Occasional Studies
Volume 20 - 2

The Eurosystem's monetary toolbox in unconventional times

DeNederlandscheBank
EUROSYSTEEM

The Eurosystem's monetary toolbox in unconventional times[1]

Authors
Jan Kakes, Inge Klaver and René Rollingswier

Subscription order for DNB Occasional Studies and requests for specimen copies should be sent to:

De Nederlandsche Bank N.V.
Communications
P.O. Box 98
1000 AB AMSTERDAM

Internet: www.dnb.nl

1 We thank Dirk Broeders, Maurice Bun, Guido Della Valle, Mariëlle Dreuning, Jan Willem van den End, Niels Gilbert, Kasper Goosen, Gavin Goy, Jurian Hoondert, Aerdt Houben, Tom Hudepohl, Julian von Landesberger, Christoph Ohlerich, Daniël Overduijn, David Rijsbergen, Tom Rood, Daniël van Schoot, Marta Skrzypińska, Jan Smit and Thomas Vlassopoulos for their useful comments.

Content

1 Introduction

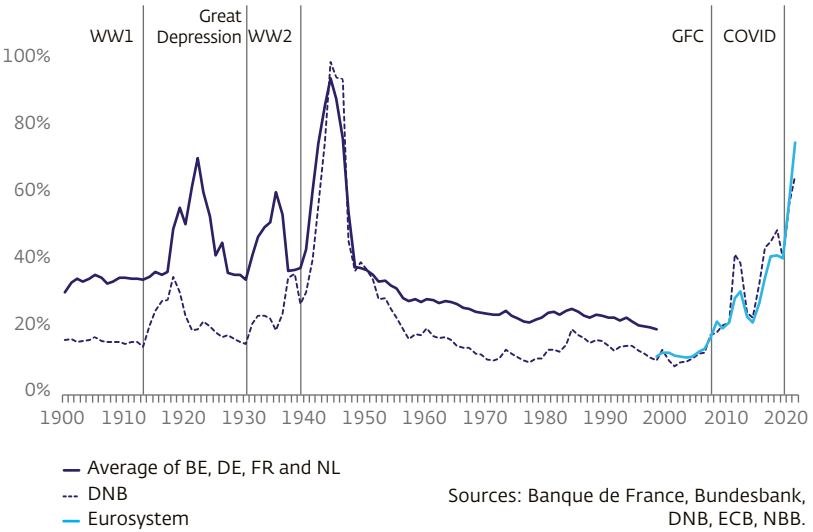
Central banks worldwide have deployed a range of new monetary policy instruments in response to extraordinary crisis circumstances and persistently low inflation. As a response to the crises – the Global Financial Crisis (GFC), the European sovereign debt crisis and the COVID crisis – central banks intervened to keep markets functioning and prevent fragmentation in the euro area. Moreover, while interest rates continued to decline, inflation remained persistently below the two percent target. With conventional policy space constrained by the effective lower bound (ELB) of interest rates, central banks have vastly expanded their toolkits to fulfil their mandates. More than a decade of implementing so-called "unconventional monetary policy" (UMP) tools has increased central banks' footprint in financial markets in an unprecedented fashion as central bank balance sheets expanded to levels that are usually associated with extreme events such as wars and severe economic crises (Figure 1.1).

While unconventional instruments share common characteristics across central banks, their configuration reflects specific jurisdictional circumstances. The most widely used unconventional instruments are enhanced central bank lending operations, asset purchase programmes, negative interest rate policies (NIRP) and forward guidance. The implementation and characteristics of these unconventional tools across central banks have been documented by the BIS in a cross-country analysis.[1] Design and implementation features depend crucially on the mandate and starting point of each central bank, the financial system in which it operates and the specific developments in its jurisdiction. In the euro area, the evolution of UMP has been shaped by its unique institutional set-up, its bank-based financial system and euro-specific developments such as the European debt

1 The report was published by the Committee on the Global Financial System (CGFS), which consists of high-level central bank officials and is located at the Bank of International Settlements (BIS). See CGFS (2019) for the report.

Figure 1.1 Total assets of central banks

Percentage of GDP



Sources: Banque de France, Bundesbank, DNB, ECB, NBB.

crisis. In its 2021 Strategy Review the ECB concluded that, while policy interest rates remain the primary policy tool, UMP will continue to play a role, especially near the ELB.

The monetary toolkit will continue to evolve in light of new challenges, such as the phasing out of support measures and the need to adapt to climate change and structural changes in the financial system. UMP has evolved in response to a series of crises, the ongoing decline of (natural) interest rates and an environment of subdued inflation. The coming years may be equally challenging, although the circumstances have changed. The aftermath of the COVID pandemic and increased inflationary pressures raise new questions about the deployment and phasing out of UMP instruments, with which the ECB has hardly any experience yet. Moreover, the toolbox might need further adjustments to accommodate emerging issues such as climate change, the development of digital currencies and the rise of non-bank finance.

This study gives an overview of how the Eurosystem's monetary policy toolkit has evolved over time and discusses future challenges.[2] As a starting point, it discusses how monetary policy is conducted within the euro area and with what aim (Section 2). Subsequently, it describes the evolution of the monetary instruments deployed by the ECB over the past decade (Section 3). Then it discusses key design considerations and presents an overview of some of the most pressing developments and challenges for the conduct of monetary policy going forward (Section 4). Section 5 concludes.

2 In this study, the term Eurosystem and ECB are used interchangeably. The Eurosystem comprises the ECB and the National Central Banks (NCBs) in the euro area and is responsible for the implementation of monetary operations. Monetary policy decisions are made by the ECB's Governing Council, which consists of the Executive Board of the ECB and the governors of all NCBs.

2 Monetary operations and the central bank's policy framework

Monetary operations are a key part of the central bank's policy framework. These operations are used for the implementation of monetary policy to pursue price stability and comprise a significant part of the central bank's balance sheet (Box 1). We first discuss the role of monetary operations relative to the central bank's policy objectives and the transmission mechanism of monetary policy. Subsequently, we discuss the main monetary operations that constitute the monetary toolbox for central banks in advanced economies, including the Eurosystem.

2.1 Policy stance, operational targets and monetary transmission

Monetary operations are carried out by central banks to implement their desired monetary policy stance. Monetary stance is the degree to which monetary policy is accommodative (supporting the economy) or tight (slowing the economy). For the ECB, the stance should support its primary objective, which is price stability. The ECB considers that price stability is best maintained by aiming for an inflation rate of two percent over the medium term.[3] Without prejudice to this primary objective, the Eurosystem should also support the general economic policies of the European Union, which is sometimes referred to as the "secondary objective".

Monetary policymakers define a desired policy stance in terms of an operational target, based on economic, monetary and financial analysis. The operational target is a variable that the central bank can largely control on a daily basis using its monetary toolkit. Most major central banks, including the Eurosystem, use short-term market interest rates as their

3 The target was amended in July 2021 when the ECB announced the outcome of the Strategy Review. Previously, the inflation target was defined as "close to, but below 2 percent over the medium term".

Box 1 Monetary operations and the central bank balance sheet

Since 2006, the Eurosystem's balance sheet has increased almost sixfold as a percentage of GDP. This can be almost entirely attributed to the expansion of monetary operations: refinancing operations and asset purchase programmes together comprised about 80 percent of end-2021 assets. Reserves were about half of the liabilities.

Assets that are not part of monetary operations include gold and foreign reserve holdings, which have grown significantly due to the increased gold price. Banknotes have traditionally been central banks' most important liability, but are now dwarfed by reserves. Various items that are not specified in the stylised balanced sheet below include, for instance, central banks' investments in euro-denominated assets for goals other than monetary policy, and, on the liability side, non-monetary deposits held by governments and official institutions – including central banks – from outside the euro area. Many central banks hold deposits with each other, as part of their foreign reserve holdings.

Consolidated balance sheet of the Eurosystem

EUR bn, end of the year

ASSETS	2006	2021	LIABILITIES	2006	2021
Monetary operations					
Refinancing operations	451	2,202	Reserves	174	4,294
Asset purchases	0	4,713			
Other balance sheet items					
Gold and foreign assets	342	1,084	Banknotes	628	1.544
Other	357	567	Other	348	2.728
Total	**1,150**	**8,566**		**1,150**	**8,566**
% GDP	13%	75%		13%	75%

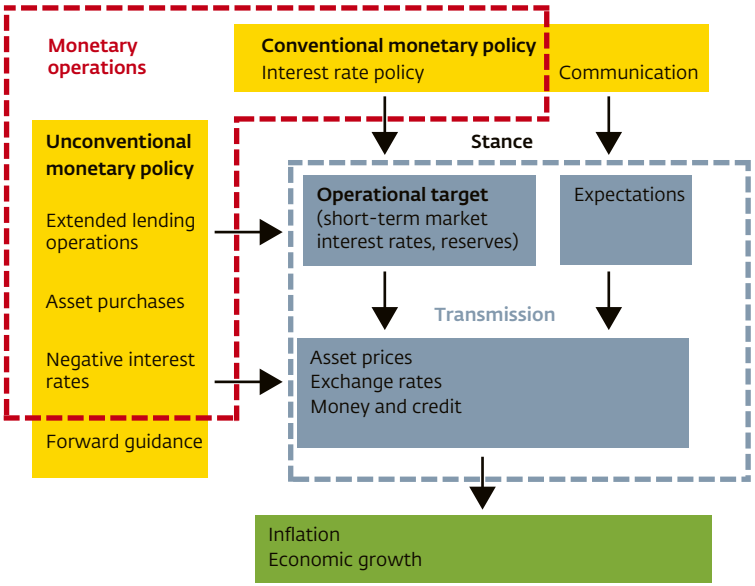
operational target for monetary policy.[4] Hence, monetary operations have long been mainly about steering short-term interest rates in line with what is deemed optimal to deliver the appropriate degree of accommodation to ensure convergence of inflation towards the objective. Since the central bank's toolkit was extended to include unconventional instruments, however, the scope of monetary operations has been broadened to target a range of financial variables.

The central bank can control its operational target – typically short-term market interest rates – because it has a monopoly on the issuance of base money. Base money, either in the form of banknotes or central bank reserves (i.e. deposits held by banks in their current account with the central bank), is the ultimate means used to settle transactions in the economy (Box 2). Hence, the demand for it is largely determined by economic developments. The amount of banknotes in the economy is generally considered an autonomous factor (i.e. exogenous to a central bank) and the remuneration is fixed at zero. However, a central bank can decide on the amount of central bank reserves it wants to supply and at what price. As central bank reserves are risk-free and fully liquid, interest rates on reserves function as an anchor for all money market rates. By means of arbitrage, all other interest rates in the economy can be influenced by the central bank to some extent via short-term rates, alongside other factors such as duration and market and credit risk.

4 Alternative operational targets are exchange rates and base money or reserves held by banks at the central bank. Exchange rates are typically used by central banks in jurisdictions that have pegged their currency. Reserves – and variables related to reserves – used to be important operational targets in the past but are hardly used any more (see e.g. Bindseil, 2014).

Monetary transmission is the process through which operational targets eventually influence inflation and economic growth. Prices for products and services cannot be influenced directly by central banks. However, via several so-called monetary transmission channels the central bank influences economic activity and inflation. Important channels are the expectations channel, the interest rate channel, the bank lending channel and the exchange rate channel. Figure 2.1 provides an illustration of the monetary transmission mechanism.

Figure 2.1 Monetary operations and the transmission mechanism



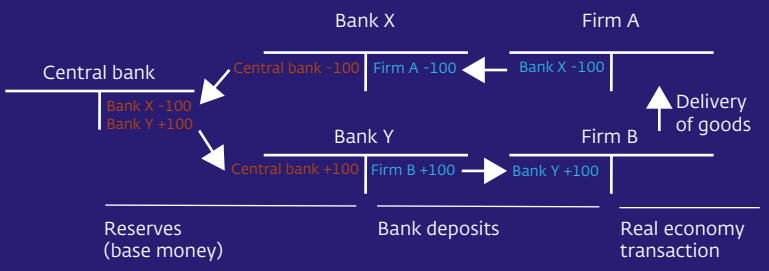
Note: this is a highly stylised presentation of monetary operations and transmission, which does not cover all possible interactions between the instruments.

Box 2 The role of base money

Base money – also known as central bank money or high-powered money – plays an essential role by facilitating transactions in the economy. Base money is issued by the central bank and consists of banknotes and reserves. The key characteristic of base money is that it provides finality of payment with absolute certainty in transactions. This means that after the payment is settled, there are no remaining obligations. Counterparties only have a claim on the central bank, which is secure because the central bank can always meet its obligations by creating more base money.

The use of base money can be illustrated by means of an example. Suppose firm A buys goods from firm B and pays a price of EUR 100. This payment may simply be settled in cash (i.e. banknotes), which ensures final payment. But in advanced economies most payments take place through the banking system, meaning that EUR 100 is transferred from firm A's account at bank X to firm B's account at bank Y. In turn, banks X and Y settle the payments through their accounts at the central bank. The final step is when bank Y adds the EUR 100 to firm B's deposit. Firms A and B have no further obligations to each other, apart from delivering the goods. One could argue that the payment still is not final, as firm B continues to have an exposure to bank Y; the firm could withdraw the EUR 100 in banknotes, which would completely finalise the transaction through base money.

There is a natural demand for base money to facilitate smooth settlement of transactions in the economy. Monetary operations are used to influence demand and supply conditions in the market for reserves – banknotes are typically considered an autonomous factor.



Conditions can be created in such a way that money market interest rates are controlled by the central bank, and can be used as a monetary policy instrument. In crisis situations, which are characterised by a rapid increase in the demand for liquidity, the central bank can provide more reserves to contain market stress.

In summary, base money facilitates secure payments in the economy, while a central bank's ability to create base money provides a tool to implement monetary policy and address liquidity crises.

Whereas conventional monetary policy focuses on the monetary stance, an important goal for UMP tools is also to address frictions in monetary transmission. Impairments in financial markets can impede the transmission of the monetary policy stance, which hampers the effectiveness of monetary operations. As such, the central bank may intervene in specific parts of the transmission chain to address certain frictions, such as excessive price movements in financial markets and a lack of market funding sources for banks. Examples of such interventions, which are discussed in more detail in Section 3, are the Eurosystem's enhanced refinancing operations, the Covered Bond Purchase Programme (CBPP) launched in 2009, the Securities Markets Programme (SMP) launched in 2010, the Outright Monetary Transactions

(OMT) programme announced in 2012 and the Transmission Protection Instrument (TPI, announced in 2022). The SMP, OMT and TPI programmes have been designed to address the risk of fragmentation due to excessively diverging interest rates across euro area countries. The OMT, which was only announced and never activated, was effective by significantly reducing redenomination risk, i.e. the perceived risk that some jurisdictions might leave the Economic and Monetary Union (EMU) so that assets would have to be redenominated into a different – and devalued – currency. While these programmes focused on monetary transmission, other monetary operations have both a stance and a transmission objective. Examples of tools that affect both stance and transmission are the Eurosystem's Targeted Long-Term Refinancing Operations (TLTROs) and the Pandemic emergency Purchase Programme (PEPP) (see Section 3).

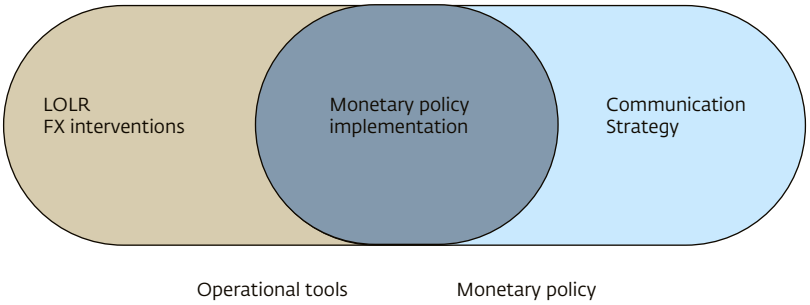
Not *all* central bank operations are connected to monetary policy. For example, emergency liquidity assistance (ELA) provided by a central bank to financial institutions as part of its lender of last resort (LOLR) role is often not motivated by monetary policy goals. Other examples are interventions to support dysfunctional financial markets or to contain excessive exchange rate movements, which may be done separately from monetary policy considerations.[5]

Moreover, operational tools are not the *only* tools to implement monetary policy. For example, forward guidance on the future path of a central bank's policy rate is recognised as a monetary policy tool (see Section 3.2.4), but consists solely of communication and hence does not need any actual operations to be implemented. Figure 2.2 illustrates the overlap and

5 Central bank operations in the context of the LOLR function and other stabilisation purposes are also typically implemented through lending operations and asset purchases and are therefore technically very similar to operations to implement monetary policy.

differences between monetary policy and operations. This study focuses on monetary operations that are used to achieve monetary policy objectives and does not pay much attention to the other goals of central bank operations.

