policy seemed well placed to "mop up the damage" after a crisis.[127]

An alternative monetary policy strategy calls for a systematic use of leaning policies, stipulating that monetary policy should take financial stability into account more forcefully. This approach has some advantages, but also a number of shortcomings, which have been reviewed in previous chapters. Limitations of a strategy relying systematically on leaning against the wind include the likely negative net benefit of such policies, as most cost-benefit analyses conclude, as well as practical problems such as the difficulty of identifying asset price bubbles in real time and possible complications linked to heterogeneous financial cycle developments across euro area countries.[128]

The current, post-global financial crisis view has become more nuanced, recognising that under some conditions there might be scope for monetary policy to address financial stability concerns. First, financial crises appear to be significantly more costly than was previously thought to be the case, including in terms of deviations from price stability and possible impairments in the transmission of monetary policy. Hence, the trade-offs between price and financial stability objectives might be less strong than was previously assessed.

Second, macroprudential policies and monetary policy can interact, for example by reinforcing each other when business and credit cycles are aligned, and vice versa (Chapter 2). This calls for some degree of coordination of

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[126] For a more detailed discussion, see Section 2.

[127] Moral hazard arguments, pointing to worsened incentives as a result of the "Greenspan put", figured prominently in this debate. They speak against systematic interventions ex post since less effort is undertaken by market participants to build up resilience against shocks, which would minimise the probability and severity of crisis episodes.

[128] See Chapter 2 above for a more detailed discussion of the assessment of leaning against the wind.

the two policy domains and a stronger role of financial stability considerations in monetary analysis.

Third, monetary policy measures may have side effects that give rise to financial stability risks, especially in an environment of persisting low interest rates (Chapter 3). At the same time, new monetary policy tools have emerged, whose design makes it possible to reduce some of the side effects on financial stability. In the euro area, targeted longer-term refinancing operations (TLTROs) and the two-tier system for remunerating excess reserve holdings are a case in point. In the case of TLTROs, the fact that the measure is "targeted" on bank credit excluding housing loans is intended to avoid contributing to a potential housing bubble, while the two-tier system alleviates the direct costs of negative interest rates.

Fourth, it can be argued that macroprudential policy – which was introduced in the aftermath of the global financial crisis with the explicit objective of counteracting excessive credit growth and the build-up of financial imbalances – is not yet fully efficient, and might never be in a monetary union with largely decentralised decision-making. Moreover, the macroprudential policy framework addresses risks related to non-bank intermediaries to only a limited extent, and thus does not seem powerful enough to prevent or mitigate financial imbalances stemming from the non-bank sector (Chapter 2). Accordingly, given that under certain circumstances micro and macroprudential policies cannot fully address such vulnerabilities, the usefulness of leaning measures cannot be ruled out even if, for the reasons outlined above, they are imperfect.

Overall, the experience of the past ten years has shown the importance of factoring in some financial stability considerations when choosing and designing monetary policy measures. However, this should not happen in a mechanical fashion. A consensus has emerged that central banks should monitor possible significant build-ups of financial vulnerabilities that could pose risks to financial stability and hence to the effective functioning of the transmission mechanism, and ultimately to price stability. The consensus view sees macroprudential policies as the first line of defence in these circumstances. At the same time, when addressing price stability risks central banks – which nowadays have at their disposal a toolkit containing multiple instruments – should choose a combination of standard (unless constrained by the effective lower bound (ELB)) and non-standard measures designed to maximise the effect on inflation while minimising the side effects on financial stability. This practice is already followed in the routine proportionality analysis that accompanies discussions on monetary policy measures. In parallel, and with the statutory objective of safeguarding financial stability, macroprudential policies can address some of these side effects in a more targeted manner. In periods of weak business and credit cycles, the release of regulatory capital buffers can in principle add accommodation in sync with monetary policy, thus strengthening its transmission. This means that, all else being equal, less intrusive non-standard monetary policy measures need to be adopted. These considerations highlight the importance of ensuring that macroprudential policy is well equipped to deliver on its objective of maintaining financial stability and to fulfil its part in an appropriate overall monetary policy/macroprudential policy mix. Lastly, in addition to the need to adapt the policy mix to a changing financial and macroeconomic landscape, the complexity of the interactions and spillovers between macroprudential policies and monetary policies for price stability and financial stability call for caution in committing monetary policy to pursue financial stability objectives in parallel with price stability objectives.

5.3.2 Empirical evidence on the growing importance of financial stability for monetary policy

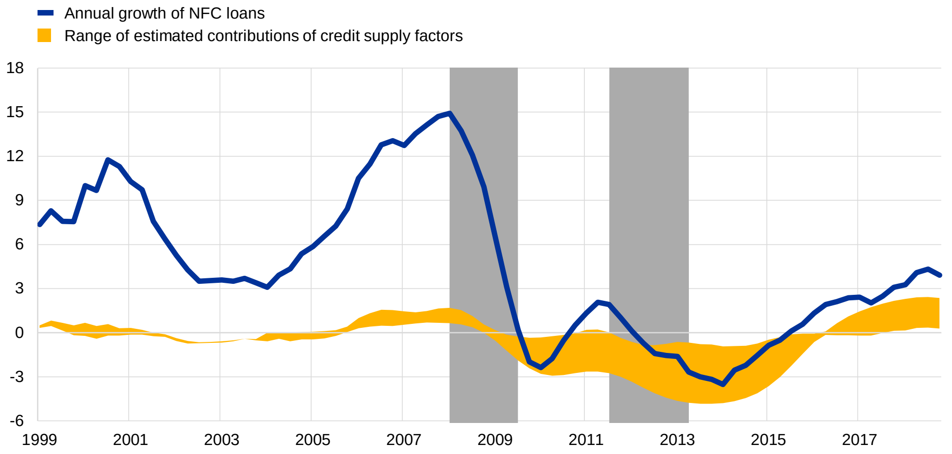
Various sets of empirical studies suggest that it may to some extent be useful to enhance the role of financial stability considerations in the monetary policy decision-making process. These include studies providing evidence of the increasing role of financial amplification in the monetary transmission mechanism and of the financial stability side effects of monetary policy measured over the past 15 years, and increasing evidence of the importance of assessing financial cycles, including asset price boom/bust cycles, in relation to the business cycle.

The evidence points to the increasing role of financial stability factors in both the monetary transmission mechanism and the design and assessment of monetary policy measures, which are core elements of the evolved monetary analysis. The evidence relating to the last three euro area recessions is particularly significant. For example, the global financial crisis of 2008-09 and the 2011-13 recession, which was accompanied by the sovereign debt crisis, were characterised by the marked role of financial instability as a source and amplification factor of macroeconomic fluctuations. This role can be illustrated by estimates of the impact of credit supply factors, which were of minor importance before 2008 but became significant afterwards (Chart 20). Subsequently, and especially from 2014 onwards, following the introduction of negative rates and other non-standard monetary policy measures (which were to a large extent designed and assessed using monetary analysis tools), financial stability side effects became an increasingly important factor (Chapter 3 above and ECB, 2021b). Finally, during the most recent recession – associated with the adverse effects of the global Covid-19 pandemic – monetary analysis has played a key role in assessing the risks of macro-financial feedback loops. Specifically, an analysis based on macro-finance models within the monetary analysis toolkit was instrumental in showing the extent to which the extraordinary monetary policy measures introduced by the ECB in 2020 allowed for a removal of the financial tail risk associated with the pandemic. It also demonstrated that the measures were crucial in maintaining favourable financing conditions and preserving the flow of credit to the economy, and ensured a degree of support to growth (Lane, 2020). Monetary analysis is still key to monitoring the risks of adverse macro-finance feedback loops associated with the removal of government support measures to households and firms.

Chart 20

Annual growth of loans to non-financial corporations and estimates of impact of loan supply shocks

(annual percentage changes, percentage points)



Sources: ECB and ECB calculations.
Notes: Range of estimated contributions of loan supply factors (yellow area) to the annual growth rate of loans to non-financial corporations (denoted as NFCs) (blue line) based on three different empirical models: a Bayesian value at risk (VaR), a proxy Bayesian VaR with bank lending survey information (Altavilla et al., 2019a) and a time-varying parameter 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 Euro Area Business Cycle Dating Committee of the Centre for Economic Policy Research (CEPR).

