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Raising Rates with a Large Balance Sheet: The Eurosystem's Net Income and its Fiscal Implications

Nazim Belhocine, Ashok Vir Bhatia, and Jan Frie

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Raising Rates with a Large Balance Sheet: The Eurosystem's Net Income and its Fiscal Implications
Prepared by Nazim Belhocine, Ashok Vir Bhatia, and Jan Frie¹

Authorized for distribution by Ashok Vir Bhatia

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ABSTRACT: The Eurosystem, having purposefully expanded its footprint in recent years, confronts a period of loss-making as rising policy rates lift the remuneration of bank reserves while assets churn more slowly. This paper projects the net income of the Eurosystem and its “top-five” national central banks over a ten-year horizon, finding that losses, while large, will be temporary and recoupable. The policy conclusions are fourfold. First, the temporary and recoupable nature of the loss-making obviates any need for capital contributions or indemnities from the state, instead allowing losses to be offset against future net income. Second, it must nonetheless be communicated that fiscal impacts will be material, with annual taxes and transfers of 0.1–0.2 percent of GDP giving way to potentially long interruptions in some cases. Third, more-conservative profit distribution policies in the future steady state could help mitigate the on-off pattern of dividends. Finally and most vitally, loss-making must remain orthogonal to monetary policy decision-making, as indeed it is at the ECB. Ultimately, credibility will rest on performance in delivering on the price stability mandate.

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Glossary

APP	Asset purchase program
CBPP	Covered bond purchase program
CSPP	Corporate sector purchase program
DFR	Deposit facility rate
EFSF	European Financial Stability Facility
EONIA	Euro overnight index average
ESM	European Stability Mechanism
€STR	Euro short-term rate
GRF	General Reserve Fund
LTRO	Longer-term refinancing operation
MLR	Marginal lending rate
MRO	Main refinancing operation
NCB	National central bank
P&L	Profit and loss
PEPP	Pandemic emergency purchase program
PSPP	Public sector purchase program
QE	Quantitative easing
QT	Quantitative tightening
SMP	Securities market program
TARGET	Trans-European Automated Real-Time Gross Settlement Express Transfer System
TLTRO	Targeted longer-term refinancing operation
WAM	Weighted average maturity

Summary

1. **The Eurosystem, having grown its footprint vastly in recent years, now faces a period of loss-making as rising policy rates lift the remuneration of bank reserves while assets churn more slowly.**

Quantitative easing (QE) removed duration risk from the private sector's balance sheet to induce portfolio rebalancing. On the liability side, it created bank reserves. In effect, the ECB executed a fixed-for-floating rate swap, leaving the Eurosystem with a large interest rate exposure in the current tightening cycle. This was not an unexpected outcome, but rather a feature of balance sheet policies shaped by the inflation objective.

2. **This paper projects the net income of the Eurosystem and its “top-five” national central banks (NCBs) over a ten-year horizon, finding that losses, while large, will be temporary and recoupable.** Our baseline, which uses market rate paths and announced policies, indicates two years of loss-making for the Eurosystem, and 0–5 years for the five NCBs. Given the home bias in NCBs' bondholdings—itsself an outcome of mutually agreed Eurosystem safeguards—NCBs whose sovereigns enjoy lower market funding costs generally see larger and more persistent losses. Asset churn into higher-yielding securities is found to have a powerful positive effect, so much so that faster quantitative tightening (QT) reduces cumulative net income as savings on the swifter reduction of reserves are exceeded by lost interest income from lower reinvestments. Parallel upward shifts in yield curves are profit enhancing. Lower banknote demand has the opposite effect.

3. **The policy conclusions are fourfold.** First, the temporary and recoupable nature of the loss-making obviates any need for capital contributions or indemnities from the state, instead suggesting losses can be offset against future net income following the US Federal Reserve's approach. Second, even without capital support from the state, fiscal impacts will be material, with annual taxes and transfers of 0.1–0.2 percent of GDP giving way to long interruptions, in one case stretching to 11 years (even if a weaker macroeconomic environment might well have had a larger negative impact on the public finances absent the ECB's balance sheet policies). Third, more-conservative profit distributions in the future steady state could help mitigate the on-off pattern of dividends. Finally—and vitally—the loss-making must remain orthogonal to monetary policy decision-making, as indeed it is at the ECB. Ultimately, credibility will rest on performance in delivering on the price stability mandate.

I. Introduction

4. **This paper focuses on the Eurosystem's profits and losses in 2022–31, quantifying the net income of the top-five NCBs and reflecting on some policy implications.** With the return to positive policy rates, remuneration of the currently large stock of bank reserves has instantly become a major expense, while income from the QE portfolios climbs only gradually with partial reinvestment. Repayment and non-renewal of targeted longer-term refinancing operations (TLTROs), by removing a subsidized claim on banks and draining some portion of bank reserves, helps in the interim, as does rising income on holdings of inflation-linked paper.

