Unconventional monetary policy under review

Past, present and future challenges

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Robert Holzmann[1]

After the global financial crisis and until 2021, the primary objective of central banks in advanced economies was to implement policies aimed at increasing inflation, given that inflation had been too low for too long. Having reached the effective lower bound (ELB) of nominal interest rates, monetary policy had to resort to unconventional monetary policy (UMP) measures, which were not without negative side effects. In response to the rise in inflation in 2021, central banks returned to policy interest rates as their primary monetary policy tool and began to unwind their set of UMP measures. Assuming that inflation has been tamed, will we be able to maintain sufficient distance from the ELB to rely broadly on policy rates? Or will we again be forced to implement UMP with all its side effects and proportionality issues? Part I of the paper outlines the rationale and instruments of UMP: how it was supposed to work and how it actually worked, including its negative side effects. Part II considers alternative monetary policy options in a low inflation environment that prove limited and little convincing. The paper ends by discussing how prolonged use of UMP impacts on central bank profitability and central bank independence, also offering possible remedies.

The global financial crisis (GFC) and the subsequent sovereign debt crisis in the euro area led central banks worldwide to take bold actions to prevent deflation. Initially, major central banks like the Federal Reserve (Fed) in the United States (US), the Bank of England in the United Kingdom and the European Central Bank (ECB) in the euro area focused on lowering interest rates to stimulate their economies. However, as nominal interest rates neared zero and failed to achieve inflation targets, the effectiveness of conventional monetary policy (CMP) declined. To overcome these limitations, central banks had to expand their monetary policy toolkit by introducing unconventional monetary policy (UMP) measures to stimulate the economy, overriding the effective lower bound (ELB) on nominal interest rates.

The recent limitations of interest rate policy and the policy relevance of the ELB are closely linked to the equilibrium interest rate r*, specifically its conjectured and estimated decline across the industrialized world over recent decades. The concept of such a mystical rate dates back to Wicksell (1898). Still, or once again, this rate serves as one guidepost for many but not all monetary policymakers when deciding on the policy interest rate. The conjectured key drivers of r* such as productivity and demography point to a further decline, and the policy space for UMP remains limited. For these reasons, the need for supplementary or alternative policy measures increases, including structural policy options that may contribute to a re-increase in r* (Holzmann et al., 2024).

In the euro area, the UMP measures included negative interest rate policies (NIRP), asset purchase programmes (APP), funding for lending (FFL) and forward guidance (FG). The objective of these UMP instruments was manifold. For one thing, they were intended to support the expansionary monetary policy efforts, i.e., to contribute to price stability, to anchor inflation expectations and stimulate economic growth. For another, they were also designed to overcome disruptions of the transmission mechanism during crises. However, these measures were controversial and untested, which raised concerns about potential negative side effects already at the time of their implementation. There were concerns about how policies such as NIRP or APP may affect the efficient allocation of resources in the economy, or if UMP tools may have negative distributional effects. In addition, there were strong concerns that some of these measures will have a negative impact on bank profitability, and hence on financial stability, in the medium to long term.

The era of low inflation and low interest rates did not end until 2021, when inflation rose after a series of inflationary shocks. In response, the ECB began the process of monetary policy normalization by tapering asset purchases in the beginning of 2022 and raising interest rates in July 2022. At the time of writing, inflation in the euro area is expected to return to levels consistent with the definition of price stability by late 2025. It remains unclear whether the ECB will maintain a comfortable distance from the ELB that suffices to make the use of UMP unnecessary. It is therefore crucial to gain insight from past experiences in a low interest rate environment. This insight can be used to inform possible options for central banks, both in terms of CMP and UMP, should they find themselves in a similar situation again. This paper aims to provide some adjusted or alternative paths for the future by discussing ex post the effectiveness of UMP instruments and highlighting design options for both UMP and CMP that would make them more efficient.

The remainder of the paper is structured as follows. Section 1 provides an overview of UMP tools that have been used at the ELB in the euro area and summarizes both intentional and unintentional consequences of these policy choices. Sections 2 and 3 outline how monetary policy tools can be designed to be more effective and address some aspects that go beyond inflation control but are crucial for central bank independence. Finally, section 4 concludes with recommendations.

1   Rationale for and consequences of unconventional monetary policy measures

In the aftermath of the GFC and the euro area sovereign debt crisis, conventional monetary policy tools appeared ineffective in raising inflation rates in the euro area. Despite a low interest rate environment, inflation remained stubbornly low, increasing the risk of deflation. The ECB therefore introduced UMP to achieve its price stability objective and to counteract the impairment of the transmission mechanism. This section outlines the development and use of these UMP tools and assesses their intended and unintended consequences.

### 1.1 Unconventional monetary policy measures in the euro area

Before 2009, the ECB conducted monetary policy primarily by adjusting three key interest rates: the deposit facility rate, the main refinancing operations rate and the marginal lending facility rate.

These rates affect money market interest rates and thus indirectly the lending and deposit rates that banks offer their customers, both firms and households. As these rates approached zero but were still too restrictive to stimulate the economy effectively, central banks developed new policy tools to achieve their goals, in particular NIRP, FFL, APP and FG.

Negative interest rate policy

NIRP is the term used to describe when policy rates are set below zero. While real interest rates – the nominal interest rate minus the rate of inflation – are often negative, zero was considered to be the lower bound for nominal interest rates for a long time. It was expected that negative nominal interest rates would mean that savers would no longer have an incentive to save since they would no longer be financially compensated for lending or holding bank deposits and that they would also rather hold cash. Despite this fear, some central banks cut interest rates to levels slightly below zero without triggering these expected effects. In the euro area, the deposit facility rate was negative from 2014 to 2022. While NIRP lowers borrowing costs and encourages bank lending, it also imposes costs on savings and it risks misallocating resources. The risks of NIRP made many central banks cautious about its implementation. Chart 1 shows how policy rates evolved in the euro area and a selected group of countries. Some major central banks, such as the Fed, never chose to take the federal funds rate into negative territory. Most central banks that had adopted NIRP exited the policy before 2022, apart from Japan, which did not raise rates until 2024.

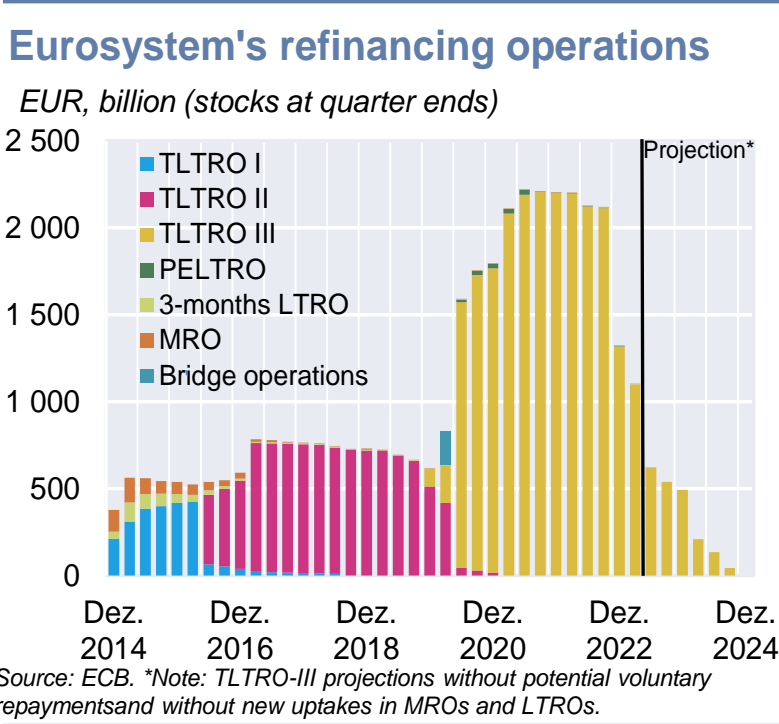**Chart 1: Monetary policy interest rates in selected economies**

Monetary policy interest rates
in %

Source: Macrobond.

