

# SFI Public Discussion Note

## Central Banks: Money, Policies, and Impact



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With its *Public Discussion Note* series the Swiss Finance Institute (SFI) is actively promoting a well-founded discussion of topics relevant to the financial industry, politics, and academia. Furthermore, SFI disseminates its findings through research, publications, Master Classes, and conferences.

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"Money is economical power" (Bagehot, 1873).

In his famous and still highly influential book on money markets and central banking from 1873, Walter Bagehot asserted that money is economical power. This is as true now as it was then, and has been throughout history. In our current monetary system, the ultimate money is the money issued, or "printed," by central banks. Practically all transactions in the economy settle in central bank money, either in the form of banknotes, which are the paper money we keep in our wallets, or reserves, which are deposits banks hold with the central bank.

Reserves are critical to the operation of modern payment and credit systems. When an individual or a firm makes a payment with their bank deposits, for example, through the usage of a debit card, reserves are transferred from the payer's bank to the receiver's bank, if these are different. Although the individual or firm sees the payment as being made with the money they have in their bank account, the transaction is ultimately settled in reserves held by their bank at the central bank. This is the case whether the payment is for groceries or financial assets. Banks also need central bank money to settle their liabilities, when these are not rolled over. The daily turnovers of dollar and euro reserves measure in the trillions.

There is no substitute for central bank money. It is, therefore, essential for banks to hold sufficient reserves for payments to go through and for the economy to function. This is not a law of economics or finance, but how society, politically, has decided to organize the matter of money. It is also the source of central banks' power and influence.

In short, central banks are infused with substantial power by virtue of having control over the ultimate money in the economy. In this note, we shed light on how central banks use their formidable power to take action and set policy to manage and influence the economy, with implications for society. Our focus is on recent times. Since the 2007/2008 Global Financial Crisis (hereafter, the financial crisis), central banks have increased their economic footprint to a size scarcely imaginable before. It is important to ask how this situation came to be, and why? What are the consequences? And what are the lessons to be learned?

# Origins, ownership, and degree of independence

We start by sketching out the origins and ownership structure of some central banks. Who set them up and who do they ultimately answer to?

Let's start at the beginning. The 'Governor and Company of the Bank of England' or as most people know it, the Bank of England, was established by Royal Charter in 1694, to raise money to fund a war with France. Over 1'200 people purchased shares (known at the time as 'Bank stock') totalling £1.2 million, which was the value of the government loan. (Bank of England, 2020)

Different central banks have different origin stories, but a common denominator among them is the involvement of government. The "Old Lady of Threadneedle Street" was established in 1694 to fund a war. While privately funded initially, today it is fully owned by the UK Government (HM Treasury). The Bank of England obtained policy independence in 1997/1998 with a mandate to keep inflation at a government-set level. This was initially 2.5%, but was reduced to 2.0% in 2004.

As shown in Table 1, other central banks, such as the US Federal Reserve System (Fed), the European Central Bank (ECB), and the Swiss National Bank (SNB) are much younger and were set up for different reasons, although also with the involvement of government.

**Table 1: Central Banks: Ownership, Control, and Monetary Conditions**

Country	United Kingdom	France	Japan	Switzerland	United States	People's Republic of China	Germany	Euro Area
<b>Central bank's name</b>	Bank of England (BoE)	Banque de France (BdF)	Bank of Japan (BoJ)	Swiss National Bank (SNB)	Federal Reserve System (Fed)	People's Bank of China (PBoC)	Deutsche Bundesbank (DBB)	European Central Bank (ECB)
<b>Date of establishment</b>	1694	1800	1882	1906	1913	1948	1957	1998
<b>Date of monopoly right to issue banknotes at the national level</b>	1844	1848	1882	1906	1913	1948	1957	Began in 1999
<b>State ownership</b>	100%	100%	55%	51%	See text	100%	100%	100% NCBs
<b>State voting rights</b>	100%	100%	100%	78%	See text	100%	100%	100%
<b>Selection process for the head of the central bank</b>	Appointed by the Monarch after recommendation by the Chancellor of the Exchequer	Appointed by the President after deliberation of the Council of Ministers	Appointed by the Cabinet (government) and subject to the consent of the House of Representatives and the House of Councilors	Appointed by the Federal Council after recommendation by the Bank Council (supervisory body)	Nominated by the President and confirmed by the Senate	Nominated by the National People's Congress and confirmed by the President	Nominated by the Government and appointed by the President	Appointed by the European Council after recommendation of the Council of the European Union, and consulting the European Parliament and the ECB's Governing Council
<b>Inflation policy</b>	Target of 2%	n.a.	Target of 2%	Between 0% and 2%	Target of 2% (as an average)	Around 3%	n.a.	Target of 2%
<b>Inflation rate (CPI), January to August 2023</b>	3.2%	4.1%	1.7%	1.8%	3.5%	-0.1%	3.8%	2.9%
<b>Central bank policy rate, December 2023</b>	5.3%	4.5%	-0.1%	1.8%	5.4%	3.5%	4.5%	4.5%

Notes: The Federal Reserve System is a government-private sector partnership. The ECB is owned by the National Central Banks (NCBs) of euro area member states.

Sources: Bank for International Settlements and the respective central banks' or governments' webpages.

The Fed was established through an act of the US Congress in 1913. Three years earlier a group of prominent bankers and politicians had met in secret on Jekyll Island off the coast of the state of Georgia to design a central banking system for the US, believing this was necessary to modernize and stabilize its financial system. Their design served as the blueprint for the Federal Reserve Act of 1913. The Fed is essentially a government-banking sector partnership. As explained on the Fed's website, the Fed "is not 'owned' by anyone," but the Board of Governors, the governing body of the Fed, "is an agency of the federal government and reports to and is directly accountable to the Congress" (Board of Governors of the Federal Reserve System, 2017). The seven members of the Board of Governors, currently chaired by Jerome Powell, are all nominated by the US president and confirmed by the Senate. In contrast, the twelve individual regional Federal Reserve Banks that make up the balance of the Fed are owned by member banks (such as Citibank, JP Morgan, and others) who elect six of the nine members of each regional Federal Reserve Bank's board of directors. The remaining three directors are appointed by the Board of Governors. Thus, there are close links between the US Government and the Fed. The Federal Open Market Committee (FOMC), which sets monetary policy, consists of the seven members of the Board of Governors, the president of the Federal Reserve Bank of New York, and four of the remaining eleven Federal Reserve Bank presidents, who serve on a rotating basis. The Fed has a mandate to foster price stability, maximum sustainable employment, and moderate long-term interest rates, but it has substantial leeway in interpreting these broad concepts. In 2020, it introduced an averaging concept to its 2% inflation rate target: "following periods when inflation has been running persistently below 2%, appropriate monetary policy will likely aim to achieve inflation moderately above 2% for some time" (Board of Governors of the Federal Reserve System, 2020).

The ECB was established in 1998 to serve as the central bank for all countries that adopt the euro as their common currency. Its legal basis is the Maastricht Treaty of 1992. The euro's underlying motivation is the political objective of unifying Europe. The ECB is owned by the National Central Banks (NCBs) of the euro area member states, which, in turn, are predominantly state owned; the central banks of Belgium, Greece, and Italy, are exceptions to this rule, having significant private ownership. Together, the ECB and the NCBs comprise the Eurosystem. Although the ECB is owned by the NCBs, the ECB determines the rules and policies in accordance with which the NCBs are obligated to act. The president of the ECB, currently Christine

Lagarde, is appointed by the European Council. Thus, ECB governance has links to member-state governments. The ECB has a price stability mandate and has operated with an inflation target of 2% since 1999, when the euro was introduced. Some ECB policies relating to outright purchases of government bonds have been challenged in court, with the claim being that such purchases violate the ban on monetary financing, that is, the financing of government deficits by money creation. The first such policy to be challenged was the Outright Monetary Transactions (OMT) program, which allows for potentially unlimited purchases of distressed countries' government bonds. In February 2014, Germany's Constitutional Court stated that "there are important reasons to assume that [the OMT] exceeds the European Central Bank's monetary policy mandate and thus infringes the powers of the member states and that it violates the prohibition of monetary financing of the budget" (Jones & Wagstyl, 2014). However, the European Court of Justice ruled in the ECB's favor in this and other challenges to Eurosystem government bond purchase programs. A critical factor in the European Court of Justice's decisions is that government bonds are not, and should not be, bought in the primary market (Bundesverfassungsgericht, 2014; European Court of Justice, 2015a, 2015b, 2018).<sup>1)</sup>

The SNB was established in 1906. Its formation was motivated by the idea that it would be advantageous to have one issuer of banknotes. As in the case of the US, there were longstanding disagreements between proponents and opponents of the establishment of a central bank. While those in favor emphasized efficiency and financial stability, those opposed feared concentrating the power to issue banknotes in one hand (Baltensperger & Kugler, 2017). Today, the public sector controls the SNB, with the Cantons and the Cantonal banks holding 51% of the shares and around 78% of voting rights. The private sector owns around 49% of the shares, but has only around 22% of the votes. The Federal Council elects six of the eleven members of the Bank Council and appoints the SNB's Governing Board, currently chaired by Thomas Jordan, upon recommendation of the Bank Council. Like the Bank of England, the Fed, and the ECB, the SNB is tasked with ensuring price stability. The SNB currently operates with a target range for inflation of 0% to 2%.