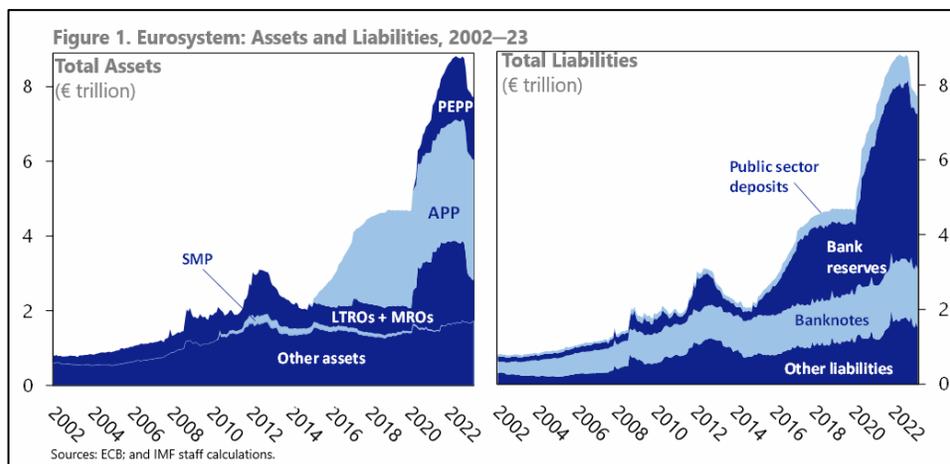
5. **The task the Eurosystem faces, of tightening monetary policy to bring inflation down to target in a timely fashion while managing a large balance sheet, is new.** Implications for the Eurosystem's net income, as explained by the ECB ([ECB 2023a](#)), are similar to those for the US Federal Reserve ([Anderson et al. 2022a](#) and [2022b](#)), with the added layer of the Eurosystem's decentralized structure. A raft of opinion pieces ([Honohan 2023](#), [Carstens 2023](#), [De Grauwe and Ji 2023](#)), papers ([Levin, Lu, and Nelson 2022](#)), and notes ([Gros and](#)

[Shamsfakhr 2022](#)) is now drawing attention to the topic. Some, including the latter, focus on valuation effects. Our work takes the view that unrealized valuation losses are of limited relevance in the Eurosystem context. We see one of our key contributions as being to explain the Eurosystem's income-sharing rules and then apply them, using transparent assumptions and public data, to generate profit and loss projections at the NCB level.

6. **The paper has seven parts.** Section II briefly catalogs the evolution of the Eurosystem's balance sheet in its first 25 years (Figure 1). Section III explains the various special Eurosystem rules that materially impact on net income at the NCB

level. Section IV lays out our assumptions. Section V presents our ten-year profit and loss projections in a baseline scenario and several alternative scenarios. Section VI is a policy discussion, covering central bank negative capital and the fiscal spillovers of Eurosystem loss-

making, offering views on both. Section VII concludes.



II. Balance Sheet Expansion

7. **In its early years, the Eurosystem, like other major central banks during the Great Moderation, had a parsimonious balance sheet.** Total assets at end-2000 were €836 billion, comprising foreign reserves and gold, monetary policy-related claims on banks, bonds held for income-earning, non-monetary policy purposes, and other items. Liabilities included €371 billion of currency in circulation and €125 billion of bank reserves, of which €116 billion were held in satisfaction of a minimum reserve requirement set at 2 percent of banks' overnight deposits and certain other specified liabilities of up to 2 years' maturity.

8. **Monetary policy implementation centered on short-term interest rates, controlled through procedures that relied on balance sheet leanness.** The marginal lending facility offered (and still offers) banks unlimited access to overnight central bank liquidity against eligible collateral, with the marginal lending rate (MLR) defining the rate ceiling. The deposit facility allowed (allows) banks to place unlimited volumes of overnight liquidity at their host-country NCBs, with the deposit facility rate (DFR) defining the floor. In between, the ECB injected or extracted bank reserves via its (weekly) main refinancing operations (MROs) and (less frequent) fine-tuning operations to steer the overnight unsecured interbank benchmark rate, EONIA, to near the mid-point of the corridor between the DFR and MLR. The MRO rate was generally seen as the main policy rate.