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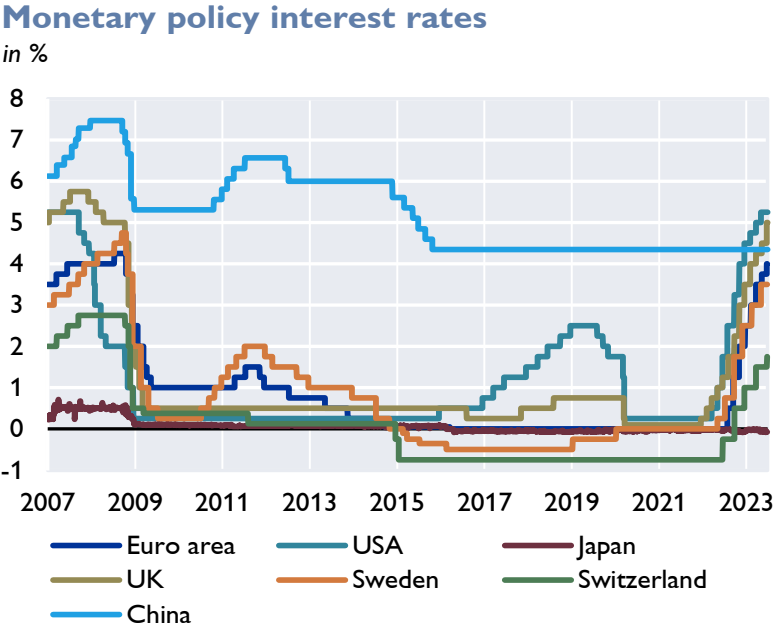
Funding for lending

FFL programs, such as the Eurosystem's targeted longer-term refinancing operations (TLTROs), provided long-term funding to banks on favorable terms, including negative interest rates, to encourage lending to households for consumption and nonfinancial corporations. The goal of FFL was to ensure that the increased liquidity reached the real economy, which was not possible to accomplish through the asset purchase programs. This policy significantly expanded central banks' balance sheets, with the Eurosystem's TLTROs having injected over EUR 2.2 trillion by 2021. Chart 2 illustrates the size of different FFL programs of the Eurosystem.

Chart 2: Eurosystem's refinancing operations

Eurosystem's refinancing operations

EUR, billion (stocks at quarter ends)

Legend:
- TLTRO I
- TLTRO II
- TLTRO III
- PELTRO
- 3-months LTRO
- MRO
- Bridge operations

Projection*

X-axis: Dez. 2014, Dez. 2016, Dez. 2018, Dez. 2020, Dez. 2022, Dez. 2024

Y-axis: 0, 500, 1 000, 1 500, 2 000, 2 500

*Source: ECB. *Note: TLTRO-III projections without potential voluntary repaymentsand without new uptakes in MROs and LTROs.*
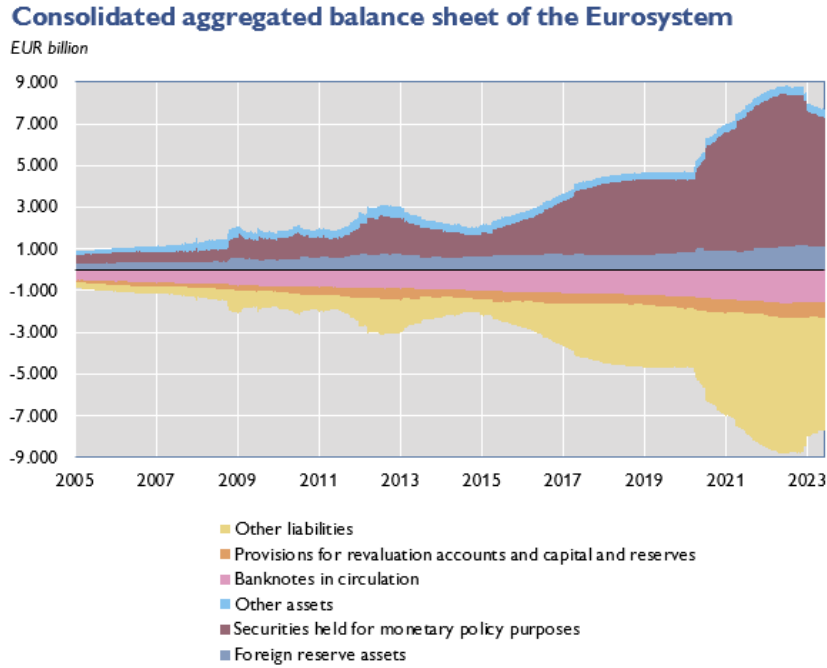
Asset purchase programmes (APP) – quantitative easing

APP, or quantitative easing (QE), involve large-scale purchases of securities, which raises the price of securities and lowers long-term yields and financing costs in the economy. As a result of central banks buying these securities, the balance sheets of both central and commercial banks expand. The APP launched by the ECB included various programs and were supplemented by the pandemic emergency purchase programme (PEPP). APP are not only supposed to stimulate the economy but also to support monetary transmission during crises. While the date of introduction and the focus of such programs varied over jurisdictions and time, securities purchased by central banks usually consist of government and corporate bonds. One of the concerns at the time was that given the scale of these programs, they could fuel asset bubbles and exacerbate market distortions. Another concern was that, to be more effective, these programs favored purchases of securities with long maturities. That meant that the programs would have a significant and lasting

impact on central banks' balance sheets. This point is discussed in more detail in section 3, and is illustrated for the case of the Eurosystem in Chart 3, which shows that securities held for monetary policy purposes increased significantly over time.

Chart 3: Consolidated aggregated balance sheet of the Eurosystem

Consolidated aggregated balance sheet of the Eurosystem

EUR billion

Other liabilities
Provisions for revaluation accounts and capital and reserves
Banknotes in circulation
Other assets
Securities held for monetary policy purposes
Foreign reserve assets

Source: ECB SDW.

Forward guidance

In times of elevated economic uncertainty, the goal of forward guidance was to provide the public with information about a central bank's future monetary policy intentions, based on how the central bank assesses the outlook for the economy, to anchor inflation expectations. With forward guidance, central banks commit to a condition under which they will deviate from their announced reaction function. This condition can be (a) a date (data contingent), (b) an outcome (state dependent) or (c) open-ended. When constrained by the ELB, forward guidance announcements have the objective of increasing inflation expectations, which then reduce real rates, to stimulate the economy. This signaling effect helps reduce uncertainty about the economic and financial outlook, and the promise of lower-for-longer rates depresses long-term rates and ex ante reduces real interest rates. Nonetheless, the policy may not be effective due to poor communication or credibility deficits.