Figure 2.2 Monetary policy and monetary operations



While pursuing its objectives, the Eurosystem is bound by some limitations, as its actions should be proportional and in line with the principle of an open market economy. These limitations are especially important for monetary operations, as these by nature intervene in market price formation and may have far-reaching side effects. An example of how the ECB operationalises the principle of an open market economy is the concept of market neutrality. This means that the ECB, while influencing the overall level of interest rates, tries to minimise its effects on the relative interest rates between or within different asset classes.

Another important principle for the Eurosystem's monetary operations is decentralised implementation. This means that, while the ECB has a coordinating role, the actual implementation is largely carried out by national central banks (NCBs). As such, De Nederlandsche Bank (DNB) conducts monetary operations with monetary counterparties within its jurisdiction and executes part of the ECB's asset purchase programmes.

2.2 The monetary toolbox

Monetary operations can be divided into three categories: open market operations, standing facilities and supplementary elements. Table 2.1 presents a stylised overview. Open market operations (OMOs) are implemented on the central bank's initiative to steer monetary and financial conditions through the supply of central bank reserves. Standing facilities are made available to banks to manage their daily liquidity position. A crucial difference as compared to OMOs is that standing facilities are permanently available and can be used by banks on demand, rather than at the central bank's discretion. With OMOs and standing facilities, central banks can largely determine demand and supply conditions in the market for central bank reserves, which enables them to control short-term market interest rates. Supplementary elements are important for the smooth implementation and risk management of OMOs and standing facilities and include minimum reserve requirements, averaging provisions, counterparty requirements and collateral requirements. Although this study focuses on the Eurosystem, the categories discussed in this section cover the instruments included in the toolboxes of most central banks in advanced economies.

Table 2.1 Stylized overview of monetary tools

Open market operations	
Liquidity providing	*Liquidity absorbing*
Credit (lending) operations	Borrowing
Outright purchases	Issuance of securities
	Outright sales
Standing facilities	
Lending facility	
Deposit facility	
Supplementary elements	
Minimum reserve requirements	
Averaging provisions	
Counterparty requirements	
Collateral requirements	

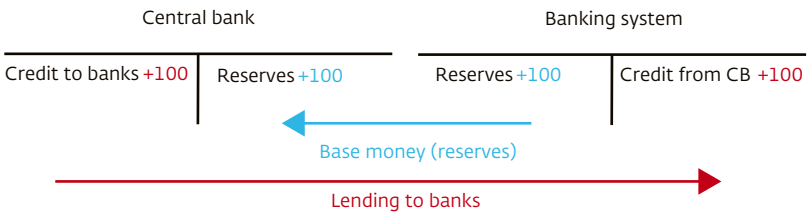
2.2.1 Open market operations

For most central banks, open market operations are the main instrument to steer the amount of central bank reserves in the financial system. These operations are implemented on the central bank's initiative and are directly reflected in the supply of reserves. Open market operations can be carried out in the form of credit operations with banks or outright purchases of securities.

Credit operations

Credit operations include lending and borrowing transactions with banks. Lending to banks increases the volume of reserves in the system (Figure 2.3), while borrowing operations reduce reserves.[6] To mitigate credit risk, central banks only lend to financially sound counterparties and against adequate collateral. This means that banks can only borrow to the extent that they have sufficient collateral that meets the central bank's eligibility criteria. This is called secured lending, for instance through a reverse repo transaction.

Figure 2.3 Stylised illustration of a credit operation



The central bank can control the volume of *lending* operations by setting either a fixed volume or a fixed rate, or both. With fixed volumes the central bank can meet the demand for central bank reserves and manage money market interest rates, for instance within a corridor defined by standing facilities (see Section 2.3). With a fixed rate and full allotment (FRFA), the supply of reserves by the central bank is in theory only constrained by the amount of collateral in the system. The amount of reserves supplied will then be determined by the demand of the banking

6 Credit operations in which central banks lend to banks are also denoted as lending operations or, in the Eurosystem's terminology, refinancing operations.

system at the given price and as such can be influenced by the central bank (although less precisely than with fixed volumes). The central bank can also fix *both* the volume and the price, i.e. fixed rate and fixed allotment. The Eurosystem followed such an approach in the first years of the euro, which caused massive overbidding in tender operations.

Central banks' *borrowing* operations can be used to drain liquidity from the system (just as lending operations increase liquidity). For instance, the central bank can issue term deposits or securities under attractive conditions so banks have an incentive to hold them. As banks pay for these securities with reserves, liquidity in the system is reduced. This may sometimes be needed to neutralise an unintended increase in reserves due to autonomous factors or liquidity injections as a result of specific operations (such as foreign exchange interventions to support the currency). The latter is called sterilisation.

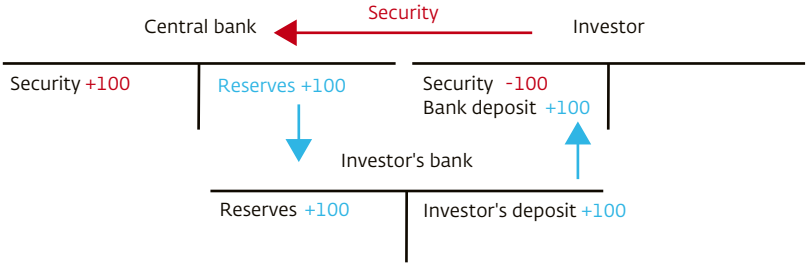
Central banks can also offer specific credit operations to manage the liquidity situation in the market. For instance, fine-tuning operations are carried out to manage liquidity conditions as a supplementary measure to regular operations. In more extreme cases, lending operations to alleviate temporary liquidity problems constitute a safety net, which is an important tool to prevent liquidity problems developing into a systemic crisis. In this way, the central bank acts as an LOLR.

Outright transactions

Outright transactions are another way to steer the amount of central bank reserves in the financial system, but they differ from credit operations in several respects. Central banks can buy a range of assets from various types of investors such as banks, insurance companies and mutual funds. But because payments are settled through the investor's bank,

the result is always an increase in banks' holdings of reserves (Figure 2.4). The bank then increases the balance on the investor's deposit account, which leads to money creation in the economy. Conversely, when central banks sell assets, the volume of reserves and money supply is reduced. Although a central bank can steer the amount of reserves through outright transactions as well as credit operations, there are important differences between both operations. In the case of credit operations, central banks have to specify the modalities of the operation such as its duration, interest rates and collateral. For outright purchases, such specifications are not necessary as the central bank buys existing assets directly from the market. In general, outright purchases expose the central bank to more risk than lending operations as the latter are secured by collateral, which gives the central bank a double recourse: the counterparty and the collateral.

Figure 2.4 Stylised illustration of an outright asset purchase



Central banks typically purchase debt securities, but in principle any type of asset can be bought. Debt securities can be secured – like covered bonds and asset-backed securities (with a risk profile closer to lending operations due to the recourse to the underlying assets) – or unsecured. The latter can be sovereign debt or corporate debt. The Bank of Japan has also bought equity since 2010 as part of its asset purchase programmes.

Does the type of open market operation matter?

In theory, the way in which a central bank provides reserves to the system should not matter for the outcome in terms of financial conditions. This is because any balance sheet composition effect on interest rates would be arbitraged away by markets. However, in the presence of frictions the composition does matter, and hence the way in which the central bank provides reserves to the financial system may influence the resulting financial conditions.

The choice between using credit operations or outright purchases can be motivated by the economy's financial structure. Initially, the Eurosystem only implemented credit operations, in line with the bank-oriented nature of most euro area economies. In bank-based economies, firms tend to attract external funds primarily by borrowing from banks rather than by raising capital in financial markets. Hence, as banks are likely to play a dominant role in the monetary transmission mechanism, credit operations are likely to be most effective because they directly affect the banking system. In the United States, where financial markets play a dominant role in the transmission of monetary policy, the central bank (the Fed) traditionally preferred outright purchases in financial markets. In more recent years, however, both the Eurosystem and the Fed have broadened their operations and both employ credit operations as well as outright purchases.

Another consideration is the purpose of the operation. If the purpose is to steer the monetary policy stance, credit operations can be particularly effective in influencing short-term interest rates. However, asset purchases may be more effective if the goal is to influence longer-term interest rates via the term premium as part of quantitative easing (QE, see Section 3.2.2). If the goal is to support monetary transmission by improving banks' funding conditions and to stimulate lending to the real economy, long-term lending

operations are particularly effective. However, if transmission is impaired in specific financial markets, asset purchases in these markets are likely to be the most direct way to improve market functioning and hence transmission.

2.2.2 Standing facilities

Standing facilities give banks permanent access to borrowing from the central bank or the possibility of placing deposits at the central bank. The essential difference as compared to open market operations is that these facilities are used at the discretion of banks, rather than the central bank. A *lending facility* provides liquidity against adequate collateral, just like a lending operation. A *deposit facility* allows banks to place reserves at the central bank, beyond the required reserves they hold.

Standing facilities provide a ceiling and a floor to short-term interbank money market rates. A lending facility rate typically provides a ceiling because banks can always obtain liquidity against this rate (which is usually higher than the main policy rate) and therefore have no incentive to borrow at a higher rate. Conversely, a deposit facility rate provides a floor because banks can always hold deposits at the central bank at this rate and hence have no incentive to lend below that rate. As the Eurosystem offers both standing facilities, euro area banks are generally unwilling to lend below or borrow above overnight outside the corridor defined by these rates, as they can get a more favourable rate at the central bank (Section 2.3).

2.3.3 Supplementary elements

Supplementary elements include minimum reserve requirements (MRR), averaging provisions, counterparty requirements and collateral requirements. These elements are important for the smooth implementation, effectiveness and risk management of open market operations and standing facilities. MRRs create a fixed minimum demand for reserves, which can be

used as a tool to tighten overall liquidity conditions and create a minimum predictable demand for reserves. Averaging provisions allow banks to meet their individual MRR on average during a sufficiently long maintenance period rather than continuously, which enables them to smooth out daily fluctuations in their liquidity position. Counterparty requirements are important to mitigate counterparty risk and are an essential element of credit operations. Traditionally, only banks that meet prudential criteria, such as minimum solvency ratios, are granted access to central bank operations. Collateral requirements provide further protection against counterparty risk in credit operations, which are always secured. Central banks only accept adequate collateral and apply haircuts – a downward adjustment to account for risks – to ensure sufficient loss absorption capacity. One way to do this is to set haircuts in such a way that all accepted collateral poses the same risk for the central bank, a concept which is called risk equivalence.

Supplementary elements are important for the implementation of OMOs and standing facilities but may also be seen as tools by themselves. For instance, if the central bank wants to increase access to its operations, it may consider easing counterparty and collateral eligibility requirements. For example, the Eurosystem's measures to address the COVID crisis in 2020 included a set of collateral-easing measures. In addition, changing the level of MRR may be used as a tool to adjust liquidity conditions in the interbank market, as an alternative to using liquidity-providing and liquidity-absorbing OMOs.[7]

7 Before the introduction of the euro, DNB frequently adjusted its minimum reserve requirements to achieve tight liquidity conditions.

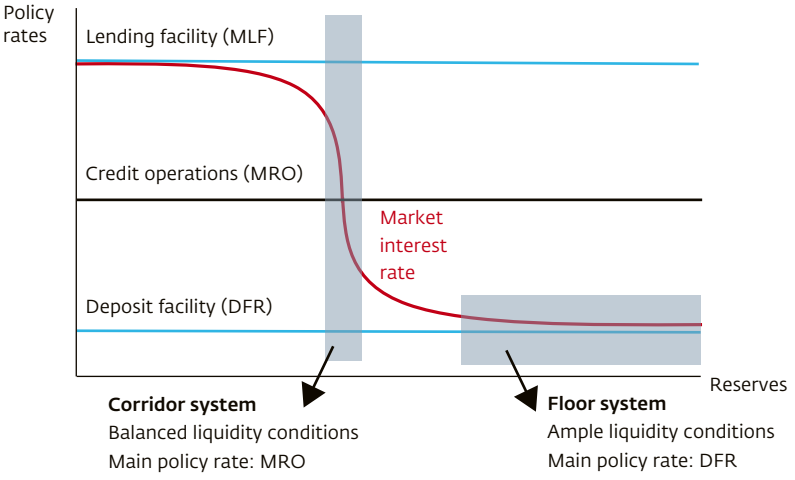
2.3 Different ways to implement the toolbox

There are many ways to achieve effective monetary policy implementation with the tools discussed, which can be illustrated by comparing corridor and floor systems (Figure 2.5).[8] A *corridor system* requires stable and predictable demand for reserves and a well-functioning interbank market. There are several ways to implement a corridor system. One approach – followed by the Eurosystem prior to the GFC – is to create a liquidity shortage by setting the MRR sufficiently high, so banks are forced to resort to the central bank's regular lending operations for additional liquidity. As a result, the interest rate on these lending operations becomes the anchor of interbank and broader money market interest rates, i.e. the operational target. Standing facilities support this mechanism by setting a ceiling and a floor for short-term market interest rates, which together define a symmetric corridor around the main policy rate. The central bank's monetary operations are implemented in such a way that the supply of reserves matches demand as closely as possible. By contrast, in a *floor system* the central bank creates abundant liquidity conditions, for instance through OMOs, so banks have more reserves than they need. As a result, short-term interbank interest rates decline until they reach the lower bound defined by the deposit standing facility. This deposit facility rate then becomes the anchor for short-term money market interest rates, making it the central bank's main policy rate to steer the monetary stance. In a floor system, a minimum reserve requirement and a lending standing facility typically do not play a major role. Moreover, a floor system does not require central banks to accurately forecast liquidity demand (a prerequisite for a corridor system), as long as the level of excess reserves is sufficient to avoid upward pressure on money market rates. As will be further discussed in Section 3, the ECB de

8 See Borio (1997, 2001) and Bindseil (2014) for more examples of central banks' operational frameworks in the past decades.

facto moved from a corridor system to a floor system after the GFC and its main policy rate – which most closely reflects the policy stance and is most relevant as an anchor for short-term interbank money market rates – changed from the rate on main refinancing operations (MRO rate) to the deposit facility rate (DFR).

Figure 2.5 Corridor system vs floor system



While the basic operations are similar, implementation frameworks differ across central banks and evolve over time (Table 2.2). Since the GFC, there has been a move towards floor systems among major central banks in advanced economies. This move can be largely attributed to an expansion of central bank balance sheets due to UMP resulting in excess liquidity.[9] All central banks in Table 2.2 use a short-term market interest rate as an operational target, in some cases extended with a long-term interest rate (Japan) or the level of reserves (China).[10] Some central banks, such as the Federal Reserve, the Bank of England and the Bank of Canada, do not impose reserve requirements. As already mentioned, the Eurosystem originally carried out all of its OMOs through credit operations, while the Federal Reserve traditionally preferred outright purchases, but both central banks have extended their toolkit and now use both types of operations.

9 See Čáp et al. (2020) for a discussion of changes in central banks' monetary policy implementation frameworks in recent years.
10 Japan's approach to target both short-term and long-term interest rates is known as yield curve control.

Table 2.2 Elements operational frameworks, selected central banks

	Operating target	Standing facilities		Reserve require-ments	Corridor or floor?
		Lending	deposit		
		Advanced economies			
Eurosystem	ST interest	Y	Y	Y	Floor
United States	ST interest	Y	Y	N	Floor
Japan	ST interest, LT interest	Y	Y	Y	Floor
United Kingdom	ST interest	Y	Y	N	Floor
Canada	ST interest	Y	Y	N	Corridor
		Emerging economies			
China	ST interest, Excess reserves	Y	N	Y	Corridor
India	ST interest	Y	Y	Y	Corridor
Brazil	ST interest	Y	Y	Y	Corridor

Source: BIS Markets Committee, Čáp et al. (2020).