9. **Monetary policy decisions adopted by the ECB during and after the global financial crisis, however, mostly had the effect of increasing the supply of aggregate bank reserves.** Early steps included a shift to fixed rate full allotment tender procedures for all bank refinancing operations, an initial maturity extension

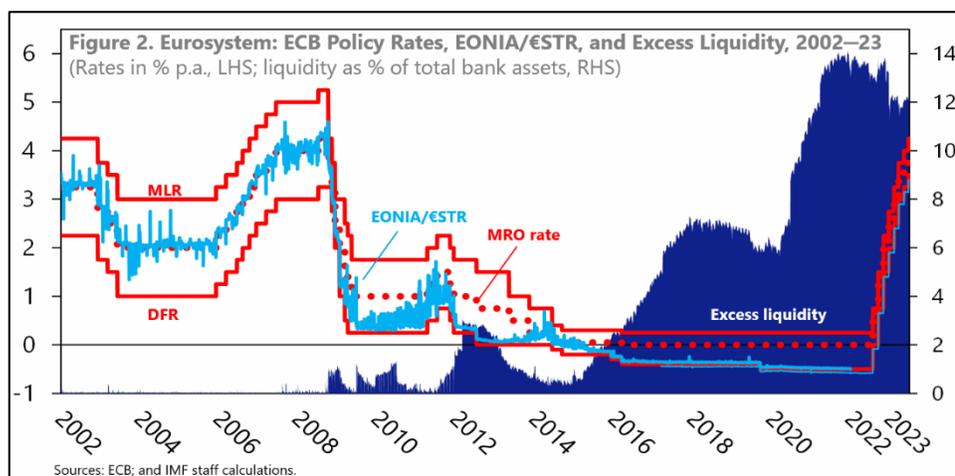
on longer-term refinancing operations (LTROs) from 3 months to 12 months, a broadening of eligible collateral, a first covered bond purchase program, the securities market program, a halving of the reserve requirement to 1 percent, and the introduction of three-year LTROs in December 2011. At each step, banks' excess liquidity at the Eurosystem increased, reaching almost €1 trillion by mid-2012.²

10. **After a period of declining reserves in 2013–14 as LTROs and other claims rolled off, negative rate policy was initiated in mid-2014, soon followed by renewed reserve expansion through QE.** In June 2014, the ECB became the first major central bank to transition to negative policy rates, cutting the DFR to –0.1 percent. With the negative DFR applying to both the deposit facility and funds on current account, banks began to pay interest on all of their excess liquidity at the Eurosystem. The same month, the ECB announced its first TLTRO. Finally, in March 2015, an expanded asset purchase program (APP) began, centered on a new public sector purchase program (PSPP), with APP monthly net purchases initially set at €60 billion.

11. **With policy rates close to the effective lower bound, the APP became the central vehicle for delivering additional monetary policy stimulus, including to counter deflation risk.** QE extracted duration risk from private sector balance sheets to induce portfolio rebalancing. Where once monetary policy had concentrated on the short end, the APP saw the Eurosystem transacting at scale along a broad maturity spectrum, directly influencing yield curves across a wide range of asset classes, centered on sovereign bonds.

12. **Flooding the system with bank reserves had deep consequences for monetary operations, with the interest rate corridor giving way to a new “floor system”** (Figure 2). Already in 2008–13, EONIA had slipped into the lower half of the corridor, generally oscillating between the MRO rate and the DFR. With the advent of the APP, the Eurosystem's supply of reserves began to far outstrip banks' demand, obviating any need for banks to participate in

MROs. Reserve abundance drove an unambiguous convergence of EONIA to the DFR, as well as a decline in EONIA volatility. Stated differently, had there been no ECB deposit facility to provide a floor, it is unclear how far EONIA might have fallen based on supply and demand forces alone. By early 2016, the regime shift was largely complete, leaving the DFR as the most relevant policy rate.



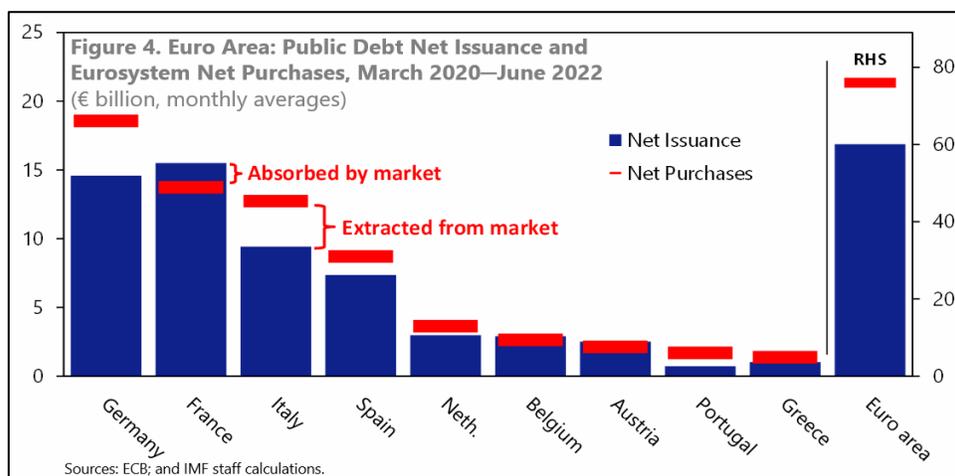
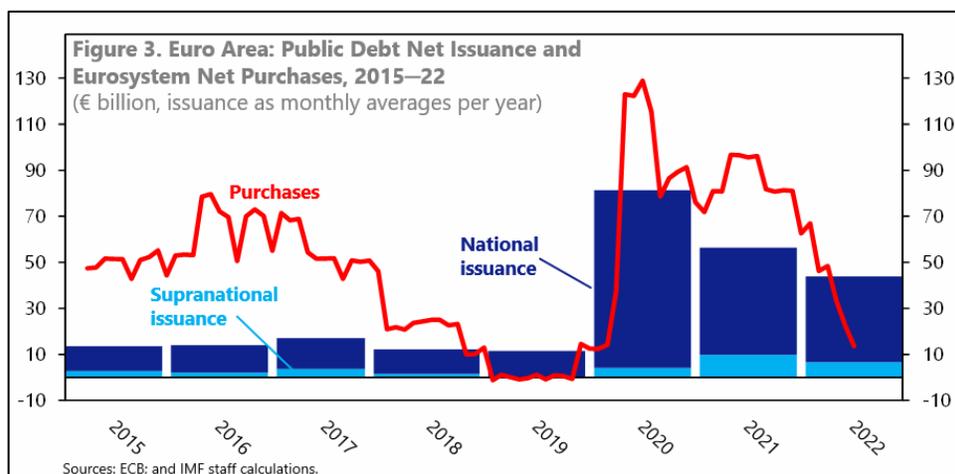
13. **Net asset purchases were slowed in three steps during 2017–18, stopped in January 2019, and restarted in November 2019, at which point a system of reserve tiering came into effect.** Under the new two-