1.2 Effects of unconventional monetary policy

Right from the beginning, the use of UMP measures was controversial because of the risks involved. Even when their theoretical effect was clear ex ante, most UMP measures were uncharted territory and carried the risk of unintended side effects. This fact has inspired a large

body of economic literature venturing to assess both the intended and unintended effects of UMP. Table 1 offers an (non-exhaustive) overview of both types of effects.

Table 1: Intended and unintended effects of UMP

UMP tools	Intended effects	Possible unintended side effects
Negative interest rate policies (NIRP)	• Reduce bank holdings • Incentivize (bank) lending to businesses and households • Have positive wealth effects on bonds and shares	• Impair monetary policy transmission mechanism • Sustained low rates affect bank profitability • Contribute to the creation of zombie firms
Asset purchasing programmes (APP): quantitative easing (QE)	• Overcome (effective) zero lower bound constraints • Lower interest rates across the yield curve, e.g. cheaper sovereign lending • Signaling effects to reduce uncertainty • Facilitate homogeneous monetary transmission mechanism across the euro area, e.g. PEPP	• Increased asset prices despite weak economic growth → emergence of asset bubbles → threats to financial stability • Price distortions in asset markets, such as bond or housing markets • Political/social tensions if asset purchases disproportionally benefit parts of society • Fall in aggregated productivity due to capital misallocation → emergence of zombie firms • Higher inflation due to increased M3
Funds for lending (FFL)	• Provide additional liquidity to banks at attractive conditions, often subsidized • Preserve favorable borrowing conditions and stimulate lending to the real economy, i.e. households and businesses	• Reduced incentive for financial institutions to hold adequate liquidity buffers (can be corrected) • Major (unintended) subsidy to the banking sector, including carry-trade • Limited volume effects of lending
Forward guidance (FG)	• Promise of lower-for-longer rates depresses long-term rates and ex ante reduces real rates • Signaling effects to reduce uncertainty about economic and financial outlook • Active communication of strategy; e.g. state-contingent, time-contingent or open-ended FG in support of QE	• Outlook of sustained UMP amid adverse effects may impact market expectations negatively • Imperfect communication has significant impact on the propagation of forward guidance • Failed communication may spur macroeconomic volatility

Source: Author's compilation

Spisso et al. (2024) systematically evaluated the results of many papers investigating APP, FG, NIRP and FFL. Their survey focuses on economic outcomes and suggests that most papers find the expected theoretical effects and that, overall, all UMP instruments studied seem to have

broadly achieved their primary objectives of supporting economic activity and raising inflation. However, these conclusions are far from unanimous. Several papers also disagree with these findings, while other papers find no effect of the policies at all, casting doubt on the true efficacy of these measures.

Even if UMP overall seems to have succeeded at stimulating the economy, it is crucial to recognize that this perceived success came at considerable costs. Employing these monetary policy tools may have numerous and potentially severe negative consequences. Alarmingly, the survey by Spisso et al. (2024) indicates that there is a notable lack of comprehensive research on the unintended side effects of UMP, such as distributional effects or resource allocation. Consequently, the full extent of these negative impacts may be underestimated.

The limited literature available on these side effects paints a troubling picture. NIRP, for instance, was found to be potentially detrimental to financial stability. The banking sector's health and stability could have been affected in a lasting way by the adverse impact that negative interest rates had on banks' net interest margins and by banks' increased risk-taking as they sought to find new sources of income. Moreover, evidence from the literature also suggests that QE and FFL may have contributed to significant resource misallocation in the economies studied (Spisso et al., 2024). Some studies suggest a non-zero probability of zombification in the economy due to QE, while FFL programs appear to have increased zombie lending, especially in euro area countries under stress. These results are particularly concerning in light of the already troubling slowdown in productivity growth. Such developments not only potentially hinder both economic recovery and competitiveness in the long term, but also contribute to the negative feedback loop of declining productivity growth, declining r* and the necessity of ever more UMP.

Another area of concern are the distributional effects of UMP. While the literature does not agree on a uniformly positive or a negative distributional effect, strong evidence links monetary policy to the value of one of the most important assets of a household, namely housing. First, expansionary monetary policy can lead to increased house prices, both in absolute terms and relative to income and rent (see, for example, Lenza et al., 2024; Weale and Wieladek, 2022). Despite perhaps increased lending for home purchases, this trend makes homeownership less affordable and widens the wealth gap between property owners and renters. This can exacerbate existing economic inequalities. Second, these effects on house prices also have adverse implications for financial stability. Overvalued real estate and relaxing real estate lending standards because of UMP could set the stage for future financial crises (Berg et al., 2022).

In conclusion, while UMP measures may have provided short-term economic stimulus, the long-term costs and risks associated with these policies are substantial and potentially underestimated. The wisdom of relying heavily on such measures is being challenged by the lack of comprehensive research on their unintended consequences, coupled with the evidence of risks to financial stability, resource misallocation and widening economic inequalities.

1.3 Unconventional monetary policy, the quantity of money and inflation

This section now delves into a specific aspect of UMP, namely its impact on the quantity of money and inflation.

According to the quantity theory of money, inflation rises when money supply growth outpaces economic growth (see Friedman, 1963, for a seminal contribution on the topic). However, the strength of this link between money growth and inflation has faded as major central banks have shifted from money to interest rate targeting and as economies have become more complex (Stock and Watson, 2006). Still, the recent episode of ultralow interest rates and the emergence of unconventional instruments provide a new laboratory for studying this relationship.

The newly created unconventional instruments have caused central banks' balance sheets to expand substantially, which increased money aggregates. Such increases were observed in a variety of monetary aggregates. Puzzlingly, during the recent period of low inflation, inflation remained subdued despite the elevated money growth, and thus the relationship between the two was virtually nonexistent.

Using money growth as a direct predictor of future inflation stopped making sense given the complexity of this relationship and the unique economic circumstances since the GFC. Starting from the 2000s, it has largely disappeared from economic analysis. In the aftermath of the COVID-19 pandemic and the subsequent economic shocks, however, inflation gained momentum along with elevated money growth. This could indicate that money growth has strong lagged effects on inflation or that it induces changing inflation dynamics. Recent research by Borio et al. (2023 and 2024) explores possible nonlinearities in the relationship between money growth and inflation. The authors find that the relationship between money growth and inflation seems to depend on the regime. In their papers, they estimate the relationship between inflation and excess money growth in a large sample of countries for the years 1960–2022. They find a one-to-one relationship for a high-inflation regime, but the relationship is less clear when inflation is low. The left panel of Chart 4 shows the overall long-run coefficient between excess money growth, while the right panel illustrates the difference between the two inflation regimes. While remaining silent on causality, one can conclude that this relationship should not be dismissed for the conduct of monetary policy. What these study suggests is that, in high-inflation regimes, it is indeed helpful to include money growth in inflation forecasts, as this improves them significantly. It is important to emphasize, however, that raw money growth itself is generally and not surprisingly a poor basis for further analysis, as it must be adjusted for trends in output growth and changes in the velocity of money (Orphanides and Porter, 2001; Ringwald and Zörner 2023). Amisano and Fagan (2013) find that adjusted money growth can serve as a useful warning indicator of an imminent change of the inflation regime.

