European Rates Viewpoint

ECB balance sheet primer

Primer

06 July 2023

Rates Research
Europe

Key takeaways

- The ECB is unwinding its balance sheet from historical highs
- This primer discusses the key assets and liabilities of the central bank
- We explain how changes in the central bank balance sheet could interact with front-end euro rates

The ECB is reducing its balance sheet…

In the euro area, the central bank's balance sheet peaked at a record c. €9trn in mid-2022 following its response to the Covid shock. This was equivalent to c. 70% of GDP. Since then, the European Central Bank (ECB) has allowed its balance sheet to decline in absolute terms and as a share of GDP, as the monetary stimulus it provided is gradually unwound.

… we discuss both sides of its balance sheet…

This primer discusses the key components on both sides of the ECB's balance sheet. On the asset side, we discuss the mechanics of the central bank's quantitative easing (QE) portfolio and lending operations: these two components accounted for c. 80% of the central bank's assets at the end of 2022. On the liability side, we discuss bank reserves, and liabilities to euro area general governments and to non-euro area residents. We pay particular attention to the remuneration rate on these liability components.

… and explain how it interacts with front-end rates

Three key types of front-end rates in the euro area are: the euro short-term rate (€str), the euro interbank offered rate (Euribor), and repo rates. We define these rates and explain how recent changes in the central bank's balance sheet have impacted them.

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Overview

The Eurosystem comprises the ECB and the national central banks (NCBs) of countries that have adopted the euro. At the time of writing, there are 20 countries that have adopted the euro. The ECB is the core of the Eurosystem. In this report, we discuss the Eurosystem's balance sheet unless explicitly stated otherwise.

In the past two decades, there have been four periods where the Eurosystem's balance sheet increased notably (Exhibit 1). The increase during these periods was driven by the ECB's response to a shock or challenge:

- **2008 global financial crisis**: the Eurosystem's balance sheet increased by c. 35% to €2trn at the end of 2008. The increase was primarily driven by the introduction of fixed rate full allotment.

- **2011-12 sovereign debt crisis**: the Eurosystem's balance sheet increased by c. 50% to €3trn at end-2012. The increase was primarily driven by two three-year longer-targeted refinancing operations (LTROs) and the Securities Market Programme (SMP).

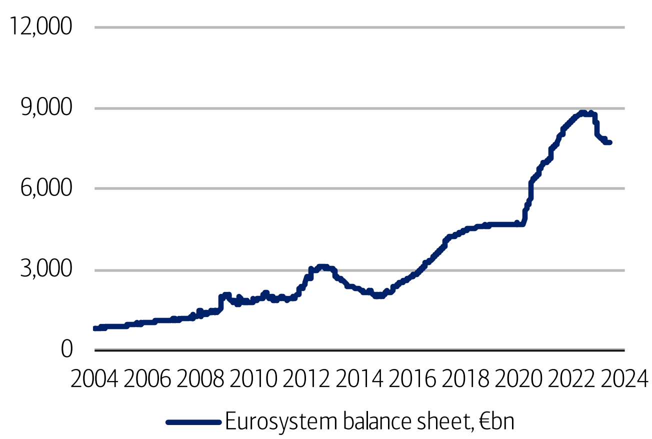
- **2014-16 low inflation**: the Eurosystem's balance sheet increased by c. 60% to €3.7trn at end-2016. The increase was due to the introduction of QE and the targeted longer-term financing operation (TLTRO) I programme.

- **2020-22 Covid**: the Eurosystem's balance sheet increased by c. 70% to €8.0trn at end-2022. The increase was driven by QE and the TLTRO III programme. The peak of the Eurosystem's balance sheet was reached in mid-2022.

As a share of GDP, the share increased from c. 10% of GDP at the end of 2004 to c. 60% at the end of 2022 (Exhibit 2).

The Eurosystem's balance sheet peaked in June 2022 at just under €9trn. Since then, the maturity of TLTRO III operations and the start of quantitative tightening (QT) in April 2023 has caused the Eurosystem's balance sheet to decline.

Exhibit 1: Eurosystem balance sheet
Peak reached in mid-2022 at €8.8trn



Source: ECB

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Exhibit 2: Eurosystem balance sheet as a % of GDP
Peak reached in mid-2022 at c. 70%

Source: BofA Global Research, ECB

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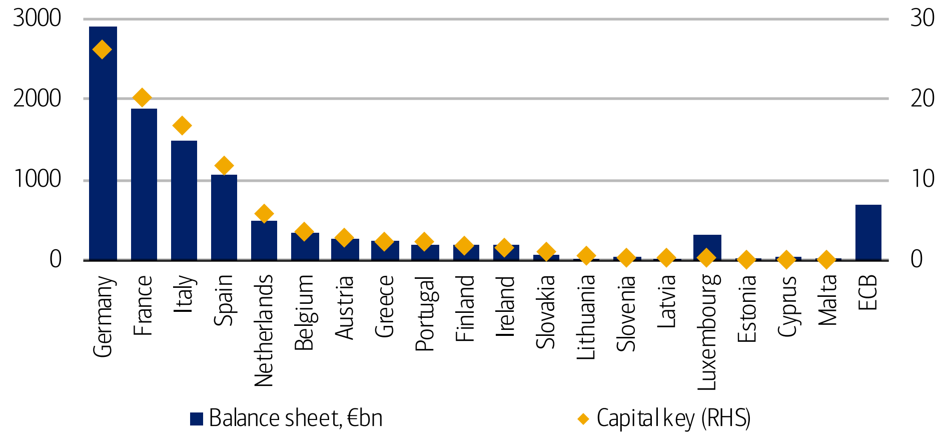
A decomposition of the Eurosystem's balance sheet by the ECB and NCBs show their relative size is generally in proportion to the capital key (Exhibit 3). The capital key equally reflects each country's share in the total population and GDP of the European Union.

To a large degree, the correlation between NCB balance sheet size and their capital key is the result of past QE programmes, where the size of purchases by each NCB was generally proportionate to their capital key weight. Deviations from this relationship tend to be a result of:

- Net purchases via QE programmes that may have deviated from capital key
- Net deposit flows from one euro area country to another, which would be reflected in TARGET2 claims/liabilities

Exhibit 3: NCB balance sheet size and capital key

Balance sheet size generally proportionate to capital key



Source: ECB. Note: capital key are normalised among Eurosystem members. Data as of end-2022.