² Strictly, “excess liquidity” is defined as the sum of balances on current account and at the deposit facility, net of any recourse to the marginal lending facility, less required reserves, whereas “excess reserves” excludes balances at the deposit facility. We use “liquidity” and “reserves” interchangeably.

tier system, banks' current account holdings in an amount equivalent to a multiple of their minimum required reserves were exempt from the negative DFR, with the multiple initially set at six.³ This sought to respond to a concern that margin compression would, over time, unduly constrain bank credit to the economy and, in so doing, impair monetary policy transmission.

14. **Only five months later, the pandemic rushed in a turbocharged new phase of fiscal-monetary expansion** (Figures 3–4). In March 2020, after a brief “dash for cash” episode, the ECB stepped up its APP and added a new and more flexible pandemic emergency purchase program (PEPP). From then through mid-2022,

euro area national public sector net debt issuance of some €1.7 trillion was more than fully funded by Eurosystem net purchases of €1.9 trillion on the secondary market. Government bonds were thus extracted from the market at scale and substituted by bank reserves. Including the effects of a new series of TLTROs and other factors, excess liquidity at the Eurosystem grew by €2.5 trillion. Almost all fiscal support to euro area households and firms during the pandemic was ultimately funded by short-term central bank liabilities.



15. **By end-2021, the Eurosystem's balance sheet had grown to €8.6 trillion** (Table 1). With monetary policy assets having expanded to the equivalent of 56 percent of euro area GDP, the footprint was significantly larger than the US Federal Reserve's, at 37 percent of US GDP. The QE book amounted to €4.7 trillion at

³ Minimum required reserves were remunerated at the MRO rate until December 20, 2022, and thereafter at the DFR.

amortized cost.⁴ Bank reserves stood at €4.3 trillion. With QE having delivered a fixed-to-floating rate swap, the Eurosystem was left exposed to losses in the rate cycle that would follow.⁵ This interest rate exposure was not an unexpected outcome, but rather a feature of policies followed pursuant to the price stability mandate.

Assets		Liabilities			
	2021	2022	2021	2022	
Securities of euro area residents denominated in euro	4,886	5,102	Banknotes in circulation	1,544	1,572
<i>of which: held for monetary policy purposes</i>	4,713	4,937	Liabilities to euro area credit institutions	4,371	4,077
TLTRO and other claims on euro area credit institutions	2,229	1,355	Liabilities to other euro area residents	771	576
Gold and gold receivables	559	593	Liabilities to non-euro area residents	713	545
Claims on non-euro area residents	513	537	Revaluation accounts	555	586
Other assets	377	369	Capital and reserves	113	115
			Other liabilities	498	485
Total assets	8,564	7,956	Total liabilities	8,564	7,956

Source: ECB.

III. Risk Sharing and Income Pooling

16. **Like the US Federal Reserve, the Eurosystem includes multiple reserve banks—now 20 in number—the key difference being that its NCBs serve sovereign states, not banking districts.** Having a single independent monetary authority authorized to issue currency as a joint and several liability on behalf of multiple countries not wedded in political and fiscal union is a defining feature of the euro area. The ECB Governing Council steers the volume of base money. Issuance is largely delegated to the NCBs.