Finally, although little attention has been paid to the role of money growth in the UMP period, some channels might be specifically important for the transmission of inflationary effects through

money growth to the economy. In particular, the portfolio rebalancing channel, which has been found to be very important for the transmission of UMP (Lane, 2024), may act as an amplifier through monetary aggregates.
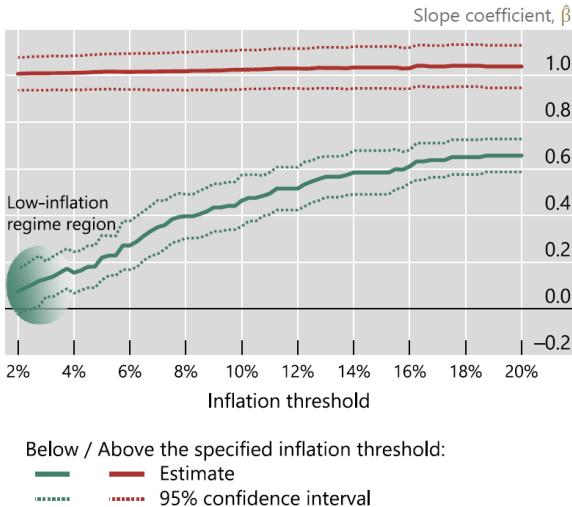
Chart 4: Money growth and inflation

Inflation and money growth go hand in hand[1]   Graph 15

A. Long-run relationship[2]
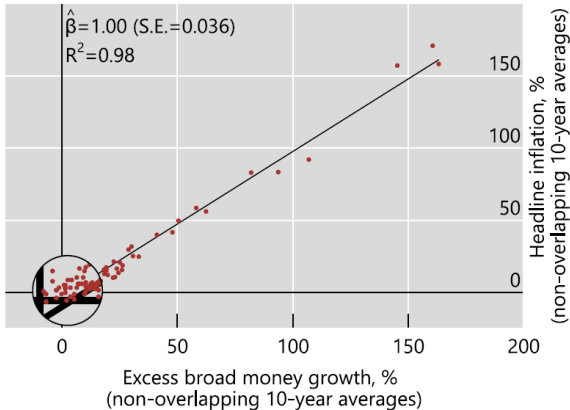
B. Long-run relationship conditional on the inflation regime[3]

[1] Country-specific non-overlapping 10-year averages from 1951 to 2021 (subject to data availability). The sample covers: AR, AU, BR, CA, CH, CL, CN, CO, DK, EA, GB, HU, ID, IL, IN, JP, KR, MX, MY, NO, NZ, PE, PH, RU, SA, SE, SG, TH, TR, TW, US and ZA. Broad money is defined following the national broad money definitions (M2 or M3) and money plus quasi-money for PE, backdated with money and quasi-money data to get long series. Excess broad money growth is defined as the difference between the growth in broad money and the growth in real GDP.   [2] The circled area shows a zoomed-in section where excess money growth and inflation are below 5%.   [3] Slope coefficients from the regression of non-overlapping 10-year average inflation on non-overlapping 10-year average excess money growth, where the coefficient on excess money growth (as well as the intercept) is allowed to switch across the specified inflation threshold; the shaded area highlights the range of (10-year average) inflation rates that are generally acknowledged as constituting a "low-inflation regime".

Source: Borio et al (2023).

2   Options for monetary policy in a low real interest rate environment

Recent decades have shown that prolonged periods of below-target inflation pose complex challenges for monetary policy. Despite new UMP tools, which tend to come at a high cost in the form of unintended effects, the ECB struggled for a long time to have inflation return to the 2% target. Could central banks have acted differently, and what lessons can be drawn for future monetary policy? This section reviews past economic challenges and successful responses and proposes three policy options for monetary policy at the ELB.

2.1 Looking back: What can we learn from the past about effective monetary policy?

The ECB's APP as a response to the GFC was controversial, with some economists arguing that the central bank acted too late and implemented the program on too small a scale. They believe that the delayed response, combined with the limited scope of securities purchased, reduced the

overall effectiveness of the program. According to these critics, an earlier and more aggressive approach could have supported economic recovery more effectively and helped the ECB meet its inflation target more consistently. Learning from past mistakes, the ECB's policy response to the COVID-19 pandemic was more decisive and forceful. In fact, an examination of other historical episodes such as the Great Depression and the Volcker shock can provide insights into how monetary policy could have been more effective.

During the Great Depression, US president Franklin D. Roosevelt's bold policies, including abandoning the gold standard and implementing expansionary fiscal measures, shifted inflation expectations, and spurred economic recovery. As inflation expectations shifted, real interest rates fell, which, combined with expectations of higher future incomes, led to more spending without much change in actual monetary policy. Similarly, the Volcker shock, a powerful tightening of US monetary policy in the early 1980s, ended the inflation surge by dramatically shifting long-term inflation expectations through bold policy changes.

In the euro area, while aiming to shift inflation expectations to counter ELB constraints, UMP did not achieve a sustained increase in expectations. This may be due to the ECB's cautious approach compared to the decisive actions seen in the historical examples. Their success hinged on credible, bold regime changes, which suggests that more forceful, coordinated policy action might have been the way forward also in the euro area.

2.2 Options for conventional monetary policy at the ELB

The economic literature has come up with three – imperfect – options that could enhance the effectiveness of monetary policy at the ELB, while reducing the need for, or reliance on, UMP measures: (1) make-up strategies, (2) asymmetric central bank reaction functions and (3) raising the inflation target. They will be discussed in turn.

Make-up strategies

Make-up strategies aim to compensate for past inflation shortfalls by tolerating temporary overshooting and vice versa. Variants include average (over some time window) inflation targeting (AI-T) and price level targeting (PL-T). AI-T gives lower weights to deviations at the beginning of the period, while PL-T compensates for them fully and equally no matter how long in the past they occurred. The effectiveness of these strategies depends on central bank credibility and on economic agents having perfect information and behaving rationally, which are strong assumptions that do not hold in reality. Since these strategies have, to date, been implemented rarely – e.g. the Fed adopted an AI-T after its strategy review in August 2020 – empirical evidence is limited. The Fed's recent experience shows mixed results in terms of public understanding and impact. Therefore, make-up strategies cannot be considered a viable option at the ELB.

### Asymmetric reaction functions

Asymmetric reaction functions imply that the central bank reacts more aggressively to undershooting than to overshooting the inflation target, thereby countering the deflationary bias

at the ELB. Because of the non-zero probability of hitting the ELB, theory predicts that rational agents anticipate that the central bank will not be able to forcefully combat deflationary spirals. For this reason alone, agents revise their inflation expectations downward, creating a deflationary bias that can become partially self-fulfilling by creating a binding ELB constraint. The success of asymmetric reaction functions therefore also depends on central bank credibility and rational expectations. The ECB adopted an asymmetric reaction function approach in 2021, but public awareness and understanding of this strategy appear to have been limited. Moreover, letting inflation overshoot can jeopardize central bank credibility and therefore reduces the effectiveness of monetary policy.