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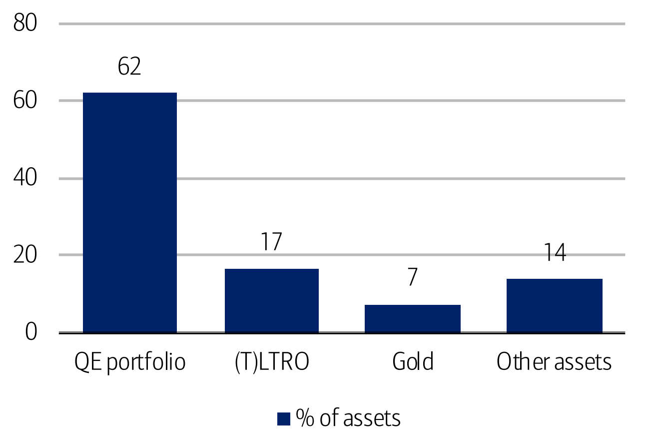
Assets

Assets on the Eurosystem's balance sheet that are directly impacted by the ECB's monetary policy include:

- QE portfolio
- Lending operations, such as (T)LTROs, main refinancing operations (MRO) and marginal lending facility (MLF)

At the end of 2022, the QE portfolio and (T)LTROs accounted for almost 80% of the Eurosystem's assets (Exhibit 4). These components drove much of the Eurosystem balance sheet's dynamics and growth since the global financial crisis (Exhibit 5).

Exhibit 4: Eurosystem assets as of end-2022
QE portfolio and (T)LTROs account for almost 80% of assets



Source: ECB

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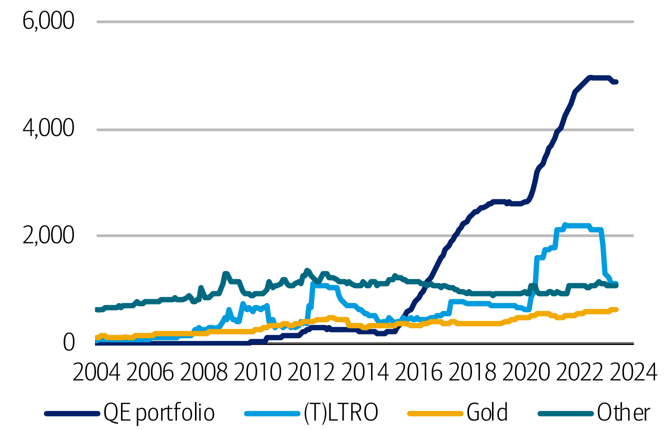
Exhibit 5: Eurosystem assets, €bn
Changes driven by QE portfolio and (T)LTROs



Source: ECB

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QE portfolio

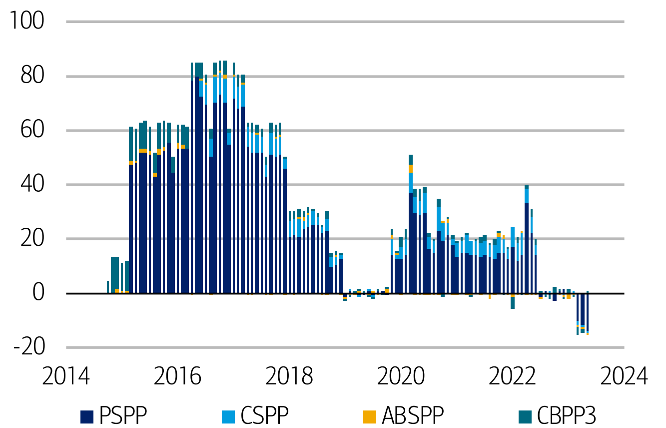
The two programmes

The QE portfolio is divided into two programmes: the asset purchase programmes (APP) and the pandemic emergency purchase programme (PEPP):

- APP: initiated in 2014 to support the monetary policy transmission and provide the amount of policy accommodation needed to ensure price stability. It consists of four programmes: 1) the public sector purchase programme (PSPP), 2) the corporate sector purchase programme (CSPP), 3) the asset-backed securities purchase programme (ABSPP), and 4) the third covered bond purchase programme (CBPP3). Most net APP purchases were conducted in the PSPP portfolio (Exhibit 6). Purchases across markets were to be proportionate to the capital key with temporary deviations allowed, assets must have a residual maturity of between one and thirty years, and purchases of government bonds were subject to a 33% issue/issuer limit. As of end-2022, the size of the APP was €3.3trn and the PSPP accounted for €2.6trn (Exhibit 7). Since April 2023, the ECB stopped full reinvestment in its APP portfolio, marking the start of QT. Since July 2023, the ECB fully stopped reinvestments in its APP portfolio.

- PEPP: initiated in 2020 in response to the Covid-19 shock. It had a pre-defined envelop size of €1,850bn for net purchases until March 2022. Assets eligible for purchase under PEPP included all assets eligible under APP, securities issued by the Greek government, non-financial commercial paper eligible under CSPP with remaining maturity of at least 28 days (vs at least 6 months under CSPP), residual maturity of public sector securities from 70 days up can be bought (from at least 1 year under PSPP). More flexibility on deviation from the capital key and issue/issuer limit was allowed under PEPP. At the time of writing, full reinvestments under PEPP is expected to continue until at least the end of 2024.

Exhibit 6: Net monthly APP purchases, €bn
Majority of net APP purchases made under PSPP



Source: ECB

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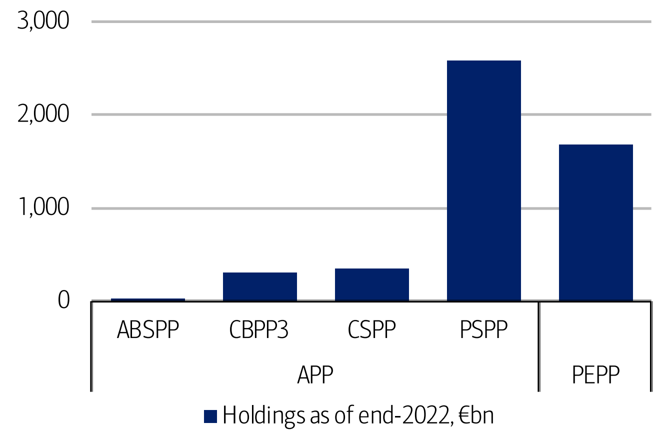
Exhibit 7: QE holdings as of end-2022
APP portfolio was €3.3trn, PEPP portfolio was €1.7trn



Source: ECB

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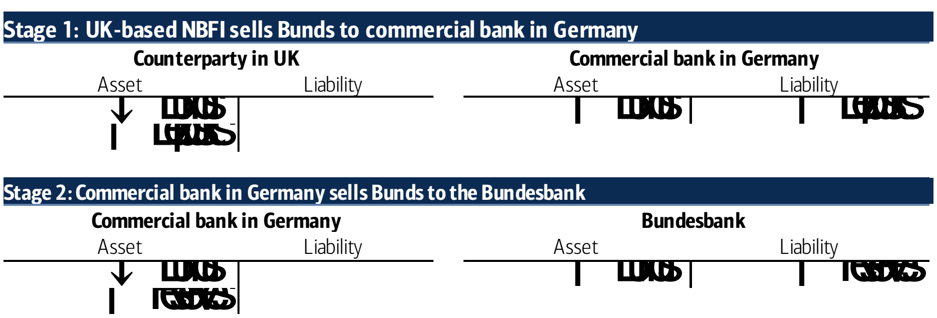
Mechanics: QE

The Eurosystem's balance sheet increases when net purchases are made via QE. The increase on the asset side of the balance sheet will be the asset purchased by the central bank. The increase on the liability side of the balance sheet will be reserves. We illustrate these dynamics using simplified balance sheets (Exhibit 8). In our illustration, a UK-based non-bank financial institution (NBFI) that is not an eligible counterparty for APP purchases is selling Bunds to the Bundesbank in accordance with the APP.