In recent years, an increasing body of empirical evidence has emerged pointing to the importance of assessing financial cycles in relation to the business cycle, in which context monetary analysis can play an important role. First, various studies provided international evidence highlighting the different properties that financial cycles, ranging from regular credit market fluctuations to asset price boom/bust cycles, have in relation to the business cycle.[129] Evidence for the euro area suggests that specific financial cycles tend to be strongly procyclical but display different properties relative to business cycles, including the robust lagging pattern of real NFC loan growth by about one year and the much more volatile fluctuations in real corporate bond issuance growth, and especially real stock price growth (Table 4). Moreover, and reflecting the gradually increasing importance of corporate bonds for NFC external financing in the euro area, the properties of overall credit cycles are likely to change further. Second, several studies have pointed to the variegated role of financial aggregates in providing leading properties for specific business cycle turning points.[130] As regards credit cycles, most recessions in the euro area are preceded by strong bank lending growth and tend to be followed by credit-less recoveries (Chart 21), developments which are driven by NFC bank lending (Adalid et al., 2020).

129 The debate was reinvigorated by Claessens et al. (2011) and Drehmann et al. (2012) and more recently by Jordà et al. (2017).

130 See Claessens et al. (2009), Gilchrist and Zakrajšek (2012), Schularick and Taylor (2012) and Jordà et al. (2013).

Table 4

Main properties of euro area financial cycles

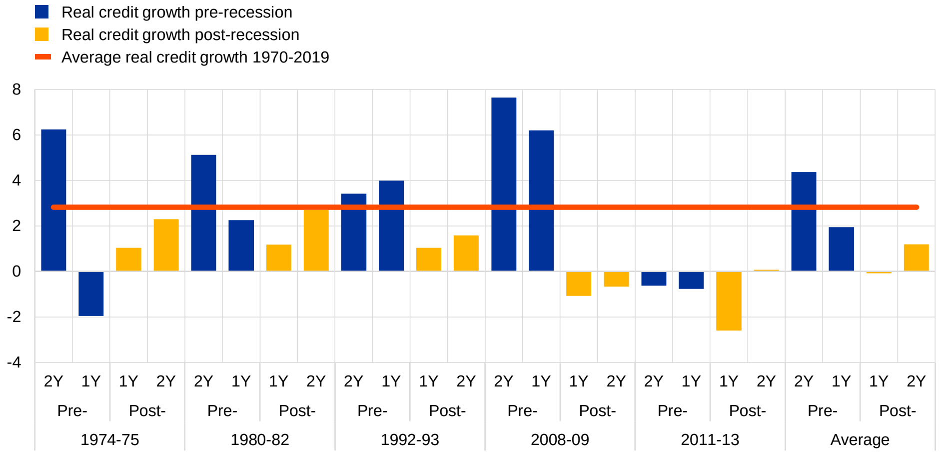
Variable	Maximum correlation	Lead (+) / lag (-)	Standard deviation	Relative standard deviation
Real NFC loans	0.54***	-3***	4.4	1.9
Real HH loans	0.38***	+3	3.1	1.3
Real NFC bond issuance	0.20***	-11**	8.3	3.6
Lending rates to NFCs	0.51***	-2	1.2	0.5
Lending rates to HHs	0.45***	-2	1.0	0.4
Yield NFC bonds	0.39***	-2	1.6	0.7
Real stock prices	0.38***	+1	31.1	13.6
Real house prices	0.44***	0	3.1	1.3
Real M1	0.48***	+4***	4.7	2.1

Source: Adalid et al. (2020).
Notes: Variables for NFCs or households (HH) are calculated as first differences for real house prices and real M1, and as quarter-on-quarter growth rates for all other variables, from the first quarter of 1990 to the fourth quarter of 2019. Maximum correlation, lead and lag and relative standard deviation are relative to real GDP growth. Significance levels of maximum correlations being different from 0, and of lead and lag (i.e. of maximum correlation being different from the contemporaneous correlation) at 10% (*), 5% (**) and 1% (***), are based on bootstrap percentile confidence intervals.

Chart 21

Lending cycles before and after recessions

(annual percentage changes)



Source: Adalid et al. (2020).
Notes: Real credit refers to aggregate bank lending to the non-financial private sector deflated by the HICP. Bars show average quarter-on-quarter growth rates two years (P-8 to P-5) and one year (P-4 to P-1) before peaks (P) and one year (T+1 to T+4) and two years (T+5 to T+8) after troughs (T). Peaks and troughs for the euro area business cycle are established by the CEPR's Euro Area Business Cycle Dating Committee.

Recent studies also point to the usefulness of credit and other financial aggregates for predicting tail risks to economic growth. More precisely, a number of empirical studies on the "growth-at-risk approach" have suggested that current financial conditions provide valuable information on the distribution of future economic growth outcomes. This refers specifically to tail risks for future growth, which are often associated with periods of financial instability.[131] Similar evidence can be found for the euro area (Figueres and Jarociński, 2020).[132] This evidence

131 See, for example, the discussion in Adrian (2019).

132 Related studies point to international evidence that rapid credit growth is followed by deeper recessions but also by longer expansions (Gadea Rivas et al., 2020).

indicates that an increased attention to financial developments in relation to specific phases of the business cycle, for which monetary analysis is particularly suited, is warranted.

The evidence also suggests that financial conditions can play a significant role in predicting the tail risks of inflation, an area where monetary analysis can potentially provide more valuable insights. For instance, Gilchrist et al. (2017) show that during the global financial crisis price setting by US firms differed depending on the degree of financial constraints they were subject to: while liquidity-constrained firms increased prices in 2008, unconstrained firms decreased their prices. Applying quantile regressions in a similar fashion to that of the growth-at-risk approach, López-Salido and Loria (2020) provide some evidence that financial conditions in the euro area and the United States can provide valuable information for the prediction of downside tail risks of inflation. Korobilis et al. (2021) report evidence that in the euro area specific credit and money indicators can play an important role in forecasting inflation tail risks, both one year and three years ahead.

5.3.3 Lessons from other central banks

After the global financial crisis, many central banks in the major industrialised countries publicly declared that they would be integrating financial stability considerations into their monetary policy decision-making frameworks. Between 2010 and 2018, central banks in Sweden, New Zealand,[133] Norway,[134] Canada and Australia, all small, open economies, explicitly integrated risks to financial stability into their flexible inflation-targeting approaches. Their communication approach varies with respect to openness and frequency of reporting. Yet all of these central banks regularly countered expectations that monetary policy aims to mitigate financial vulnerabilities at all costs and as a first line of defence. Therefore, the actual application of leaning against the wind has been rare: the Bank of Canada and Norges Bank each altered their interest rate path once, in 2013 and 2016 respectively, because of high and rising household debt. The Bank of Canada invoked its risk management approach in late 2019 when it resisted the global push towards easier monetary policy. Given the lack of a unified theoretical or empirical framework, these decisions relied heavily on judgement, supported by a cost-benefit analysis (in the case of Norway) and an alternative scenario analysis (Canada).[135]

The experience of other central banks suggests that leaning against the wind is not unproblematic. Sveriges Riksbank followed a leaning approach from 2010 to 2014, setting its monetary policy rate slightly higher than the prospects for inflation and resource utilisation would have suggested. The bank argued that its aim was to help dampen the development of household debt and housing prices. In 2014,

133 The Reserve Bank of New Zealand uses macroprudential tools, in particular capital buffers and a LTV ratio policy.

134 Norges Bank regularly advises the Norwegian Ministry of Finance on the countercyclical capital buffer rate for banks.