3 Evolution from conventional to unconventional operations

The Eurosystem's monetary policy implementation can be subdivided into pre-GFC conventional policy and post-GFC unconventional policies. In the first decade of the euro, monetary policy focused on steering the short-term interest rate under tight liquidity conditions, employing the operations discussed in Section 2. In fact, this was a continuation of pre-euro monetary policy in Europe, particularly by the Bundesbank, and what we now call conventional monetary policy. Since the GFC, the monetary toolbox has been extended to include unconventional instruments. These instruments have a much broader scope to address frictions in monetary transmission and to deal with very low inflation. This section discusses conventional policy in the initial years of the euro, followed by a discussion of UMP tools that have been implemented since 2008.

3.1 Pre-crisis period: conventional monetary policy

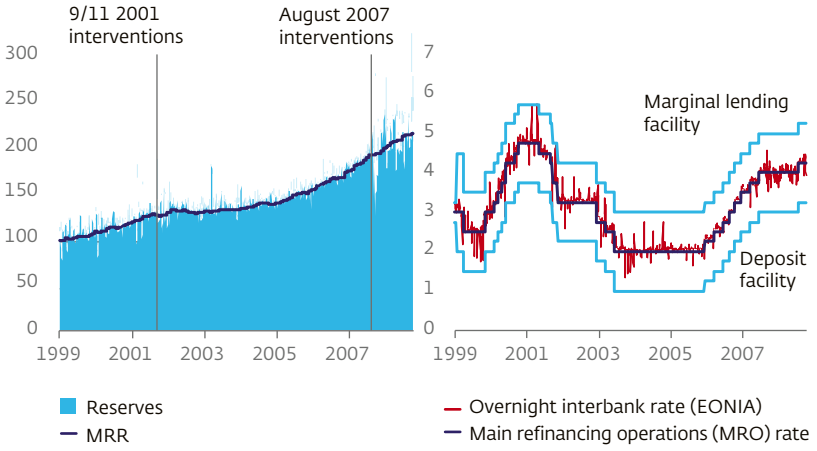
Monetary operations in the first decade of the euro were aimed at steering short-term interest rates in a corridor system.[11] The Eurosystem provided reserves via regular lending operations: Main Refinancing Operations (MROs) with a one-week maturity and Longer-Term Refinancing Operations (LTROs) with a three-month maturity. As explained in Section 2.3, the Eurosystem implemented its corridor system by creating a liquidity deficit to ensure that the central bank was the marginal lender for banks. This was achieved by imposing a sufficiently high MRR to create a liquidity shortage. Banks' daily liquidity management was supported by including an averaging provision in the MRR and by the standing facilities, which provide a ceiling and floor to interbank money market rates. This resulted in a system with interbank money market interest rates – such as EONIA – that were close to the ECB's main refinancing rate (MRO rate) and hardly ever moved

11 See EMI (1997) for an overview and discussion of the operational framework the Eurosystem would have at its disposal at the start of the euro, and ECB (1999) for a discussion on the first experiences with this framework.

outside the range defined by the two standing facility rates. As Figure 3.1 shows, this system was very effective to steer short-term interest rates during the first decade of the euro.

Figure 3.1 Corridor system with balanced liquidity conditions

Daily data, January 1999 – September 2008, EUR billions and percentages



Source: ECB.

The pre-crisis operational framework was characterised by a strict separation between the implementation of monetary policy and the provision of liquidity. This so-called "separation principle" made it possible to keep the formulation of the monetary policy stance distinct from pure liquidity and operational considerations. An advantage of the principle, which was often emphasised in the Eurosystem's communication, was that changes in liquidity provision or in the operational framework were typically not interpreted as signals of a change in the monetary stance. This made it

easier to adjust the modalities of lending operations – such as the move from fixed-rate tenders to variable-rate tenders in 2000 – and to provide liquidity injections in exceptional circumstances without influencing the formulation of monetary policy. Examples of such exceptional circumstances are the massive liquidity injections after the 9/11 attacks in 2001 and during the market stress in August 2007, which caused both great uncertainty in financial markets and temporary higher demand for liquidity.

The operational framework remained broadly the same up to the GFC. Some adjustments were made over time, such as changes in tender procedures and a full harmonisation of collateral requirements across NCBs. But essentially, the implementation of operations through a corridor system remained an effective way to pursue the desired monetary stance throughout the first decade of the euro. This was possible because the main preconditions for this system were fulfilled: the banking sector's demand for reserves was predictable and a well-functioning interbank market ensured a smooth distribution of liquidity across the banking system.

3.2 After the Global Financial Crisis: unconventional measures

Since 2008, unconventional monetary policy tools have been implemented through enhanced lending operations, asset purchases, negative interest rates and forward guidance. All of these new tools have been facilitated by the operational framework that was available at the start of the euro (see Section 2). But the scale and purpose of the operations changed substantially relative to the pre-crisis period, which is why they are called "unconventional". The measures were a response to extraordinary crisis circumstances – the GFC, the European sovereign debt crisis and the COVID crisis – and a prolonged period of low inflation. Moreover, the measures were initiated against the backdrop of a structural decline in

nominal and real interest rates over the past decades (see Figure 4.1 in Section 4), which has limited the scope for monetary easing through regular interest rate policy.

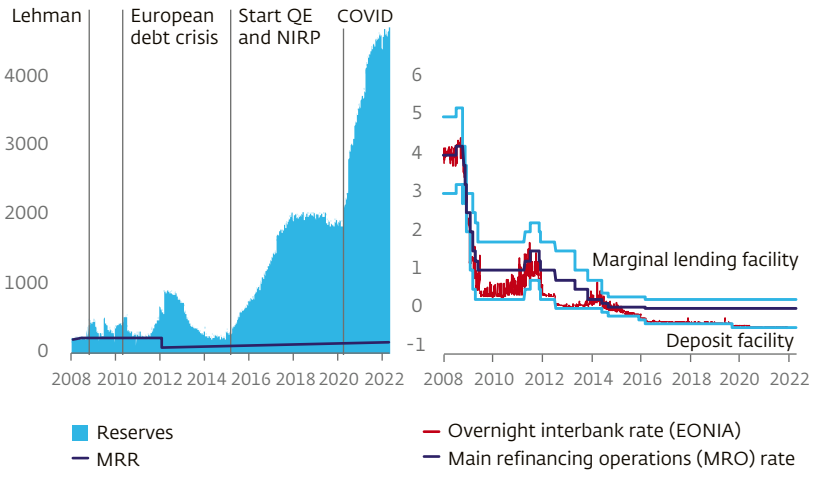
Unconventional measures have also changed the conditions under which conventional monetary policy is implemented. The Eurosystem's massive liquidity injections in 2008 and unconventional measures in the subsequent years resulted in a more than twentyfold increase in reserves by the end of 2021. As a result of this excess liquidity, the main conditions underlying the corridor system were no longer fulfilled. Moreover, the strict distinction between monetary policy and liquidity provision became blurred and the "separation principle", as it was defined before the GFC, was abandoned.

The steering of interest rates moved from a corridor system to a floor system approach. As explained in Section 2.3, a corridor system with tight liquidity conditions is an effective way to steer money market interest rates to a level close to the MRO rate, which was the Eurosystem's main pre-crisis policy rate. With excess liquidity, however, banks are holding more reserves than required by the MRR, which are remunerated at the deposit facility rate (DFR). Hence, the Eurosystem's role has changed from marginal lender to marginal borrower and the main policy rate has moved from MRO to DFR. With the lower bound of the corridor – i.e. the DFR – as the main determinant of money market rates, this system has become a de facto floor system (see Figure 3.2).[12]

12 "De facto" because there has never been a formal decision to change to a floor system.

Figure 3.2 Floor system with excess liquidity

Daily data, January 2008 – June 2021; EUR billions and percentages



Source: ECB.

As a consequence of excess liquidity conditions, unsecured interbank transaction volumes have declined significantly.[13] As banks no longer have a strong incentive to conduct these transactions to manage their liquidity, an increasing proportion of overnight transactions involve non-bank counterparties. These developments have undermined the robustness of the Euro OverNight Index Average (EONIA) rate, a key benchmark interest rate in financial markets based on interbank transactions. Therefore, an alternative benchmark has been developed that also covers transactions

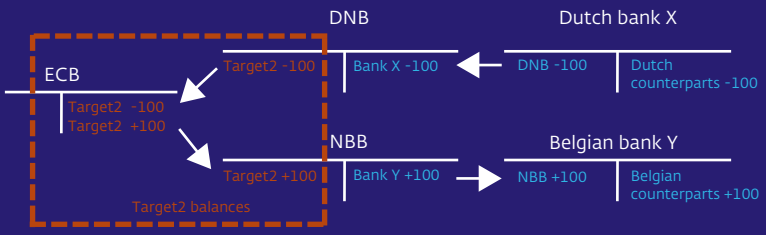
13 In addition to excess liquidity, a tightening of financial regulation since the GFC, such as increased capital requirements for banks, has resulted in higher balance sheet costs of unsecured borrowing relative to secured repo transactions, which further discouraged interbank unsecured trading.

with non-bank counterparties: the Euro Short-Term Rate (€STR).[14] Another implication of excess liquidity is that cross-border payments in the euro area are no longer matched by interbank transactions, which leads to an accumulation of net money flows on individual NCBs' balance sheets. These net positions, with some NCBs in surplus and others in deficit, are known as Target2 balances (Box 3).

Box 3 Target2 balances

Target2 balances are intra-Eurosystem claims, which reflect accumulated net money flows between euro area member states.[15] Cross-border payments are settled between NCBs, which adds an additional layer to the settlement of transactions in base money discussed in Box 2. Suppose that a Dutch bank X transfers EUR 100 to a Belgian bank Y, to settle a transaction for their clients. As a result, bank X's reserves at DNB are reduced by EUR 100, while the same amount is added to bank Y's account at the National Bank of Belgium (NBB). DNB and the NBB settle their accounts at the ECB to close their balance sheets which is also reflected in their Target2 balances. In this example, the Target2 balance of NBB increases, while the Target2 balance of DNB decreases. At the euro area aggregate level, Target2 balances by definition amount to zero or, in other words, the sum of NCBs with positive Target2 balances is equal to the sum of NCBs with negative Target2 balances and the ECB's Target2 balance. Target2 balances are mainly an accounting phenomenon – in principle, it does it matter where liquidity is created in a currency union.

14 Because €STR also includes transactions by non-banks, which do not have access to the Eurosystem's deposit facility, this rate may decline below the DFR, i.e. outside the corridor (see Figure 3.7).
15 Target2 is the Eurosystem's real-time gross settlement system. Transactions in central bank money are processed through this payment system.

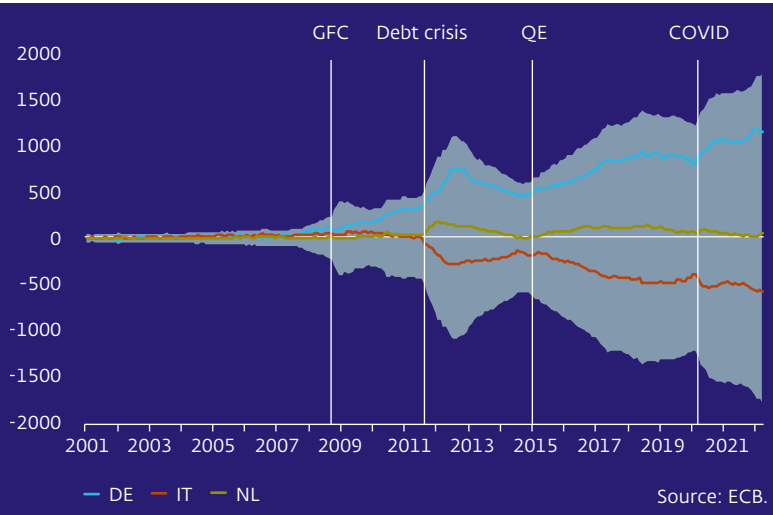


Under the pre-crisis corridor system, Target2 balances were small because banks kept their average reserve holdings close to the minimum requirements. This means that, if both banks in our stylised example started with exactly the minimum reserves required, the transaction would result in a EUR 100 reserve shortfall for bank X and a EUR surplus for bank Y. Bank X would then borrow in the interbank market to restore its reserves, while bank Y would offer liquidity. In this way, cross-border interbank transactions largely reversed any change in Target2 balances induced by payments like the one in our stylised example.

The situation fundamentally changed with the implementation of UMP instruments leading to the creation of excess reserves. The interbank market lost its self-equilibrating function and net payment flows accumulated on the Eurosystem's balance sheets.

There have been two main drivers of Target2 balances since the start of UMP, which can both be linked to the origin of liquidity creation. First, liquidity creation may be demand-driven, as banks borrow reserves through the Eurosystem's refinancing operations. The best illustration of this is the European debt crisis around 2012, which caused capital flows from vulnerable countries towards core countries like Germany.[16]

16 See DNB (2012).



Source: ECB.

To settle deposit outflows, banks in the vulnerable countries needed additional liquidity which they borrowed directly from the Eurosystem.

Second, liquidity creation may be supply-driven, i.e. induced by the Eurosystem itself.[17] The most important example is quantitative easing, which started in 2015 and was intensified in the COVID crisis. Money creation due to asset purchases is not evenly distributed across countries. One reason for this is that NCBs purchase part of the assets from foreign investors, leading to cross-border payments and, hence, a change in Target2 balances. And even if assets are bought from domestic investors, these sometimes prefer to hold their deposits in a different country where banks have a lower risk profile, again causing cross-border payments.

17 See DNB (2016).

3.2.1 Enhanced lending operations

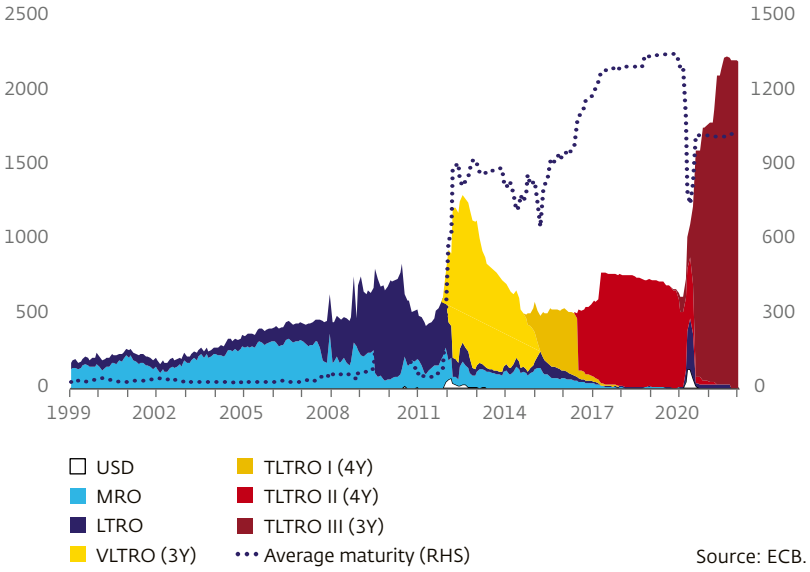
Since October 2008, the Eurosystem has provided liquidity to banks through fixed rate full allotment (FRFA) refinancing operations. This means that banks, as long as they have sufficient collateral, can obtain unlimited central bank reserves at a fixed interest rate. Refinancing operations with full allotment had been carried out in previous periods of market stress, to meet the extra demand for liquidity that typically arises in a crisis. These used to be temporary operations, to contain the crisis and to avoid excess demand for reserves driving up market interest rates.
In October 2008, however, deeper concerns about the financial system triggered a steep increase in precautionary demand for reserves, causing an uneven distribution of liquidity. On 8 October 2008, the ECB announced that weekly refinancing operations would be provided against FRFA for a longer period. This policy is still in place, although it has lost much of its relevance, given the increase in reserves due to other – and often more attractive – lending operations and asset purchases by the Eurosystem.

Over time, refinancing has been provided with longer maturities, making these operations attractive as a source of funding for banks. Before the financial crisis, most Eurosystem lending was provided through MROs with a one-week maturity, and a limited share through LTROs with a three-month maturity. Since 2007, the proportion of LTROs has grown, with increasing maturities of six months (2008), one year (2009) and three years (2011 – also known as very long-term refinancing operations or VLTROs). With these operations, the Eurosystem sought to reduce stress by lowering banks' funding uncertainty. Since the GFC, it had become more difficult for banks to attract longer-term funding; by lengthening their lending operations, central banks provided a counterweight. From 2014 onwards, so-called Targeted LTROs (or TLTROs) were offered: long-term refinancing (three or four years) with an embedded incentive for banks to maintain or

increase lending to the real economy. With these two aspects – facilitating bank funding and credit supply to the economy – TLTROs can be considered an instrument to support transmission as well as monetary stance. See Box 4 for a further discussion of TLTROs. Figure 3.3 shows how the different types of refinancing operations evolved over time and how the average maturity of the operations has increased. A more detailed overview of unconventional lending operations is presented in the Annex.