Exhibit 8: Simplified illustration of increase in reserves from QE
Bond holdings of central bank (asset of central bank) matched by reserves (liability)



Source: BofA Global Research

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Stage 1: UK-based NBFI sells Bunds to commercial bank in Germany

Eligible counterparties for QE purchases are those eligible for the Eurosystem's monetary policy instruments or counterparties used by the Eurosystem for the investment of its euro-denominated portfolios.

For the Bundesbank to purchase Bunds from the UK-based NBFI, the UK-based non-bank financial institution (NBFI) must first use an eligible counterparty, such as a commercial bank in Germany, as an access point. The UK-based NBFI reduces its Bund holdings and receives deposits from the commercial bank in Germany.

Stage 2: Commercial bank in Germany sells Bunds to the Bundesbank

The commercial bank in Germany receives reserves from the Bundesbank in return for the Bund. We stress reserves are an asset of the commercial bank in Germany and a liability of the Bundesbank.

The net impact for the commercial bank in Germany is an increase in reserves on the asset side of the balance sheet, which is matched by an increase in deposits to the counterparty in the UK on the liability side.

Mechanics: Passive QT

We illustrate the mechanics of passive QT. In our illustration, we assume the German government already has deposits at the central bank to repay the maturing Bund. We assume the German government rolls over its maturing Bund, selling the Bund to a non-bank investor who has an account with a commercial bank in Germany.

Exhibit 9: Simplified illustration of decrease in reserves from passive QT

Issue of bonds by government to roll over maturing debt held by central bank will reduce reserves

Bundesbank		Commercial bank in Germany		Investor		German government	
Stage 1: Bund matures							
Asset	Liability	Asset	Liability	Asset	Liability	Asset	Liability
↓ Bund	↓ Gov deposits					↓ Gov deposits	↓ Bund
Stage 2: Government rolls over Bund by selling to investor							
Asset	Liability	Asset	Liability	Asset	Liability	Asset	Liability
	↓ Reserves	↓ Reserves	↓ Deposits	↓ Deposits		↑ Gov deposits	↑ Bund
	↑ Gov deposits			↑ Bund			

Source: BofA Global Research

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Stage 1: Bund matures

The Bund matures and the German government uses its deposits at the Bundesbank for settlement.

Stage 2: Government rolls over Bund by selling Bund to investor

Possibly at a similar time as Stage 1, the German government issues Bund to investors. The investors direct their commercial bank to pay the government for the Bund. This will cause bank reserves to decline and government deposits at the Bundesbank to increase.

The net impact for the commercial bank in Germany is a decrease in reserves on the asset side of the balance sheet, which is matched by a decrease in deposits to the investors on the liability side.

Lending operations

The Eurosystem lends to banks via lending operations (Exhibit 10). These loans are on the asset side of the Eurosystem's balance sheet and are matched by reserves on the liability side. The dominant form of lending by the Eurosystem to banks has shifted over time, from refi pre-2008, to LTROs, and then to TLTROs (Exhibit 11).

Exhibit 10: ECB lending operations

Banks can currently borrow from the ECB via MLF, refi, and LTRO

Tool	About	Interest rate	Outstanding, €bn**
Marginal lending facility	Overnight collateralised borrowing	MLF	0
Main refinancing operation	1w collateralised borrowing	Refi	19
LTRO	3m collateralised borrowing	Refi	4
TLTRO III*	3y collateralised borrowing	As low as depo-50bp	592

Source: BofA Global Research, ECB. *Last operation was in December 2021. ** As of 30 Jun 23

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MLF

MLF is a standing facility offered by the Eurosystem to banks that provide overnight liquidity to banks. The MLF rate forms the theoretical ceiling of the overnight market rate corridor. The floor of the corridor is set by the deposit facility (depo) rate, which is the interest rate on overnight deposits at the central bank's deposit facility.

MRO

MROs are standard weekly operations that allows banks to borrow from the central bank for a week. The interest rate on MROs is the refi rate and is below the MLF rate. The refi rate forms the de-facto ceiling of the ECB's policy rate corridor.

LTROs

LTROs are regular operations that allow banks to borrow from the central bank for three months. LTROs are conducted monthly and the interest rate is the average refi rate over the period.

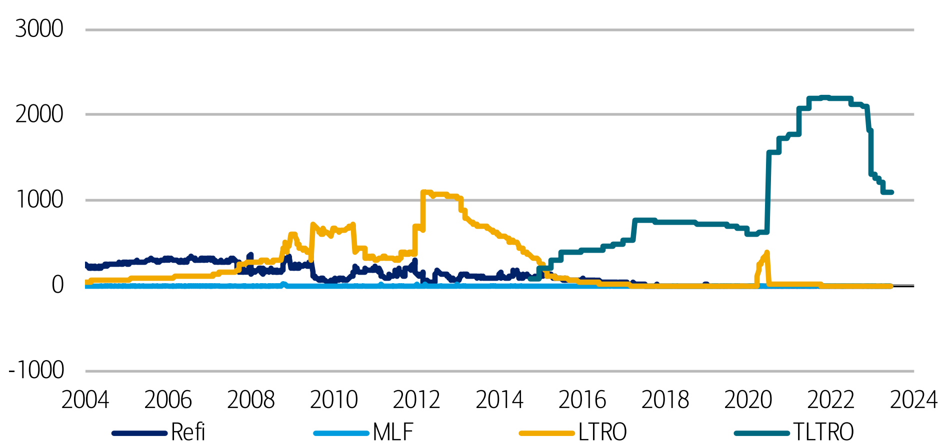
In the past, ad-hoc LTROs have been introduced in response to shocks. These include the introduction of two three-year LTROs in during the sovereign debt crisis and additional weekly LTROs during the initial response to the Covid shock.