1) See also Nyborg (2016) for discussion. In May 2020, the German Constitutional Court required a satisfactory proportionality assessment of the public sector purchase program (PSPP) as a condition for the *Deutsche Bundesbank's* continued participation. This condition was subsequently met. For further details see Lawson (2020).

These brief summaries show that central banks are, by and large, born out of political processes, often with the involvement of private-sector banks. Although many central banks currently have a large degree of operational autonomy, their importance to government and society can be seen by the fact that heads of state or government, or a governmental body, typically appoint the heads of central banks and other members of their governing bodies. Today, central banks may seem as natural as government itself, but in the past their establishment was often strongly resisted because of the power entailed by their monopoly on issuing banknotes. In some quarters, central banks

are still viewed as controversial. In 2010, 16% of respondents in a Bloomberg National Poll said the Fed should be abolished (Zumbrun, 2010). Over time, central banks' powers have grown, as they have become increasingly central to the payment system, to the formation of interest rates, to the money supply, and so on. The foundation of this power is the monopoly right to control the ultimate means of payment. Modern payment and banking systems run on central bank money. The ability of a central bank to conduct monetary policy to manage interest rates and the economy rests on this simple fact.





# The growth of central banks

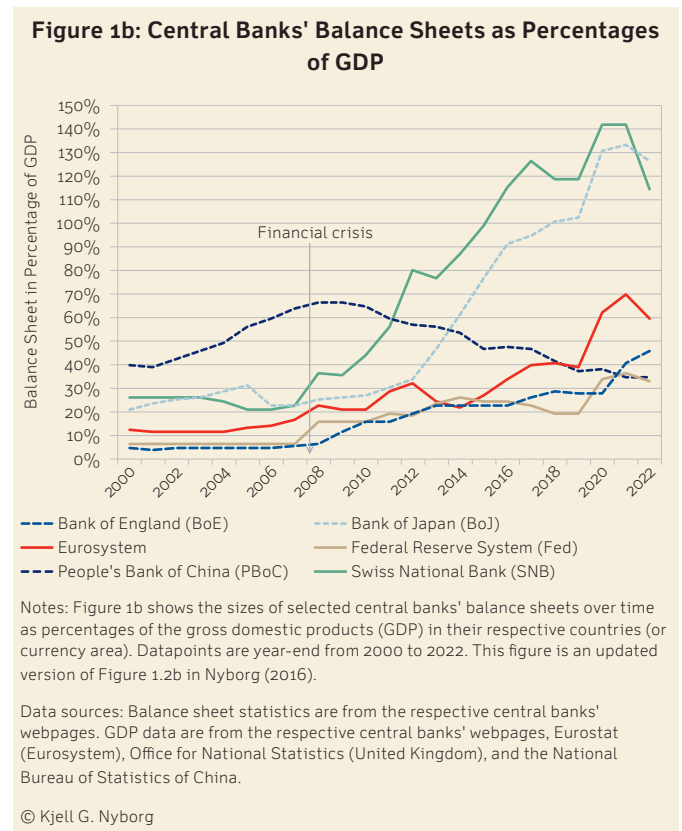
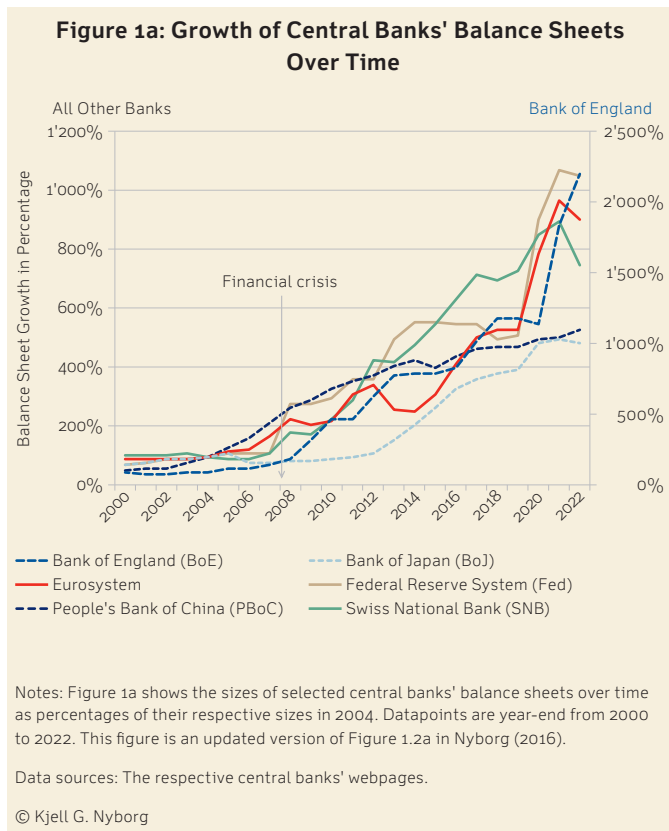
Like any bank or corporation, central banks have balance sheets. Their assets are gold, securities, loans to commercial banks, and so on. Their liabilities are primarily the money they have created when making loans or buying assets. Equity capital is typically a small portion of the overall balance sheet; for example, 0.5% for the Fed, 1.5% for the Eurosystem, and 10.0% for the SNB, in 2022. Like commercial banks, central banks essentially create money through the act of lending, although in the post financial-crisis era, outright purchases of securities have been the biggest contributing factor to central bank money creation. Reserves are created by crediting an institution's central bank account; these institutions are, for the most part, commercial private sector banks. Money creation and central bank growth thus go hand in hand.

Figures 1a and 1b show that, since the financial crisis, central bank balance sheets around the world have exploded in terms of the assets held by central banks and, as a consequence, the amount of central bank money they have created. In Figure 1a, the size of each central bank's balance sheet is normalized

to 100 in 2004. At the end of 2022, the consolidated balance sheet of the Eurosystem was nine times larger. The Fed and the Bank of England had grown by multiples of more than ten and twenty, respectively, and the SNB by more than seven.

As economies grow, the demand for money typically increases, since growth means more economic activity. However, Figure 1b shows that the growth in central banks' balance sheets over the last two decades vastly outstrips economic growth. Before the financial crisis, the consolidated balance sheet of the Eurosystem hovered around 12% of euro area GDP. The corresponding numbers for the Fed and the SNB were around 6% and 24%, respectively. At the end of 2022, these balance-sheet-to-GDP ratios had grown to 60% for the Eurosystem, 33% for the Fed, and 114% for the SNB—about five times larger than pre-crisis levels.

This explosive growth, and the policies underlying it, have not come without some trepidation from investors and even from central bankers. In April 2015, Yngve Slyngstad, then the head



of the Norwegian "oil fund," which at the time had around USD 1 trillion under management, was quoted in a Bloomberg article as saying that "monetary policy does affect pricing in today's market to such an extent that monetary policy itself has been a risk you have to watch" (Mohsin, 2015). This is a remarkable statement, coming from a major player in the markets, since central banks are supposed to be pillars of stability, not introducers of risk.

In 2012, Thomas Jordan, the president of the SNB, expressed the view that:

As a result of the measures implemented during the crisis, central banks took much more risk onto their balance sheets, which could potentially lead to substantial losses. ... In order to act appropriately, they need room to maneuver, which implies a sound central bank balance sheet with sufficient equity. (Jordan, 2012, p. 291)

This sentiment was echoed by Klaas Knot, the president of the *De Nederlandsche Bank (DNB)*:

The unprecedented expansion of central banks' balance sheets since the start of the crisis is certainly revealing. It shows that central banks' balance sheets are becoming more and more exposed to economic risk and political pressure. Eventually, this may result in a substantial amount of negative capital in a central bank's balance sheet. This is undesirable, because it could undermine a central bank's credibility and independence. (Knot, 2013, p. 2)

As we now know, notwithstanding these concerns, central banks continued to grow their balance sheets, eventually reaching the unprecedented levels seen in Figures 1a and 1b. While there are few indications that central banks' hard-earned relative independence is under threat, their policies have been subject to debate. As mentioned above, court battles over ECB policies whereby the Eurosystem can buy government bonds have gone all the way to the European Court of Justice, where decisions favored the ECB.