Figure 3.3 Composition of refinancing operations

Total volumes outstanding (EUR bn), weighted maturity (days, initial maturity)



Source: ECB.

Box 4 Targeted Long-Term Refinancing Operations (TLTROs)

TLTROs are longer-term refinancing operations with an incentive for banks to maintain or increase their lending to the real economy, stimulating competition among banks and exerting downward pressure on lending rates. TLTROs are an example of "funding for lending" operations, which have been offered by several central banks.

Common elements in the TLTRO operations (see table):

- *Eligible loans*: loans that are targeted by the TLTRO. In the TLTROs offered so far, these include loans to the private sector, excluding loans to households for house purchases.
- *Borrowing allowance*: the maximum take-up, formulated as a percentage of eligible loans prior to the launch of the TLTRO.
- *Benchmark*: the level of eligible loans that forms the basis for assessing whether a bank qualifies for more attractive conditions.
- *Threshold*: the extent to which the lending benchmark has to be exceeded to receive the full extra benefits.

Whereas incentives in TLTRO I were formulated in terms of access to additional funding, TLTRO II and TLTRO III were based on price incentives. Moreover, TLTRO III was further enhanced and made more attractive as part of the Eurosystem's response to the COVID pandemic, by increasing the borrowing allowance and reducing the borrowing costs by a "pandemic discount". Empirical studies have shown that TLTROs have been effective as a tool to stimulate bank lending and facilitate bank funding.[18]

18 See for instance Bats and Hudepohl (2019), Altavilla et al. (2021).

Overview TLTRO-operations

	TLTRO I	TLTRO II	TLTRO III
Launched	5 June 2014	10 March 2016	7 March 2019
Maturity	Up to 4 years	Up to 4 years	Up to 3 years
Allowance	Initially 7 percent of eligible loans outstanding at 30 April 2014, with additional allowance based on lending performance.	30 percent of eligible loans outstanding at 31 January 2016.	Initially 30 percent, subsequently increased to 55 percent of eligible loans outstanding at 28 February 2019.
Benchmark	Flat for positive net lenders prior to the operation, declining trend for negative net lenders.	Flat for positive net lenders prior to the operation, net lending Feb15-Jan16 for negative net lenders.	Flat for positive net lenders prior to the operation, net lending Apr18-Mar19 for negative net lenders.
Pricing	First two operations: MRO + 10 bp, subsequent operations average MRO	Linked to lending benchmark. Min: DFR Max: MRO	Linked to lending benchmark Min DFR, Max: MRO *(DFR – 50 bp from 24 June 2020 to 23 June 2022)*
Incentive	Extra allowance if benchmark is met.	Price discount: if benchmark exceeded by 2.5 percent threshold, banks pay DFR.	Price discount: if benchmark is preceeded by 1.15 percent threshold is met, banks pay DFR. *(DFR – 50 bp from 24 June 2020 to 23 June 2022, never more than -100 bp)*
Take-up	EUR 418 bn	EUR 750 bn	EUR 2214 bn

Another aspect that made lending operations attractive is their pricing. Under the pre-crisis conventional framework, refinancing operations were offered close to market rates and included price incentives to limit banks' participation. In particular, variable rate tenders were used in which banks could bid for a fixed amount of offered reserves at different prices. With FRFA, this mechanism no longer exists. The pricing of some longer-term operations has even become more attractive than comparable market funding, especially for banks with lower credit ratings. This is particularly the case for the most recent TLTROs, where generous pricing is made conditional on whether banks meet a predefined lending benchmark (Box 4).

In addition to regular operations in euros, the Eurosystem has offered lending in US dollars.[19] Such operations have been made possible by cooperation between central banks and help to facilitate banks' liquidity need for US dollars in times of global markets stress. After the 9/11 attacks in 2001, the ECB and the Federal Reserve entered into a swap arrangement to make their currencies available to each other. This allowed the Eurosystem to provide dollar liquidity to European banks, preventing liquidity shortages from morphing into financial stability risks. Similar arrangements have been in place since the GFC, and have been extended during the COVID crisis. The Eurosystem has provided euro liquidity facilities to several central banks through swap and repo lines.[20] By offering liquidity in foreign currencies, central banks not only support their own banking system, but also help to avoid undesired responses such as fire sales of foreign assets, which could thwart the monetary policy of the central bank issuing the currency.

19 On a smaller scale, the Eurosystem has also provided operations in Swiss francs.
20 Albrizio et al. (2021) present an overview of euro liquidity lines provided by the Eurosystem and provide evidence that these facilities have been effective as a stabilisation tool.

Looking back, lending operations have evolved from an instrument to steer interest rates via pure liquidity provision to a tool to support bank funding and sustain credit to the real economy. The initial response to the GFC was primarily aimed at meeting the rising demand for liquidity and signalling through FRFA that ample liquidity would remain available for an extended period. Subsequently, the focus shifted towards banks' funding needs, by increasing the maturity of credit operations. Finally, TLTROs have been used as an incentive for banks to maintain or increase their supply of credit to the real economy. Since 2014, TLTROs have been the main component of the ECB's credit operations.

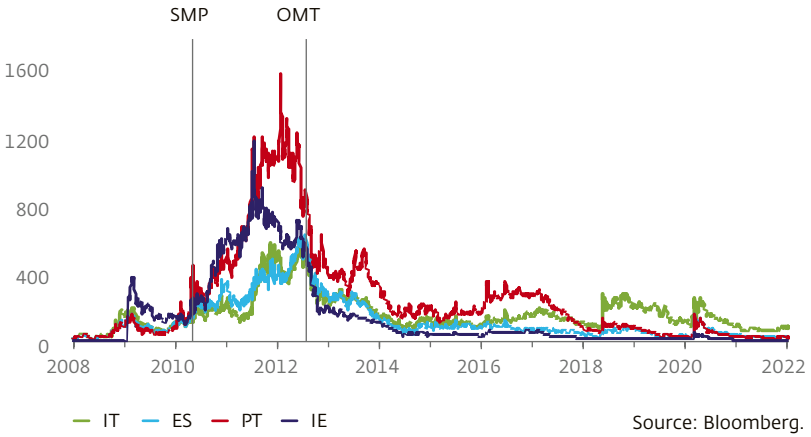
3.2.2 Growing role of asset purchases

The first asset purchase programmes were initiated in response to the Global Financial Crisis and the European sovereign debt crisis, and were aimed at monetary transmission. The GFC led to a serious loss of confidence in the banking sector and a reluctance on the part of investors to buy banks' funding instruments. In May 2009, the Eurosystem announced that it would purchase covered bonds – bank bonds backed by bank assets as collateral – to support bank funding markets: the Covered Bond Purchase Programme (CBPP). It was followed by a similar programme (CBPP2) in 2011, alongside funding support for banks through long-term refinancing operations (see Section 3.2.1). The first purchases of government bonds occurred via the Securities Markets Programme (SMP), which was launched in 2010. This programme addressed tensions in bond markets of individual member states that were severely hit by the European debt crisis: initially Greece, Ireland and Portugal; later expanded to include Italy and Spain. Because the purpose of the SMP was not to ease the monetary stance in general, the reserves created by the purchases were 'sterilised' by liquidity-absorbing operations. In 2012, the SMP was terminated and replaced by the Outright Monetary Transaction (OMT) programme, which attaches specific

conditions to countries whose debt is purchased. These conditions are that the country (1) receives support from the European Stability Mechanism (ESM) and meets the conditionality of the ESM programme, (2) has access to sovereign bond markets and (3) interest rates are distressed, i.e. higher than justified by economic fundamentals. Transactions under the OMT focus on the shorter end of the yield curve, particularly on bonds with maturities between one and three years. So far, the OMT has never been activated, but the significant improvement of market sentiment and the reduction in sovereign risk premiums (Figure 3.4) can be largely attributed to the announcement this instrument, as it provided a backstop for extreme scenarios.[21] Hence, the OMT has been an important tool to prevent fragmentation in the euro area due to excessive divergence of interest rates.

Figure 3.4 Risk premiums declined after OMT announcement

Five-year CDS spreads, basis points



Source: Bloomberg.

21 A first reference to the OMT programme – which then still had to be specified – was made by ECB president Draghi in his famous "Whatever it takes" speech (Draghi (2012). Altavilla et al. (2016) provide evidence that OMT has led to a decrease in interest rate spreads and the economic recovery of vulnerable countries.

From 2014 onwards, the focus of asset purchases shifted from supporting monetary transmission to monetary easing, i.e. the policy stance. This significantly widened the scope of the Eurosystem's asset purchases, in terms of asset classes, eligible maturities and size. The launch of the Asset-Backed Security Purchase Programme (ABSPP) and the third Covered Bond Purchase Programme (CBPP3) in 2014 were motivated by the need both to enhance transmission and to contribute to the monetary stance. Subsequently, the start of the Public Sector Purchase Programme (PSPP) in 2015 and the Corporate Sector Purchase Programme (CSPP) in 2016 were motivated purely by monetary stance considerations. These two additional programmes made it possible to achieve purchase volumes that have a major impact on financing conditions in the whole economy. Together, the ABSPP, CBPP3, PSPP and CSPP comprise the expanded Asset Purchase Programme (APP), which is commonly referred to as "quantitative easing" (QE). Like other central banks, the Eurosystem has implemented QE to mitigate the risks of prolonged low or even negative inflation. Central banks resorted to this instrument as the scope for further easing through conventional interest rate policy was limited, given the already very low short-term interest rates (see Section 3.2.3).

QE supplements conventional interest rate policy through downward pressure on longer-term yields. Conventional policy controls short-term interest rates by setting policy rates and influences the expectations component of longer-term rates with its communication policy. Unconventional policy through asset purchases provides additional easing by pushing down risk premia, particularly the term premium. Purchases are carried out in different segments of the yield curve, up to a maturity of 31 years. As a result, duration is extracted from the market, which leads to portfolio adjustments by investors and downward pressure on the term

premium.[22] If the intention is announced to continue asset purchases for an extended period, these can already have a major market impact in the short run, which is known as the signalling channel. Recent studies estimate that the downward impact of the Eurosystem's asset purchases on the term premium has been up to about 150 basis points in the ten-year maturity segment.[23] In addition, asset purchases can affect the long-term yield through other channels, for instance by signalling monetary policy intentions or through downward pressure on credit spreads. Regarding the latter, the acquisition of low-risk assets encourages other investors to adjust their portfolio towards riskier assets through the so-called portfolio rebalancing channel. In addition, by purchasing riskier assets the central bank itself absorbs credit risk, the effect of which is enhanced if a central bank explicitly declares itself pari passu with other creditors. This combination of increased demand and reduced availability affects the pricing of credit risk in the market.

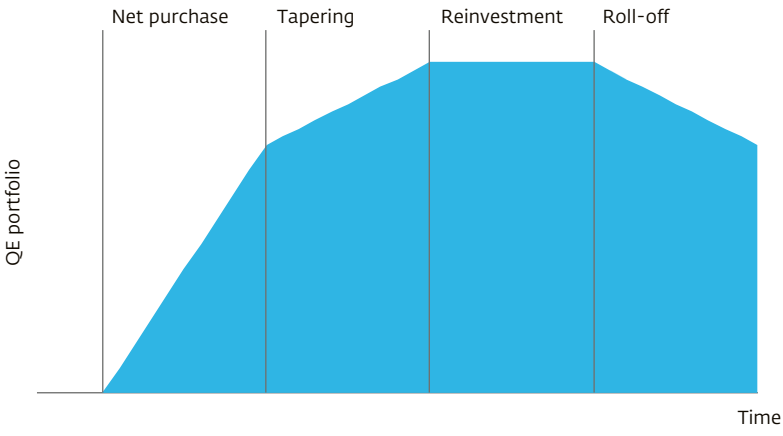
Within QE programmes, different phases can be distinguished in which assets are accumulated, maintained and reduced (Figure 3.5). The period in which the portfolio is accumulated is referred to as the *net purchase phase*. Net purchases are made on top of reinvestments of maturing assets already on the central banks' balance sheet, resulting in a growing asset portfolio. Periodic net purchases can be either pre-determined or flexible. The horizon can be calendar-based or open-ended until certain economic or financial conditions are met. The pace of net purchases can be increased or reduced

22 By purchasing securities with a long duration, which are sensitive to interest rate changes, the Eurosystem absorbs interest rate risk from the market. As a result, the compensation for this risk declines, as investors who are willing to hold bonds with a high duration will drive up the price of these securities. This will be reflected in a lower term premium.

23 Altavilla et al. (2021) find that by the end of 2019 purchases under the APP had reduced ten-year term premia on sovereign debt by almost 100 basis points. In the same study, the expansion of purchases in response to the COVID pandemic is estimated to have added an additional 45 basis points by mid-2021. The downward pressure on interest rates is lower for shorter maturities; for instance, the overall impact on the five-year term premium is estimated at about 100 basis points.

over time (recalibration). A path-wise reduction in the pace of net purchases, which is a first step towards normalisation, is typically referred to as *tapering*. When periodic net purchases have declined to zero, the central bank enters the *reinvestment phase*. In this phase the central bank only purchases assets to maintain the existing portfolio size, which would otherwise shrink because of principal redemptions. The Eurosystem's APP was in a reinvestment phase between January and October 2019 and again since July 2022. A next step would be the passive *roll-off phase*, in which reinvestments would be lower than redemptions. The Eurosystem experience with the roll-off of asset purchase portfolios has been limited so far (only CBPP1, CBPP2 and SMP). The Fed temporarily reduced the size of its asset portfolio between 2017 and September 2019. Balance sheet shrinkage is also called "quantitative tightening" (QT). If a central bank wishes to speed up the pace of the balance sheet reduction, it may also choose to actively sell off the assets held.

Figure 3.5 Stylised illustration of QE phases



The monthly pace of net asset purchases under the APP was adjusted several times. Initially, the pace of purchases was fixed for a specific horizon, mostly comprising six to nine months. In January 2019 net purchases were suspended. In November of that year net purchases were resumed in response to the deteriorating economic outlook. The main difference as compared to the previous episodes of net purchases under the APP was that the communicated duration of the programme was now open-ended and tied to conditions instead of a specific date, also referred to as state-contingent as opposed to time-contingent forward guidance on the duration of net asset purchases (see also Section 3.2.4). Given the recent rise in inflation, the Eurosystem has ended net purchases under the APP since 1 July 2022 after reaching a programme size of EUR 3.265 bn. The ECB has indicated that it will continue to reinvest maturing assets in full for an extended period following its first rate hike in July 2022.

Asset purchases are subject to several restrictions. This includes aspects such as periodic purchase targets, the allocation of purchases, risk limits and the exclusion of assets with specific characteristics. Restrictions are generally most stringent for purchases of public debt, to avoid monetary financing of governments, which is prohibited by the European Treaty. For example, the Eurosystem does not purchase government securities in the primary market, i.e. when they are issued. In addition, under the PSPP the Eurosystem can buy up to a maximum of 33 percent of a specific government bond.[24] The other purchase programmes under the APP also have specific restrictions and configurations.

24 The limit of 33 percent derives from Collective Action Clauses in debt securities contracts, which stipulate the legal framework for any future debt restructuring. Some individual bonds have other thresholds, and as such the limit on individual bonds may deviate from this general rule. Holdings above the limit would give the Eurosystem a blocking vote in a potential future restructuring of government, which would constitute a transfer from the Eurosystem to governments with the consent of the Eurosystem. This may be seen as breaching the prohibition of monetary financing of governments.