TLTROs

TLTROs are non-regular operations that incentivise banks to support lending to the real economy by offering banks long-term funding at attractive conditions. Banks can voluntarily repay TLTRO borrowings early. There have been three TLTRO programmes to date:

- TLTRO I: 8 operations of two-to-four-year maturity between 2014 and 2016
- TLTRO II: 4 operations of four-year maturity between 2016 and 2017
- TLTRO III: 10 operations of three-year maturity between 2019 and 2021

Exhibit 11: Outstanding refi, MLF, LTRO, and TLTRO, €bn
Relative volume of lending operations changed over time



Source: ECB

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Collateral

Banks must pledge collateral when borrowing from the Eurosystem. Marketable and non-marketable assets are accepted by the Eurosystem. The Eurosystem has four main tools to manage the risk of financial loss in the event of counterparty default, which would cause the underlying asset to be realised: 1) haircuts, 2) markdowns, 3) variation margin, and 4) limit on use of unsecured debt issued by credit institutions.

In the case of haircuts, the haircut on an eligible marketable asset depends on four factors: the credit quality step (CQS, Exhibit 12), the asset's residual maturity in years, the coupon structure, and the category of the asset. Marketable assets are divided into five categories:

- Category I: Debt instruments issued by central governments; debt instruments issued by the European Union; ECB debt certificates; and debt certificates issued by NCBs prior to the adoption of the euro in their respective Member State
- Category II: Debt instruments issued by local and regional governments, agencies that meet certain quantitative criteria[1], multilateral development banks and international organisations other than the European Union; legislative covered bonds, and multi cédulas
- Category III: Debt instruments issued by non-financial corporations, corporations in the government sector, and agencies that are non-credit institution but not included in Category II
- Category IV: Unsecured debt instruments issued by credit institutions, financial corporations other than credit institutions, and agencies that are credit institutions but not included in Category II
- Category V: Asset backed securities

For non-marketable assets, the haircut on credit claims depends on: the CQS, the assets' residual maturity in years, and the coupon structure. Fixed-term deposits are not subject to any haircuts.

Exhibit 12: Mapping of CQS to probability of default and external ratings
Assets with a long-term external rating of at least AA- (S&P or equivalent) will have a CQS of 1

CQS	Probability of default over a one-year horizon	Short-term external rating (at least, S&P or equivalent)	Long-term external rating (at least, S&P or equivalent)
1			AA-
2	0.10%	A-1	A-
3	0.40%	A-3	BBB-
4	1.00%		BB+
5	1.50%		BB

Source: ECB

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Haircuts get larger as the CQS decreases (1 being the highest), as the category number for marketable assets decreases (1 being the highest), and as the residual maturity / weighted average life (WAL) increases (Exhibit 13).

[1] 1 The following quantitative criteria are assessed on an average annual basis from 1 August of the previous year to 31 July of the current year: 1) the average of the sum of the nominal values outstanding of all eligible marketable assets issued by the agency is at least €10bn over the reference period; and 2) the average of the sum of the nominal values of all eligible marketable assets with a nominal value outstanding of at least €500mn issued by the agency over the reference period results in a share equal to 50% or more of the average of the sum of nominal value outstanding of all eligible marketable assets issued by that agency over the reference period.

Exhibit 13: Haircuts applied to eligible marketable assets and credit claims

Haircuts depend on credit quality, residual maturity, coupon structure, and category of asset

		Eligible marketable assets									Non-marketable assets	
		Category I		Category II		Category III		Category IV		Category V	Credit claims	
Credit quality	**Residual maturity/ WAL (years)**	Fixed or floating coupon	Zero coupon	Fixed or floating coupon	Zero coupon	Fixed or floating coupon	Zero coupon	Fixed or floating coupon	Zero coupon	ABS	Fixed interest payment	Floating interest payment
Steps 1 and 2	0-1	0.5	0.5	1.0	1.0	1.0	1.0	7.5	7.5	4.0	8.0	8.0
	1-3	1.0	2.0	1.5	2.5	2.0	3.0	10.0	11.5	5.0	11.5	8.0
	3-5	1.5	2.5	2.5	3.5	3.0	4.5	12.0	13.0	7.0	15.0	8.0
	5-7	2.0	3.0	3.5	4.5	4.5	6.0	14.0	15.0	9.0	20.0	11.5
	7-10	3.0	4.0	4.5	6.5	6.0	8.0	16.0	17.5	12.0	26.0	15.0
	10-15	4.0	5.0	6.5	8.5	7.5	10.0	18.0	22.5	18.0	33.0	20.0
	15-30	5.0	6.0	8.0	11.5	9.0	13.0	21.0	25.0	20.0	38.0	26.0
	>30	6.0	9.0	10.0	13.0	11.0	16.0	24.0	31.5	22.0	40.0	33.0
Step 3	0-1	5.0	5.0	5.5	5.5	6.5	6.5	11.5	11.5	7.0	16.0	16.0
	1-3	6.0	7.0	7.5	10.5	9.5	12.0	18.5	20.0	10.0	25.0	16.0
	3-5	8.5	10.0	11.0	16.0	13.0	18.0	23.0	27.0	13.0	35.0	16.0
	5-7	10.0	11.5	12.5	17.0	15.0	21.5	25.5	29.5	15.0	42.0	25.0
	7-10	11.5	13.0	14.0	21.0	17.0	23.5	26.5	31.5	18.0	46.0	35.0
	10-15	12.5	14.0	17.0	25.5	19..5	28.0	28.5	35.0	27.0	48.0	42.0
	15-30	13.5	15.0	20.0	28.5	22.0	31.0	31.5	39.0	31.0	50.0	46.0
	>30	14.0	17.0	22.0	32.5	25.0	35.5	34.5	43.0	33.0	52.0	48.0
Step 4	0-1	8.0	8.0									
	1-3	12.0	13.0									
	3-5	14.0	15.0									
	5-7	15.5	17.0									
	7-10	16.5	18.0									
	10-15	17.0	20.0									
	15-30	19.0	22.0									
	>30	20.0	23.0									
Step 5	0-1	10.0	10.0									
	1-3	14.0	15.0									
	3-5	16.5	17.5									
	5-7	18.0	19.5									
	7-10	19.0	20.5									
	10-15	20.0	23.0									
	15-30	21.0	24.0									
	>30	23.0	26.0									

Source: ECB

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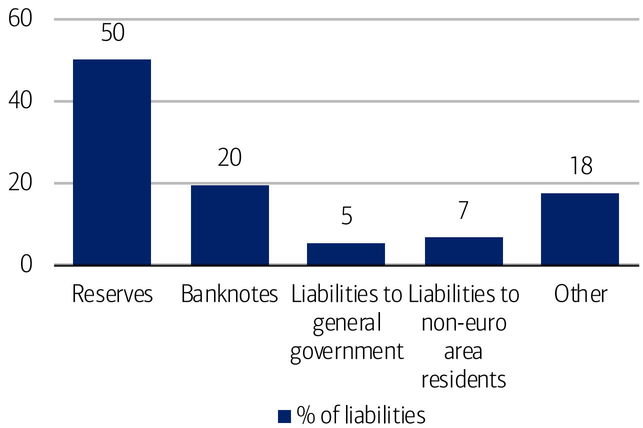
Liabilities

The main liability of the Eurosystem are deposits. The largest deposit holder is euro area banks, and their deposits at the Eurosystem are reserves. Other deposit holders are euro area governments and certain non-euro area residents. Reserves and liabilities to euro area general governments and to non-euro area residents collectively accounted for 62% of the Eurosystem's liabilities at the end of 2022. Banknotes accounted for 20% of the Eurosystem's liabilities (Exhibit 14). Since 2016, reserves in the euro area exceeded banknotes (Exhibit 15).