Raising inflation targets

An increase in the inflation target can help avoid the ELB constraint in an economic environment of structurally low real interest rates. A higher inflation target would compensate for lower nominal interest rates caused by a low real neutral rate of interest, r*. Studies suggest that a reduction in the neutral rate would justify a higher inflation target (see, for example, Andrade et al., 2019; Billi et al., 2024), but this approach risks long-term losses in the value of money and potential nonlinearities. An increase from 2% to 3% or 4% would have significantly increased cumulative inflation over the past decades (as illustrated in Chart 5), potentially damaging central bank credibility in a lasting way (Gnan and Holzmann, 2023).

Chart 5: Cumulative inflation forecast

Source: Macrobond, Eurostat.   Note: EA and USA 2023-2025 forecast Dec 2022.
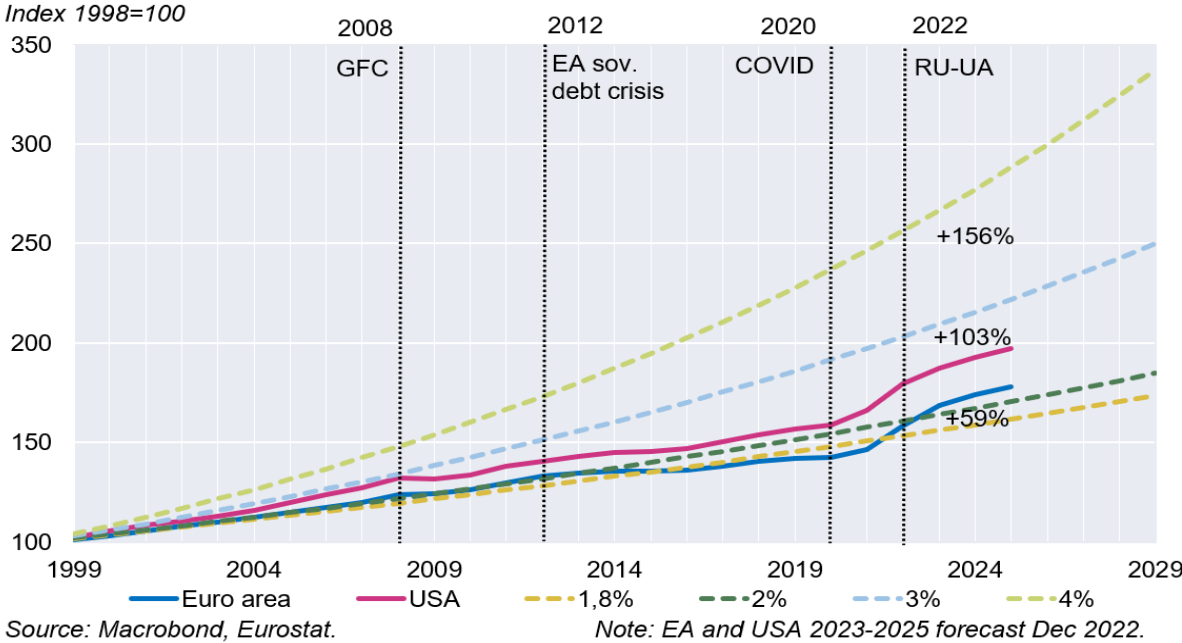
3   Reworking the setup of unconventional monetary policy

While the options discussed in section 2 could offer solutions for making conventional monetary policy at the ELB more effective, they are not without challenges and limitations. The success of

make-up strategies, asymmetric reaction functions and raising inflation targets heavily depends on central bank credibility and economic agents' rational expectations. In other words, it depends on conditions that run the risk of not being met in practice. Given these uncertainties, central banks have resorted to UMP measures to address persistent low inflation. However, as discussed above, UMP measures come with their own set of complications. In this section, we address an additional challenge arising from the use of UMP that is related to central banks' finances and independence. Understanding these implications is crucial for developing a more sustainable approach to monetary policy in a low interest rate environment.

3.1 Unconventional monetary policy and central banks' balance sheets

To start the discussion, it is useful to analyze the historical relationship between UMP, central banks' balance sheets and their finances. We use the euro area as an example. Starting with the GFC (2007–09), the ECB ushered in an era of unprecedented monetary accommodation, which lasted until 2022. During this period, monetary policymakers were up against a binding ELB, which they countered by introducing UMP (see section 0). This prolonged period of UMP implied an immense injection of central bank reserves into the financial system and a shift from a corridor system with scarce reserves to a floor system with abundant reserves (see box 1). Thus, when the ECB raised its key policy rates after the inflation surge of 2021, legacy assets from the UMP period remained on the balance sheets of Eurosystem central banks. The resulting maturity mismatch between the asset and the liability side became a financial burden for central banks: the rising interest rates they had to pay to commercial banks on their deposits with the central bank compounded the challenges in an environment of abundant reserves.

Box 1

The ECB's operational framework

When the Governing Council of the ECB raises or lowers the key interest rates in the euro area, it changes not just one, but three key interest rates: As a rule, it sets the interest rate for the main refinancing operations at a new level, together with the interest rate for the marginal lending facility and the interest rate for the deposit facility. The latter two form an interest rate corridor around the mid-point, i.e. the rate for the main refinancing operations. The Eurosystem uses the key interest rate corridor to control short-term money market interest rates in the euro area. If one bank borrows reserves from another, it is not prepared to pay an interest rate higher than that for the marginal lending facility, as it can borrow the reserves directly from the Eurosystem at this rate. Conversely, a bank will never accept an interest rate below the deposit facility for the transfer of reserves, because at this rate it can deposit its excess reserves directly with the Eurosystem. In other words, the key interest rate corridor sets the framework within which the very short-term interest rates for interbank loans move on the interbank market.

Where exactly this interbank interest rate lies within the corridor depends on the relationship between the supply of and demand for central bank reserves. If the Eurosystem provides a large amount of reserves that exceeds demand, the interest rate to be controlled will be at the lower end of the corridor. If, on the other hand, only few reserves are in circulation, meaning that supply is less than demand, the interest rate on the interbank market will rise and move toward the upper end of the key interest rate corridor, i.e. the marginal lending facility rate. Only if the Eurosystem succeeds at supplying as many reserves as the banks demand, will the money market interest rate lie exactly in the middle of the corridor.

The Eurosystem responded to the numerous crises since 2008 with a series of monetary policy measures, creating large amounts of central bank reserves. As a result, the reserves currently circulating significantly exceed banks' needs. Since the 2010s, very short-term money market interest rates have been at the lower end of the key interest rate corridor, i.e. the deposit facility rate. As a result, the short-term money market interest rates have moved from within the corridor – a corridor system – to the floor of the corridor – a floor system. Chart 6 illustrates this transition.