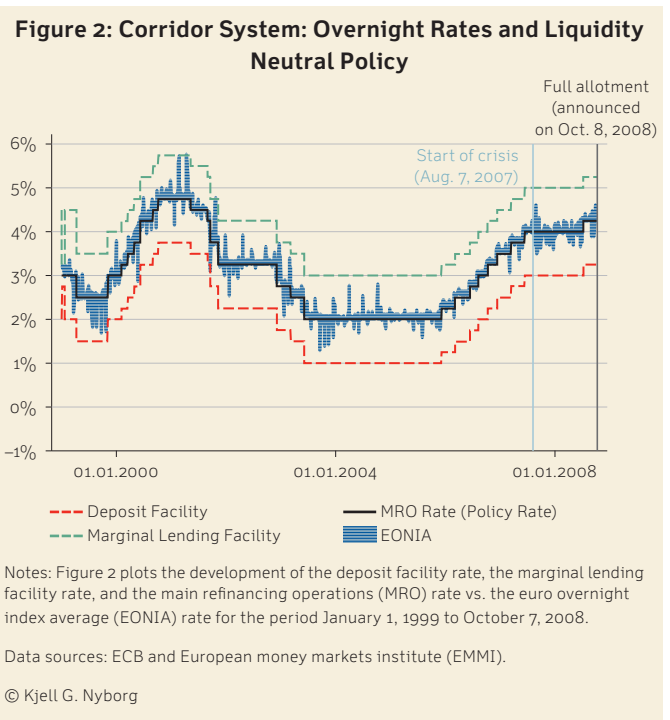


# The many dimensions of monetary policy

In the media and in most academic discourse, central bank monetary policy is typically equated with setting short-term interest rates. For example, the SNB targets and aims to control a three-month interest rate, while the Fed and the ECB target overnight rates. The idea is that controlling these rates helps steer inflation. However, monetary policy consists of more than just interest rate policy. There are two further dimensions, namely, liquidity and collateral (Nyborg, 2016). These three elements are connected via what economists refer to as central bank liquidity provisioning, that is, the creation of central bank money and the depositing of this money, as reserves, into banks' accounts at the central bank.

There are many different ways for central banks to control short term rates, but all of these typically include the interaction of interest rate, liquidity, and collateral policies. As an example, let us look at the euro area before the financial crisis.

As shown in Figure 2, until the autumn of 2008, the Eurosystem operated with what is referred to as a liquidity neutral corridor system. In such a system, the overnight rate at which banks lend reserves to each other is meant to track the middle of a corridor determined by two rates set by the central bank for overnight transactions between the central bank and banks. In the euro area, banks could borrow reserves from the Eurosystem at the marginal lending facility rate and deposit excess reserves at the deposit facility rate, two percentage points lower. This large spread encouraged banks to trade, instead, directly with each other. Because the ECB's policy was to inject into the banking system the quantity of reserves that banks needed, in aggregate, to fulfill reserve requirements, most interbank trade took place in the middle of the corridor between the two facilities. This average rate was commonly referred to as the Eurosystem's policy, or target, rate and served as the minimum bid rate in the Eurosystem's weekly main refinancing operations (MROs), where the quantity of reserves in the banking system was controlled. Figure 2 plots the three key rates—marginal lending facility, MRO, and deposit facility—and the resulting overnight interbank rate, captured at the time by the EONIA (euro overnight index average). Consistent with the theoretical ideas behind the liquidity neutral corridor system, the EONIA is seen to track, with some noise, the MRO rate.



This illustrates how liquidity policy and interest rate policy are linked. Collateral policy is also involved because the Eurosystem, like other central banks, provides reserves against collateral such as government bonds, covered bonds (*pfandbrief*), unsecured bank bonds, corporate bonds, and so on. The terms of exchange between collateral and reserves are set in central banks' collateral frameworks (Nyborg, 2016). For example, a central bank may be willing to provide reserves against a government bond up to the full market value of the bond less a safety margin, officially known as a haircut.

While collateral haircuts are a risk management tool of the central bank, they can also affect market values in the first place because reserves are valuable; reserves provide utility by facilitating transactions between agents in the economy. The more reserves a central bank is willing to provide against a particular piece of collateral, relative to other assets, the more the collateral would be expected to be worth. The impact can be sizeable. A recent Swiss Finance Institute working paper estimates that the yield on a one-year Italian government bond



increases by around two basis points for each percentage point increase in its haircut (Nyborg & Woschitz, 2021). The size of an asset's reserves convertibility premium is likely to vary over time as economic and monetary conditions fluctuate.

In the euro area, the lowest haircuts are reserved for government bonds, and banks use a substantial quantity of these bonds to obtain reserves. However, banks use a proportionally larger quantity of lower-quality collateral, suggesting that these securities' haircuts are not big enough (Nyborg, 2016, 2017). Favored securities have low opportunity costs, and haircuts do not equilibrate opportunity costs across different eligible collateral (Bindseil et al., 2009). A collateral policy that favors illiquid and risky assets can have adverse consequences for the financial system and the real economy because it incentivizes

the production of such assets. By way of an aphorism, "if central bank money is available only against igloos or igloo-backed securities, igloos will be built" (Nyborg, 2016, p. 22). What central banks provide reserves against, and the exact terms of exchange between these assets and reserves, can have a profound impact on the financial system and the economy. The more reserves are issued, the more important this becomes.

In contrast to the Eurosystem, the SNB does not require a haircut on eligible collateral. This choice necessarily favors relatively lower quality collateral with low opportunity costs. However, the SNB's list of eligible collateral is much more restrictive than that of the Eurosystem, so that this may be less of a concern for the SNB than for the Eurosystem.

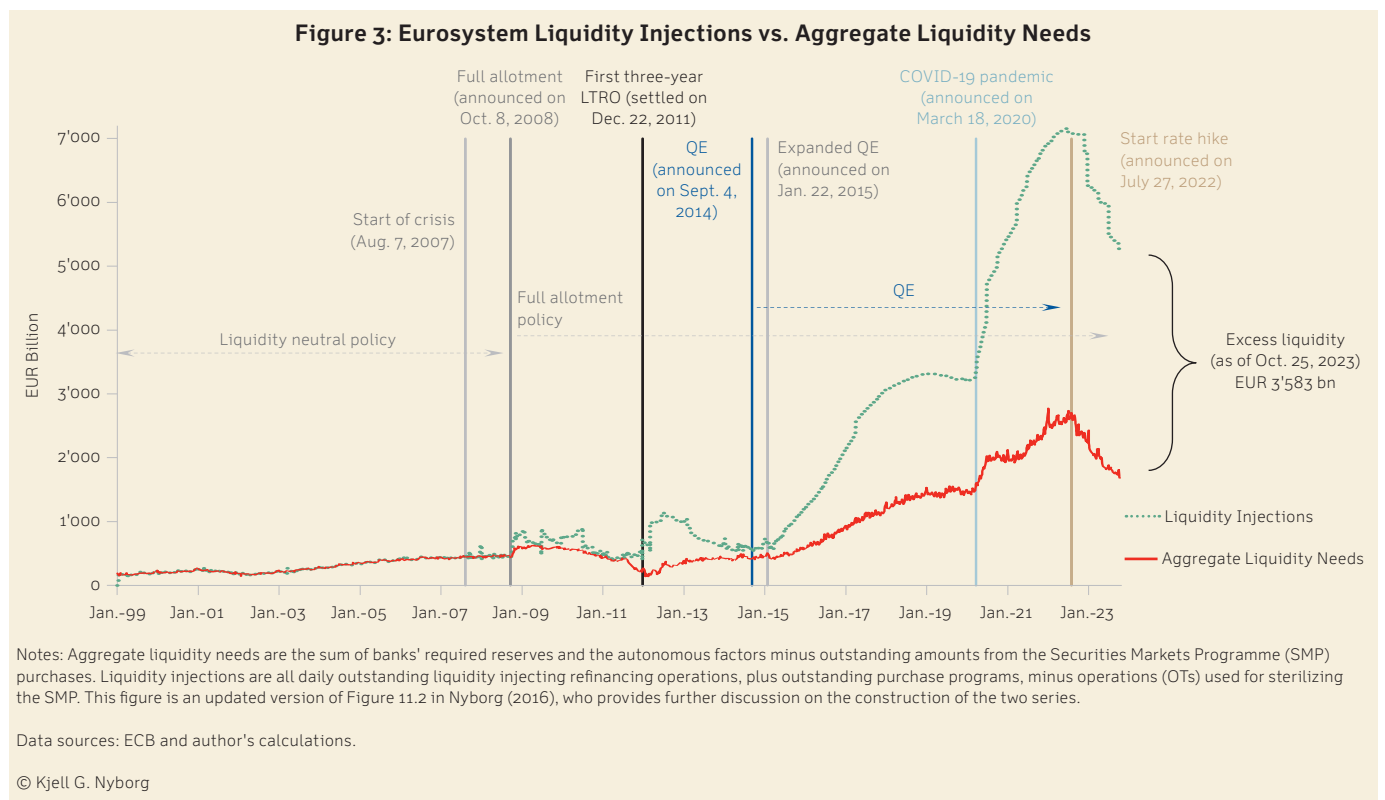


# Spiral of increasingly accommodative policies

During the financial crisis, and especially after the bankruptcy of Lehman Brothers in the autumn of 2008, the flow of money and credit was severely impeded. To keep markets from becoming unhinged, central banks altered some of their policies. Their key response was to increase their presence, vis-à-vis banks and other market participants, by injecting vast amounts of liquidity (reserves) into the financial system. Providing liquidity against good collateral and at a penalty rate is the traditional recipe for dealing with a liquidity problem at an individual bank, as prescribed by Bagehot in 1873. In response to the turmoil that ensued after Lehman's default, central banks essentially applied the Bagehot rule to the financial system as a whole. This was influenced by lessons from the US stock market crash in 1929 and the Great Depression of the 1930's which suggest that the economic downturn would have been less severe if the Fed had provided liquidity more easily to ease deflationary pressure and to stimulate bank lending (Bernanke, 1983; Friedman & Schwarz, 1963). What is surprising, however, is that many of the policies put in place after the financial crisis ran for years on end, with some still being in force today. Furthermore, the policies became more accommodative over time in the

sense that the liquidity injections picked up pace and excess liquidity in the system grew. This is surprising because we typically think of a liquidity problem as being a relatively short-term phenomenon. It was eventually the emergence of stubbornly high inflation levels in 2022, substantially above central banks' targets, that led central banks to finally put the brakes on the spiral of ever more accommodative policies.