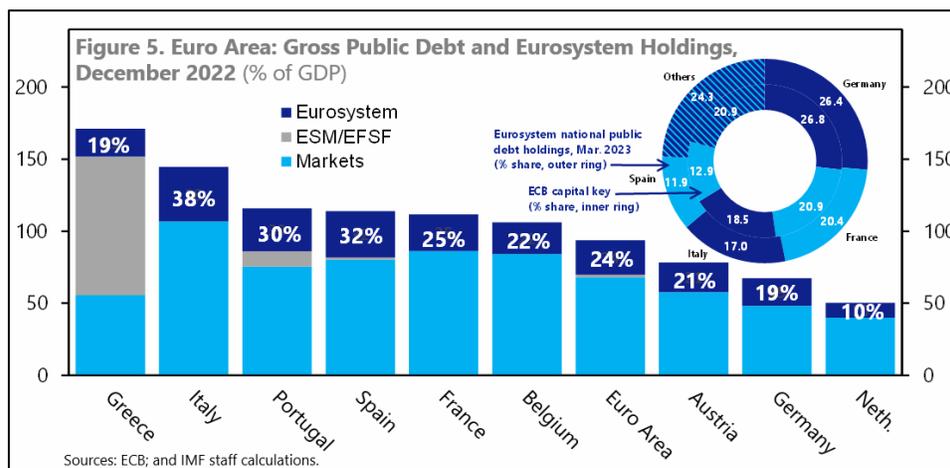
17. **Given the absence of fiscal union, assessing the fiscal spillovers of Eurosystem profits and losses requires disaggregated net income projections at the NCB level, which this paper will provide.** Projections are made and shown for the Eurosystem, the ECB, Deutsche Bundesbank, Banque de France, Banca d'Italia, Banco de España, and De Nederlandsche Bank, with a focus on the five NCBs. (Solo results for the ECB are given slightly less attention, including because they affect national budgets only indirectly.)

18. **Projections at the NCB level are complex to produce, with a web of intra-Eurosystem claims and internal rules requiring formulae to be solved at the level of the system.** Three interlocking sets of rules, all quite unique to the Eurosystem, help shape the NCB-specific results:

⁴ Amortized cost accounting adjusts the book value of an asset from market value at purchase to face value at maturity based on contractual cash flows less realized impairments. As of end-2021, the ECB's QE portfolio stood at €445 billion at amortized cost and €453 billion at market value; those of the top-five NCBs stood at €3.46 trillion at amortized cost and €3.53 trillion at market value.

⁵ The return of the DFR to positive territory in September 2022 saw a large sweep of bank reserves from the current account, where interest is capped at zero, to the deposit facility, to earn the newly positive DFR.

- **Parametric limits to ensure that QE delivers generalized monetary policy stimulus, not support to specific sovereigns, and preserves price-based**



incentives for fiscal prudence (Figure 5). These rules, first applied to the PSPP, later more flexibly to the PEPP, and referenced in several important court judgements, are essentially twofold. First, they require that national public debt purchases generally mirror the ECB's capital key, not favoring any specific sovereign or sovereigns. Second, they stipulate that holdings shall be subject to per-issue and per-issuer limits, both set at 33 percent in most cases (but with PEPP holdings not consolidated into PSPP holdings), protecting the price signal. The composition of the Eurosystem's aggregate sovereign debt portfolio thus reflects an iterative balancing procedure between the relative economic weight of member states and their public sector debt outstanding.

- **Bond allocation and risk-sharing rules to limit mutualized support to specific member states in the event of debt distress.** These rules, also first applied to the PSPP and later to the PEPP, stipulate that of every €100 of public sector debt acquired €80 must be domestic national debt bought by NCBs, €10 must be supranational debt bought by NCBs, and €10 must be national debt bought by the ECB. Credit losses on national public sector debt held by NCBs remain each NCB's own responsibility. In contrast, credit losses on supranational debt held by NCBs, national debt held by the ECB, and all private sector securities owned are fully shared across the Eurosystem. As of end-2022, roughly two-thirds of the Eurosystem's QE portfolio thus purposefully comprised NCBs' holdings of debt securities issued by their own home sovereigns, by mutual agreement of the ECB and all NCBs.
- **Pooling rules to ensure the equitable sharing of monetary income** (Table 2). These rules, laid out in Decision (EU) 2016/2248 of the ECB, prescribe how monetary income is to be calculated, netted, and shared within the Eurosystem (ECB 2016). Once a year, the ECB collects net monetary income from NCBs, aggregates it, and allocates it back to NCBs based on their shares in the capital key. Every NCB's profit and loss statement therefore includes a line item called "net result of the pooling of monetary income." Monetary income is defined as income deriving from " earmarkable" assets, and is measured at the actual rate of return, for certain assets at a "reference rate" currently set at the MRO rate, or in the case of gold at zero. Expenses on bank reserves are shared fully. To offer one example of the impact of these rules, Banca d'Italia does not benefit from the full gross income on its Italian sovereign bondholding: it may only retain actual income less an amount calculated at the MRO rate.