Chart 6: The ECB's interest rate corridor 1999–2024

**Key ECB interest rates and money market rates**
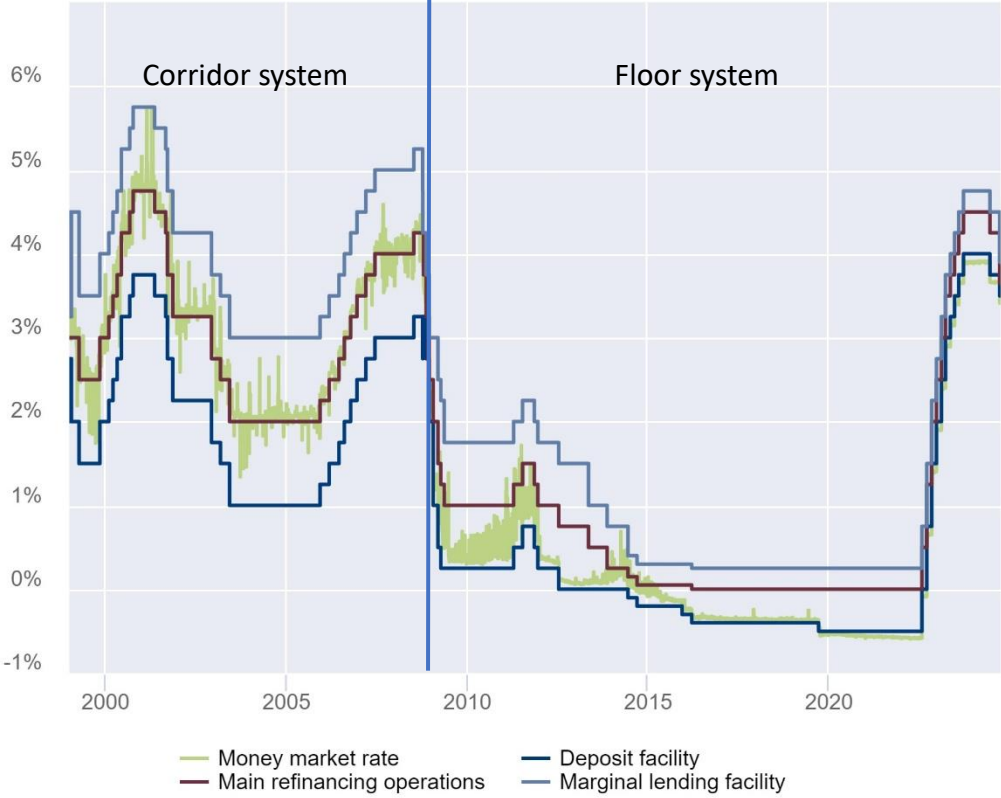
Source: ECB SDW (public).

Two instruments were responsible for the expansion of central bank balance sheets in the euro area: APP (or QE) and FFL programs, including longer-term refinancing operations (LTROs and TLTROs). In contrast to conventional monetary policy, which primarily focuses on short-term operations, APP and LTROs extend the maturity profile of the central bank's balance sheet. While these policies affect the asset side, the use of APP, LTROs and TLTROs also affects the liability side of a central bank's balance sheet. The instruments create additional commercial bank reserves that are of short maturity and are remunerated with the deposit facility rate; this expansion of the balance sheet is shown schematically in Figure . The resulting maturity mismatch increases central banks' exposure to interest rate risk, i.e. potential losses from adverse changes in interest rates.

While both APP and FFL programs expand a central bank's balance sheet and lengthen its maturity profile, there are also notable differences between the impact of APP and of credit operations on a central bank's balance sheets. First, in the case of APP, the Eurosystem itself decides on the size of its balance sheet, whereas credit operations are more driven by commercial banks' demand. If a central bank wishes to retain more control over the size of its balance sheet through demand-driven credit operations, it must rely on offering more – or less – favorable terms. Second, while APP generate a fixed income stream for the central bank, policymakers can choose between fixed rate and indexed tenders for credit operations. The former are more accommodative, as there is less uncertainty for banks, but the latter reduce the central bank's interest rate risk. Third, while a central bank can choose the maturity for both APP and credit operations, APP maturities tend to be longer, to increase their effectiveness, while the counterparts on the liability side are short term in nature. For example, the maximum maturity of TLTROs in the euro area was four years. In contrast, the weighted average maturity of the Eurosystem's securities holdings under the public sector purchase programme is about twice as long. Finally, while both tools increase the central bank's credit risk, credit operations entail less credit risk than asset purchases. Credit

Figure 1: UMP and central bank balance sheet expansion
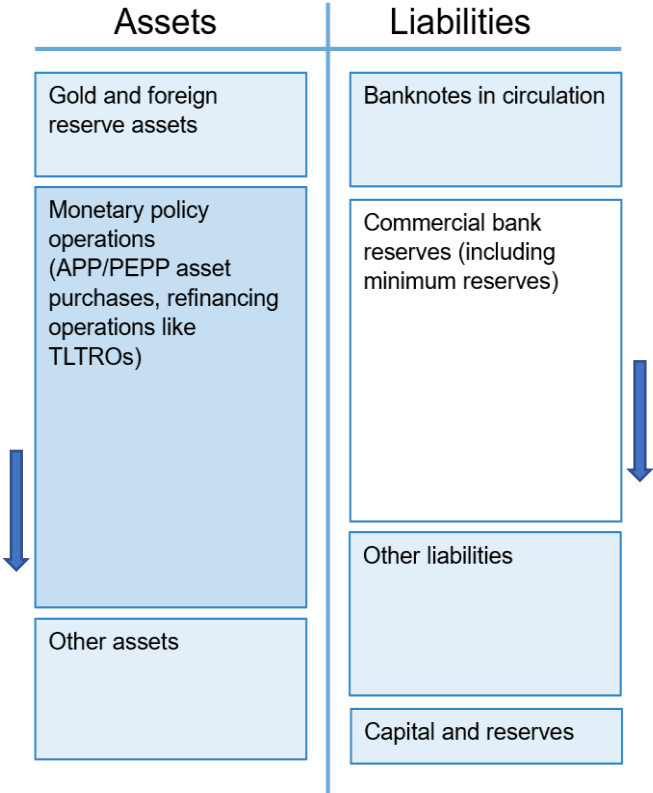

Source: OeNB

operations are collateralized, but it is also fair to say that the default risk of sovereign bonds is quite low.

Policy rates may begin to normalize, when a UMP intervention, such as APP and TLTROs, is successful and inflation rates return to target or interest rates are raised quickly to counter a surge in inflation. Apart from the indexed LTROs mentioned above, the resulting mismatch in the sensitivity of assets and liabilities to changes in short-term interest rates had a negative impact on central banks' profitability and will lead to a prolonged period of losses.