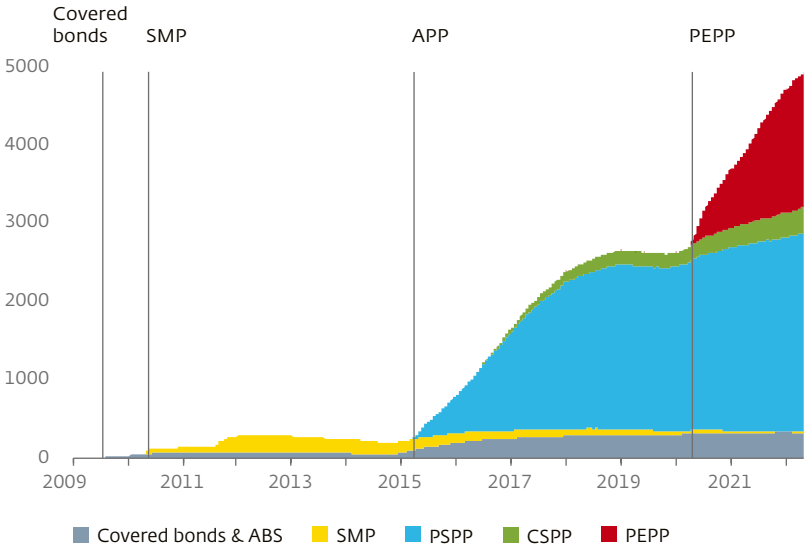
The Pandemic Emergency Purchase Programme (PEPP), launched at the start of the COVID pandemic, was aimed at both stance and transmission. As an initial response to the pandemic, the APP was enhanced by adding an additional envelope of EUR 120 bn on 12 March 2020, to be deployed flexibly over the course of the year. A few days later, on 18 March, the Eurosystem announced a separate and larger programme named PEPP (EUR 750 bn maximum, later extended to EUR 1,850 bn). PEPP was explicitly linked to the COVID crisis and motivated by both monetary stance and transmission considerations. The Eurosystem considered revising self-imposed limits on public sector bonds to the extent necessary and widened the scope of purchases.[25] To address specific frictions in transmission, the PEPP was implemented allowing flexibility over time, across asset classes and jurisdictions, which enabled the Eurosystem to adjust the pace and composition of purchases to the situation at hand. In December 2020, the calibration of purchases was explicitly linked to the intention of preserving favourable financing conditions consistent with countering the downward impact of the pandemic on the projected path of inflation. Net purchases under the PEPP were discontinued at the end of March 2022, after reaching a programme size of EUR 1,718 bn.

25 Purchases under PEPP were extended by asset categories that are not eligible under the APP, particularly short-term public debt securities (bills) and short-term commercial paper (i.e. with a remaining maturity of at least 28 days) issued by non-financial firms.

Asset purchase programmes solely aimed at monetary transmission have been smaller and implemented for shorter periods than those aimed at monetary stance. The first two covered bond programmes (CBPP and CBPP2) were activated for about a year and the SMP for about two and a half years, and were relatively modest in size compared to the APP (see Figure 3.6). The OMT has not been activated at all but is nonetheless considered effective as a backstop. Measures that were introduced to affect monetary stance under the APP have been in place since early 2015. This is consistent with the fact that the motivations for monetary easing through the APP – ongoing disinflationary pressure and limited policy space through conventional interest rate policy – have continued to be relevant over a long period. However, worldwide inflation dynamics have changed since the pandemic, eroding the rationale for additional monetary stimulus via net asset purchases. This is reflected in the end of net purchases under the PEPP in March 2022 and under the APP in July 2022. At the same time, a new stabilisation programme was launched in July 2022: the Transmission Protection Instrument (TPI). This instrument was announced together with the first interest rate increase by the ECB since 2011, to help prevent that increasing rates would have a disproportionally greater impact on financial conditions in some member states than others. The TPI will only be activated if differences in the pass-through of interest rate increases cannot be justified by economic fundamentals.

Figure 3.6 Development of asset purchase programmes

EUR bn



Source: ECB.

3.2.3 Negative interest rate policy (NIRP)

The Eurosystem has implemented a negative interest rate policy since 2014, to address a weakening inflation outlook in the context of very low natural interest rates.[26] The deposit facility rate (DFR) was set at -0.1 percent in June 2014, and further reduced in several steps to -0.5 percent in September 2019.[27] NIRP removed the perception that policy interest rates

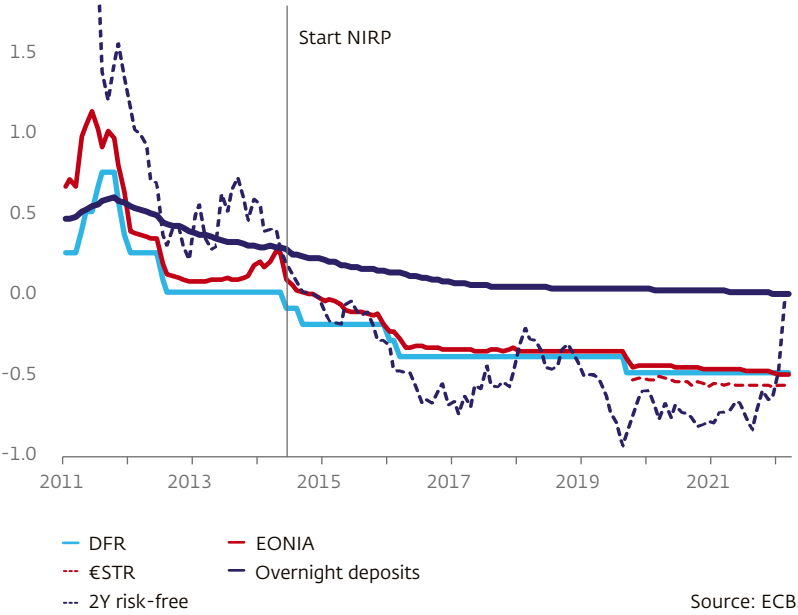
26 The natural (or neutral) interest rate can be defined as the real interest rate that is consistent with an economy operating at full employment with stable inflation. Although the natural rate is a theoretical concept and can only be estimated with great uncertainty, it is an important benchmark for the formulation of monetary policy stance. See Bonam et al. (2018) for a further discussion and Figure 4.1 for an estimate of the natural rate.

27 Other central banks, such as Riksbank (2009), Danmarks Nationalbank (2012), the Swiss National Bank (2014) and the Bank of Japan (2016), have also reduced their policy rates into negative territory.

are constrained at zero and was effectively transmitted to market rates (Figure 3.7).[28] Other unconventional measures, such as the QE and forward guidance, reinforced NIRP so that longer-term interest rates were also pushed below zero.

Figure 3.7 Negative interest rates

Percentages



Source: ECB.

The 2Y interest rate is based on AAA government debt securities. The deposit interest rate is a weighted average of demand deposits of households and non-financial firms.

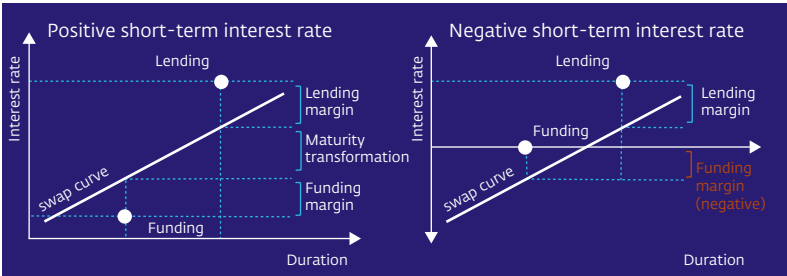
28 See e.g. Ball et al. (2016) and Jobst and Lin (2016).

While NIRP has been successful in easing the monetary stance, the effectiveness of further declines in policy rates is likely to be limited. Because of negative side effects, beyond a certain point the impact of a further interest rate cut may reverse and become contractionary. This interest rate is known as the effective lower bound (ELB) or reversal rate. One of the causes of the ELB is that banks are reluctant to reduce interest rates on deposits of households and non-financial firms below zero (Figure 3.7).[29] There are several reasons for this reluctance, including reputational concerns, deposit holders' option to keep their money in cash (i.e. with zero percent interest) and – in some jurisdictions – legislation limiting the scope for negative deposit rates. This downward rigidity of deposit rates is a direct impairment of monetary transmission, but also squeezes banks' interest rate margins (Box 5). In addition, institutional investors such as pension funds and life insurers are hurt by very low interest rates, as they have made long-term commitments that can only be met with higher yields. These negative consequences for banks and institutional investors are unintended side effects of NIRP, which at some point may outweigh the intended stimulus of negative rates.

Box 5 Negative interest rates and bank profitability

Traditionally, banks provide loans to the real economy and largely fund themselves with deposits. In normal circumstances with positive rates, the banks' lending rate is somewhat higher than the corresponding risk-free market rate (creating a lending margin), while their funding costs are lower than the corresponding market rate (funding margin) – see the left-hand figure below. These margins are a compensation for banks' credit intermediation. If the duration of assets and liabilities is different and not hedged, banks can also benefit from maturity transformation.

29 See also Eisenschmidt and Smets (2018).



With negative interest rates, however, the situation becomes different if deposit rates cannot be reduced below zero. As markets rates fall while deposit rates remain close to zero, the funding margin is squeezed and even becomes negative (right-hand figure), which hurts bank profitability. If at some point this were to affect their solvency, banks' intermediation role may be constrained, which would counteract the monetary stimulus. Koby and Brunnermeier (2019) have defined the reversal rate as the interest rate level below which further rate cuts reverse and have a contractionary rather than stimulating effect on the economy.

It is difficult to assess the reversal rate empirically, as declining interest rates have various effects that work in different directions.[30] Declining rates lead to capital gains on debt securities and reduce credit risk, which – at least temporarily – supports banks' profitability. In addition, banks may try to compensate for the reduced funding margin by increasing their lending margin or charging higher fees on payment services, or switch to funding sources that are not affected by the zero lower bound, such as market instruments. This mitigates the impact of negative rates on the funding margin, although some of these measures, like higher fees and higher lending rates, may also by themselves constrain monetary transmission.

30 Freriks and Kakes (2021) show that the impact of NIRP on the funding rate has been significant – comprising about one-third of banks' return in recent years – but that it may take several years before the full impact is felt, allowing time to take mitigating measures. Altavilla et al. (2018) present evidence that the negative impact of NIRP on banks has been more or less compensated by increasing non-interest income, lower provisions and cost reduction.

In 2019, the Eurosystem introduced the Two-Tier System for the remuneration of reserves to mitigate the unfavourable impact of NIRP on the bank-based transmission of monetary policy. Up until then, banks "received" the MRO rate (zero percent since 2016) on their MRR and the (negative) DFR on any excess reserves. To compensate banks for the disadvantages of negative rates and support the transmission of monetary easing, the ECB decided in September 2019 to exempt part of the excess reserves – up to six times the MRR – from the negative DFR rate. Instead, banks received zero percent interest on this "exempt tier". Altogether, with the MRO at zero, this means that banks were remunerated at zero percent on seven times the MRR.[31]

3.2.4 Forward guidance

The ECB has used forward guidance (FG) since 2013 to clarify future policy intentions based on its outlook for price stability. Central bank communication has always been a key element of monetary policy, as it can enhance the effectiveness of monetary operations by steering expectations. Several central banks have introduced FG as part of their communication, which means that they provide specific and systematic statements about their intended policies going forward. By providing information about future policy actions, the central bank can anchor inflation expectations and thereby strengthen the impact of monetary policy decisions on capital markets. FG is an important part of the UMP toolkit, given its signalling function to reduce the uncertainty around these new tools and the importance of the time dimension of monetary policy.[32] In July 2013, the ECB used FG in a general and qualitative way, by indicating that key interest rates were expected to remain low for an extended period of time and referring to

31 Boucinha et al. (2022) discuss and review the Two-Tier System.
32 Research finding an effect of FG at the ELB for the euro area includes Andrade and Ferroni (2021) and Coenen et al. (2017).

the subdued outlook for inflation. In subsequent years, the ECB has made more specific commitments, referring to a minimum period during which the APP would be implemented (i.e. calendar-contingent FG) and by linking the purchases to its price stability goal (i.e. state-contingent FG).

3.3 Interaction between the various instruments

Different UMP instruments often work through the same transmission channels and hence interact with each other. Previous sections have shown that unconventional monetary policy tools serve a variety of goals and target different market segments. These tools have not been deployed in isolation and often reinforce each other, as the transmission channels overlap. For example, QE reinforces the forward guidance on interest rates, whereas TLTROs help to stimulate bank lending at favourable rates. The interaction can also have negative effects, as illustrated by the fact that TLTROs can discourage the issuance of covered bonds and reduce the scope for purchase programmes. Table 3.1 gives a schematic overview of these different interactions.

Table 3.1 Interaction between UMP instruments deployed by the ECB

From \ To	TLTRO	Purchase programmes	NIRP	Forward guidance
TLTRO	Eases credit conditions, facilitates bank funding	Makes bank lending more attractive relative to holding securities. Reduces covered bond issuance	Encourages the transmission of low rates to lending to non-financial firms and households	Strengthens signal low rates for longer via fixed borrowing rate for the maturity of the operations
Purchase programmes	Make lending more attractive relative to bond holdings, improves banks' solvency through capital gains	Mitigate market dysfunction, support transmission, reduce term premium	Support floor system via extra reserves, push longer-term interest rates below zero	Strengthen signal of continued accommodation
NIRP	Strenghtens price incentive to meet lending target	Strengthens pressure on term premium by providing incentives to move towards longer-term assets	Removes perception zero bound policy rates	Broadens the scope of FG
Forward guidance	Helps to embed the interest rate expectations and encourage the take-up of the TLTROs	Anchors short-end of the yield curve	Lowers uncertainty about future interest rates, which NIRP may have increased by introducing two-way variation at low rates	Helps to control front-end of the forward curve

Source: based on Rostagno et al. (2021) and Altavilla et al. (2021).

4 Design considerations and future challenges

Over a decade of unconventional monetary policy has provided important lessons and challenges for the Eurosystem. The broad and persistent use of UMP instruments has considerably changed the role of the ECB in the financial system. The change in the composition and size of the Eurosystem's balance sheet, which has increased almost sixfold since 2006, is the most vivid illustration of this (see Box 1 and Section 3). The experience with different types of UMP instruments has provided important lessons on the optimal use and design of such tools. Moreover, due to their sheer size and broad reach, UMP instruments also come with unwarranted side effects. In its Strategy Review in 2021, the ECB concludes that UMP instruments have been effective and proportionate and have reinforced each other.[33] While policy interest rates remain the primary policy tool, UMP instruments will continue to play a role, especially near the effective lower bound on interest rates. However, to prevent or mitigate unwarranted side effects, the ECB also recognises the need to perform regular proportionality assessments and adopt appropriate design features. Going forward, a key question is how central banks may reduce their footprint in financial markets once circumstances allow. At the same time, the environment in which central banks operate continues to evolve due to developments such as climate change, digitisation and the emergence of non-banks, which may require monetary operations to adapt. This section first discusses various considerations relating to the design of monetary operations. It then reviews the challenges the Eurosystem faces in relation to its monetary operations in the coming years.

33 See ECB (2021b). For analyses of the effectiveness of unconventional measures and side effects, see e.g. Altavilla et al. (2021) for the euro area, Bailey et al. (2020) for the United Kingdom and CGFS (2019) for several economies.

4.1 Considerations regarding the design of monetary operations

The design of a specific monetary operation should consider its goal, effectiveness, side effects, operational aspects, risks and exit considerations. The first three of these aspects (goal, effectiveness, side-effects) are particularly related to the motivation and specification of the tool. Does it address monetary stance or transmission? Should design features be flexible or fixed for a longer period? Are there side-effects and can these be mitigated? The next two aspects (operational and financial risks) are related to potential risks and costs for the central bank. These may be mitigated by taking sufficient lead time and holding financial buffers to cover potential losses. Finally, it is important to incorporate elements that could facilitate an orderly exit, for instance through measures to prevent cliff effects.

The choice and the use of appropriate policy instruments require a careful weighing of the costs and benefits in order to safeguard proportionality. The proportionality assessment is particularly important for unconventional instruments, given their intrusive and multifaceted nature. Adjusting policy instruments in pursuit of price stability, while at the same time mitigating negative side effects, has implications for instrument design, the intensity and duration of interventions and the extent to which flexibility embedded in the medium-term orientation of the Eurosystem's monetary strategy should be exploited.

4.1.1 Goal of the operation

A clear specification of an operation's goal is crucial to guide an effective and efficient choice and design of an instrument. Monetary policy interventions have developed from mainly steering the stance via adjustments in the policy rate to the expanded set of tools used since the

GFC, which also serves the purpose of ensuring smooth transmission of monetary policy (see Section 3). This has added complexity to certain instruments, making it all the more important to clearly specify the purpose of an intervention. Defining the goal guides the policymakers' choice, design and implementation of the instrument, but also the public's expectations, which can enhance the effectiveness of the intervention.