Figure 3 illustrates the spiral of increasingly accommodative liquidity policies in the euro area. The graph shows (i) the aggregate liquidity needs of euro area banks (red line) and (ii) Eurosystem liquidity injections (green line). From the inception of the euro in January 1999 to October 2008, these two quantities coincide, due to the liquidity neutral system described above (see Figure 2). This system relies on the interbank market to reallocate reserves between those banks that have too much and those that have too little. Borrowing in the interbank market is typically much cheaper than tapping the central bank's marginal lending facility. It is also disadvantageous for a bank with excess liquidity not to lend it out, because of the low interest rate earned at the central bank's deposit facility.





This promotes interbank activity. However, after the Lehman bankruptcy, many banks with excess liquidity feared lending it out to banks with shortages. The interbank flow of reserves slowed. In response, the ECB introduced the full allotment policy under which banks would get whatever quantity of reserves they asked for in the Eurosystem's main and longer-term refinancing operations at a fixed rate. After this policy change, Eurosystem liquidity injections began to exceed aggregate liquidity needs. Although the full allotment policy seemed a sensible response to a severely stressed interbank market, it would also have been possible for banks with liquidity shortages to sell assets, such as government bonds. But such sales could have exacerbated the downward pressure on the prices of these assets, which was viewed as undesirable. Although an emergency measure, the full allotment policy is still in place at the time of writing, more than fifteen years later.

That this emergency policy is still in effect suggests that the underlying issues that motivated it have not been resolved. Indeed, excess liquidity has increased dramatically over the years, facilitated by large liquidity-injecting operations with multiyear maturities, as well as by the policy of quantitative easing (described below). Before the financial crisis, there was no systematic excess liquidity, and the total quantity of reserves stood at less than EUR 500 billion. In 2011-2012, the ECB held two three-year longer term refinancing operations (LTROs) that provided banks with approximately EUR 1 trillion in total. Subsequent quantitative easing asset purchases and targeted longer term refinancing operations (TLTROs) brought the amount of excess liquidity in the euro area to a peak of around EUR 4.8 trillion in November 2022. By October 2023, this was reduced to EUR 3.6 trillion. This reduction is explained by TLTRO repayments, rather than by Eurosystem asset sales.





# Market discipline

Market discipline speaks in favor of smaller central banks with tighter liquidity policies. Loose, accommodative liquidity policies can help during a crisis, but they have adverse effects over the long run. If banks can get whatever they need directly from a central bank, their incentive to trade among themselves is reduced and market discipline suffers. In the liquidity neutral system described above, in which banks reallocate reserves from those that have too much to those that have too little, lenders have incentives to monitor borrowers. Banks with bad credit have to pay a premium or, in the worst case, are denied credit altogether. This system creates incentives for banks to improve their performance and solidity. It puts pressure on poorly performing banks and, potentially, weeds them out or accelerates their restructuring.

Even a liquidity neutral system, however, does not guarantee effective market discipline. An accommodative collateral policy can undermine it. For example, within the German banking sector before the financial crisis, there is evidence that relatively poorly performing banks with relatively low quality collateral received an overweight of reserves in the Eurosystem's operations (Fecht et al., 2016). When weak banks with bad collateral are the lenders in the interbank market, because they receive an overweight of reserves from the central bank, market discipline suffers.





# Quantitative easing

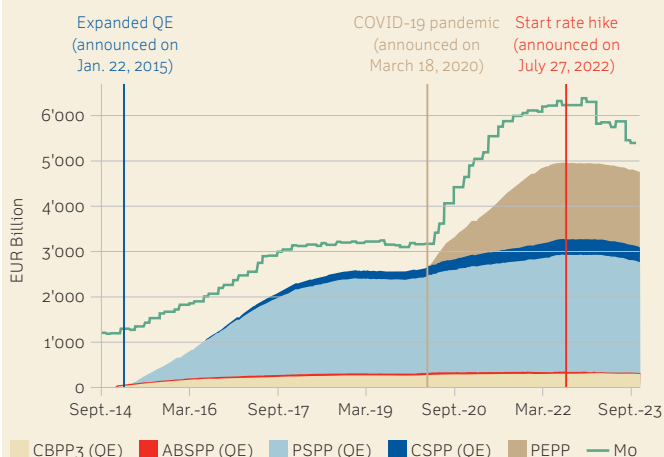
In September 2014, the ECB announced that it would follow in the footsteps of other central banks, notably the Fed and the Bank of Japan, and start quantitative easing (QE). This is a policy whereby the central bank buys assets in unsterilized operations. In colloquial terms, the central bank buys chosen securities with freshly printed money. As a result, excess reserves increase. In the euro area, the assets to be purchased were initially covered bonds and asset-backed securities (ABSs). In January 2015, the ECB announced that it would also buy public sector securities, such as government bonds. The announcement came a week after an interim ruling by the European Court of Justice that essentially gave the green light for the Eurosystem to buy government bonds, which it began doing in March 2015. As shown in Figure 3, this policy change precipitated a very large increase in excess liquidity.

Under the Covid-19 pandemic emergency program, which also consisted mostly of buying government bonds, excess liquidity subsequently more than doubled. A strong central bank response to the pandemic, involving large-scale government bond

purchases, was not unique to the ECB. The balance sheets of the Fed, the Bank of England, and other central banks also show sharp growth around this time (see Figures 1a and 1b).

Just as a full allotment policy provides support to banks that have difficulty finding the reserves they need in the interbank market, QE provides support to the entities whose securities are being bought by a central bank. Figures 4 and 5 show that, in the euro area and the US, central banks have predominantly bought government bonds (known as Treasury securities in the US). At the same time, the indebtedness of many countries has grown. Figure 6 shows that the overall debt-to-GDP ratio in the euro area grew from less than 70% before the financial crisis to around 92% in 2022, with the Italian debt-to-GDP at 144%. Reflecting its weak fiscal position, Italian ten-year yields have traded at an average of approximately 1.65 percentage points above German ten-year yields since the start of public sector QE. From October 2022 to October 2023, the Italy-Germany spread averaged to approximately 1.85 percentage points. But even the German debt-to-GDP ratio has rarely been below the

**Figure 4: Eurosystem QE Purchase Programs and Monetary Base**

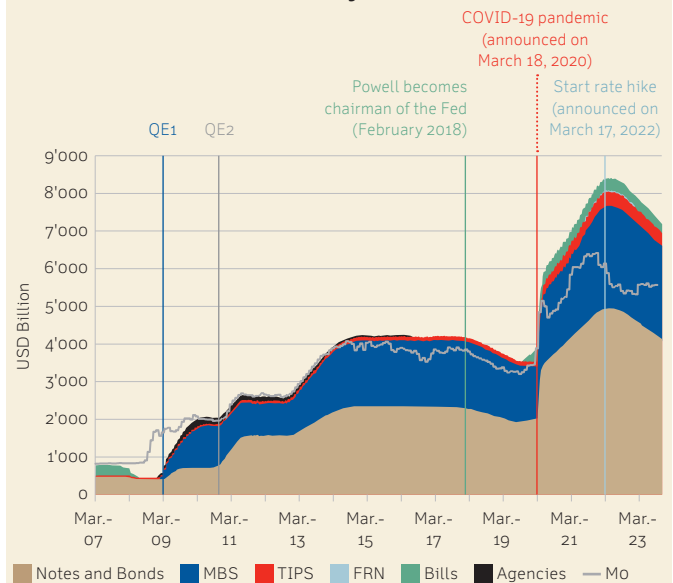


Notes: Figure 4 shows the aggregate outstanding amounts of the Eurosystem's QE purchase programs for the period September 4, 2014 (when QE for ABSs and covered bonds were announced) to October 25, 2023. CBPP stands for covered bond purchase programme; ABSPP stands for asset-backed securities purchase programme; PSPP stands for public sector purchase programme; CSPP stands for corporate sector purchase programme; PEPP stands for pandemic emergency purchase programme; Mo is monetary base.

Data source: ECB.