Exhibit 14: Eurosystem liabilities at end-2022
Reserves accounted for 50% of liabilities



Source: ECB

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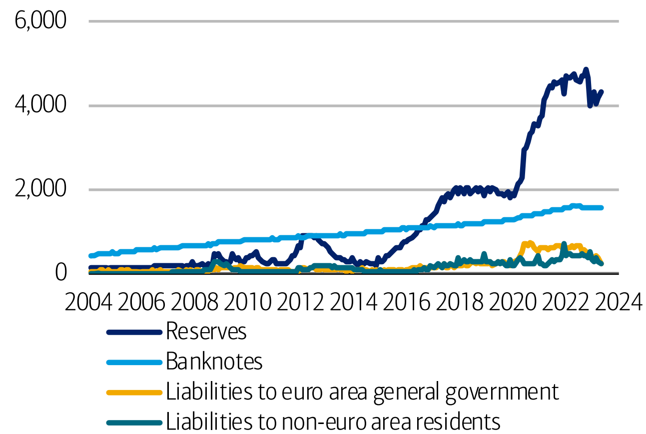
Exhibit 15: Eurosystem liabilities, €bn
Reserves exceeded banknotes since 2016



Source: ECB

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An important driver of deposit changes in the Eurosystem is the remuneration rate applied on the deposits (Exhibit 16).

Exhibit 16: Remuneration structure on selected euro-denominated deposits at the Eurosystem
Remuneration rate can influence deposit flows in Eurosystem

Category		**Current remuneration rate**	**Size, €bn***
Current account	Minimum reserve requirement	Depo rate	165
	Other cash	0%	9
Deposit facility		Depo rate	3,577
Liability to general government		€str-20bp	258
Liabilities to non-euro area residents		Majority likely at €str-20bp	300

Source: ECB. As of 30 Jun 23

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Reserves

Deposits placed by euro area banks in the Eurosystem, i.e. reserves, are known as monetary policy deposits. Banks can place reserves in one of two accounts:

- Current account: contains banks' minimum reserve requirement, which have been remunerated at the depo rate since December 2022. Reserves in the current account above and beyond the minimum reserve requirement are remunerated at the lower of 0% or the depo rate.

- Deposit facility: this is one of the two standing facilities at the ECB. It allows banks to deposit reserves overnight. Reserves at the deposit facility are remunerated at the depo rate.

The remuneration structure, which has been different in the past, can cause banks to shift reserves from one account to another:

- In October 2019 when the depo rate was negative, the ECB implemented a two-tier structure that exempted a certain amount in the current account from negative rates. That caused a shift of reserves from the deposit facility into the current account (Exhibit 17). When the depo rate returned to strictly positive territory in September 2022, significant reserves were shifted from the current account into the depo facility given the remuneration rate on reserves at the depo exceeded that on the current account. The two-tier structure was suspended in the same month.

- Prior to December 2022, minimum reserves were remunerated at the refi rate.

Excess reserves in the euro area are defined as the sum of the balance in the current account, deposit facility minus the minimum reserve requirement and MLF outstanding. It is a measure of euro liquidity in the banking system.

Liabilities to euro area general governments and non-euro area residents

Deposits placed at the Eurosystem by non-euro area banks are known as non-monetary policy deposits. Two key holders of non-monetary policy deposits are euro area general governments and non-euro area residents (Exhibit 18).

Euro area general government

Sources of these deposits include tax revenues and proceeds from debt issuance. The remuneration rate on euro-denominated deposits has changed over time:

- Prior to the introduction of a negative depo rate in June 2014, most government deposits were remunerated at 0%

- Between June 2014 and September 2022, when the depo rate was strictly negative, the ceiling on the remuneration rate was the lower of the depo rate or the relevant market rate

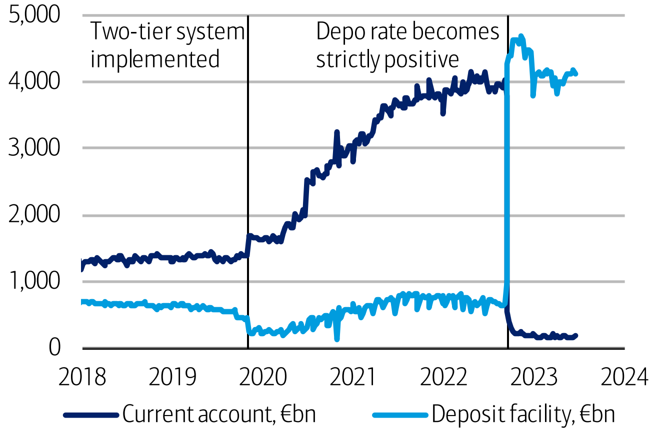
- Between September 2022 and April 2023, the ceiling was set at the lower of the depo rate or €str

- Since May 2023, the ceiling was set at €str minus 20bp since May 2023.

Non-euro area residents

Certain non-euro area residents may also place deposits at the Eurosystem, including non-euro area reserve managers through the Eurosystem reserve management services. Sources of these deposits may include euro cash in foreign reserve holdings, euros obtained from FX swaps, and euro cash received from repo transactions. The remuneration rate on euro deposits of non-euro area residents is not explicitly stated. But our understanding is the remuneration rate will not exceed the depo rate and is unlikely to exceed the remuneration rate on government deposits.