Instruments used to steer the stance typically have a broad impact, whereas instruments to alleviate transmission problems tend to be more targeted. Instruments that are primarily intended to enforce the monetary stance typically work through multiple transmission channels simultaneously and have a broad impact, i.e. they "get into all the cracks". The flipside of this broad impact is that side effects are more widely spread across the economy (see Section 4.1.3). By contrast, instruments aimed at transmission are typically more targeted at alleviating adverse effects in specific parts of the transmission mechanism, such as money market stress, impairment of the credit channel, or fragmentation in sovereign bond markets. The goal of the intervention thereby shapes the scope of the instrument.

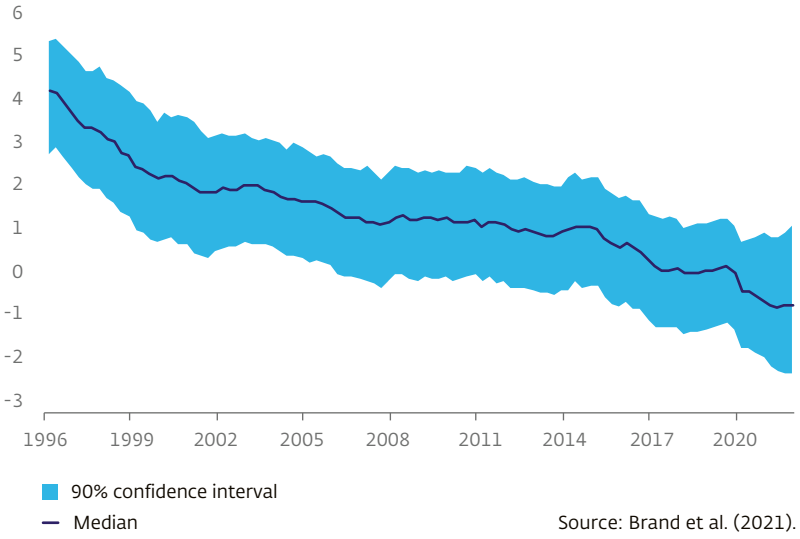
4.1.2 Effectiveness

The effectiveness of monetary policy tools can be assessed by considering their impact on intermediate targets and, eventually, price stability. Although economic outcomes such as inflation are eventually most relevant to an evaluation of monetary policy, individual tools should also be judged by considering the (intermediate) targets they are aimed at. For instance, TLTROs may be evaluated by considering their impact on lending conditions and the effectiveness of QE may be assessed by considering its impact on the term premium. With the increase in policy instruments, the range of financial variables that are targeted – or financial conditions at large – has expanded as well, which complicates an assessment of individual instruments.

Moreover, the structural decline in the natural rate of interest implies that monetary policy will operate in the proximity of the ELB more frequently (Figure 4.1). This affects the instrument choice and likely requires ongoing availability of UMP tools, as concluded in the ECB's Strategy Review (ECB, 2021b). Hence, a good understanding of the effects of different UMP tools is crucial for the optimal calibration of the instrument mix used in the future.

Figure 4.1 Estimated euro area natural rate of interest

Real interest rate, percentage



Source: Brand et al. (2021).

The effectiveness of different measures is time- and state-dependent. Effectiveness may decrease as measures are implemented for an extended period of time, while side effects could become more pronounced, which could compromise the overall effectiveness of the intervention. Moreover, the effectiveness of policy measures is state-dependent. For instance, asset purchase programmes can be most effective in times of market stress, when the mitigating effect on economic uncertainty and market frictions is greatest.[34] By contrast, the targeted element of TLTROs may be less effective at times of great economic uncertainty, as banks could face difficulty in forecasting credit demand under these circumstances and hence may be less sensitive to the incentives provided.

To enable tailor-made interventions under the prevailing circumstances, flexibility and adaptability of instruments is key. This can be achieved by adjusting the calibration and other features of monetary instruments. In some cases, a combination of instruments may be preferred as opposed to a single operation, as that creates even more scope to tailor the intensity of the interventions.

4.1.3 Side effects

Monetary operations may have unintended effects on market functioning, monetary transmission and financial structure. Market functioning can be hampered if monetary operations reduce the availability of securities to market participants. For instance, although purchases can enhance market functioning, as extra demand stimulates liquidity (flow effect), they also reduce the free float of assets in the market (stock effect), which at some point may harm liquidity. In addition, whereas NIRP has been important in providing more monetary stimulus, it also squeezes banks'

34 See Haldane et al. (2016).

interest rate margins (see Box 5) and reduces intermediation capacity. Continuous long-term refinancing operations can also have an unintended effect on financial structure if banks become overly reliant on central bank operations rather than using market funding. This may reduce market discipline, as central bank operations are provided under the same conditions to all eligible counterparties, regardless of their risk profile or other characteristics.

Monetary operations can also have unintended consequences for financial stability. For instance, a prolonged period of expansionary policy may lead to financial imbalances by fuelling debt levels and asset prices to excessive levels. As history shows, such episodes are often followed by severe downward corrections that could cause financial crises.[35]

In the calibration of monetary policy instruments, potential side effects need to be taken into account. To this end, the ECB has announced that it will systematically assess the proportionality of its instruments, as an outcome of the Strategy Review. This proportionality assessment includes an analysis of the benefits and possible side effects of monetary policy measures, their interaction and their balance over time.[36]

Macroprudential instruments have a central role in addressing financial imbalances. Macroprudential policy is a new area that emerged after the GFC to address risks to the financial system as a whole, instead of solely those of individual financial institutions. Examples of macroprudential instruments are countercyclical capital buffers for banks, which can be increased when financial vulnerabilities rise, and loan-to-value and

35 See for example Borio (2006) and Drehmann et al. (2011).
36 See ECB (2021b).

debt-to-income restrictions that limit mortgage loans relative to house prices and debt-servicing costs. The Eurosystem is involved with the formulation of macroprudential policy because most NCBs have been designated as macroprudential authorities in their own jurisdictions. Moreover, the ECB has the power to tighten national macroprudential policies (Houben et al., 2022). The ECB concludes in its Strategy Review that macroprudential tools are the first line of defence against financial stability risks, implying that monetary policy can play a supplementary role.

In addition, central banks can take mitigating measures to alleviate negative side effects of UMP. For example, bond scarcity is alleviated by the Eurosystem's Securities Lending Facility, which makes securities acquired under purchase programmes available for market participants to use in transactions. Another example is the Eurosystem's Two-Tier System for the remuneration of excess reserves, which mitigates the negative impact of NIRP on transmission via banks (see Section 3.2.3). An example of design features to mitigate financial stability is the exclusion of loans for house purchases from the TLTROs, which helps to avoid these operations unintentionally fuelling residential real estate prices.

4.1.4 Operational complexity and lead time

The time needed to implement an instrument and the complexity in executing the operations should be taken into account when considering new measures. More complex operations are likely to entail higher operational and hence reputational risks, as well as higher costs. Sufficient lead time can help to mitigate these risks and should therefore be weighed against the urgency of the measures. Moreover, some measures might require lead time for market participants as well, as was the case, for example, when NIRP was considered as financial institutions' systems needed to be adapted to be able to handle negative interest rates.

With sufficient time to prepare, the implementation itself does not have to be complicated. For example, purchases of new asset classes may require the hiring of new expertise and adaptation of systems, but once these requirements are in place the execution need not be complex.

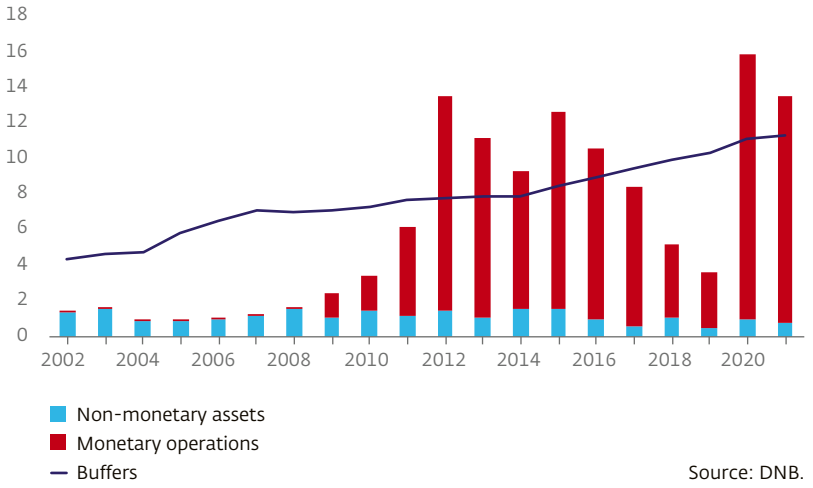
4.1.5 Financial risks for the central bank

Containing balance sheet risks is an important consideration for monetary operations. A central bank needs a strong balance sheet to operate credibly and to be able to absorb risks embedded in monetary operations. In principle, monetary operations are designed to be risk-efficient, meaning that the option with the least financial risk is chosen when various policy tools are available to achieve the desired impact. Equity and general reserves are the main cushions to absorb risks. Technically, central banks can operate with negative equity to the extent that they can cover their liabilities by money creation, seigniorage or resorting to government support. Such a situation should be avoided, however, as it would affect financial independence and may undermine policy independence.[37] Therefore, central banks generally aim to hold sufficient capital and the Eurosystem has increased its buffers in recent years (see Figure 4.2 for DNB).

37 Wessels and Broeders (2022) discuss the capitalization of central banks and present guidelines for capital adequacy.

Figure 4.2 Risk exposure and capital and reserves of DNB

EUR bn



Source: DNB.

Note: risks include interest rate risk and credit risk of DNB's exposure to the Eurosystem's asset purchase programmes and refinancing operations, as well as financial risks of DNB's own investments. Buffers consist of capital and reserves and include a provision for financial risks. See DNB (2022) for a further discussion.

Since the start of UMP, risks related to monetary operations have increased substantially. As shown in the previous sections, the volume of monetary operations has expanded rapidly and these now comprise the lion's share of central bank assets (Box 1). The Eurosystem has deliberately assumed risks from other sectors in the economy in order to pursue its policy objectives. Outright purchases are significantly riskier than credit operations, as they are not protected by collateral. Figure 4.2 shows how DNB's risk exposure has evolved over the past two decades. Most of the risk exposure is due to the public sector assets purchased under the APP and PEPP, where risks and returns are borne by NCBs that purchase debt

securities of their own governments. The remaining risks are mainly the result of risk-sharing arrangements within the Eurosystem for most operations, and therefore reflect DNB's share in the risk exposures of the Eurosystem as a whole.

A significant part of DNB's current risk exposures is interest rate risk. This is the flipside of asset purchases to reduce term spreads through duration extraction and the provision of longer-term funding to banks through refinancing operations at a fixed interest rate. Interest rate risk is due to the fact that most assets have fixed interest rates with longer maturities than central bank liabilities. The latter for the most part have very short maturities and variable interest rates. Interest rate risk would materialise if interest rates increased rapidly. In contrast to other financial institutions, interest rate risk cannot be hedged with instruments such as interest rate swaps, as that would counteract the intended monetary easing through UMP.

Finally, operations can erode central banks' profitability and capital if the terms and conditions involve costs for the Eurosystem. Two key examples are the Two-Tier System of reserves remuneration and the pandemic discount on TLTRO III refinancing. Under the Two-Tier System, banks receive zero percent interest on part of their excess reserves, rather than the negative DFR (see Section 3.2.3). This has reduced the Eurosystem's income from negative rates on monetary deposits by more than EUR 4 bn per year since the Two-Tier System was introduced in September 2019. With the pandemic discount, banks pay the DFR minus 50 basis points if they meet the lending benchmark (see Box 4). As banks also receive the DFR on the reserves that are created with TLTRO III, this involves a direct money transfer from the Eurosystem to the banking system.

4.1.6 Exit considerations

The longer-term effectiveness of operations depends not only on successful implementation, but also on whether they can be phased out smoothly. A specific measure may no longer be needed once the desired policy objective has been reached or if other instruments are deemed more effective. At the same time, an abrupt exit may cause cliff effects, leading to a disorderly adjustment process. A specific challenge for stance-related UMP instruments is that, so far, these have generally been implemented in only one direction, to ease financial conditions. The ECB and other major central banks have only limited experience with the exit from UMP instruments that has recently started as a response to increasing inflationary pressure. Only the Federal Reserve has gradually reduced its balance sheet between end-2017 and mid-2019, by reinvesting only a part of maturing assets.

To prevent a clustering of tightening events and ensure a process of gradual normalisation, instruments can be phased out sequentially. Priority can be given to unwinding exceptional measures taken over the last years first. Asset purchases have been employed to support the rate instrument at the ELB, and it therefore stands to reason that this instrument should be reversed first. Moreover, asset purchases are considered to be more intrusive and have larger side effects the longer they are in place than changes in short-term rates. The more limited control over the effects of QE also makes them less suitable as a marginal instrument of adjustment. The optimal sequencing, however, also depends on the state of the economy and characteristics such as financing structure.

Several design features can be incorporated in monetary operations to facilitate a smooth exit. One approach is to let operations self-liquidate through a carefully designed price mechanism. The best example of this is backstop pricing, by setting interest rates at a sufficiently higher level than

market rates in normal times but lower than market rates in crisis times. A second approach is to incorporate gradualism, for instance by offering operations in different series that mature at different points in time. For asset purchase programmes, a gradual approach is to scale down net purchases in several steps (i.e. tapering), followed by a period of only (partially) reinvesting existing assets and, eventually, net selling of assets (see Figure 3.5 in Section 3.2.2). Obviously, clear and timely communication is important to support gradual policies. The latter was illustrated by the "taper tantrum" in 2013, when financial markets misinterpreted the US Federal Reserve's communication about reducing its asset purchases, causing a spike in treasury yields.

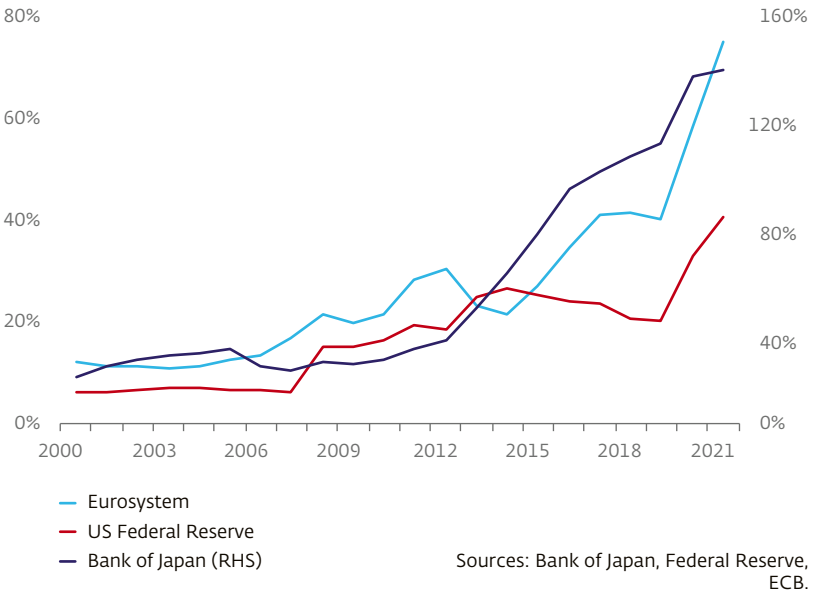
4.2 Future challenges

4.2.1 Balance sheet reduction

The Eurosystem's balance sheet size and asset duration have substantially increased over the past decade due to UMP (see Section 3). The average remaining maturity of asset purchase programmes was more than seven years at the end of 2021, while the last TLTRO III operation will mature at the end of 2024. This is a marked difference compared to the pre-GFC situation when most monetary assets consisted of Main Refinancing Operations with a maturity of only a week. Meanwhile, total assets as a percentage of GDP have increased almost sixfold, to more than 70 percent of GDP. Balance sheets of other major central banks, such as the Federal Reserve and the Bank of Japan, show a similar pattern (see Figure 4.3).

Figure 4.3 Total assets of major central banks

Percentage GDP



Sources: Bank of Japan, Federal Reserve, ECB.