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**Figure 5: Fed QE Outright Purchases and Monetary Base**

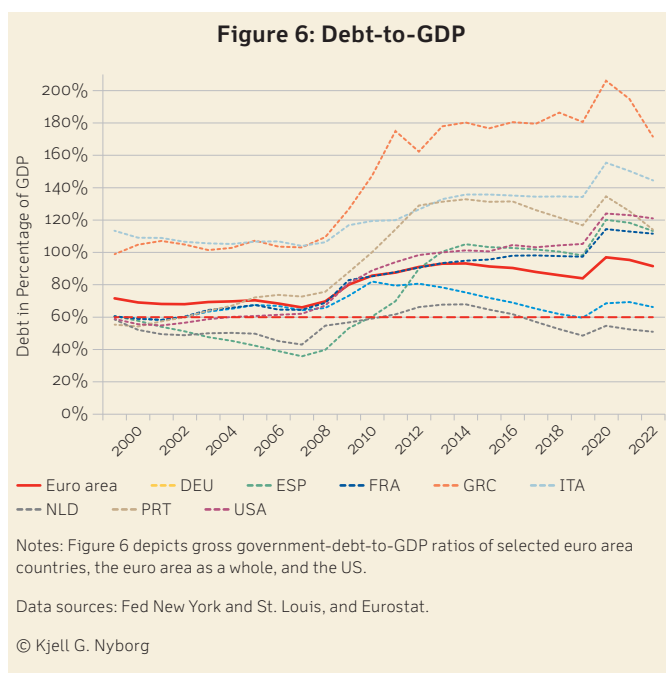


Notes: Figure 5 shows the aggregate outstanding amounts of the Fed's QE outright purchases for the period March 21, 2007 to October 25, 2023. Notes stands for T-Notes; MBS stands for mortgage-backed securities; TIPS stands for treasury inflation-indexed securities; FRN stands for floating-rate notes.

Data sources: Fed New York and St. Louis.

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Maastricht treaty's ceiling of 60%. France, the second largest economy in the euro area, had a debt-to-GDP ratio of 111% in 2022, up from 64% in 2006 and 96% in 2015. The fiscal position of the US has also weakened over time. Figure 6 shows that the US debt-to-GDP ratio hovered around 60% before the financial crisis, but ballooned to more than 120% by the end of 2022. Central bank purchases of government bonds have facilitated the increase in government borrowing seen in Figure 6. If central banks had not purchased these bonds, it is not clear who would have done so, or at what rate.



One line of argument is that central banks stepped in when the financial crisis hit back in 2007/2008, saved the day, and prevented another crisis through their increasingly accommodative policies. Another perspective is that, while their actions were necessary at the height of the crisis, the central banks' generous liquidity policies have weakened market discipline and encouraged ever more government debt. Weakening market forces weakens the efficiency of the economy; resources do not flow to where they yield the best returns, and the overall society suffers. The apparent need for ever more accommodative policies suggests an underlying problem that is getting worse, not better.

In the euro area, it is well known that while the Eurosystem has been buying government bonds across the board according to the capital key, there are large and systematic one-directional money flows out of some countries and into others. Figure 7 depicts the Target 2 balances, which reflect cross-country flows, between 2007 and 2023. The largest outflows are from Italy and Spain, with the largest inflow, by far, being to Germany. When money flows from an Italian bank account to a German bank account, for example, reserves are debited from the Italian bank's reserve account with the *Banca d'Italia* and an equal amount is credited to the German bank's reserve account with the *Deutsche Bundesbank*. To make this work, a liability is created on the balance sheet of the Banca d'Italia, with a corresponding asset on that of the Deutsche Bundesbank (with the ECB in the middle). The Target 2 balances capture these inter-system liabilities and credits. While we call them "balances," large Target 2 debits and credits reflect large inter-system imbalances. Sinn (2014) shows that these imbalances were extremely small, almost zero, prior to the financial crisis, as one can also see from Figure 7. By July 2023, the total imbalance had grown to around EUR 1.7 trillion.

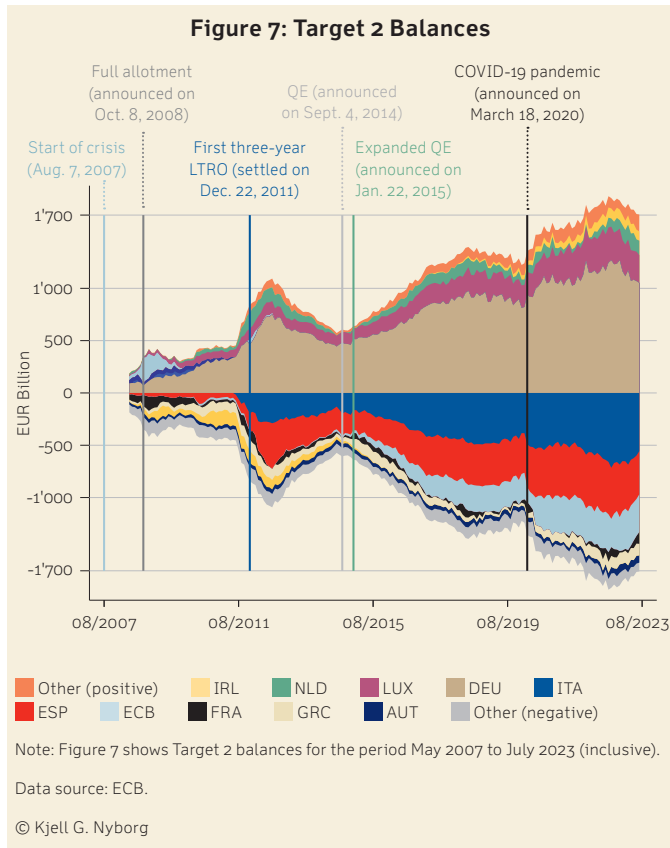


Figure 7 helps complete the picture of what has been happening in the euro area since the financial crisis as regards government debt and monetary production and flows. We know that the Eurosystem has injected huge amounts of reserves into the system by buying government bonds and other securities. At the same time, government indebtedness has risen relative to GDP overall and, especially, in major economies such as Italy, Spain, and France (Figure 6). Thus, the Eurosystem can be viewed as having facilitated a large expansion of government debt. Although monetary financing is not legal, the courts have ruled that central bank purchases of government bonds are allowed, as long as they comply with the principle of proportionality and take place in the secondary market. A problem, however, is that much of the money that has been injected by the Eurosystem is essentially fleeing more indebted countries to less indebted countries. Even the ECB itself has become a large net debtor to its owners, the NCBs. It is hard to see how this overall pattern can be sustainable or to predict how it will end.



# Fragmentation within the euro area

Maintaining a single monetary policy for a disparate set of economies within a currency union is likely to give rise to imbalances and differences of some form or another. In turn, these imbalances can influence policy to maintain the union. In the euro area, imbalances show up as fragmentation across member states—fragmentation that has been persistent since the onset of the financial crisis. The growing Target 2 imbalances in Figure 7 are one element of this. As reserves flow out of the Italian and Spanish banks into those of Germany, something must be done to maintain functional payment and banking systems, as well as government funding. The injection of excess reserves helps replenish the reserves of banks in countries with large outflows, thereby helping maintain the banking system across the euro area, as well as the euro itself. Yet the outgoing head of the ECB's Supervisory Board, Andrea Enria, is quoted as saying that the euro area banking market is becoming "more and more segmented along national lines," which creates an "element of risk" (Arnold & Noonan, 2023).

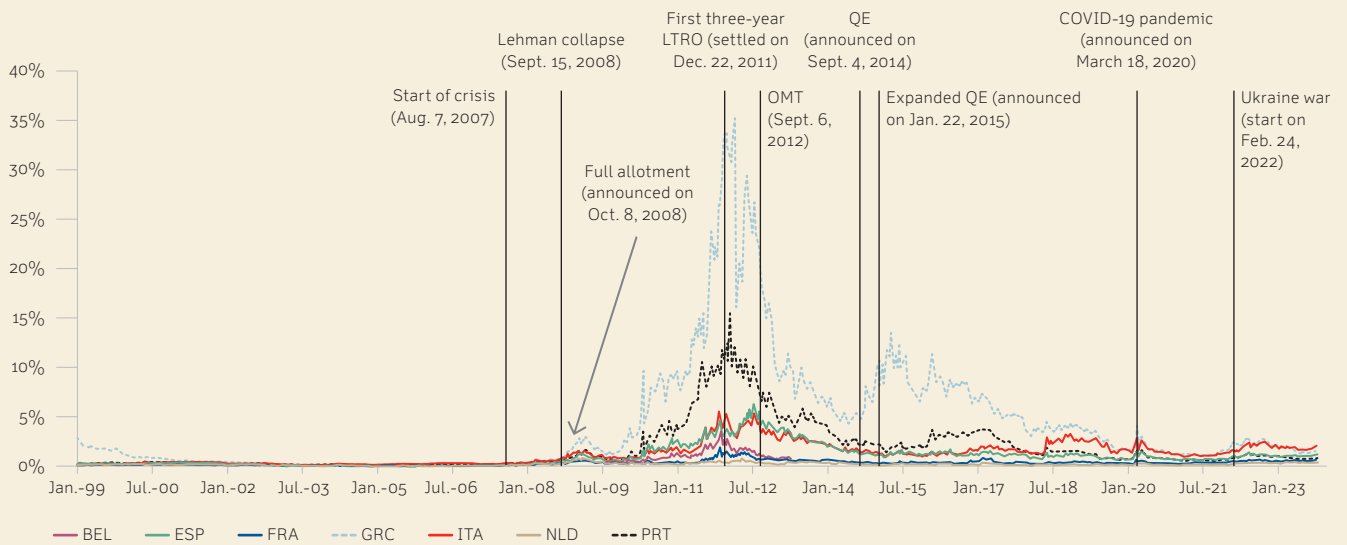
It is sometimes argued that the growing Target 2 imbalances after the onset of QE do not represent capital flight, but are merely a technical byproduct of NCBs buying predominantly their own country's bonds combined with many sellers banking in other countries (Auer & Bogdanova, 2017; European Central Bank, 2020). For example, when the *Banco de España* buys a Spanish government bond from an investor with a bank account in Germany, this gives rise to a Target 2 liability for the Banco de España and a corresponding credit for the Deutsche Bundesbank. But it does not involve a movement of deposits from a Spanish bank account to a German one. While this is technically correct, the fact that the Banco de España's Target 2 liabilities have been rising over time means that the investors with foreign bank accounts who are selling Spanish bonds are not reinvesting those funds in Spain. This is just another expression of capital flight.