Table 2. Eurosystem: Remuneration Rules for the Pooling of Monetary Income

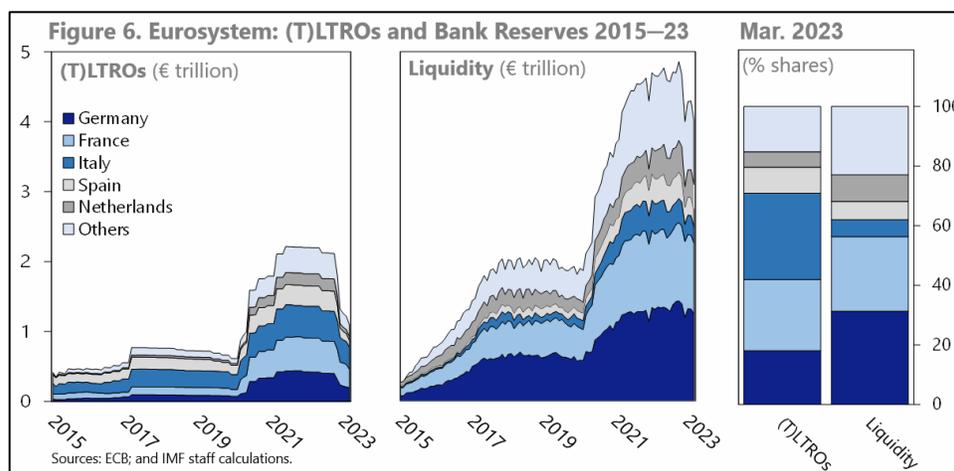
Earmarkable assets	Remuneration rate	Liability base	Remuneration rate
Amount of gold holdings in proportion to each NCB's capital key share	0 percent	Banknotes in circulation	Not applicable
Claims equivalent to the transfer of foreign reserves to the ECB (except gold)	MRO rate	Liabilities to euro area credit institutions related to monetary policy operations denominated in euro	Rate of return
Lending to euro area credit institutions related to monetary policy operations denominated in euro	Rate of return	Net liabilities arising from balances of TARGET accounts	MRO rate
CBPP, CBPP2, PSPP (government/agency), and PEPP (government)	MRO rate		
SMP, CBPP3, PSPP (supranational), CSPP, and PEPP (excluding government/agency)	Rate of return		
Claims on non-Eurosystem central banks that relate to liquidity-providing operations	Actual interest income (including accruals)		
Accrued coupon interest-related balances on impaired securities held for monetary policy purposes and for which full income/risk sharing applies	Not applicable		
Net claims related to the allocation of euro banknotes within the Eurosystem	MRO rate		
Accrued interest relating to regular monetary policy operations with maturity > 1 year	Not applicable		

Source: ECB.

19. The pooling rules, in particular, can benefit from an item-by-item explanation:

- **Net lending to euro area banks related to monetary policy operations** (Figure 6). Claims on banks include MROs, at the MRO rate, and TLTROs, indexed to applicable ECB policy rates. Liabilities to banks, which are much larger than total claims, include required reserves, previously remunerated at the MRO rate and since December 21, 2022 at the DFR; banks’ deposits in current accounts, unremunerated; and banks’ deposits in the deposit facility, remunerated at the DFR. Interest on these items is fully pooled on an actual

basis, meaning that each NCB shoulders a share of the Eurosystem’s aggregate net expenses proportional to its share in the capital key. On the

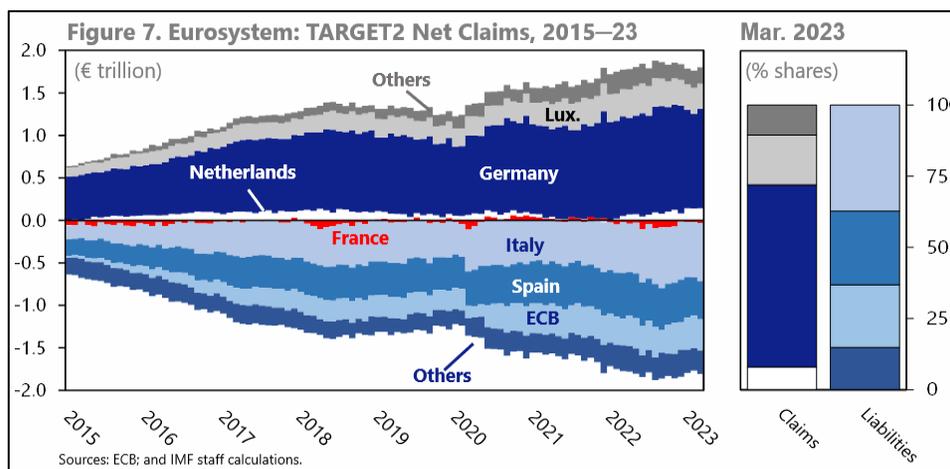


asset side, the Bundesbank, Banque de France, and Banca d'Italia hold the largest TLTRO claims. On the liability side, the Bundesbank and Banque de France hold the largest reserves, reflecting the large share of bonds acquired in cross-border QE from sellers in Germany and France.