3.2 Central banks' finances and the conduct of monetary policy

In fulfilling their primary mandate, central banks experience profits and losses as side effects of monetary policy. Until 2020/21, the ECB's monetary policy was profitable for central banks, but since then this has changed due to the maturity mismatch between assets and liabilities. As sketched above, the excess liquidity created by UMP is deposited in the deposit facility and is remunerated with the deposit facility rate, the main policy rate, which increased sharply starting in mid-2022. In contrast, returns on the asset side remained low, as assets were mainly comprised of long-term bonds purchased during the low interest rate period. Chart shows the ECB's profit and loss account from 2019 to 2023. The decomposition into different components shows that the decline in net interest income following the increase in policy rates is the main contributor to the overall decline in profits, especially in 2023. As the legacy assets are held to maturity and there is no intention of pursuing an active reduction of the balance sheet, it will take many years for

Chart 7: Components of the ECB's profit and loss account (in EUR million)
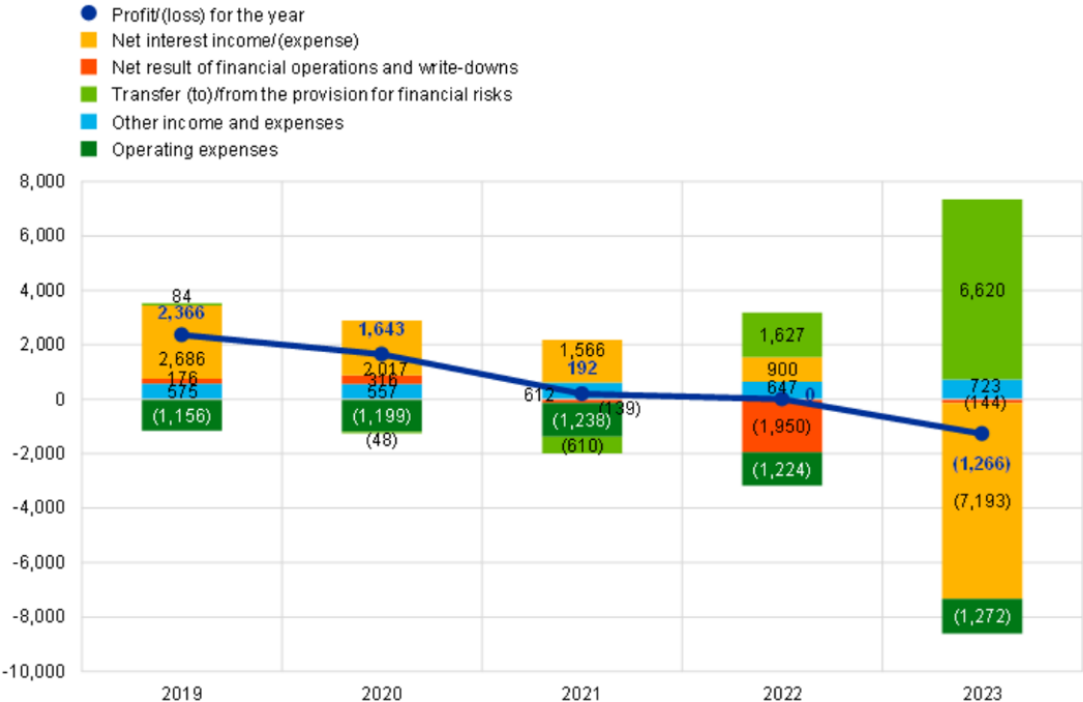
Source: ECB Annual Accounts 2023

several Eurosystem central banks to become profitable again (Belhocine et al., 2023). See box 2 for an illustrative example of such a development.

In principle, and in contrast to commercial banks and firms, negative capital should not be a problem for a central bank (Wessels and Broeders, 2022). Central bank losses can, however, become problematic if they interfere with the conduct of monetary policy (Stella, 1997). While a central bank's financial strength may further bolster its credibility when it has been weakened, it adds little to a central bank's ability to conduct monetary policy successfully when its credibility is unquestioned (Archer and Moser-Boehm, 2013). Nevertheless, even when a central bank's credibility is unquestioned, the need for recapitalization by the owner, i.e. the government and its representatives, will arise if negative capital is sustained over a longer horizon and/or a central bank is prohibited from building the necessary reserves. This can, in turn, put a central bank's future independence and credibility at risk.

Exemplary loss/profit projection[2] for a Eurosystem central bank

The purpose of this box is to illustrate the severe and prolonged impact that the maturity mismatch between central banks' assets and liabilities can have on their profitability. Central banks in the euro area face different degrees of mismatch between interest income on their asset side and interest expenditures on their liability side. Both capital endowments and reserve buffers vary across the Eurosystem. Still, a number of central banks will not only face a prolonged period of losses (see, e.g., Knot (2022) for the case of De Nederlandsche Bank, or NBB (2023) for the case of the National Bank of Belgium) but will also run the risk of having negative capital as a result. This concern is illustrated by a simple calculation based on a small Eurosystem central bank such as the Oesterreichische Nationalbank. In other words, the illustrative example is based on the same share in the Eurosystem's capital as the OeNB's.

Given the current characteristics of many central bank balance sheets, the low-yielding assets will take years to mature. In order to make a simple projection of the future profits and losses, it is necessary to make several simplifying assumptions: Assuming that (1) the future path of monetary policy interest rates is in line with market expectations (according to the survey of monetary analysts as of September 2024), that (2) the assets in the monetary policy portfolio mature (on average) at the same pace as until now, that (3) the remuneration of minimum reserve requirements remains zero, that (4) the Eurosystem will work with a small amount of excess reserves in the future and that (5) the interest on and from other assets and liabilities, respectively, balance each other out, such a representative central bank is projected to incur losses until about 2030. From the time at which the central bank becomes profitable again, it will take about ten years to recover the accumulated losses and to restore a positive capital value, and then a few years more to establish reserves that reach their original level. Chart shows the projected path of future profits and losses of such an illustrative central bank, as well as the loss that is accumulated and carried forward.

Yet, this assumes that the central bank is free to use its profits for this purpose. The treatment of these profits is subject to the respective national central bank legislation, which determines how much can be used to replenish reserves (and conversely, how much must be transferred to the state). Many central banks' laws are silent on how to handle losses, making central banks vulnerable to losing their capital and leaving them in

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[2] Note that this projection is meant for illustrative purposes, it is subject to a considerable level of abstracting assumptions and substantial uncertainty. A change in the future interest rate path, the pace of quantitative tightening, the growth of banknotes in circulation or the assets banks hold (determining the necessary amount of excess liquidity in the system) among other assumptions would imply future paths of profits that differ considerably from this projection.

unchartered territory. Therefore, it may also take much longer to reach the financial status quo before 2023. Crucially, these figures should only be considered a conservative best-case scenario. Should the euro area economy face economic conditions similar to those that had led to the ELB in the 2010s, it may be necessary to conduct another APP. While this might be profitable in the short term, it would initiate another cycle of low central bank profitability in the future.

Chart 8: Projected path of future profits/losses and resulting cumulative loss

Source: OeNB

In the event of prolonged low profitability, a central bank can employ several other strategies to address the situation.

In the short term, central banks can adjust the way in which minimum reserve requirements (MRR) are set. Until the end of 2022, minimum reserve requirements have been remunerated at the main refinancing operations rate. From December 2022 to the summer of 2023, the remuneration of the minimum reserve holdings was reduced to the deposit facility rate, which aligned the remuneration of minimum reserve holdings more closely with short-term money market rates. Finally, in July 2023, the Governing Council of the ECB decided to set the remuneration of minimum reserves at 0%. These steps were key to improving the efficiency of monetary policy in the current economic context. They reduced the total amount of interest that central banks must pay on reserves to implement the appropriate monetary policy stance, thereby easing the burden on central bank finances, without sacrificing the effectiveness of monetary policy.