An important dimension of fragmentation is the large range in borrowing costs across euro area member states. Figures 8a and 8b plot ten-year yields of selected government bonds as spreads over German ten-year yields. Until the spring of 2008, these spreads were close to zero. They reached their peak at the height of the sovereign debt (or euro) crisis, from around November 2011 to March 2012. While they are lower now, they are fairly similar to what they were in the autumn of 2008, after the Lehman bankruptcy. Such fragmentation is a concern to the ECB because it may impede the transmission of monetary policy. Very high borrowing costs and indebtedness levels are a strain on national finances and on the common currency. The persistence of euro area fragmentation reveals that there are significant underlying differences across euro area member states that years of ultra-loose monetary policy have not resolved. The issue became acute for the ECB in 2022, when it had to start tightening its policies in response to significant inflationary pressure. Thus, when the ECB started hiking rates in the summer of 2022, it also announced new policies that allow for Eurosystem government-bond purchases and holdings to deviate from the capital key. One such tool is the Transmission Protection Instrument, which "can be activated to counter unwarranted, disorderly market dynamics that pose a serious threat to the transmission of monetary policy across the euro area" (European Central Bank, 2022). The idea is that it may be necessary to buy government bonds to fight yield spreads that are deemed to be too high. In the future, Eurosystem bond holdings may thus be skewed toward relatively highly indebted countries with large yield spreads.

Mario Draghi, the former president of the ECB, famously declared in 2012 that "within our mandate, the ECB is ready to do whatever it takes to preserve the euro" (Draghi, 2012). This statement shows that, although the ECB has a great deal of independence with respect to how it chooses to wield the tools and power it has, preserving the euro is its overriding objective. If the euro is threatened by fragmentation, then addressing this is the number one priority. Many of the ECB's policies in recent times can be understood from this perspective.



**Figure 8a: Sovereign Yield Spreads (10 Years) Relative to Germany Since 1999**

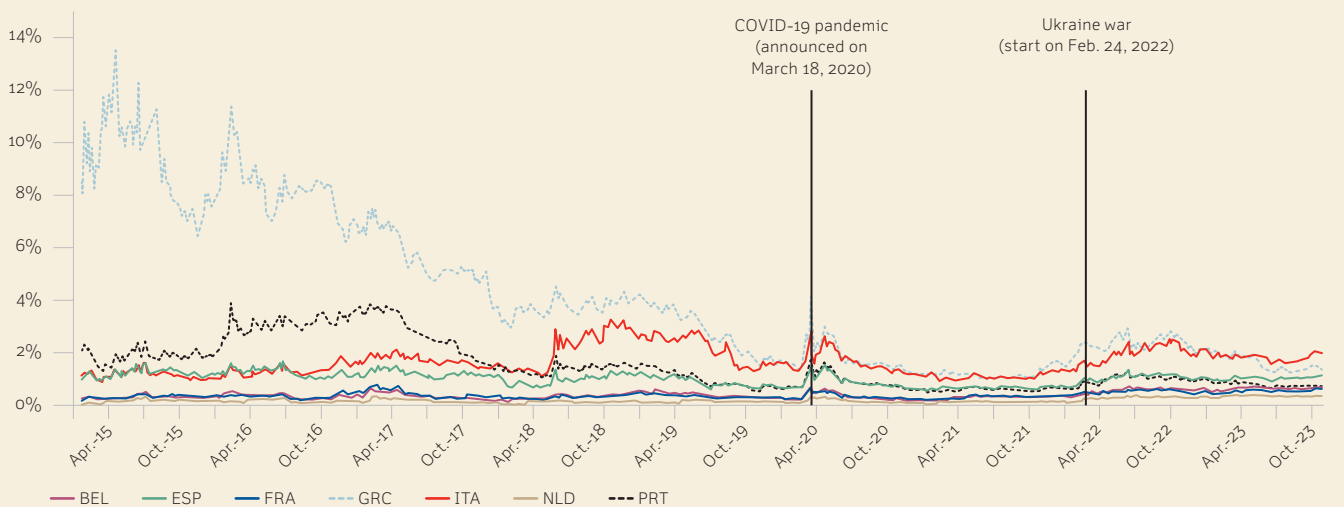


Notes: The data for figure 8a is based on the yields of the on-the-run ten-year sovereign bonds for each country on a daily basis. The figure is an updated version of Figures 12.1a and 12.1b in Nyborg (2016).

Data source: Bloomberg.

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**Figure 8b: Sovereign Yield Spreads (10 Years) Relative to Germany Since Public Sector QE**



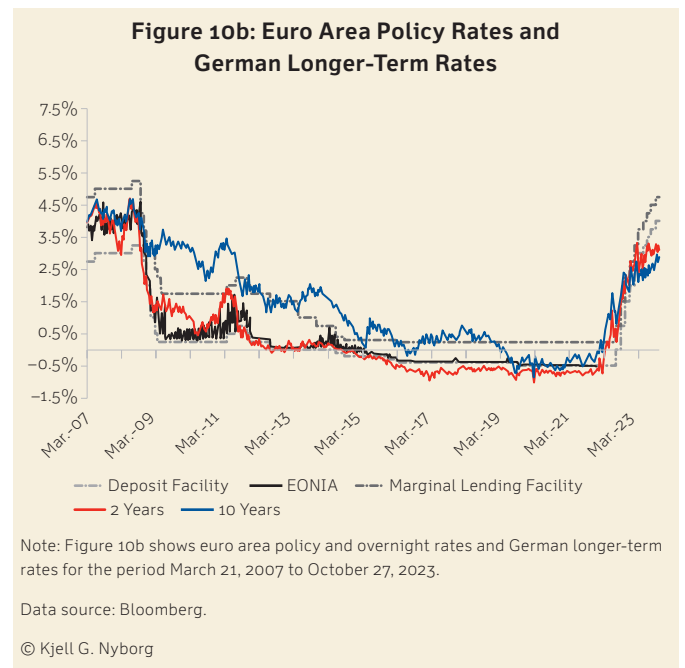
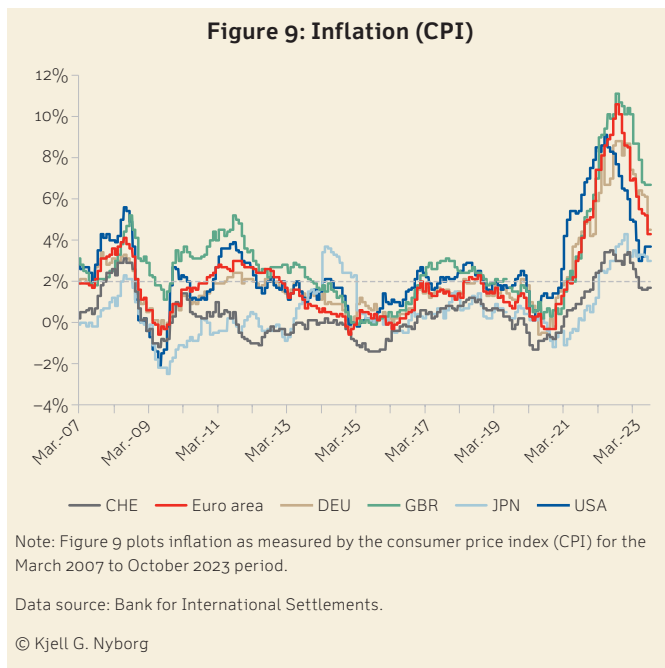
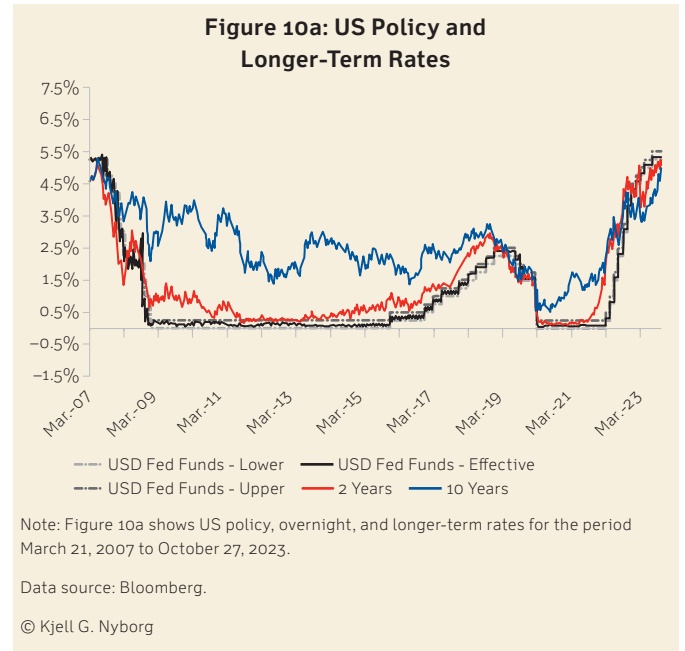
Note: Figure 8b repeats figure 8a for the period January 2015 (announcement of public sector QE) to October 2023.