If circumstances allow UMP instruments to be phased out completely, the challenge is to normalise the balance sheet in an orderly fashion. An increase in uncertainty and hence volatility is inherent in the process of reducing monetary stimulus and tightening the monetary stance, but the process should be designed in such a way that unnecessary volatility on financial markets is avoided. Gradualism and predictability through clear communication on the path of downsizing the balance sheet are crucial elements to prevent such unwarranted volatility. At the same time, monetary stance considerations (particularly the path of inflation) will largely determine the speed and size of the reduction, but the impact on the

financial system will need to be taken into account so as not to hamper monetary transmission. Although this issue concerning the timing and speed of tightening has always been an inherent feature of monetary policy, the limited experience with an active reduction of the balance sheet (also known as "quantitative tightening" or QT) makes the next tightening cycle especially challenging. Relative to phasing out asset portfolios, the termination of the TLTRO III lending operation follows a more deterministic path as the last tranche of this operation matures in December 2024. Moreover, this operation allows for voluntary early repayments, which – depending on market circumstances – could speed up the normalisation process.

Open questions regarding quantitative tightening pertain to the eventual operating framework and the optimal size and composition of the balance sheet. Although consensus exists that the Eurosystem – given the side effects described in Section 4.1.3 – should reduce its footprint in financial markets, a return to the pre-GFC operational framework with balanced liquidity conditions may be unlikely. First, banks' demand for reserves may have become higher and more volatile due to changes in banks' business models and liquidity regulation for banks.[38] Aiming for balanced liquidity conditions might therefore prove difficult and require constant fine-tuning. Hence, a floor system where the central bank provides ample reserves to the banking system may continue to be the most efficient way to steer short-term interest rates. Second, the Eurosystem may continue to implement asset purchases alongside credit operations, which were the only open market operations before the GFC. Especially under a floor system, asset purchases can be a useful permanent tool as the amount of reserves supplied is determined by the central bank, while the size of refinancing operations also depends on banks' demand for reserves (which

38 See Åberg et al. (2021).

can only be influenced indirectly through the modalities of the operations). Moreover – as in recent years – the Eurosystem may want to directly influence the term premium rather than just short-term interest rates, for which asset purchases are an effective tool. Third, given the growing role of financial markets and the rise of non-banks in recent years, there may be a greater need for instruments to address market dysfunction. Such instruments may be implemented through outright purchases as well as lending operations. If such instruments are designed as a backstop, their impact on the balance sheet in normal times is limited and any increase in the balance sheet would by design be self-corrected when benign market conditions are restored.

4.2.2 Monetary operations and sustainability considerations

Climate change impacts inflation via the economy and the financial system and hence should be considered in the design of the monetary framework. Climate change and climate policy affect inflation and are therefore relevant to the ECB's price stability objective. Prices of goods and services may fluctuate more sharply due to economic shocks resulting from climate change events such as droughts or floods. Governments' climate policies, especially carbon emission taxes, in principle also affect the aggregate price level and relative prices. In a scenario where governments would be forced to raise emission taxes abruptly, for example because they were initially too slow to react to reduce carbon emissions, prices could rise significantly. While such effects on inflation are uncertain in terms of timing, direction and size, central banks must have these risks on their radar, given their price stability mandate.

The Eurosystem will include climate change considerations in its monetary operations, in the areas of disclosure, risk assessment, collateral and its corporate sector asset purchases. As such, the ECB has committed itself to an action plan to incorporate climate change considerations in its monetary policy strategy.[39] For example, the Eurosystem will disclose its exposure to climate risks and make climate-related reporting a precondition for financial institutions' participation in monetary operations and the qualification for purchase and eligibility (as collateral) of assets. The action plan also contains specific measures for incorporating climate considerations in the ECB's risk control measures, as climate change has consequences for the value and risk profile of assets held on the central bank balance sheet. Regarding the asset purchase programmes, the main question is how to adjust the allocation of corporate bond purchases to better account for climate change considerations, in pursuing the price stability objective. Recently, this has resulted in the first steps to incorporate climate change in its monetary operations, with measures on disclosure requirements, the collateral framework, risk management and corporate bond purchases. The ECB will review these measures on a regular basis to assess their effects and adapt them if necessary.[40]

The Eurosystem's operational monetary framework needs to evolve in line with the increased financial risks due to climate change. The knowledge and expertise of what financial risks emanate from climate change, in terms of both physical risk as well as transition risks, will increase over time. In addition, current data on carbon emissions and other climate change indicators is still incomplete and the quality and comparability can

39 See ECB (2021a).
40 See ECB (2022).

be improved. This is rapidly advancing however, also driven by EU standards and rules on climate-related taxonomy and disclosures. These new data and insights should be incorporated in the ECB's approach to adapting its operational framework to better reflect these risks.

4.2.3 Central bank digital currency

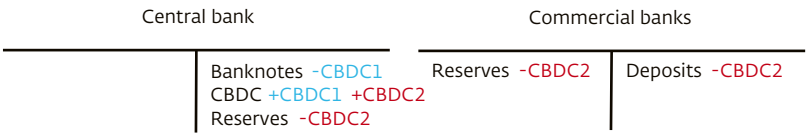
Introduction of a digital euro could have implications for monetary policy, monetary transmission and financial stability. Many central banks, including the Eurosystem, are currently investigating the introduction of a central bank digital currency (CBDC).[41] CBDC as digital money issued by the central bank would appear on the balance sheet as a liability, complementing banknotes and central bank reserves. Although opportunities for monetary policy are not part of the motivation for examining the digital euro, the digital euro will have an impact on policy implementation. The extent to which these effects occur depends greatly on design choices (such as remuneration and user limits) and behavioural effects which determine whether CBDC is substituted for cash or bank deposits and by what amount.

Substitution of CBDC for banknotes has no direct implications for bank balance sheets. This is merely a shift between two forms of central bank money – from banknotes to CBDC – and does not affect commercial bank balance sheets. This is illustrated in Figure 4.4 (an amount of CBDC1 is substituted for banknotes). For the central bank, the composition of the balance sheet changes, without changing the amount of central bank reserves.

41 See ECB's Report on a digital euro (ECB, 2020).

Substitution of CBDC for commercial bank deposits, however, could reduce the intermediation capacity of banks and could affect monetary transmission and impact financial stability. In this case, private money is converted into central bank (i.e. public) money. For commercial banks, the substitution leads to a loss of deposit funding and a simultaneous decrease in central bank reserves, shortening their balance sheets (denoted by CBDC2 in Figure 4.4). The size of the central bank balance sheet remains unchanged, but CBDC is now withdrawing reserves from the banking system (CBDC2). The latter involves a tightening of liquidity conditions, which should be taken into account in the implementation of monetary policy. Bank credit provision and resilience may be impacted by this withdrawal of funds. Moreover, in times of stress, rapid conversion of bank deposits into CBDC may affect the severity of a system-wide bank run, posing a significant threat to financial stability.

Figure 4.4 Stylised illustration of the impact of CBDC



CBDC1: substitution of CBDC for banknotes
CBDC2: substitution of CBDC for bank deposits

4.2.4 The rise of non-bank finance

In recent years, the importance of non-bank finance has increased. Traditionally, European economies have been more bank-oriented than other major economies such as the United States. Since the GFC, however, the importance of financial markets and non-bank financial intermediaries has increased relative to banks (Table 4.1). This trend can be partly attributed to a tightening of regulatory standards for banks, such as increased capital requirements, which has made it more difficult for banks to expand their balance sheets and engage in specific activities such as market making. Another driver is technological change, such as Fintech, which enables non-bank institutions to play a role in activities related to lending, payments and securitisation. Finally, low interest rates have likely increased investors' appetite to take risk, aiming for higher expected returns. In practice, this often implies moving from relatively safe bank deposits towards investments in marketable securities, either directly or through investment funds.

Table 4.1 Growth banks vs non-banks since the GFC

Euro area, percentage of GDP

Sector	2007	2020	Change
Banks	300%	294%	-6%
Non-banks*	192%	407%	+214%
Total	**492%**	**701%**	**+209%**

* Broad category of non-bank financial intermediaries, including mainly insurers, pension funds, investment funds, captive financial institutions and money lenders, central counter-parties, broker-dealers, finance companies, trust companies and structured finance vehicles.

Source: Financial Stability Board, Global Monitoring Report on Non-Bank Financial Intermediation.

The rise of non-bank finance may have implications for the way monetary operations are implemented and for access to such operations. Central banks may consider more direct interventions in financial markets to target a desired stance or to address market dysfunction. Another consideration is to what extent non-banks have access to central bank operations such as credit operations or the deposit facility. As long as banks play a pivotal role, the most efficient way to inject liquidity in the financial system is through banks. However, with other players gaining relevance in the financial system, giving such players access to central bank liquidity facilities may be considered to enhance the effectiveness of monetary operations and to protect financial stability.

5 Concluding remarks

Unconventional monetary policy instruments have broadened the scope and effectiveness of the Eurosystem's monetary operations. The extended toolbox has increased the effectiveness of policy measures to steer the monetary stance and facilitate monetary transmission in the euro area. Moreover, these instruments can – if calibrated properly – reinforce each other. As such, these instruments have supported the ECB in achieving its mandate. The effectiveness of various measures has proved to be state-dependent, with a higher impact when frictions in the financial system are greater.

The new instruments led to an unprecedented increase in the Eurosystem's balance sheet and potential side-effects. The scope and potential side effects of the Eurosystem's actions have increased in tandem with its balance sheet size, with implications for market functioning, financial stability, monetary transmission and market structure. This warrants a proper weighing of the costs and benefits of the instrument mix the ECB deploys. This proportionality assessment should not only be done when deciding upon new measures, but on a regular basis when instruments remain in use.

An eventual phasing out of UMP instruments should be gradual and predictable and minimise unnecessary volatility, which can be facilitated by the design of operations. A reduction of monetary stimulus generally increases uncertainty and volatility on financial markets, but design features can mitigate unwarranted effects of tightening on financial markets at least partially. Any reduction of stimulus should be gradual to the extent possible and should be complemented by clear communication on the expected path of normalisation. Several major central banks have started withdrawing stimulus in response to building inflationary pressures during the economic recovery from the pandemic. The ECB has terminated net asset purchases,

increased its interest rates and announced a new stabilisation instrument (TPI) to counter potential excessive increases in interest rate spreads in specific markets.

Going forward, the ECB's monetary policy toolkit will continue to evolve. Firstly, in the coming years the ECB will incorporate climate change considerations in its operational framework, for example by adjusting corporate bond purchases and by imposing additional requirements regarding climate disclosures on counterparties and issuers of bonds it purchases. Secondly, the potential introduction of a "digital euro" may have profound implications for the composition of the Eurosystem's balance sheets and as such also for the size and composition of its monetary operations. Lastly, changes in the structure of the financial system, such as the increase of non-bank financial intermediaries, might warrant a reconsideration of the way monetary operations are pursued. The experiences of the last decade, however, have shown that the ECB is flexible in adjusting its monetary toolkit in light of new challenges and changed circumstances. As such, it is well positioned to face any challenge arising in the future to conduct monetary policy in an effective and efficient way in support of its mandate.

Annex Overview of unconventional monetary policy measures

Table A.1 Refinancing operations

Operation	First announcement	Implementation	Maximum amount	Purpose	Transmission or stance?
Fixed rate full allotment (FRFA)	8 October 2008	October 2008 –		Improve banks' liquidity positions on a longer-term basis.	Transmission
6M LTRO	29 March 2008	April 2008 – November 2010	EUR 36 bn	Improve banks' liquidity positions on a longer-term basis.	Transmission
1Y LTRO	7 May 2009	June 2009 –October 2012	EUR 668 bn	Improve banks' liquidity positions on a longer-term basis.	Transmission
VLTRO (3Y)	8 December 2011	December 2011 – March 2015	EUR 1,018 bn	Improve banks' liquidity positions on a longer-term basis.	Transmission
TLTRO I (up to 4Y)	5 June 2014	September 2014 – September 2018	EUR 425 bn	Pursue favourable lending conditions, smooth transmission and support accommodative policy stance	Transmission and stance
TLTRO II (up to 4Y)	10 March 2016	June 2017 – March 2021	EUR 740 bn		Transmission and stance
TLTRO III (up to 3Y)	7 March 2019	September 2019 – December 2024	EUR 2,214 bn		Transmission and stance
PELTRO (1Y)	30 April 2020	May 2020 – December 2021	EUR 25 bn	Liquidity backstop, to preserve a smooth functioning of money markets	Transmission

Table A.2 Asset purchase programmes

Programme	Announcement	Implementation	Maximum amount	Purpose	Transmission or stance?
Covered Bond Programme (CBPP)	7 May 2009	July 2009 – June 2010	EUR 60 bn	Support functioning of bank funding markets.	Transmission
Covered Bond Programme 2 (CBPP2)	6 October 2011	Nov. 2011 – Oct. 2012	EUR 16 bn	Support functioning of bank funding markets.	Transmission
Securities Markets Programme (SMP)	10 May 2010	May 2010 – Sept. 2012	EUR 220 bn	Address dysfunction of specific euro area debt markets and restore monetary policy transmission.	Transmission
Outright Monetary Transactions (OMT)	2 August 2012	–	–	Safeguard an appropriate monetary policy transmission and the singleness of the monetary policy.	Transmission
Asset Backed Securities Purchase Programme (ABSPP)	6 June 2014	Nov. 2014 – July 2022*	EUR 31 bn	Enhance monetary policy transmission and support credit provision to the economy.	Transmission and stance

Programme	Announcement	Implementation	Maximum amount	Purpose	Transmission or stance?
Covered Bond Programme 3 (CBPP3)	4 September 2014	Oct. 2014 – July 2022*	EUR 302 bn	Enhance monetary policy transmission and support credit provision to the economy.	Transmission and stance
Public Sector Purchase Programme (PSPP)	22 January 2015	March 2015 – July 2022*	EUR 2,593 bn	Price stability.	Stance
Corporate Securities Purchase Programme (CSPP)	10 March 2016	June 2016 – July 2022*	EUR 345bn	Price stability.	Stance
Pandemic Emergency Purchase Programme (PEPP)	18 March 2020	March 2020 – March 2022*	EUR 1,718 bn	Counter risks to monetary transmission and the outlook for the euro area.	Transmission and stance
Transmission Protection Instrument (TPI)	21 July 2022	–	–	Address dysfunction of specific euro area debt markets and restore monetary policy transmission.	Transmission

*Net purchases suspended, start of the reinvestment phase.

References

Åberg, P., M. Corsi, V. Grossmann-Wirth, T. Hudepohl, Y. Mudde, T. Rosolin, and F. Schobert (2021), Demand for central bank reserves and monetary policy implementation frameworks: the case of the Eurosystem, ECB Occasional Paper Series, No 282.

Abrizio, S., I. Kataryniuk, L. Molina and J. Schaefer (2021), ECB Euro Liquidity Lines, Banco de España Working Paper, No. 2125.

Altavilla, C., D. Giannone, and M. Lenza (2016), The financial and macroeconomic effects of OMT announcements. International Journal of Central Banking, 12(3).

Altavilla, C., M. Boucinha and J.-L Peydro (2018), Monetary policy and bank profitability in a low interest rate environment, Economic Policy, 33(96), pp. 531-586.

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

Andrade, P. and F. Ferroni (2021), Delphic and Odyssean monetary policy shocks: evidence from the euro area, Journal of Monetary Economics, 117, pp. 816-832.

Ball, L., J. Gagnon, P. Honohan and S. Krogstrup (2016), What else can central banks do?, Geneva Reports on the World Economy, no 18, ICMB and CEPR.

Bats, J., and T. Hudepohl, (2009), Impact of targeted credit easing by the ECB: bank-level evidence, DNB Working Paper, No. 631.

Bailey, A., J. Bridges, R. Harrison, J. Jones and A. Mankodi (2020), The central bank balance sheet as a policy tool: past, present and future, Bank of England Staff Working Paper, No. 899

Bindseil, U. (2014), Monetary policy analysis and the financial system, Oxford University Press.

Bonam, D., P. van Els, J.W. van den End, L. de Haan and I. Hindrayanto (2018), The natural rate of interest from a monetary and financial perspective, DNB Occasional Study, No. 16-3.

Borio, C. (1997), The implementation of monetary policy in industrial countries: a survey, BIS Economic Papers, No. 47.

Borio, C. (2001), A hundred ways to skin a cat: comparing monetary policy operating procedures in the United States, Japan and the euro area, BIS Papers, No. 9.

Borio, C. (2006), Monetary and prudential policies at a crossroads? New challenges in the new century, BIS Working Papers, No. 216.

Boucinha, M., L. Burlon, M. Corsi, G. Della Valle, J. Eisenschmidt, I. Marmara, S. Pool. J. Schumacher and O. Vergote (2022), Two-tier system for remunerating excess reserve holdings, ECB Occasional Paper Series, forthcoming.