Exhibit 17: Current account and deposit facility balance
Remuneration structure can cause banks to shift reserves



Source: ECB

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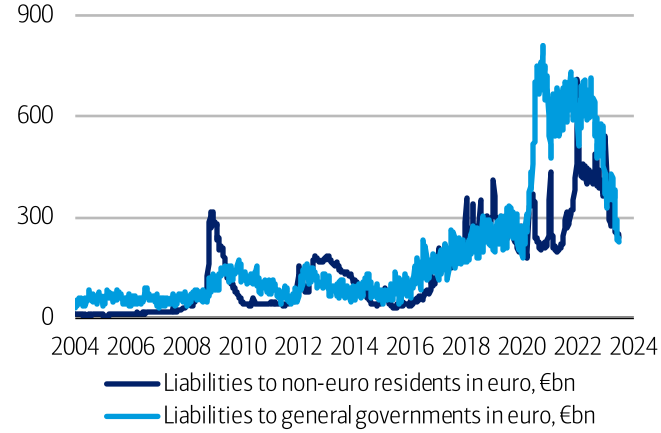
Exhibit 18: Liabilities to general government and non-residents
Historical amount impacted by remuneration rate



Source: ECB

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Interaction with front-end euro rates

The ECB's policy rates determine banks' lending and borrowing rates from the central bank. Three key types of front-end euro market rates are: €str, Euribor, and repo. The transmission from policy rates to front-end euro rates may not be straightforward. There is limited direct one-for-one mapping between policy rates and market rates: Exhibit 19 indicates the relevant rates for banks when borrowing or lending from the central bank or the market, on an overnight/term and secured/unsecured basis.

Exhibit 19: Policy rates and front-end market rates
Policy rates may have different transmission mechanisms to impact market rates

			Policy rates			Market rates		
			Depo	**Refi**	**MLF**	**€str**	**Repo**	**Euribor**
Banks borrow cash	**Overnight**	**Secured**			✓		✓	
		Unsecured				✓		
	Term	**Secured**	✓ (via TLTRO)	✓ (1w and via LTRO)			✓	
		Unsecured						✓
Banks lend cash	**Overnight**	**Secured**					✓	
		Unsecured	✓					
	Term	**Secured**					✓	
		Unsecured						

Source: BofA Global Research, ECB

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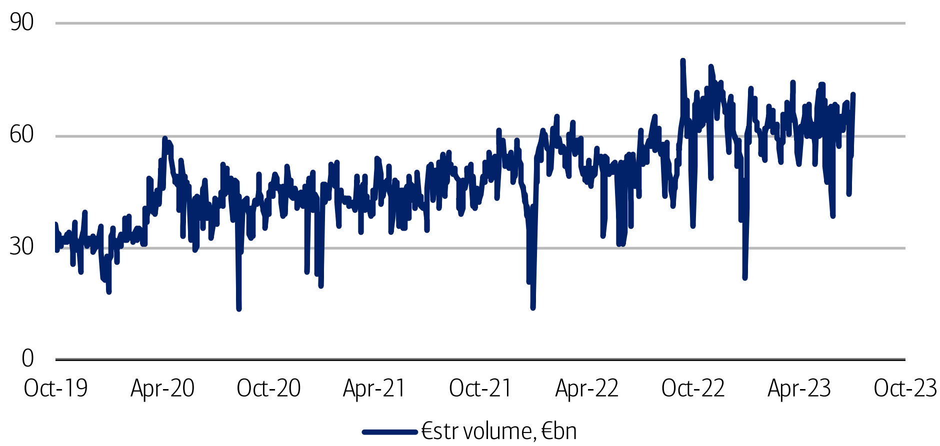
€str

€str is the euro risk free rate and is the euro overnight indexed swap (OIS) benchmark rate. It is defined as the wholesale euro unsecured overnight borrowing rate of euro area banks and has been published by the ECB daily since 2 October 2019. €str volumes have increased from c. €30bn at its inception to €60-70bn (Exhibit 20).

Exhibit 20: €str volumes
Volumes increased since inception



Source: ECB

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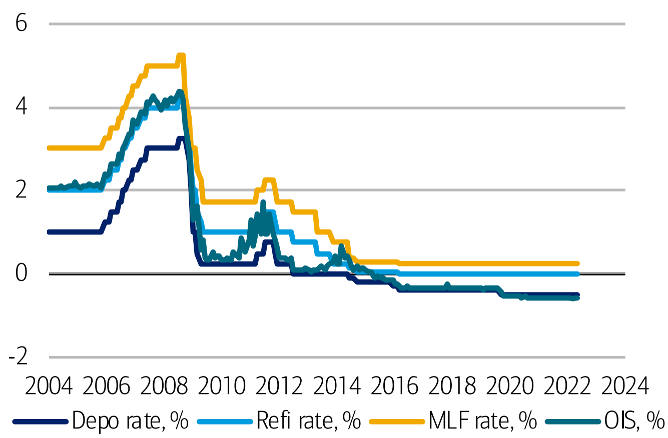
Prior to €str, the euro OIS rate was the euro overnight indexed average (Eonia), which was defined as €str + 8.5bp from 1 October 2019 until the end of 2021. Prior to 1 October 2019, Eonia was the weighted average overnight unsecured interbank lending rate calculated by the European Money Markets Institution (EMMI).

€str is calculated using actual transaction of banks that report in the Money Market Statistical Reporting (MMSR) dataset. The €str fixing is a volume weighted trimmed mean rounded to the third decimal from:

- Ordering transactions from the lowest rate to the highest rate
- Aggregating the transactions occurring at each rate level
- Removing the top and bottom 25% in volume terms
- Calculating the mean of the remaining 50% of the volume-weighted distribution of rates

The de-facto ceiling for the euro OIS benchmark rate has been the refi rate, and the floor has been the depo rate (Exhibit 21). The refi rate has been the de-facto ceiling because of it being lower than the MLF rate, reflecting MROs being a standard open market operation (OMO) (the MLF is a standing facility) and thus historically having more volumes than MLF (Exhibit 22).

Exhibit 21: ECB policy rate and OIS
The de-facto ceiling is the refi rate and the floor is the depo rate



Source: ECB

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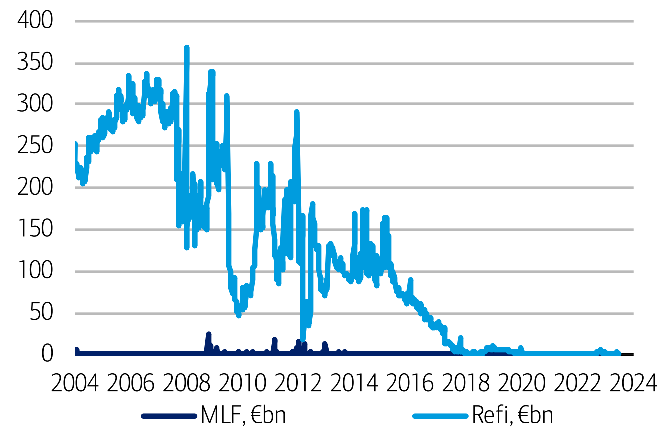
Exhibit 22: MLF and refi volumes
Historically higher refi volumes supported refi being the de-facto ceiling



Source: ECB

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The increase in excess liquidity, driven by QE and TLTRO, pushed the OIS rate below depo rate and below the ECB's policy rate corridor (Exhibit 23). High excess liquidity levels increased bank balance sheet and, being cash rich, bank demand for funding from the wholesale market declined. Reduced demand to borrow has put downward pressure on €str, as it is a bank borrowing rate, further below the depo rate. When €str is below the depo rate, banks are able to gain by placing €str borrowings at the ECB's deposit facility at a positive spread. This positive spread can be interpreted as what banks charge their €str counterparties for balance sheet usage.