Data source: Bloomberg.

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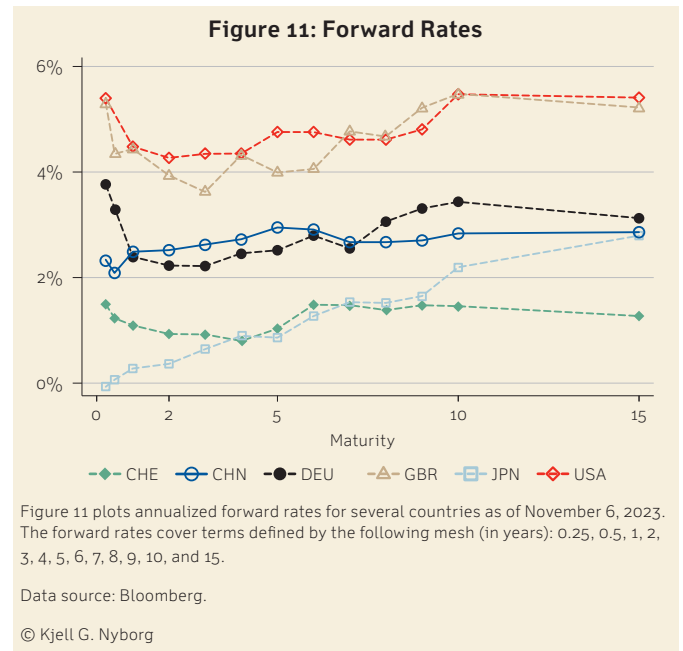
# Interest rates and inflation

Central banks are, by and large, tasked with ensuring price stability, with inflation targets typically set at around 2%. As seen in Figure 9, central banks' recent track record is mixed. The great recession that accompanied the financial crisis, involved strong deflationary pressure that, in turn, led central banks to set interest rates at or close to zero for many years. In the euro area, the rate was even negative until July 2022, when soaring inflation could no longer be ignored. As inflation rates started shooting up in late 2021 and early 2022 to 1970s levels, central banks had to act. As seen in Figures 10a and 10b, the Fed and the ECB responded by increasing policy rates to try to cool the economy and get inflation down and closer to target. Longer-term rates also increased. Along with central bank balance sheet reductions, these rate increases have had an effect. Inflation has come down, although at the time of writing it is still excessive. Some countries have also experienced periods of negative real growth as central bank policies have tightened.



While central bankers have argued that inflation picked up as a result of supply-chain problems associated with the outbreak of Covid-19 and the surge in energy prices triggered by the Russia-Ukraine war, we also know that some central banks flushed the market with reserves and bought large amounts of government bonds as government debt rose. Some of these central banks subsequently oversaw inflation rates multiple times above their targets. One argument is that years of loose monetary policy—exemplified by low interest rates and large quantities of excess liquidity—finally had to be paid for in the form of very high inflation. The quantity theory of money says that inflation is a reflection of the quantity of money. In its most simple form, it says that the more money there is, the less the money is worth, and so, the more money you need to buy goods and services. Inflation is a tax on consumers because the money they hold is worth less. At the same time, high inflation can help deflate government debt, since this debt is, for the most part, not inflation-linked. Whereas inflation hurts consumers by making their money worth less, it can help governments by reducing their debt in real terms.

To battle inflation, many central banks have recently signaled that they will keep interest rates "higher for longer" (Cox, 2023). To get a sense of how long this might be, Figure 11 plots forward rates for four western and two Asian countries, as implied by government bond yields at the beginning of November 2023. This poll, so to speak, of bond-market participants predicts that interest rates are expected to come down by a percentage point or so over the next one to two years in western economies and increase by about half a percentage point in the two Asian countries. The market evidently puts little weight on scenarios where rates will once again dip to zero. Over the medium term, German and Chinese rates are predicted to level off around 2 percentage points below those of the US and the UK, with Switzerland and Japan yet another 1.5 percentage points lower. Inflationary pressures and economic conditions are evidently different across countries and regions.





# The Swiss National Bank

The growth in the balance sheet of the SNB is also the result of QE. But, in contrast to the Fed and the Eurosystem, the SNB has not been creating money to buy predominantly its own government's bonds, but rather to buy foreign bonds and equities. The idea is that this would keep the Swiss franc weaker than what it otherwise would be and, thereby, help Swiss exporters stay competitive without wages being reduced or jobs lost. By doing the reverse, that is, selling bonds and buying francs, the SNB can now strengthen the franc to reduce the inflationary pressure coming from increasingly high foreign currency import prices. While this countercyclical policy can

help stabilize prices, it comes at a cost. The bonds that the SNB bought when rates were low have decreased in value as interest rates have increased, thus causing the SNB to experience losses on its substantial foreign bond holdings. Its equity holdings have also been vulnerable to rising interest rates. At their height in 2021, the SNB's foreign currency investments stood at CHF 966 billion, approximately 30% more than Swiss GDP that year. In 2022, the SNB booked an overall loss of CHF 132 billion, and its equity shrank by CHF 116 billion, which contributed to the reduction in the balance sheet of the SNB shown in Figure 1a.





# Central bank losses and capital ratios

The SNB is not the only central bank to experience losses on its security holdings from past QE. However, not all central banks are as transparent as the SNB. Many do not mark their holdings to market, that is, value the security holdings in their balance sheets at actual market values. This makes it difficult to gauge their losses. Nonetheless, a recent International Monetary Fund (IMF) working paper estimates that valuation losses to the Eurosystem's QE holdings were EUR 758 billion in 2022 (Belhocine et al., 2023). This amount is approximately 5.7% of euro area GDP in 2022. The same IMF paper estimates that these losses will increase to approximately EUR 1 trillion in 2023, or 7.2% of GDP. However, as Belhocine et al. (2023) also write, "under the applicable accounting norms, unrealized gains or losses on the QE portfolio do not feed through the income statement or reflect on the balance sheet" (p. 19). The Fed also does not mark its holdings to market, but reports unrealized gains or losses. As of June 2023, its cumulative valuation losses amounted to approximately USD 1 trillion. In addition, cumulative earnings losses, booked as "deferred assets," were USD 75 billion.

What the impact of these losses will be is open to debate. However, as noted above, the heads of the Swiss and Dutch central banks expressed concerns more than ten years ago about potential central bank losses and the specter of negative capital. In 2006, the capital ratios of the Fed, the Eurosystem, and the SNB were 3.5%, 5.8%, and 53.8%, respectively. At the end of 2022, the corresponding numbers were approximately 0.5%, 1.5%, and 10.0%, with reported capital being USD 41.8 billion, EUR 120.2 billion, and CHF 88.4 billion, respectively. Thus, the Fed's and the Eurosystem's equity capital would be negative if assets were marked to market. The Fed's cumulative earnings losses are also sufficient to wipe out its equity. Overall, these trends have reignited a debate on the importance of central banks' finances. While examples exist of central banks operating with negative equity over prolonged periods, we cannot rule out the possibility that losses, negative equity, or adventurous policies can erode public confidence in central banks and their money. The rise of Bitcoin and other cryptocurrencies since the financial crisis and the onset of QE could be viewed in this light. Losses and negative equity do not disappear just because they are not booked as such.

# Central bank digital currencies

One of the most hotly debated and politicized monetary topics in recent years is the potential introduction of central bank digital currencies (CBDCs). These are electronic, or digital, money issued by central banks. They can be viewed as a response to the cryptocurrencies offered by private, potentially decentralized, entities. CBDCs can be tailored to the wholesale market, as a substitute for reserves; or to the retail market, as a substitute for banknotes or regular bank deposits. According to a Bank for International Settlements survey of central banks in 2021, 86% were actively looking into CBDCs, 60% were experimenting with the technology, and 14% were running pilot projects (Bank for International Settlements, n.d.). The SNB announced a pilot project for wholesale CBDC in November, 2023.