One can go a step further and increase the unremunerated MRR, which would reduce the central bank's interest expense on excess reserves, i.e. reserves held in excess of the MMR. While the MMR is now unremunerated, central banks still remunerate excess reserves at the deposit facility

rate. Increasing the MRR would decrease excess reserves, therefore reducing the amount of interest paid to commercial banks by central banks. De Grauwe (2023) proposes an approach that could be relatively modest at the outset, with the potential for further increases in the future. As a result, an MRR of 10% to 15% on certain commercial bank liabilities would reduce the Eurosystem's interest expense by EUR 60 billion to EUR 90 billion per year. Consequently, the period during which euro area central banks incur losses in their fight against inflation could be shortened by transferring less profit to commercial banks.

In the longer term, the design of UMP instruments could be adjusted to make them more financially sustainable for the central bank. Central banks could focus on buying assets with shorter maturities, which would reduce the interest rate risk associated with such operations and reduce the maturity mismatch in the balance sheet. Alternatively, if central banks were to react more quickly and more decisively in future times of crises, this would shorten the period over which low-yielding assets are purchased, and thus reduce the maturity mismatch. In addition, excess reserves could be reduced more quickly through an active quantitative tightening (QT). Obviously, active QT leads to a faster reduction of excess reserves than passive QT. Yet, selling low-yielding assets in a high interest rate environment could result in financial losses for the central bank as well. Financial stability concerns, in particular the risk of market fragmentation in the euro area, may also require further consideration. Fragmentation risks could arise if markets are unwilling to absorb sovereign bonds sold by the Eurosystem (ECB, 2023). Additionally, the implementation of either strategy must be consistent with the Eurosystem's overall policy stance.

Apart from designing monetary policy instruments, central banks have other options for shaping the actual implementation of their policies that can help safeguard independence. One option concerns central banks' operational framework. Between 1999 and 2008, the Eurosystem used a classical corridor system to manage short-term money market rates. A feature of this broad corridor was the comparably high volatility of money market rates, as can be seen in Chart 6. Nevertheless, the steering of short-term interest rates was effective, as changes in key policy rates at that time were swiftly and completely transmitted to the EONIA, the unsecured overnight money market rate.

The main advantage of a corridor system is that it is consistent with a smaller central bank's balance sheet, which prevents large mismatches between the asset and the liability side in the future. It furthermore encourages an active interbank market since the external options (i.e. the deposit facility rate and the marginal lending facility rate) are relatively expensive compared to the prevailing money market rate. So, it becomes attractive for banks to find trading partners within the money market.

Furthermore, central banks can also pursue a high seigniorage base, i.e. a high level of banknotes and digital currency in circulation, which provides seigniorage income. Last but not least, the creation of interest rate risk provisions can help central banks address potential losses from

mismatches between the sensitivity of their assets and liabilities to changes in short-term interest rates. This is particularly important if central banks are forced to resort to UMP again.

4   Conclusions and policy recommendations

The global financial crisis and the subsequent sovereign debt crisis in the euro area led central banks around the world to engage in unprecedented monetary policy expansions to combat deflationary pressures. Initially, central banks relied on conventional measures such as interest rate cuts, before turning to unconventional monetary policy (UMP) tools to stimulate economies stuck at the effective lower bound (ELB). The effectiveness and unintended consequences of UMP remain topics of ongoing analyses and debates. This paper draws on recent experiences to inform future policy decisions and evaluates the effectiveness and broader implications of UMP tools for multiple economic dimensions. Surprisingly, Eurosystem and ECB research on these policy areas is scarce. Perhaps academic and research institutions are better positioned to engage in such work.

Despite varying degrees of evidence, UMP instruments have generally succeeded in achieving their intended monetary policy goals, but not without tradeoffs and unintended costs. These findings underscore the need for informed policymaking that adapts to the evolving economic landscape. Central banks face significant challenges in achieving their inflation targets while preserving financial stability, which points to the need for ongoing evaluation and potential adjustment of monetary policy strategies in the future.

When we draw parallels with historical episodes such as the Great Depression and the Volcker shock, it is clear that bold policy action, coupled with effective communication, played a key role in successfully shaping inflation expectations and improving economic outcomes after a crisis. Indeed, the ECB's response to the global financial crisis, while substantial, may have lacked the decisiveness and credibility necessary for effective expectation management, possibly due to hesitancy and institutional constraints. Furthermore, history has shown that the effectiveness of monetary policy can be enhanced or hindered by fiscal policy decisions. Better coordination between fiscal and monetary policies, especially during economic crises, may lead to more effective policy interventions while creating problems of its own.

When the effectiveness of monetary policy at the ELB diminishes, alternative strategies such as make-up strategies, asymmetric reaction functions and inflation targeting may come into play. Each strategy poses its own set of challenges and requires policymakers to carefully consider central bank credibility, economic conditions, and the limits of rational expectations.

Moreover, as central banks grapple with the financial implications of UMP and seek to maintain credibility and independence, exploring financially sustainable UMP approaches gains importance. The ECB's use of UMP, particularly QE and TLTROs, has had a significant impact on its balance sheet and financial sustainability. Strategies such as adjusting the design of the MRR or UMP instruments, active QT, changes to the design of the operational framework and maintaining a high seigniorage base could mitigate losses and ensure the financial sustainability of the central

bank. However, central banks face a daunting challenge of balancing these strategies while fulfilling their mandate.

Central banks are required to maintain an adaptable monetary policy framework amid an ever-changing economic environment that includes both prolonged periods of low inflation and interest rates and unexpected inflation surges. This implies that central banks should review their policy frameworks regularly to ensure that they remain effective in the face of new challenges. Moreover, central banks should ensure that they have a diverse set of UMP tools ready for use when conventional monetary policy becomes ineffective. Learning from the lessons of the recent and more distant past may help them improve the effectiveness and efficiency of such tools.

Last but certainly not least, a comprehensive rethinking of monetary policy is needed as economic considerations suggest a further fall in the non-observable but nevertheless policy-relevant equilibrium interest rate that makes hitting the ELB more likely. The level, direction and dynamics of the equilibrium interest rate are closely linked to factors that are not fully within the realm of economic policy but also not totally outside. Cases in point are productivity – and here most importantly total factor productivity – and demography – and here most importantly labor supply growth. Exploring policy options in this area looks promising (Holzmann et al., 2024).

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6 Annex

Abbreviations

Asset purchase programmes	APP
Average inflation target	AI-T
Conventional monetary policy	CMP
Effective lower bound	ELB
Euro overnight index average	EONIA
Euro short-term rate	ESTR
European Central Bank	ECB
Federal Reserve	Fed
Forward guidance	FG
Funding for lending	FFL
Global financial crisis	GFC
International Monetary Fund	IMF
Longer-term refinancing operation	LTRO
Minium reserve requirement	MRR
Negative interest rate policies	NIRP
Pandemic emergency purchase programme	PEPP
Price level target	PL-T
Public sector purchase programme	PSPP
Targeted longer-term refinancing operation	TLTRO
Quantitative easing	QE
Quantitative tightening	QT
Unconventional monetary policy	UMP