Historically, the sensitivity of where the OIS rate is in the corridor to changes excess liquidity declined meaningfully when excess liquidity is above €1trn. But structural changes over the years, including regulation that raises bank reserve demand, may have raised such threshold. This means the sensitivity of the OIS rate to changes in excess liquidity may increase meaningfully before excess liquidity falls below €1trn.

Euribor

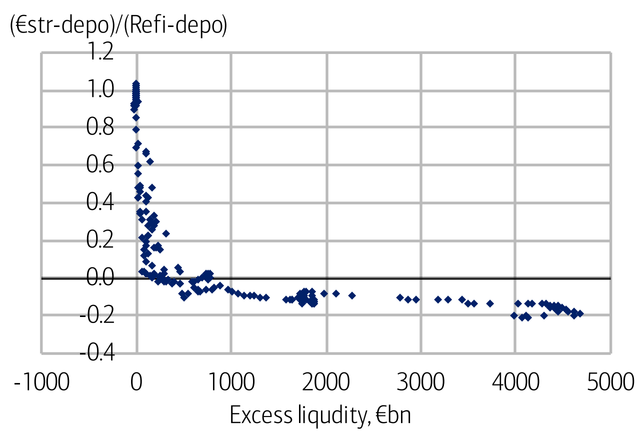
Euribor is the wholesale euro unsecured borrowing rate of 19 panel banks in the EU and European Free Trade Association (EFTA) countries. The fixing rates are available for one-week, one-month, three-month, six-month and twelve-month tenors. €str and Euribor theoretically form the wholesale unsecured borrowing curve: €str being the o/n tenor, and Euribor being the term tenors. Euribor fixings, in particular the six-month and three-month tenors, are used as the reference rate for euro swaps.

The current hybrid methodology for Euribor was authorised by the Financial Services and Markets Authority (FSMA) of Belgium on 2 July 2019, which means it is compliant with the Benchmark Regulation (BMR).

Submissions by panel banks are based on a hybrid methodology that aims to use transactions to the extent possible. Submissions follow a three-level hierarchical structure:

- Level 1: Transactions at defined tenors
- Level 2.1: Adjusted interpolation from adjacent defined tenors
- Level 2.2: Transactions at non-defined tenors
- Level 2.3: Transactions from prior dates
- Level 3: Transactions from range of markets closely related to unsecured euro money market, using modelling techniques and/or expert judgement

Exhibit 23: Where €str is in ECB policy rate corridor vs excess liquidity
Sensitivity of €str to excess liquidity declines as excess liquidity increased



Source: BofA Global Research, ECB. Data since 2005. Prior to Oct19, €str defined as Eonia – 8.5bp.

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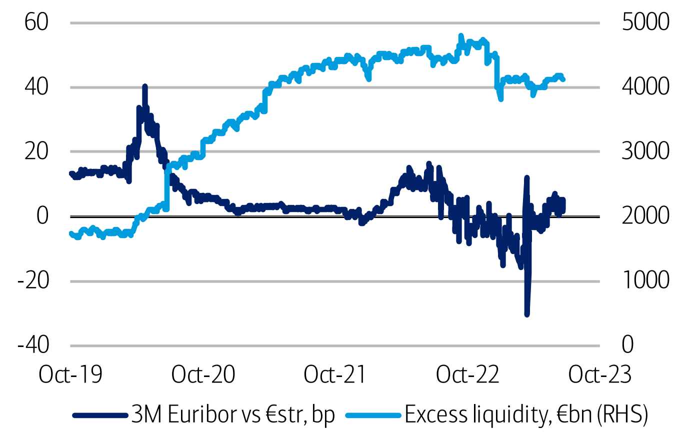
Exhibit 24: 3M Euribor vs €str spread and excess liquidity
Increase in excess liquidity compressed term premium



Source: BofA Global Research, Bloomberg, ECB

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The largest type of submission contribution is level 3 and reflects limited eligible transactions by banks that can be used in the Euribor methodology. This has been due to the high excess liquidity level in the euro area following QE and large TLTRO borrowings, which reduced bank funding demand. Low demand for term borrowing has been reflected in a compression of the Euribor-€str spread, which a measure of term premium in the wholesale unsecured borrowing market for banks (Exhibit 24). But as excess liquidity started to decline in late 2022, the Euribor-€str has started to widen again as bank demand for term funding starts to return.

Repo

The repo market allows its participants to trade cash against securities. In a repo agreement, party A - the repo seller - sells securities to party B - the repo buyer - for cash at a given price, with the obligation to repurchase the securities at a pre-specified price at a pre-specified later date. When demand for collateral is high, the repo rate falls; when demand for cash is high, the repo rate rises. A reverse repo is the opposite of a repo, where party A would buy securities with cash from party B, with the obligation to sell the securities back to party B at a pre-specified price at a pre-specified later date. The three largest euro repo markets by volume are Italy, Germany, and France; these three markets collectively accounted for 76% of the average one-day repo volumes in 2022 (Exhibit 25).

Cash-driven repos: General collateral (GC)

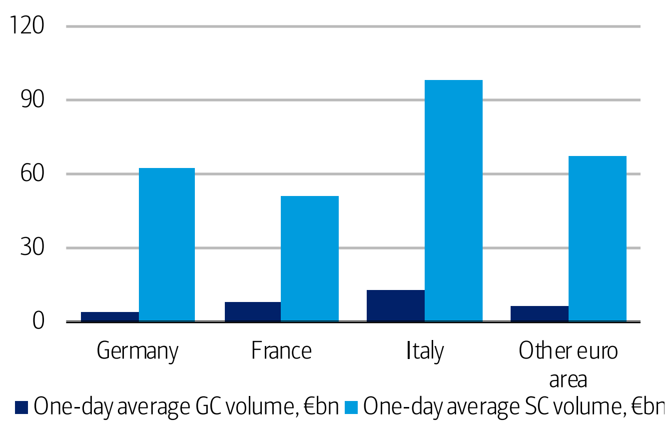
GC repos allow participants to acquire short-term funding by using securities as collateral. In GC repos, the collateral is in a basket of securities that can be substituted for one another at little or no cost. GCs tend to include government bonds and bills. The substitutability of securities in GC repos means the GC repo rate is driven by cash demand rather than demand for a specific security, and the choice of security is the seller's subject to the buyer's consent. In the euro area, each country has their own GC basket as different sovereign bonds are not necessarily interchangeable.