135 See also Norges Bank (2016), Poloz (2019) and Bank of Canada (2019).

however, Sveriges Riksbank had to stop this approach because inflation had undershot its target for too long, long-term inflation expectations had begun to fall and unemployment was high. Svensson (2014) argues that the Riksbank failed in its attempt to reduce macro-financial risks stemming from the housing market because lower inflation pushed up household debt. In hindsight, the Governor called leaning against the wind a "fair-weather" policy that can only be pursued if confidence in the inflation target is intact.[136] Likewise, central banks in New Zealand, Norway and Canada regularly emphasise that leeway is essential when monetary policy is intended to counteract financial imbalances. In a similar vein, the monetary policy of the Reserve Bank of Australia is not uncontroversial: some critics think that the undershooting of the inflation target in recent years is the result of an overemphasis on financial stability risks related to the change in the inflation control agreement in 2016.[137] In a recent speech, the Reserve Bank's Governor indeed indicates a partial reversal of their policy approach, stating that the positive effects of monetary easing on financial stability will be given more weight.[138]

The Bank of England takes a different approach, using "financial instability escape clauses". The Prudential Regulation Authority, the Bank's macro and microprudential regulation arm, was set up in 2013. Since then, the remit of the Monetary Policy Committee (MPC) has allowed for it to deviate from its inflation target if the Financial Policy Committee (FPC) formally judges and warns that attempts to keep inflation at target may pose a risk to financial stability. The "financial stability knock-out" in the Bank's forward guidance in 2013-14 was based on cooperation between the MPC and the FPC. These arrangements assume that the FPC will issue such a warning only if its macroprudential tools are insufficient to contain the risks to financial stability.[139] So far, the escape clauses have not been applied. But they are appealing as they allocate accountability to the respective committees and internalise spillovers, as the MPC and FPC share four members and are chaired by the same person. Moreover, the integration of financial stability considerations in this set-up is not mechanical but features a non-linear interaction, whereby financial stability risks are taken into account in periods when they are arguably particularly relevant.

At the Federal Reserve System, clear communication on how financial stability concerns actually translate into monetary policy is scarce. One possible reason for this is that committing to a systematic approach is difficult. Nonetheless, according to its minutes the Federal Open Market Committee (FOMC) has for many years discussed the financial situation in each of its meetings and assessed, in alternate meetings, how financial vulnerabilities have changed, as the associated risks may significantly threaten the achievement of its dual mandate. The Federal Reserve System began publishing an annual Financial Stability Report in 2018, shortly before announcing its review of monetary policy. Since this review it has gone

[136] See Ingves (2019).

[137] See Kirchner (2018) and The Guardian (2019).

[138] See Lowe (2020) and Reserve Bank of Australia (2020).

[139] See UK Treasury (2020) and Bank of England (2013, 2019). The "financial stability knock-out" of 2013 states that not only the FPC, but also the Financial Conduct Authority and the Prudential Regulation Authority, must have exhausted their policy tools before the instrument is implemented.

a step further, explicitly stating that fulfilling its mandate depends upon a stable financial system. Overall, the Federal Reserve System does not think that its monetary policy has contributed significantly to financial vulnerabilities.[140] FOMC members also stress the high costs associated with a leaning against the wind approach and the still imprecise knowledge of interactions between the monetary policy stance and financial vulnerabilities. Nonetheless, financial stability considerations do seem to play a role in monetary policy. For instance, when discussing monetary policy tools as part of their strategy review, some FOMC members cautioned against the use of negative interest rates as they assumed that the adverse effects on market functioning and financial stability in the United States would be more significant than in other countries. Some FOMC members also see a need for a clear communication strategy on the implications of financial vulnerabilities for monetary policy. Financial instability escape clauses are repeatedly mentioned in this context.[141]

The Bank of Japan has struggled to address both price stability and financial stability concerns since the collapse of Japan's asset price bubble in the early 1990s. In 2006, the Bank adopted a "two perspectives" approach, in principle still valid today. As one perspective, the Bank of Japan examines various risks to the outlook, including financial stability risks, over the longer term. When choosing its monetary instruments, it also takes financial instability risks into account, as demonstrated by the tiering system that mitigates the impact of negative policy rates on the banking system. Nonetheless, IMF (2020) and Westelius (2020) argue that the Bank of Japan has put a large relative weight on price stability since introducing the 2% inflation target in 2013, thereby causing financial stability costs. They suggest that the Bank should better balance its price and financial stability objectives, for example by emphasising the medium to long-term nature of achieving the price stability objective to gain flexibility and by being less ambitious about its inflation target.

To sum up, the current practices of major central banks outside the euro area do not support the adoption of a mechanical leaning against the wind policy but consider financial stability in a more flexible manner. Several central banks have become more willing in recent years to occasionally consider financial stability considerations in their monetary policymaking.

5.4 A review of useful indicators and tools

This section discusses how monetary analysis might be adapted to allow for an enhanced role of financial stability considerations. The focus is on indicators and tools and takes current monetary analysis as a reference point. Four aspects are in general considered to inform the monetary policy process: (i) indicators that provide information on the capacity of the financial system to transmit monetary policy actions in the short to medium term (a "thermometer" of financial stability);

[140] See also Goldberg et al. (2020).

[141] See also FOMC (2019) and FOMC (2020a and 2020b).

(ii) indicators that provide information on the build-up of risks in the financial sector in the longer term (a "barometer" of financial stability); (iii) the choice of monetary instruments, particularly at the ELB; and (iv) ways to measure the stance of macroprudential policy and its ability to preserve financial stability, or its limitations in so doing.[142] [143]

The first set of indicators looks at how financial stability risks – and conditions in the financial sector more generally – affect the monetary transmission mechanism and specifically those channels that operate through the financial system. Monetary analysis, as conducted today, examines these risks in depth by taking a snapshot of indicators which reveal the intermediation capacity and other characteristics of the banking sector and the wider financial system (i.e. including non-bank intermediaries). These include risk-taking and competition, as well as financial vulnerabilities in the private non-financial sector. These affect the way monetary policy actions transmit through credit supply into the real economy.

With respect to the banking sector, analysis of these indicators has been included in monetary analysis since the European sovereign debt crisis. This analysis has evolved over the years to cover a broad range of indicators, in particular those describing banks' risk-bearing capacity, capitalisation, funding conditions and profitability. It points out the implications for monetary transmission using indicators that also appear in the ECB's Financial Stability Review. A special focus in an environment of negative interest rates is the profitability of banks' lending operations and, more specifically, their compressed lending margins, as profitability is what ultimately determines the banking sector's incentive to engage in lending. In recent years, increasing attention has also been paid to financial amplification risks. Taking the analysis of the implications of financial stability risks for the monetary transmission mechanism a step further, this discusses the potential spiralling nexus between a materialisation of credit risk and further credit tightening. Another point of interest is the relatively new AnaCredit dataset, the more extensive use of which could lead to a more in-depth monitoring of credit developments and vulnerabilities in the real sector.[144]

Current monetary analysis discusses potential impairments to bank-based financial intermediation in great depth. However, there is a need to develop summary indicators of the strength of the empirically well-established bank lending channel and to increase the focus on issues related to non-bank financial intermediation. Regarding the bank lending channel, a strongly impaired intermediation capacity prevents the smooth transmission of monetary policy.[145] Here, the literature has yet to identify a single summary indicator of a hampered bank lending channel that would address the potential non-linearity of the effect of banks' balance sheet strength on the transmission of monetary policy. As for non-

[142] See Borio and Drehmann (2009b).

[143] The indicators have already been widely reviewed at area and individual country level in the ECB's Macroprudential Report and in the ECB and national central banks' financial stability reports.

[144] For an example of the use of AnaCredit data in monetary policy analysis, see Altavilla et al. (2020a).

[145] The empirical evidence thus far is inconclusive. Kashyap and Stein (1995, 2000) and Jimenez et al. (2012), for example, conclude that weaker banks are more responsive to monetary policy, while Acharya et al. (2019) find the opposite.

bank financial intermediation, the analysis of non-banks in credit provision should continue to be expanded as more insights on the role and influence of these intermediaries might also contribute to a better understanding of monetary policy transmission, given their recent increase in importance.

A second set of possible financial stability indicators in the enhanced monetary analysis framework points to possible risks to medium-term price stability from financial imbalances. These indicators focus on the fact that high systemic risk – in both the cross-section and time-series dimensions – can lead to financial instability and consequent macroeconomic losses in terms of output and inflation. Monitoring the gradual build-up of financial imbalances may signal risks to financial stability and the longer-term macroeconomic outlook.[146] This suggests including in the current monetary analysis framework an explicit discussion of risks in the financial sphere that could have an impact on the macroeconomy beyond the traditional monetary policy horizon of two to three years. By their nature, these developments happen at a lower frequency than that of the business cycle; they could therefore be monitored in depth on a semi-annual or annual frequency.