Brand, C., G. Goy and W. Lemke (2021), Natural rate chimera and bond pricing reality, ECB working paper No. 2612.

Brunnermeier, M. K., and Y. Koby (2019), The reversal interest rate, mimeo.

Čáp, A., M. Drehmann and A. Schrimpf (2020), Changes in monetary policy operating procedures over the last decade: insights from a new database, BIS Quarterly Review, December 2020, pp. 27-39.

Coenen, G., M. Ehrmann, G. Gaballo, P. Hoffmann, A. Nakov, S. Nardelli, E. Persson and G. Strasser (2017), Communication of monetary policy in unconventional times, ECB Working Paper Series, no. 2080.

Committee on the Global Financial System (CGFS), 2019, Unconventional monetary policy tools: a cross-country analysis, CGFS Papers, No. 63.

De Nederlandsche Bank (2012), Target 2 balances: Indicator of the intensity of the European debt crisis, DNBulletin, 12 April 2012.

De Nederlandsche Bank (2016), Target2 imbalances reflect QE and persistent fragmentation within the euro area, DNBulletin, 16 June 2016.

De Nederlandsche Bank (2022), Annual Report 2021, www.dnb.nl.

Draghi, M. (2012), Speech by Mario Draghi, President of the European Central Bank at the Global Investment Conference in London, 26 July 2012.

Drehmann, M., C. Borio and K. Tsatsaronis (2011), Anchoring countercyclical capital buffers: the role of credit aggregates, International Journal of Central Banking, 7(4), pp. 189-240.

Eisenschmidt, J. and F. Smets (2018), Negative interest rates: Lessons from the euro area, in A. Aguirre, M. Brunnermeier and D. Saravia (eds), Monetary policy and financial stability: transmission mechanisms and policy implications, Central Bank of Chile, Santiago, Chile.

European Central Bank (1999), The operational framework of the Eurosystem: description and first assessment, Monthly Bulletin, May 1999, pp. 29-43.

European Central Bank (2020), Report on a digital euro, 2 October.

European Central Bank (2021a), Press release: ECB presents action plan to include climate change considerations in its monetary policy strategy, 8 July.

European Central Bank (2021b), An overview of the ECB's monetary policy strategy, 8 July.

European Central Bank (2022), ECB takes further steps to incorporate climate change into its monetary policy operations, 4 July.

European Monetary Institute (EMI), (1997), The single monetary policy in stage three. Specification of the operational framework, Frankfurt.

Freriks, J., and J. Kakes (2021), Bank interest rate margins in a negative interest rate environment, DNB Working Paper, No. 721.

Haldane, A., M. Roberts-Sklar, C. Young and T. Wieladek (2016), QE: The story so Far, Bank of England Working Paper, No. 624.

Houben, A., J. Kakes and A. Petersen (2022), The interaction of monetary and financial tasks in different central bank structures, In: R. Holzmann and F. Restoy (eds), Supervisory architecture in Europe – Lessons from crises in the 21st century, Edward Elgar.

Jobst, A. and H. Lin (2016), Negative interest rate policy (NIRP): Implications for monetary transmission and bank profitability in the euro area, IMF Working Papers no 16/172, International Monetary Fund.

Markets Committee (MC) (1999), Large central bank balance sheets and market functioning, Bank for International Settlements.

Rostagno, M., C. Altavilla, G. Carboni, W. Lemke, R. Motto, A. Saint Guilhem and J. Yiangou (2021), Monetary Policy in Times of Crisis: A Tale of Two Decades of the European Central Bank, Oxford University Press

Wessels, P., and D. Broeders (2022), On the capitalisation of central banks, DNB Occasional Study, Nr. 20-4.

Glossary

Asset Backed Securities Purchase Programme (ABSPP) - One of the Eurosystem's asset purchase programmes, launched in 2014, under which asset-backed securities are purchased. Part of the APP. Since July 2022, net purchases under this programme have been ended and the programme is now in the reinvestment phase.

Asset Purchase Programme (APP) - Combination of the Eurosystem's purchase programmes that were launched since 2014 and together implement Quantitative Easing policy. The APP consists of the ABSPP, the CBPP3, the CSPP and the PSPP. Since July 2022, net purchases under these programmes have been ended and the programmes are now in the reinvestment phase.

Averaging provision - Provision that can be incorporated in the conditions of an operation or requirement. Averaging is part of the Eurosystem's minimum reserve requirement, which allows banks to meet this requirement on average over each maintenance period. This helps banks to smooth out daily fluctuations in their liquidity position.

Base money - Money created by central banks, comprising banknotes (in circulation) and reserves (held by banks). Also known as central bank money or high-powered money.

Central bank money - See Base money.

Collateral - Assets posted in a (reverse) repo transaction.

Corporate Sector Purchase Programme (CSPP) - One of the Eurosystem's asset purchase programmes, launched in 2016, under which corporate sector bonds are purchased. Part of the APP. Since July 2022, net purchases under

this programme have been ended and the programme is now in the reinvestment phase.

Corridor system - System in which interest rates on standing facilities define a ceiling and a floor for overnight interbank market interest rates. The central bank's main policy rate is typically in the middle of the corridor. In the Eurosystem's pre-GFC corridor approach, tight liquidity conditions were created to ensure the central bank became the marginal lender for banks. The DFR and MLF rates defined the corridor symmetrically around the MRO rate, which reflected the intended monetary stance.

Covered Bond Purchase Programme (CBPP) - One of the Eurosystem's asset purchase programmes, under which covered bonds of banks are purchased. The current programme (CBPP3) was launched in 2014 as part of QE. Previous programmes (CBPP, CBPP2) were aimed at supporting bank funding markets. Part of the APP. Since July 2022, net purchases under this programme have been ended and the programme is now in the reinvestment phase.

Credit operation - Central bank lending operations (liquidity-providing) and borrowing transactions (liquidity-absorbing) with monetary counterparties (typically banks). Example of an open market operation.

Deposit facility - Standing facility allowing banks, at their own initiative, to deposit reserves at the central bank.

Deposit Facility Rate (DFR) - Interest paid by the Eurosystem to banks on excess reserves. The main policy rate since the Eurosystem moved to a de facto floor system.

Duration - Sensitivity of an asset's value – such as a debt security – to changes in interest rates. In general, a bond's duration is higher the longer its maturity and the lower the level of interest rates.

Effective lower bound (ELB) - Policy interest rate below which the effect of further rate cuts reverses and becomes contractionary rather than accommodative. Also known as the reversal rate.

Emergency liquidity assistance (ELA) - Provision of liquidity by a central bank to financial institutions facing liquidity problems, which is not part of monetary policy. Example of the lender of last resort (LOLR) function of a central bank.

EONIA - Weighted average of overnight unsecured lending transactions in the interbank markets, provided on a daily basis by a panel of banks. Important benchmark rate for money market transactions until end-2021.

€STR - Euro area short-term interest rate, which reflects wholesale – i.e. also covering non-banks – unsecured overnight borrowing costs of banks located in the euro area. Has replaced EONIA as key benchmark rate.

Excess reserves - Banks' reserve holdings above the MRR.

Federal Reserve ("Fed") - The Federal Reserve System is the system of central banks in the United States. It consists of the Federal Reserve Board, which is located in Washington DC, and twelve regional Reserve Banks located in each of the twelve Districts.

Fixed rate full allotment - Tender procedure for a lending operation, in which the interest rate is fixed in advance and in which banks can borrow an unlimited amount, to the extent they have posted sufficient collateral.

Fixed rate tender - Tender procedure for a lending operation, in which the interest rate is fixed in advance.

Floor system - System in which the central bank creates ample liquidity conditions, so that banks are forced to hold excess reserves at the central bank. This has become the de facto Eurosystem approach since the GFC, with the remuneration of excess ressrves (DFR) as the main policy rate.

Forward guidance - A tool that central banks use to provide information about their future monetary policy intentions. By communicating these intentions to the public, central banks can influence current economic and financial conditions.

Lender of last resort (LOLR) - Safety net provided by central banks, where the central bank provides funds to financial institutions after these have exploited all other options. An example is Emergency liquidity assistance (ELA).

Lending facility - Standing facility allowing banks, on their own initiative, to borrow reserves from the central bank. For the Eurosystem, see Marginal lending facility.

Lending operation - Operation in which a central bank provides credit to a counterparty – typically a bank – against adequate collateral. Example of a credit operation.

Liquidity - See Reserves.

Liquidity-absorbing operation - Operation in which the central bank sells assets or borrows from counterparties, for example by issuing term deposits or medium-term securities, to reduce the volume of reserves.

Liquidity-providing operation - Operation in which the central bank purchases assets or provides credit to counterparties, to increase the volume of reserves.

Longer-Term Refinancing Operation (LTRO) - Regular lending operation with a three-month maturity, offered every month through a (reverse) repo transaction. On a more ad hoc basis, LTROs with a longer maturity have been provided, such as one-year LTROs and three-year LTROs (the "very Long-Term Refinancing Operation" or VLTRO).

Main Refinancing Operation (MRO) - Regular, weekly lending operation provided by the Eurosystem, through a (reverse) repo transaction.

M**aintenance period -** Period over which minimum reserve requirements are imposed. Since 2015, maintenance periods have typically been six or seven weeks; before 2015, maintenance periods were shorter.

Marginal Lending Facility - The Eurosystem's lending facility, a standing facility, which allows banks to borrow overnight against the MLF rate.

Minimum Reserve Requirement (MRR) - Minimum amount of reserves banks have to hold as a percentage of deposits and short-term funding liabilities. Since 2012 the MRR has been 1 percent; before 2012 it was 2 percent.

MLF rate - Interest paid by banks to the Eurosystem on the Marginal Lending Facility.

Monetary policy stance - The degree to which monetary policy can be considered accommodative or restrictive.

MRO rate - Interest paid by banks to the Eurosystem on Main Refinancing Operations. The main policy interest rate before the Eurosystem moved to a de facto floor system.

Natural interest rate - Real interest rate that is consistent with an economy operating at full employment with stable inflation. Also known as neutral interest rate.

Net purchase phase - Phase of an asset purchase programme during which, in addition to reinvesting maturing assets, additional securities are purchased and the stock of assets on the central bank balance sheet grows.

Open market operation - Credit operations and outright purchases. An essential characteristic is that these are carried out on the central bank's initiative and cannot be initiated by monetary counterparties.

Operational target - A variable that the central bank can control on a daily basis with its monetary operations. In normal times, and with conventional monetary policy, changes in this variable indicate changes in monetary policy stance. Most major central banks, including the Eurosystem, use short-term market interest rates as an operational target.

Outright Monetary Transactions (OMT) - Asset purchase programme, announced in 2012. Stabilisation programme, aimed at supporting monetary transmission in specific member states. The programme can only be activated under strict conditions, including an ESM programme. This programme has never been activated so far.

Outright purchases - Direct purchase of securities by a central bank in the market. Example of an open market operation.

Pandemic Emergency Longer-Term Refinancing Operation (PELTRO) - Temporary lending operation provided in 2020-2021 to provide liquidity support and support smooth money market conditions, as a liquidity backstop. Part of the ECB's measures to address the consequences of the COVID pandemic.

Pandemic Emergency Purchase Programme (PEPP) - Asset purchase programme launched in 2020 to counter risk to monetary policy transmission and the outlook for the euro area posed by the COVID virus outbreak. Since March 2022, net purchases under this programme have been ended and the programme is now in the reinvestment phase.

Policy interest rates - Interest paid to central banks in lending operations or lending facilities, and interest paid by central banks on deposits. Policy rates are an important instrument for monetary policy. The Eurosystem's main rates are the MRO rate, the DFR rate and the MLF rate.

Public Sector Purchase Programme (PSPP) - One of the Eurosystem's asset purchase programmes, launched in 2015, under which public sector bonds are purchased, which are issued by national governments various national and European institutions. Part of the APP. Since July 2022, net purchases under this programme have been ended and the programme is now in the reinvestment phase.

Quantitative Easing (QE) - Type of unconventional monetary policy in which the central bank purchases securities, in order to inject liquidity into the financial system and reduce the term premium of interest rates.

Quantitative Tightening (QT) - The opposite of quantitative easing; policies that shrink the central bank's balance sheet.

Refinancing operation - See Lending operation.

Reinvestment phase - Phase of an asset purchase programme during which securities are only purchased to compensate for maturing assets, so the total portfolio remains constant.

Reserves - Money held by banks in their current account with the central bank. Part of base money.

Roll-off phase - Phase of an asset purchase programme during which asset purchases are lower than maturing assets, so the total portfolio declines.

Securities Lending Facility - Facility under which securities purchased under the Eurosystem's asset purchase programmes are made available for securities lending to eligible counterparties. The purpose is to support bond and repo market liquidity without unduly curtailing normal repo market activity.

Separation principle - Strict separation between on the one hand the intended monetary policy stance and on the other hand the design of the operational framework to implement monetary policy and to provide liquidity.

Reversal rate - See Effective lower bound (ELB).

Securities Markets Programme (SMP) - Asset purchase programme, announced in 2010. Stabilisation programme, aimed at supporting monetary transmission in specific member states. Terminated in 2010 with the announcement of OMT.

Standing facility - Facility allowing banks to borrow from the central bank or to deposit reserves at the central bank, on their own initiative. The Eurosystem's standing facilities are the Marginal Lending Facility (MLF) and the Deposit Facility (DF).

Sterilisation - Liquidity-absorbing operation to neutralise liquidity creation caused by credit operations or asset purchases.

Tapering - Phase of an asset purchase programme during which net purchases are reduced, as a first step towards reversing monetary stimulus through QE. See also Net purchase phase.

Targeted Longer-Term Refinancing Operation (TLTRO) - Longer-term lending operations (up to four years) in which a bank's access to attractive terms and conditions is made conditional on its lending performance.

Target2 balances - Intra-eurosystem claims that reflect accumulated net money flows between EMU member states. These cross-border payments

are settled between NCBs. Target2 balances of individual NCBs and the ECB can be positive or negative; all Target2 balances together total zero.

Transmission Protection Instrument (TPI) - Asset purchase programme, announced in 2022. Stabilisation programme, aimed at supporting monetary transmission in specific member states against the background of a tightening monetary policy stance.

Two-Tier System - Remuneration system for banks' holdings of excess reserves. On part of these reserves, the exempt tier, the remuneration rate is higher than the DFR, which is the normal remuneration rate for excess reserves. The goal is to support bank-based monetary transmission of monetary policy in the context of negative policy rates.

Variable rate tender - Tender procedure for a lending operation, in which the interest rate is determined after banks have submitted bids, in the form of amounts they are willing to borrow and related interest rates they are willing to pay. With limited allotment, the central bank then allocates the funds to the most competitive bids.

Zero lower bound (ZLB) - Downward rigidity of deposit interest rates around zero percent, which is particularly relevant for deposits of households and non-financial firms.

Abbreviations

ABSPP	Asset-Backed Securities Purchase Programme
APP	Asset Purchase Programme
CBDC	Central bank digital currency
CBPP	Covered Bond Purchase Programme
CBPP2	Second Covered Bond Purchase Programme
CBPP3	Third Covered Bond Purchase Programme
COVID	Coronavirus disease
CSPP	Corporate Sector Purchase Programme
DFR	Deposit Facility Rate
ECB	European Central Bank
ELB	Effective lower bound
EMU	Economic and Monetary Union
EONIA	Euro OverNight Index Average
€STR	Euro Short-Term Rate
FG	Forward guidance
FRFA	Fixed rate full allotment
GFC	Global Financial Crisis
LTRO	Long-Term Refinancing Operation
MRO	Main Refinancing Operation
MRR	Minimum Reserve Requirement
NCB	National Central Bank
NIRP	Negative interest rate policy
OMT	Outright Monetary Transactions
PELTRO	Pandemic Emergency Longer-Term Refinancing Operation
PEPP	Pandemic Emergency Purchase Programme
PSPP	Public Sector Purchase Programme
QE	Quantitative easing
QT	Quantitative tightening
SMP	Securities Markets Programme
TLTRO	Targeted Long-Term Refinancing Operation

TPI	Transmission Protection Instrument
UMP	Unconventional monetary policy
VLTRO	Very long-term refinancing operation

DeNederlandscheBank

EUROSYSTEEM

De Nederlandsche Bank N.V.
PO Box 98, 1000 AB Amsterdam
+31 20 524 91 11
dnb.nl