Collateral-driven repos: Specific collateral (SC)

SC repos allow a participant to acquire a specific bond, which supports the liquidity of the bond market. Collateral in SC repos tends to be in high demand and cannot be easily substituted for another security. SC repos typically include bonds that are benchmark bonds or cheapest to deliver (CTD) of futures. The low substitutability of the collateral means the SC repo rate is driven by demand for the securities rather than demand for cash, and the SC repo rate would typically be lower than the GC repo rate.

Exhibit 25: Average one-day repo volumes in 2022

Italy, Germany, and France repo markets are the largest in euro area



Source: CME Group

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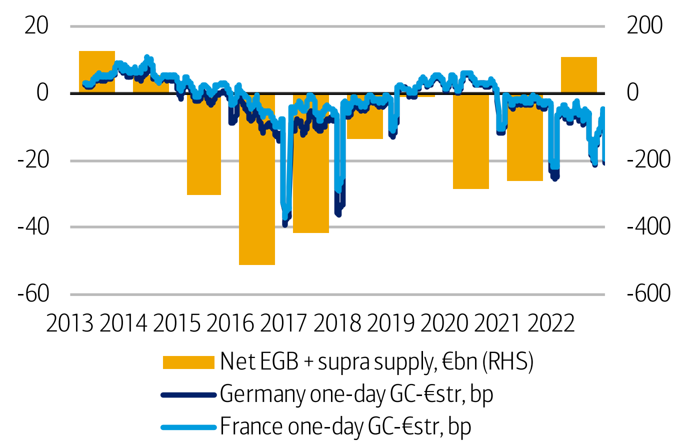
Exhibit 26: Moving 30d average GC-€str spread vs net supply

Richening of GC vs €str following implementation of QE in 2014



Source: BofA Global Research, CME Group. Prior to Oct19, €str defined as Eonia – 8.5bp.

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Collateral and cash availability

Eurosystem operations and balance sheet changes can impact repo via from cash and collateral aspects, oftentimes concurrently. In the case of QE, net purchases by the central bank led to an increase in reserve supply and decline in the availability of collateral in the market. The expansion of the Eurosystem's QE portfolio has been reflected in a notable richening trend of repo rates vs OIS since QE was introduced (Exhibit 26).

In the case of cash lending operations, euro area banks must pledge collateral to the central bank for all borrowings, causing the asset used as collateral to be encumbered and this will reduce collateral supply in the repo market. A wide range of collateral can be pledged, not necessarily just government bonds. The impact on repo rates from lending operations has been strongest during the TLTRO III programme, when net take-up in 2020 and 2021 led to a meaningful rise in assets pledged at the Eurosystem, including government securities (Exhibit 27).

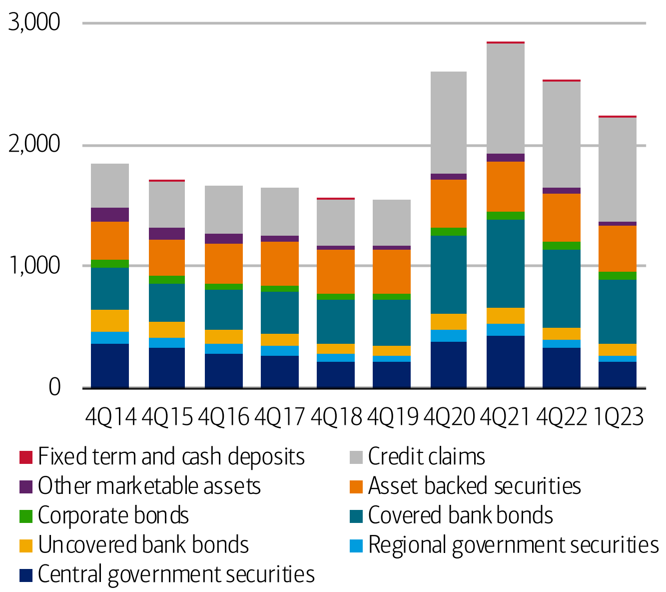
To address excessive side effects from its monetary policy operations on collateral availability, the Eurosystem lends securities purchased under its QE programmes against cash and securities collateral.

- Securities lent against securities collateral is priced at the higher of 5bp or prevailing market rates.

- Securities lent against cash collateral is priced at the lower of depo minus 20bp or prevailing market repo rate. The overall limit of PSPP and public sector PEPP securities lent against cash collateral is currently set at €250bn. The overall limit has been raised three times so far, 1) from €50bn to €75bn in March 2018, 2) to €150bn in November 2021, 3) to €250bn in November 2022.

Securities lending by the Eurosystem can help limit richening pressures on repo rates, especially over quarter-end and year-end turns (Exhibit 28). But the degree of which pressures are limited is also a function of the size of the bilateral lines between each NCB and market participant. A larger bilateral line would provide more capacity for the market to borrow scarce bonds and alleviate richening pressures on the repo rate.

Exhibit 27: Collateral pledged at the Eurosystem, €bn
Strong take-up in TLTRO III programme increased collateral pledged



Source: ECB. After valuation and haircuts.

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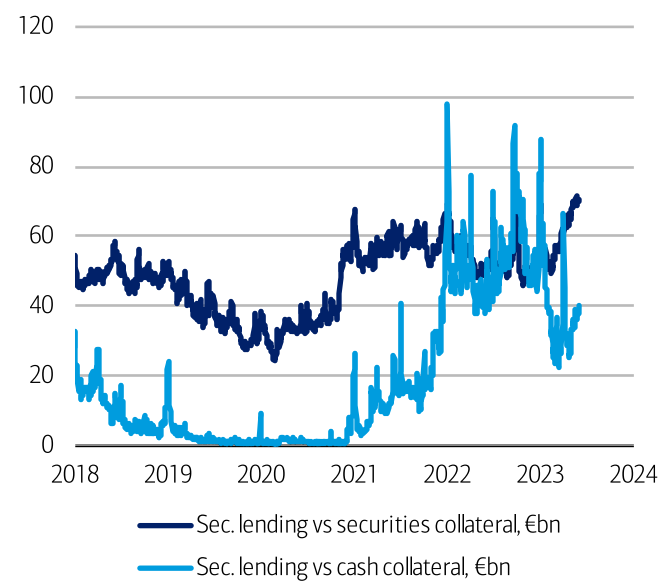
Exhibit 28: Securities lending by Eurosystem
Use particularly high over quarter-end and year-end turns when repo is rich



Source: ECB

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