The Eurosystem's Financial Stability Reviews and the ECB's Macroprudential Report and Macroprudential Bulletin contain indicators and scoreboards for exactly this purpose, focusing on the euro area as a whole and on individual sectors and countries. The latter focus is important, and has a bearing on the aggregate, because country-specific financial stability risks can become significant for monetary policy if and when contagion leads to spillovers to the rest of the euro area. Of special interest are systemic risk indicators (SRIs). These vulnerability metrics capture the general state of the financial environment and its resilience to a shock, without triggering adverse amplification and severe repercussions for the macroeconomy. The first group of these indicators comprises cyclical SRIs, which capture the state of the credit cycle and are available at both country and euro area level. In addition to standard credit-to-GDP gaps, indicators such as leverage, gross and net international positions, measures of risk tolerance from the euro area bank lending survey, measures of the financial cycle (e.g. by Schüler et al., 2020) and the composite SRI by Lang et al. (2019) are all relevant. The second group comprises structural SRIs. These capture risks from interconnectedness, asset commonalities and overlapping portfolios, which can propagate adverse shocks throughout the financial system. A third group of SRIs specifically examines risks in real estate markets, as these have played a prominent role in many financial crises.

To understand the implications of these indicators, narratives are of special importance. Specific, and important, questions include whether there is evidence of heightened risk-taking in financial markets. Monetary analysis should also reflect on how realistic the assessments of risks in the financial system are. It should consider, for example, what changes can be expected from events such as a wave of financial innovation, a growth in non-bank intermediation, new trends in productivity, unusual volatility in financial markets or the advent of new policy instruments. Answers to these questions will necessarily be qualitative and based on a broad picture of where

[146] The second aspect of monitoring financial stability can be traced to Issing (2003), Trichet (2009) and Praet (2016), among others.

we currently stand with respect to longer-term trends in the macro and financial domains.[147]

The third possible set of indicators of an enhanced monetary analysis framework would inform an "instrument-choice analysis" which evaluates the mix of monetary policy instruments, particularly at the ELB. These evaluations already feature to a large extent in the process of deciding which tools to use from the Eurosystem's expanded monetary policy toolkit, and of subsequently evaluating and updating the monetary instrument mix. Analysis of this nature is important because the side effects of monetary tools can change over time as the macroeconomic, financial and policy environment changes.[148] It could benefit from further research on the interactions of different monetary policy instruments.

Finally, a possible fourth aspect of enhanced monetary analysis involves indicators of the macroprudential policy stance and an assessment of the interactions between monetary and macroprudential policies. This includes the analysis of the ability of macroprudential policies to preserve financial stability, or its limitations in that respect. The focus is on whether and how the activation of macroprudential measures to maintain financial stability affects the transmission of monetary policy and the outlook for price stability in the longer term. This matters for monetary policy for three main reasons. First, macroprudential policy can act in sync with monetary policy, amplifying accommodation or its withdrawal. This is particularly important when the monetary policy space is limited. Second, it can help mitigate any adverse side effects (for example excessive risk-taking, the build-up of vulnerabilities in the real estate sector, etc.) which monetary accommodation may have on financial stability. Whether such side effects are effectively tackled (i.e. whether an appropriate overall mix of monetary and macroprudential policy is achieved) has a significant bearing on the design and proportionality assessment of non-standard monetary policy measures. Third, as the usefulness of leaning against the wind measures cannot be ruled out, such an analysis would help determine whether, in certain circumstances, micro and macroprudential policies cannot or do not fully address a build-up of financial vulnerabilities.

The discussion in this section points to a number of novel aspects to be included in the monetary analysis. They would entail looking more deeply into the longer-term build-up of financial vulnerabilities that can have adverse consequences for output and inflation as well as for monetary transmission. And they would provide insights to the way in which macroprudential policies interact with variables analysed from a monetary policy perspective. In both cases, adding a systematic, monetary policy-oriented discussion on the build-up of financial imbalances that goes beyond the traditional two- to three-year horizon, for example in the form of growth-at-risk models, and that extends to the sector and jurisdiction level, might prove useful. Monetary analysis could also be enhanced by a regular complementary assessment of the possible limitations of macroprudential policies and their implications for

[147] An example of such a qualitative assessment is the analysis of former Bank of Japan Governor Shirakawa of the origins of the Japanese crisis (Shirakawa, 2014).

[148] The Reserve Bank of New Zealand provides an example of such a framework, referring to five principles (one of them being financial system soundness) on which it judges the usefulness of different unconventional monetary policy tools.

monetary policy. The analysis of all of these aspects could draw and expand on the work that is already being carried out in other business areas of the ECB, in particular in the financial stability field.

It is important to stress that the individual elements of this enhanced monetary analysis would need to be carefully integrated to ensure that it retains its monetary policy focus. To enable a robust analysis of the above aspects, it would be important to develop an enhanced analytical framework that makes it possible to assess the various trade-offs when considering alternative monetary policy tools and their financial stability implications. In particular, further work on modelling the non-linearities associated with the tail risks for the macroeconomy if financial risks materialise, for example by extending existing growth-at-risk and inflation-at-risk models, is warranted. An enhanced analytical framework of this nature could benefit from a more tractable definition of the aim of macroprudential policy (for modelling purposes) and a discussion on how it relates to the ECB's primary objective of price stability.

ECB (2021c) discusses how the ECB's monetary policy strategy can be adapted to reflect the greater role of financial stability considerations. The adaptation would affect both input to the monetary policy decision-making process and the associated public communication. The analysis presented in this paper suggests that various options featuring a dual analysis could be considered, with an integrated monetary and financial analysis that includes some of the above considerations alongside the traditional economic analysis.

5.5 Conclusions

Financial stability is a precondition for price stability and therefore cannot be disregarded. Financial considerations have been a part of monetary analysis since the monetary policy strategy was established in 1998. The depth and breadth of monetary analysis has evolved over the years, along with the changing financial, macroeconomic and regulatory landscape. However, it has always been subject to the main objective of price stability. While it is widely recognised that a systematic use of leaning against the wind monetary policies is problematic, an increased role of financial stability considerations in the monetary policy decision-making process may be warranted both when macroprudential policies could face limitations and to account for the potentially significant side effects of monetary policy measures. Starting from the premise that financial stability is not regarded as a secondary objective to be actively and systematically pursued by monetary policy, the monetary policy decision-making process could be extended along several dimensions to incorporate financial stability considerations in a more comprehensive fashion.

Appendix

A.1 The Dong, Miao and Wang (2020) variant used in Section 4.2.1

To illustrate how the medium term should be modified in order to take financial stability concerns into account, we conduct simulations using a medium-scale quantitative macroeconomic model for banks and the possibility of asset price bubbles. The banking block is a variant of the Gertler and Karadi (2011) and Miao and Wang (2018) frameworks.[149] Banks lend to the real economy but are subject to a moral hazard problem which is alleviated by constraining their balance sheets to only a certain fraction of their market value. This gives rise to the possibility of rational asset price bubbles on the banks' stock market valuation, which increases their ability to borrow and generates a boom in lending and economic activity.

For a bubble on a bank's share price to exist, two conditions must be met: (1) investors must earn their required risk-adjusted return from holding the bubbly equity; (2) the bubble cannot explode relative to the size of the economy. In most other models of rational bubbles (e.g. Martin and Ventura, 2012), bubbles are entirely worthless and do not pay a dividend. They deliver returns to investors only through capital gains. Hence the above two conditions require the presence of dynamic inefficiency in the economy, a situation that occurs when the real interest rate is below the economy's growth rate. This is how the bubble can grow in line with GDP in the long run while still providing the holder with a competitive rate of return. The Miao and Wang framework, however, does not require dynamic inefficiency and we do not assume it in the exercise. This is because it increases bank profits by relaxing credit constraints. In other words, in addition to capital gains the bubble also delivers higher dividends to bank shareholders. The mechanism works as follows. When investors are optimistic about bank leverage and profitability, this raises the bank's share price and allows it to borrow more. If lending is profitable, this increases the bank's profits, thus making the optimism about the bank's share price a self-fulfilling prophecy. The additional bank profits resulting from higher leverage mean that the bubbly component of the bank's share price also feeds into investors' required rate of return. The aggregate effect of the bubble is to relax credit constraints and improve economic activity, the downside being that the boom relies on positive investor sentiment and can quickly turn to a bust if sentiment turns pessimistic. This is why a policy response to moderate the rise in bank leverage and bank vulnerability is appropriate.