- **Securities held for monetary policy purposes.** As already seen in the example for Italy above, NCBs retain income on their holdings of national public debt to the extent that the actual rate of return exceeds the “reference rate,” currently defined as the MRO rate. An amount calculated by applying the reference rate is remitted to the ECB for pooling and redistribution irrespective of whether the actual rate of return exceeds or falls short of the reference rate. Among the top-five NCBs, Banca d'Italia and Banco de España enjoy the largest excess of actual rates of return on their national public debt holdings over the reference rate; the Bundesbank, in contrast, retains essentially nothing. Income on supranational, institutional, and most private sector debt is fully pooled.

- **Net intra-Eurosystem TARGET2 (now T2) claims** (Figure 7). T2, the ECB's real-time gross settlement system, can be viewed as a conduit for base money flows within the Eurosystem. When Banca d'Italia, for example, buys

a bond from, say, a seller in Germany, the transaction creates bank reserves in Germany, a liability of the Bundesbank. The matching asset for the Bundesbank is a net T2 claim.



Such transactions occurred repeatedly during the years of QE, resulting in a large buildup of the Bundesbank's net T2 claims and both Banca d'Italia's and Banco de España's net T2 liabilities. Although these net positions were fiercely debated from a euro area break-up perspective ([Sinn and Wollmershäuser 2012](#)), little attention was paid to their remuneration, for the simple reason that the reference rate is the MRO rate, and the MRO rate was zero.

- **Net intra-Eurosystem claims on euro banknotes.** Currency in circulation, of course, is the original source of seigniorage, providing central banks with a perpetual zero-interest source of funding from which to acquire interest-earning assets. To equitably share this privilege within the Eurosystem, each NCB receives a banknote total-value allocation proportional to its share in the capital key, after deducting an allocation of 8 percent for the ECB. The country-wise allocation, however, may be exceeded or left underutilized by different NCBs, depending on national preferences for cash. It is well known, for instance, that the demand for cash is significantly higher in Germany and the Netherlands than in, say, Italy or Spain. The resulting net intra-Eurosystem liability positions, in this case of Germany and the Netherlands, are charged at the reference rate, for pooling and redistribution.

20. **This paper's projections explicitly take into account the intra-Eurosystem pooling effects.** To add clarity on the T2 dimension specifically, its figures presenting the NCB-by-NCB results show the net results on net T2 claims separately from other net results of the pooling of monetary income. For some NCBs, the pooling calculations materially affect the bottom-line financial outturns.

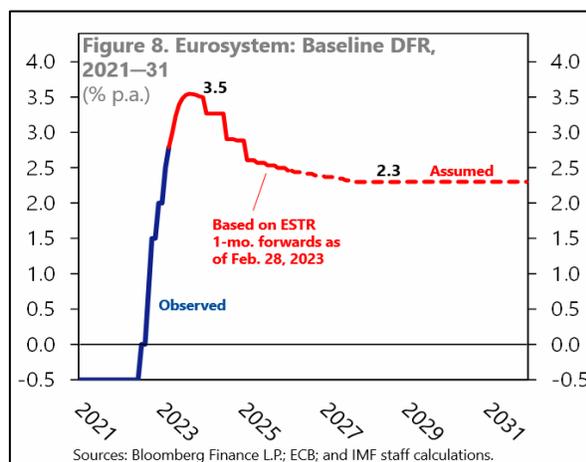
IV. Methodology and Key Assumptions

21. **Projecting net income involves some iteration as the calculations march forward month by month to end-2031.** Earnings and expenses for each month are calculated by applying the interest rate assumptions for the month to the relevant balances at the end of the previous month. When pre-provision net income is negative, the full amount is subtracted from “other assets” and “other liabilities” as part of constructing a balance sheet for the end of the current month, a process that also feeds in TLTRO repayments, QT, and banknote growth. When pre-provision net income subsequently reverts to a positive value, payouts are assumed to be zero until the sum of capital and reserves and general provisions are replenished to its end-2021 level, after which the observed average payout ratios for 2008–21 are applied. The starting point for the projections is end-2021, the end of the last calendar year before the tightening cycle began.

22. **We view the balance sheet in seven blocks.** Three are on the asset side: the QE book, assumed to carry a weighted average remaining maturity of 7.1 years (Annex I); TLTROs, assumed to roll off at maturity (Annex II); and “other assets” including securities held for non-monetary policy purposes, foreign assets, gold, real estate, and so on. Three are on the liability side: banknotes; bank reserves; and “other liabilities” including government and non-EU official deposits, revaluation accounts, general provisions, and capital and reserves. The seventh block, the net T2 position, may appear on the asset or liability side, depending on its sign. Whereas QE books are projected at amortized cost, securities held for non-monetary policy purposes are revalued monthly. The valuation change is added back into “other assets” and “other liabilities.” Strictly, this should be done on a quarterly basis, and foreign assets should also be revalued, which we do not do.