Some voices in the banking world have expressed caution and skepticism. Commenting on retail CBDCs, Fed Governor Michelle Bowman recently noted that:

The potential benefits of a US CBDC remain unclear, and the introduction of a US CBDC could pose significant risks and tradeoffs for the financial system. These risks and tradeoffs include potential unintended consequences for the US banking system and considerable consumer privacy concerns. (Bowman, 2023)

Consumer privacy is also acknowledged as a concern in an SNB working paper by Chaum et al. (2021) and by the ECB, which announced the start of a retail digital euro preparation phase in November 2023. As explained "the Eurosystem would not have access to or store users' personal data" (European Central Bank, 2023). But this does not exclude the possibility that other agencies would.

For some, the potential for government intrusion and surveillance override any of the potential benefits of CBDCs. There is a fear that transactional freedom can be compromised; for example, technology could allow someone's CBDC wallet to be turned on or off contingent on circumstances. Ron DeSantis, the governor of Florida, signed a bill in March 2023 that "prohibits the use of a federally adopted central bank digital currency (CBDC) by excluding it from the definition of money within Florida's Uniform Commercial Code" (DeSantis, 2023).

As explained by DeSantis (2023):

The government and large credit card companies should not have the power to shut off access to your hard-earned money because they disagree with your politics. Biden's Central Bank Digital Currency aims to increase government control over people's finances, and we will not allow it. In Florida, we value personal freedom and won't allow self-interested elites to chip away at our liberty.

Money that, in an extreme scenario, can be turned on or off is very different from the money that we are familiar with. Today's banknotes are fully fungible and have no contingencies attached to their use. A related concern is that CBDCs may allow central banks to impose negative interest rates on consumers. Some proponents of CBDCs view this ability as an advantage, in terms of monetary policy.

As alluded to in the quote from Governor Bowman above, CBDCs also raise other concerns. The nature of banking can change in ways that are hard to predict. If individuals and firms can have accounts at central banks, bank runs could potentially occur more easily. Larger central bank footprints will put pressure on their collateral frameworks. The larger they become, the more central banks will have to be in the business of assessing and valuing collateral, and the more likely it is that they may have to take lower quality collateral onto their balance sheets. Larger central banks can erode market forces further and magnify the impact of potential mistakes. Bindseil (2023) provides further discussion on the pros and cons of CBDCs.

# Final remarks

Since the financial crisis, central banks around the world have run ultra-accommodative monetary policies. Policy rates have been historically low, in some cases even being negative, and trillions of assets have been purchased by central banks with freshly created unsterilized reserves. As a result, central bank balance sheets have reached unprecedented levels and their capital ratios have plummeted. When it became apparent, in 2022, that inflation levels well above central banks' targets were firmly entrenched, these highly accommodative policies were no longer viable. Thus, central banks started tightening monetary policy by raising rates substantially and reducing, or at least not expanding, their asset holdings. This medicine has worked. Inflation levels have come down significantly. In the autumn of 2023, as recessionary forces picked up, central banks such as the Fed, the ECB, and the SNB halted further interest rate increases. The new talking point became "higher for longer," rather than how high rates would go. In some cases, expansionary fiscal policies have continued to put upward pressure on inflation which, in turn, means it is difficult for the central bank to ease up on interest rates. Forward rates, implied from bond prices, suggest that rates may not drop much more than a percentage point or so over the next few years. Interest rates at or close to zero appear to be a thing of the past.

As central banks have raised rates, they have also experienced substantial losses on their vast bond portfolios. In 2022, the SNB marked down its foreign asset holdings by CHF 132 billion to reflect reduced market values. While the SNB had enough capital to absorb these losses, other central banks, if they had recognized valuation losses, would have seen their equity wiped out. This situation has reignited interest in the question as to whether central banks can operate efficiently with negative capital. In some quarters, it is said that negative equity does not matter and it is emphasized that, unlike other banks, central banks can hardly go bankrupt; they can always settle claims in their own currency by printing more of it. After all, they are the monopoly issuers of the ultimate money in their economies. However, substantial central bank losses imply large transfers of wealth from some agents in the economy to others, alternatively, large losses for all. Printing money to cover a central bank's losses would result in inflationary pressure and losses to consumers. Money would be worth less.

Large central bank losses are hardly desirable, but are a risk when central banks hold large asset portfolios. Policies where central banks expand their balance sheets in bad times, when rates are low, and reduce them in better times, when rates are high, inevitably put pressure on central banks' profitability and on their equity capital.

By its nature, an accommodative liquidity policy impedes market discipline. When the central bank becomes the main counterparty to banks in the market for reserves, banks' incentives to monitor each other are reduced. The incentive for information production in the private sector is curtailed. It is difficult to restore market discipline in the banking sector in systems with large quantities of excess liquidity. When the central bank becomes a major buyer of assets, the importance of market forces is reduced in asset markets as well. In a liquidity crisis, central bank intervention can mitigate the situation. What is surprising, however, is that the loose, accommodative policies enacted in response to the financial crisis have lasted so long. This points to underlying problems that have not been resolved. Although central banks have started reducing their balance sheets, it may well be that they will remain "larger for longer."

Different central banks face different, if not wholly unrelated, challenges. In the US, fiscal expansion has been substantial and government debt has reached levels that are unprecedented in the post-WWII era. The bond market is signaling that interest rates will have to stay "higher for longer" to attract buyers to US Treasury securities, as the Fed starts to reduce its balance sheet. In the euro area, the ECB is continuing to grapple with the problem of fragmentation, which to a large extent has an underlying fiscal explanation. Ultra-accommodative policies have not resolved this problem, but have simply pushed it down the road. As expressed by de Larosière (2023), former governor of the *Banque de France* and former president of the European Bank for Reconstruction and Development, "ultra-accommodative ECB monetary policies ... have disincentivised structural reforms. ... The ECB's quantitative easing reduced problems caused by spreads in bond yields but heightened general indebtedness and the vulnerability of the financial system."

As emphasized by Nyborg (2016), resolving the problems in the euro area is especially challenging because the member states are sovereign nations. Central banks exercise their power on a stage that is largely set by governments. Dealing with fragmentation by buying the bonds of highly indebted nations with large borrowing costs is unlikely to resolve the underlying problem. Fragmentation in deficits and indebtedness will have to be addressed in a more fundamental way. de Larosière (2023) goes as far as to say that "unless new policies are forthcoming, a new euro crisis could erupt sooner or later."

The monopoly right to issue the ultimate money has long been viewed as a source of economic power. It is not without reason that the creation of central banks in democracies such as the US and Switzerland were fiercely debated. In the US, the debate goes back to its founding days. One of the fears was that a government-controlled central bank would strengthen the hand of the federal government. Although the central banks covered in this note have operational independence, they are not detached from their governments. With some variations, their chiefs and governing bodies are appointed by heads of state or government or political bodies, they are largely owned by the state, they pay dividends to the state, and they answer to the state. Central banks' power is ultimately bestowed on them by the state. Their policy mandates are, naturally, also given by the state, although the banks often have substantial flexibility in interpreting these mandates. Given that central banks are attached to the state, it is not surprising if they end up accommodating the policies of government. The primary feature of the policies run by some central banks since the financial crisis is the creation of money to buy government bonds at ultra-low interest rates. In some countries, governments were able to increase their borrowing substantially at rates close to, or even below, 0%. Governments running large deficits would seem to be the primary beneficiaries of central banks' ultra-accommodative policies.

Our experience with experimental, ultra-loose monetary policies over the last fifteen years is not uniformly positive and raises questions. For example, how big should central banks' footprints be? How broad should the set of actions they can take be? How close should their links to government be? Central banks have mandates to foster stability in prices, the financial system, and the economy as a whole. This is challenging and outcomes are not always as expected or desired. The economy is an extremely complex system. Because it is so hard to get monetary policy right, because of the risk of significant negative unintended consequences, and because of the influence of government, a case could be made that, like other public bodies of power, central banks should be subject to independent checks and balances. This seems to be an especially pertinent issue now that technology is making it possible for governments and central banks to increase monetary control to levels not imaginable when they were set up or even just a generation ago, for example, through CBDCs. Depending on their designs and uptakes, CBDCs could potentially introduce a Pandora's box of far-reaching and unintended consequences.

The advisability of constraining discretion and restraining power has been understood through the ages. In the *Odyssey*, Homer famously illustrates this ancient and immutable wisdom in his tale of Odysseus' homeward voyage after the Trojan War. On this journey, Odysseus sails by the island of the Sirens, whose irresistible song, he is warned, lures any sailor who hears it to the Sirens and certain death. Odysseus, wanting to hear the song and live, has his men tie him to the mast of his ship and stuff beeswax into their own ears so that they cannot hear the Sirens' song, or Odysseus' inevitable commands to untie him and to steer the ship toward the Sirens. The question is whether governments and central banks should also be tied to the mast, with respect to monetary adventures, if feasible.



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