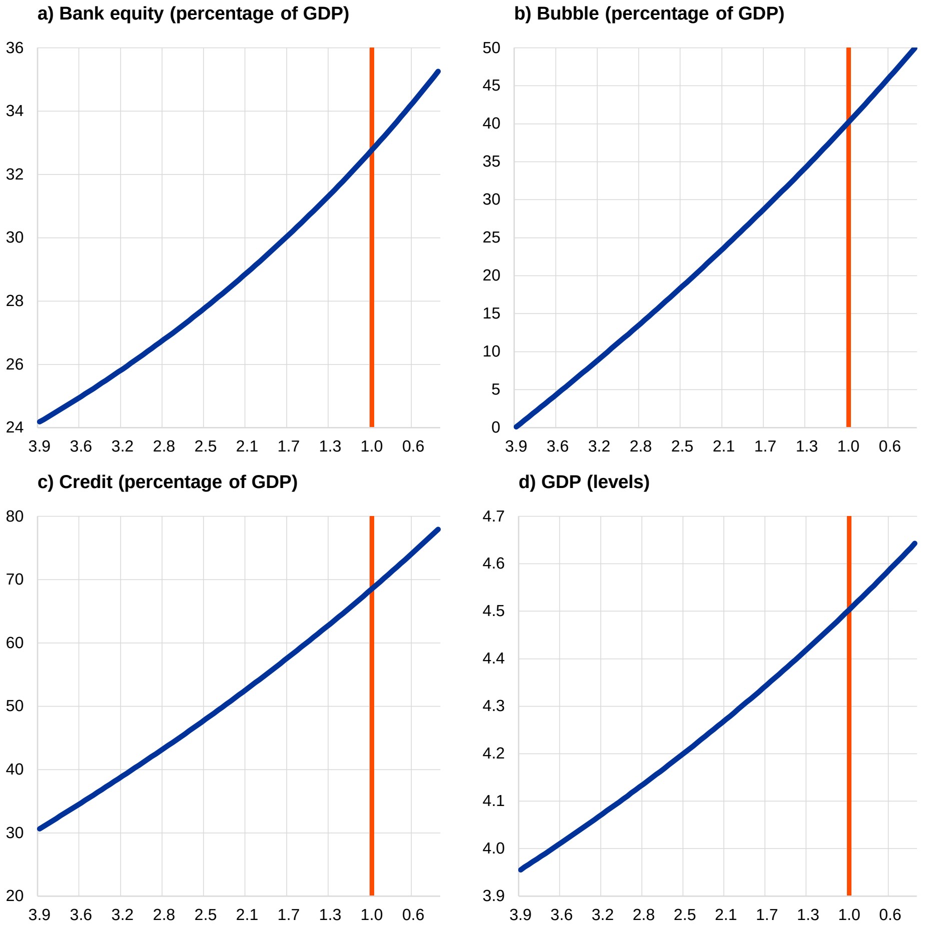
As we are interested in how monetary policy can lean against the bubble, it is useful to see how it is affected by long and short-term movements in real interest rates. Chart A.1 below shows that the bubble becomes larger as real

[149] The model has a number of real rigidities such as consumption habits, investment adjustment costs and backward-looking price indexation within the Calvo framework, the aim being to generate realistic dynamics in response to shocks. Monetary policy is governed by a Taylor-type rule and the response coefficients to inflation and output growth are taken from the NAWM II paper (Coenen et al., 2018).

interest rates decline. When long-term real interest rates are very high (above 4% in the figure), the bubbly equilibrium does not exist. This is because the increase in bank profitability from higher leverage is not sufficient to provide investors with their very high required rate of return. However, as the interest rate falls, the bubbly equilibrium emerges and the size of the bubble expands sharply. This suggests that the financial stability risks from asset price bubbles increase significantly in a low real interest rate environment such as the one we are currently experiencing.

Chart A.1

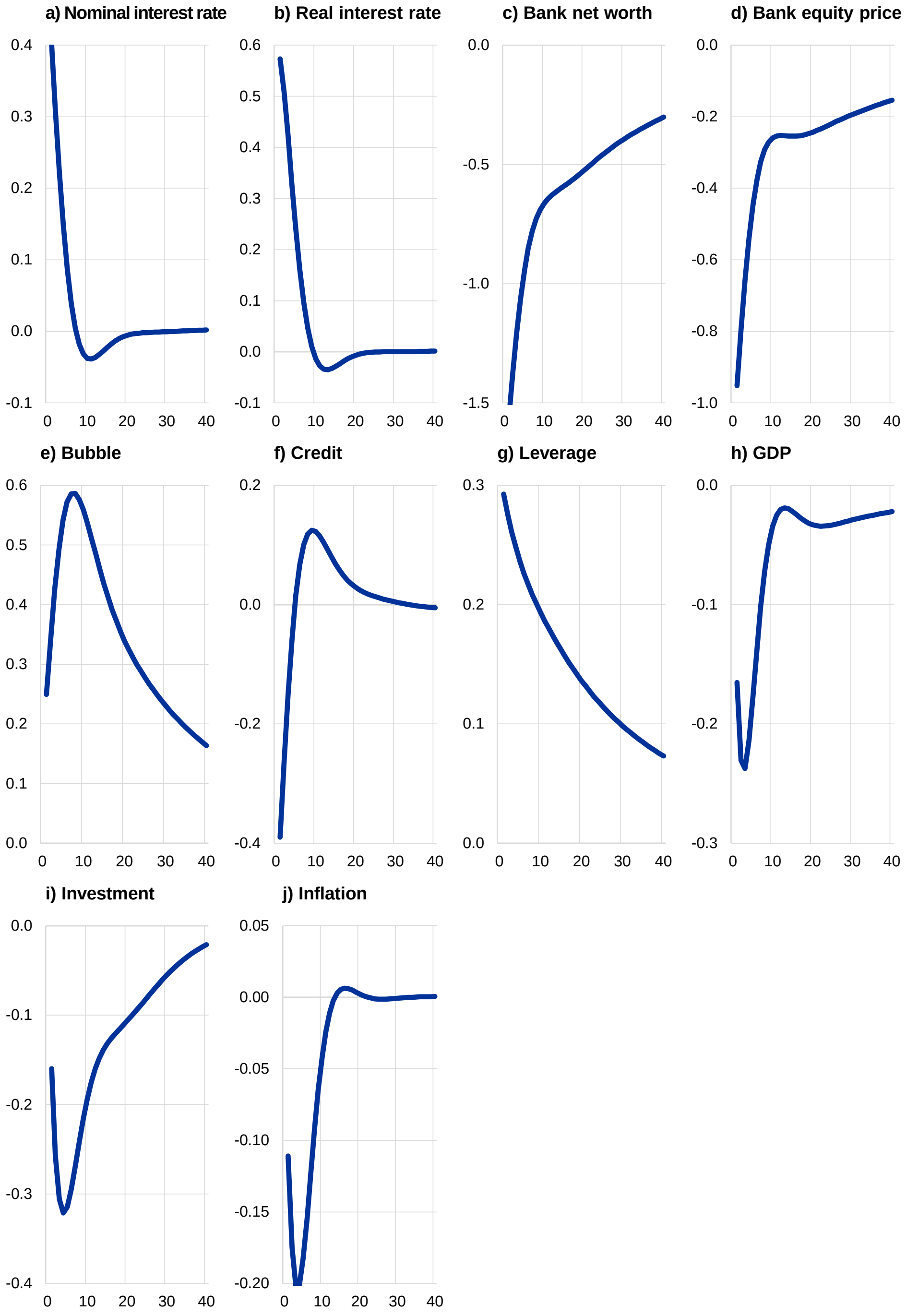
Bubbles and the steady-state real interest rate



Source: ECB calculations.
Note: The blue line displays in all four panels how the steady state values respectively of Bank equity, Bubble, Credit and GDP evolve for different values of the annualised real interest rate. The orange vertical line denotes the calibration value of the annualised interest rate used for the impulse response functions of Chart 11. The different values of the annualised real interest rate are shown on the x-axis.

In Chart A.2 we examine the response of the economy to a positive monetary policy shock of 1 standard deviation (as estimated in the NAWM II paper). We see that monetary tightening increases the size of the bubble, in contrast to the finding of the Dong et al. (2020) paper. The surprising effect of monetary policy on the bubble flows directly from the fact that the higher real interest rate reduces the bank's net worth, thus tightening the supply of credit to the real economy. This effect is missing in the Miao and Wang framework, which abstracts from the bank capital channel. Adding this channel changes the model's implications. Since the bubble derives its value from its ability to relax the borrowing constraint, a fall in net worth which tightens financial conditions also increases the size of the bubble. Nevertheless, the monetary tightening reduces the bank's overall equity price (which includes both the bubble and fundamental components) as well as the bank's access to credit. This means that monetary policy could be used to restrain the build-up of leverage during the period when the bubble is growing.

Chart A.2
Monetary policy shock



Source: ECB calculations.
Note: GDP, Investment, Credit, Bank net worth, Bank equity price and the Bubble are all expressed in percentage deviations from the steady state. Leverage is expressed in level deviations from the steady state and then multiplied by 100. Inflation, the Nominal interest rate and the Real interest rate are all annualized in level deviations from the steady state. The x-axis in all panels displays quarters.

Important caveats from the literature on leaning against asset price bubbles

Leaning against asset price bubbles is best done using macroprudential policy when possible. Aoki and Nikolov (2015) show that investors without access to high yielding investments are the ones most likely to be exposed to an asset price bubble. In contrast, a profitable and well capitalised banking sector will not want to endanger its charter value by exposing its net worth to very risky investments. Hence, timely ex ante measures to build up banks' capital buffers during the boom are effective in dissuading banks from taking on risky exposures during a bubble episode.

Leaning may be counterproductive. In an influential paper in the rational bubbles tradition, Galí (2014) argued that higher interest rates may lead to faster (rather than slower) bubble appreciation. If investors hold a bubbly asset as well as nominal bonds, they will require the same risk-adjusted return on both types of asset in equilibrium. When the return on the nominal bond increases as a result of monetary tightening, the size of the bubble has to grow faster in order to provide investors with the capital gains which persuade them to continue to hold that bond. If investors do not expect a faster appreciation of this type, the bubble will collapse.

According to Galí, the fundamental and non-fundamental parts of asset prices react differently to higher interest rates. Due to arbitrage, all assets must deliver higher expected returns in future if they are to remain attractive alongside higher interest rates on nominal bonds. For the fundamental value of a stock, for example, a monetary tightening induces a drop in its price, which then gradually appreciates over time, thus delivering a higher expected return. The decline in the fair value of stocks occurs because it is equal to the net present value (NPV) of dividends, which is reduced by higher interest rates. In contrast, bubbles in the Galí framework are components of the asset price which are unrelated to real productive activities. As a result, their behaviour is not governed by the NPV logic. Provided that the bubble does not burst, it must grow faster when the safe interest rate increases in order to remain attractive. If it is not expected to grow faster, it will burst. This implies that a monetary tightening to lean against bubbles may be a risky strategy. Because the existence and evolution of the bubble are not tied to fundamentals but depend on investor sentiment, it may be hard to predict how the market will react to the monetary tightening.

Other academic studies have disputed Galí's pessimistic conclusions. Adam et al. (2016), Adam and Merkel (2019) and Adam (2020) use a different notion of asset price bubbles, positing that investors extrapolate their expectations of future asset price appreciation on the basis of past experiences. This departure from rational expectations is very strongly supported by the empirical evidence on the way real people form expectations (Coibion and Gorodnichenko, 2015). In real life financial markets, moreover, this is not an obviously irrational way to behave, given the well-documented momentum factor in financial prices, i.e. the tendency for excess returns to be auto-correlated.

Adam et al. (2016) show that this can lead to very pronounced and long-lived movements in pessimism and optimism even if the degree of extrapolation

(and hence the departure from rational expectations) is quantitatively small. A semi-rational exuberance framework of this nature implies considerable inefficiencies when asset prices lead to real investment decisions. For instance, high stock prices increase business investment and high house prices stimulate house building. Moreover, when such investment booms are driven by optimism rather than fundamentals, they sow the seeds of their own demise by creating a future investment overhang. Adam and Merkel show that monetary policies which lean against financial imbalances caused by optimism improve welfare by stabilising asset prices and preventing bubbles.

A.2 The Ajello et al. (2019) variant used in Section 4.2.3

The results in Section 4.2.3 are based on a variant of the model in Ajello et al. (2019). This paper analyses the desirability of a leaning against the wind approach, using a two-period version of the standard New Keynesian model extended to account for the possibility of financial crises.

The focus is on the optimal monetary policy choice in period 1, given the risk of a financial crisis in period 2. The probability of the crisis is assumed to be a function of the level of credit growth, which is measured by the five-year cumulative growth rate of real bank loans. No other shocks are taken into account, so the economy can be perfectly stabilised if no crisis occurs. If, however, a financial crisis takes place, the economy incurs an inevitable cost in terms of negative inflation and output gap (calibrated to the inflation and GDP drops observed in the global financial crisis). An important assumption is that such cost is given. There is nothing that policy can do ex post to reduce the depth of the economic recession. The only option is to act ex ante to minimise the likelihood of the crisis occurring. This is possible because changes in policy rates are assumed to influence the crisis probability through their impact on credit growth.[150]

Our illustrative calibration of the model largely follows Ajello et al. but it is adapted for euro area data – see Box A1. We choose the discount factor in such a way as to ensure that equilibrium nominal interest rates are equal to 2.5%, reflecting a 2% inflation target. The crisis probability is assumed to depend on aggregate credit conditions. Ajello et al. estimate the parameters governing this relationship using the methodology and dataset introduced by Schularick and Taylor (2012) to analyse the relationship between the financial indicator and the probability of a crisis in 14 countries over 138 years. As their sample includes Germany, Spain, France, Italy and the Netherlands, we keep their estimated parameter values unchanged.

In turn, the sensitivity of credit conditions to macroeconomic variables and the policy interest rate are re-estimated using quarterly euro area data. Unlike the US results in Ajello et al., we find the policy rate coefficient to be negative and significant. This

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150 Like Ajello et al. (2019), we focus on the case in which the private sector holds irrationally optimistic expectations as to the probability of a crisis, i.e. it assumes that probability to be constant and very small.

implies much more effectiveness in leaning against the wind, since a monetary policy tightening will directly curb credit growth. By contrast, in Ajello et al. a policy tightening affects credit growth only indirectly, by reducing the output gap.

The central bank faces a trade-off between, on the one hand, the desire to stabilise inflation and the output gap in period 1 and, on the other, the benefits of reducing the probability of a crisis in period 2. This trade-off is depicted in Chart A for the benchmark model, assuming an initial credit condition of 0.1 (equal to the euro area sample mean). Chart 12 in the main text illustrates how, for different values of the initial credit condition, the optimal interest rate level in period 1 changes. The larger the initial credit growth, the higher the probability of a financial crisis in period 2. It is therefore optimal for the central bank to set a policy rate above 2.5%, but at some cost in terms of below-target inflation and a negative output gap.

Our main interest is in an extension of this modelling framework to include partly backward-looking expectations. We simply assume that, in the absence of a financial crisis, expectations of future inflation (and output) are partly forward looking, partly equal to current inflation (output). Chart 13 in the main text compares optimal monetary policy in this case to the purely forward-looking benchmark.

Box 1

Ajello et al. (2019) model and calibration

The key equations of the Ajello et al. (2019) two-period New Keynesian model can be summarised by the following private sector equilibrium conditions

$$y_1 = -\sigma i_1 + \sigma\left[(1-\epsilon)\pi_{2,nc} + \epsilon\pi_{2,c}\right] + \left[(1-\epsilon)y_{2,nc} + \epsilon y_{2,c}\right] \quad (1.a)$$

$$\pi_1 = \kappa y_1 + \beta\left[(1-\epsilon)\pi_{2,nc} + \epsilon\pi_{2,c}\right] \quad (2.a)$$

$$L_1 = \rho_L L_0 + \phi_0 + \phi_y y_1 + \phi_\pi \pi_1 + \phi_i i_1, \quad (3)$$

where y_t is the output gap, defined as the gap between the nominal policy rate and its long-run natural rate and π_t denotes the gap between inflation and its long-run target. The variable L_t is a proxy for credit conditions. Given these model equations, the policymaker chooses the optimal policy rate to minimise the loss function

$$\boldsymbol{W1} = \boldsymbol{u}(\boldsymbol{y_1}, \boldsymbol{\pi_1}) + \boldsymbol{\beta}\mathbb{E}_1[\boldsymbol{W2}], \quad (4)$$

where

$$\mathbb{E}_1[W2] = \frac{(1-\gamma_1)u(y_{2,nc}, \pi_{2,nc}) + \gamma_1 u(y_{2,c}, \pi_{2,c})}{1-\beta\mu}, \quad (5)$$

$$\gamma_1 = \frac{\exp(h_0 + h_1 L_1)}{1 + \exp(h_0 + h_1 L_1)}, \quad (6)$$

and

$$u(y, \pi) = \frac{1}{2}(\lambda y^2 + \pi^2) \quad (7)$$

To estimate the coefficients of equation (3) for the euro area, we follow the methodology presented by Ajello et al. and choose the five-year cumulative real bank loan growth as a proxy for aggregate credit conditions L_t. Formulated with a quarterly frequency, this growth rate can be approximated by

$$L_t \approx \frac{19}{20} L_{t-1} + \Delta log B_t - \pi_t \quad (8)$$

where ΔB_t denotes quarterly nominal credit growth. We thus estimate the reduced form equation

$$\Delta log B_t = c + \theta_i i_t + \theta_y y + \theta_\pi \pi_t + \varepsilon_t^B L_t \approx \frac{19}{20} L_{t-1} + \Delta log B_t - \pi_t \quad (9)$$

We use euro area data from the first quarter of 1999 to the fourth quarter of 2019 on nominal bank loans to domestic households and NFCs, the euro overnight index average, the quarterly HICP core inflation rate and the Jarociński and Lenza (2018) euro area output gap estimates. Due to a potential simultaneity bias, the lagged values of the policy rate and the output gap are used as instruments for their contemporaneous values. The resulting estimates are reported below.

Table A

Estimates results

Coefficients	Values
c	1.90*** (0.18)
θ_i	-1.02*** (0.30)
θ_y	0.43*** (0.04)
θ_π	0.06 (0.18)
Observations	83

The model parameters φ_i, φ_y and φ_π can then be determined by combining equations (8) and (9). Since our estimate for θ_π is insignificant and it holds that $\varphi_\pi \approx (\theta_\pi - 1)$, we set φ_π equal to -1. In order to reach a steady-state value of 0.1 for the credit condition, which is the euro area average of the real credit growth variable over the sample period, we set φ_0 equal to $(1- \rho_L)$*0.1.

In the extension of the Ajello et al. model with partly backward-looking expectations, equations (1) and (2) become

$$y_1 = -\sigma i_1 + \sigma\{(1-\epsilon)[(1-\zeta_\pi)\pi_{2,nc} + \zeta_\pi \pi_1] + \epsilon\pi_{2,c}\} + \{(1-\epsilon)[(1-\zeta_y)y_{2,nc} + \zeta_y y_1] + \epsilon y_{2,c}\}, \quad (1.b)$$

and

$$\pi_1 = \kappa y_1 + \beta\{(1-\epsilon)[(1-\zeta_\pi)\pi_{2,nc} + \zeta_\pi \pi_1] + \epsilon\pi_{2,c}\}, \quad (2.b)$$

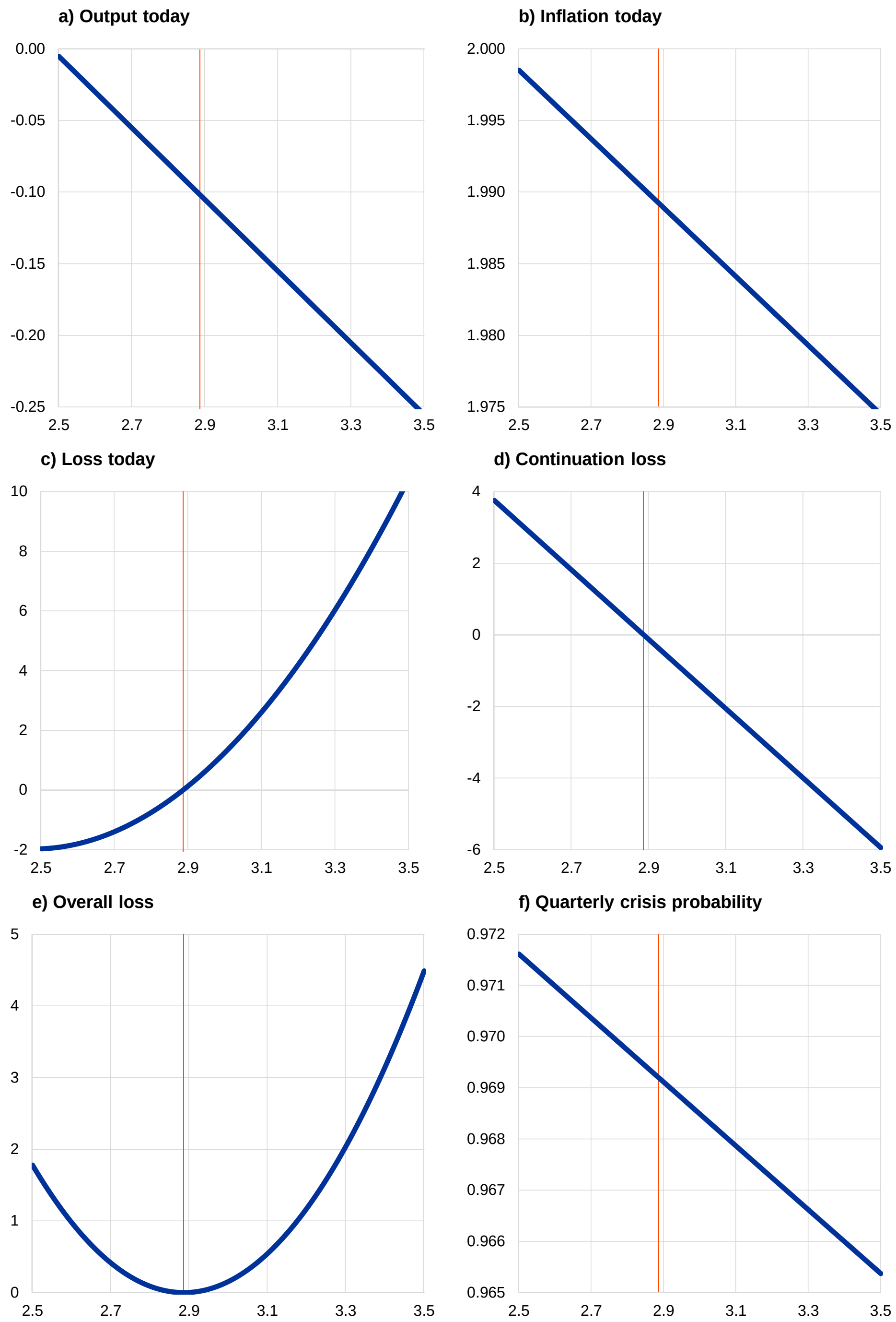
where ζ_π and ζ_y govern the degree to which private sector expectations are backward looking.

In graph 13, for illustrative purposes, $\zeta_\pi = \zeta_y = 0.5$.

Chart A

The central bank's trade-off

The model equilibrium for varying levels of the policy rate



Source: Ajello et al. (2019) p. 299, with changed calibration.
Notes: L_0 is set to 0.1, which corresponds to the average level of Lt for the euro area sample period. The normalisation of the losses follows Ajello et al. (2019). The red vertical line depicts the optimal choice of policy interest rate if L_0 is 0.1. The Output gap is expressed in percentages; the Inflation today is expressed in annualised percentage points. The Loss today, Continuation loss and Overall loss are expressed in percentage points. The quarterly crisis probability is expressed in percentages per year. The x-axis displays the values of the annualised policy interest rate.

A.3 The medium term in response to waves of pessimism and optimism

An additional interpretation of financial instability concerns the possibility of the private sector being swept by a sentiment of "excessive" optimism, for example regarding the assessment of the economy's investment opportunities. Such optimism would be excessive in that it would tend to be followed by a sharp correction in private sentiment. As such, it would result in a boom-bust cycle and thus be a reason for concern for central banks.

We capture this type of scenario in a version of the model in Karadi and Nakov (2021), which incorporates financial intermediaries facing occasionally binding balance sheet constraints in a standard macroeconomic model. The cycle of optimism and pessimism is generated exogenously, as a sequence of positive and negative shocks which induce expectations in the economy, first of exceptionally high and subsequently of low returns on investment in the future. These developments lead to an initial boom in credit, investment and output, followed by a recession.

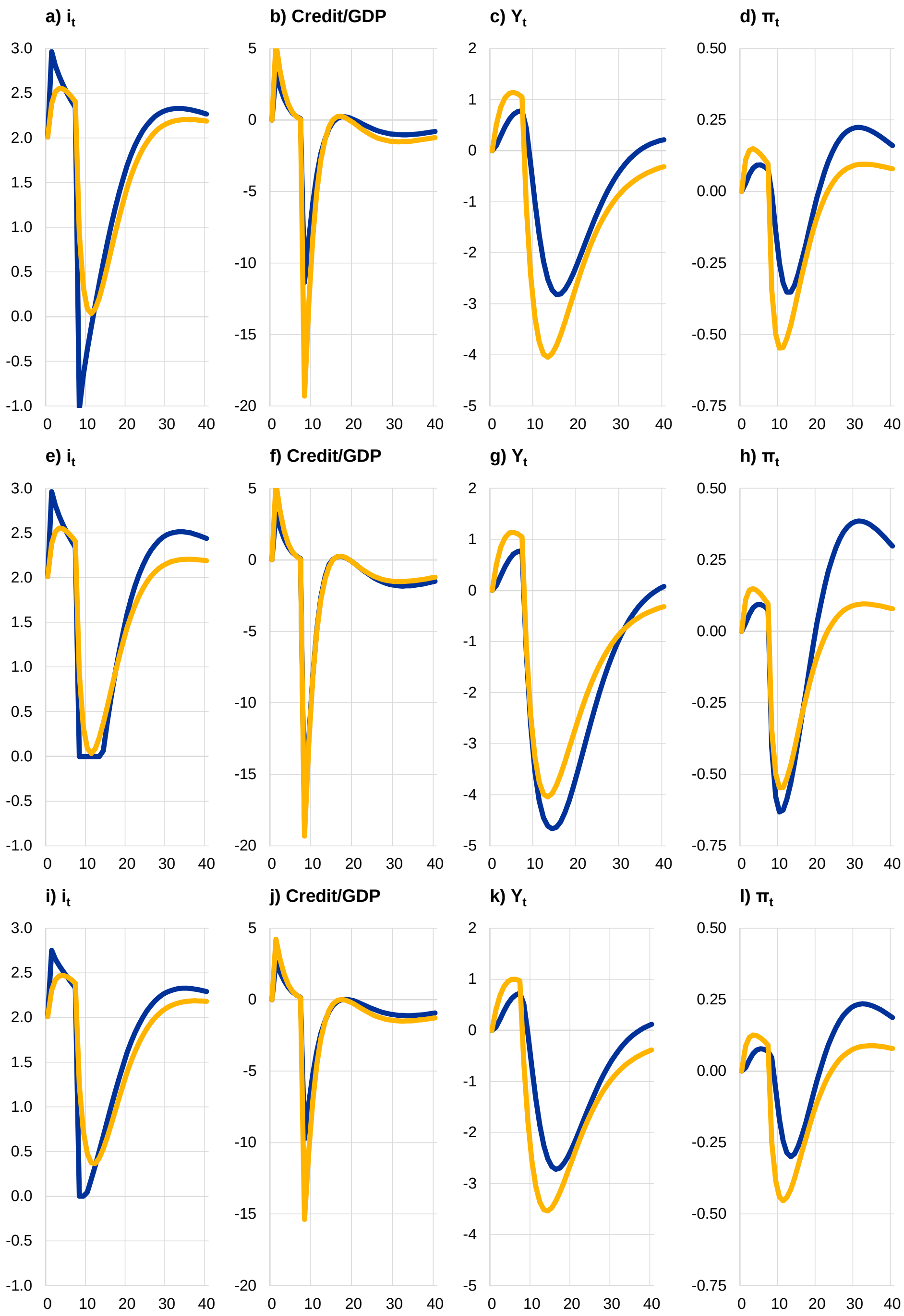
As in Section 4.2.1 in the main text, monetary policy is described in terms of either a standard Taylor rule or a Taylor rule augmented by a reaction to credit. The credit reaction coefficient is such that, all else being equal, a 1% increase in credit/GDP is associated with a 20-basis point increase in the policy rate.

The first row of Chart A.3 shows the case in which the initial optimism turns into pessimism after two years. As in the case with bubbles in Section 4.2.1, reacting to the period of optimism can be seen to have beneficial effects. The monetary policy stance is tighter during the period of optimism and looser when optimism turns to pessimism. This more activist monetary policy approach mitigates the growth in credit during the economic expansion. In so doing, it limits the boom in investment and GDP, but it also cushions their fall once pessimism prevails and a recession ensues. Contrary to the model with bubbles, the more aggressive reaction to credit/GDP is not so strong as to change the sign of the impulse response of inflation.

Chart A.3

Responses to an optimism-driven boom

(x-axis: time in quarters; y-axis: annualized percentage changes from the steady state.)



Source: Karadi and Nakov (2021).
Notes: The first row shows the evolution of selected macroeconomic variables in an economic cycle induced by a wave of initial optimism turning into pessimism after eight quarters. The second row shows the evolution of the same variables taking into account the ELB constraint (at zero). The third row considers the possibility of quantitative easing. i_t = nominal interest rate; Y_t = GDP; π_t = inflation rate.

If the optimism shock continues over a prolonged period of time, the monetary policy stance must remain persistently tighter than it would be under a Taylor rule. With respect to the standard Taylor rule reaction, at some point this would result in a slight policy-induced recession, as well as a deflationary period. Taking this deflationary period into account, the medium term would have to be extended from about 16 quarters under the standard rule to almost 30 quarters under the rule reacting to credit. Not surprisingly, the smaller the inflation response coefficient in the monetary policy rule, the longer the extension of the medium term would have to be.

These results abstract from the ELB constraint. However, an important benefit of the rule reacting to credit growth might be to reduce the probability of reaching the ELB, or its duration, when pessimism is so pervasive as to generate a liquidity trap situation. In this case, while curbing the boom ex ante, a rule reacting to credit growth may also reduce the extent to which monetary policy is constrained ex post.

To analyse this possibility, we impose the ELB constraint on the simulation. However, the same reaction to credit/GDP shown in the previous two figures would now be counterproductive. The rule would imply such an activist response of the policy interest rate that the ELB would be reached too often and no solution would exist. The second row of Chart A.3 therefore displays results based on a smaller reaction to credit/GDP (all else being equal, a 10-basis point increase in the policy rate for every 1% increase in credit/GDP). In this case the rule is not detrimental to the economy but induces macroeconomic dynamics that are not substantively different from the case of a standard Taylor rule. More specifically, the ELB constraints apply for approximately the same number of periods irrespective of the policy rule specification.

These results show that symmetry is an important property of the rule in reacting to credit growth. To produce stabilising effects, the rule must not only implement a tighter policy stance in the boom years, but also ease interest rates more aggressively once the boom turns to bust. This suggests that if the recession is very deep, the ELB constraint will be reached more quickly with a rule reacting to credit, and its beneficial properties may be lost.

Our final exercise asks whether these conclusions are affected by the deployment of quantitative easing (QE) during the pessimism phase. For this purpose, it assumes a simple QE rule such that the central bank starts purchasing government bonds once the policy rate reaches the ELB. The results are reported in the third row of Chart A.3. For comparability with the second row, we consider again the case of a smaller policy reaction to credit growth. The results show that the deployment of QE restores the good stabilisation properties of the rule reacting to credit. This rule, coupled with QE, ensures a slightly better smoothing of output and inflation both in the boom years and during the ELB period, even if the duration of that period remains broadly unchanged.

At the same time the rule taking financial stability concerns into account requires a slightly larger QE intervention and a more prolonged ELB episode during the crisis than does the standard Taylor rule. By assumption, QE is deployed in both cases when credit spreads increase to unwarranted levels. Under the standard Taylor rule, the combination of conventional and unconventional accommodation implies that policy rates fall, but the ELB is never binding. When the interest rate rule also reacts to credit/GDP, however, a larger amount of QE is required and the policy rate reaches the ELB over a longer period.

Once again, the medium term must be extended significantly when monetary policy takes financial stability concerns into account. Inflation returns to target after about 20 quarters on the basis of a standard policy rule, while it remains above target after 40 quarters with the rule reacting to credit.

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