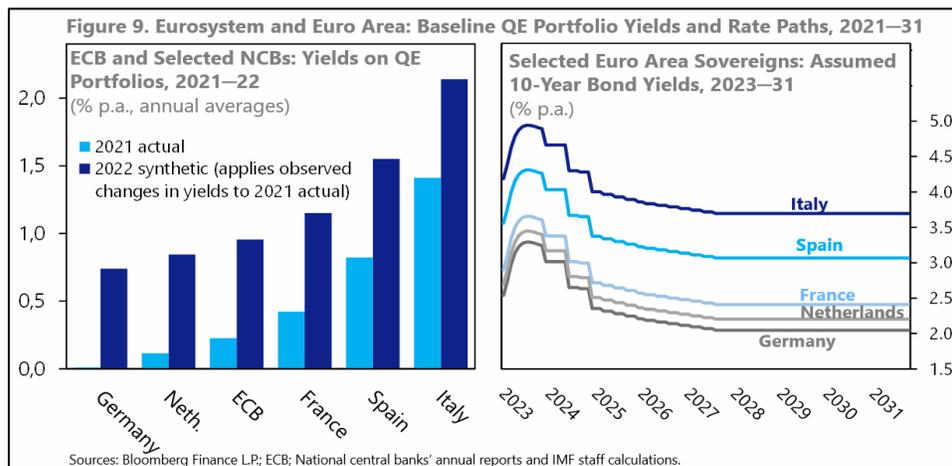
23. **Our key assumptions are:**

- **Policy rate path** (Figure 8). The baseline DFR trajectory is derived from market pricing of €STR forwards as of end-February 2023. This vintage indicates a peak DFR of 3.5 percent around mid-2023, falling to 2.6 percent three years later. Thereafter, the rate is assumed to converge linearly to an assumed nominal neutral rate of 2.3 percent by end-2028 and remain at that level thereafter. The 50 basis point policy margin of the MRO rate over the DFR is assumed to remain constant.



- **Yields on QE portfolios** (Figure 9). The starting points for projecting returns on the QE books are the reported period-average rates of return for 2021 on the portfolios of the five NCBs and the ECB. From January 2022 through February 2023, rates of return are assumed to increase in lockstep with

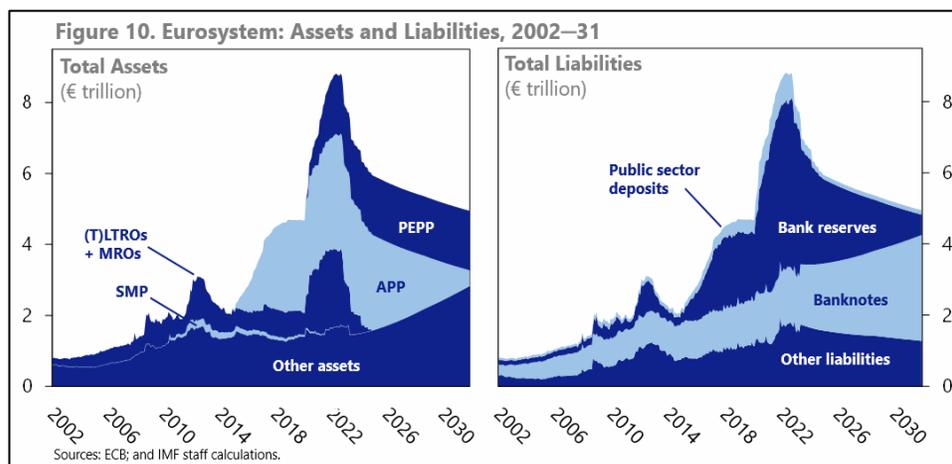
observed changes in 10-year sovereign bond yields. Thereafter, the 10-year bund yield is projected to move in lockstep with the baseline DFR, while for the other



sovereigns synthetic 10-year yields are constructed by applying the observed average historical spread over bunds for 2015–22. The latter was 16 basis points for the Netherlands, 36 basis points for France, 102 basis points for Spain, and 165 basis points for Italy. An average of the rates of return at the top-five NCBs is used as the yield for the Eurosystem as a whole, for the “rest of the Eurosystem,” and for own funds and other, non-monetary policy securities holdings.⁶ New bonds acquired through reinvestment are assumed to yield the projected interest rate at the time of purchase.

- **TLTRO repayments, QT, and other balances** (Figure 10). The stock of TLTROs incorporates actual repayments through March 2023 and normal maturity schedules thereafter. No replacement of maturing TLTROs by MROs or 3-month LTROs is assumed.⁷ The baseline QT path is based on announced policies, with the APP portfolio shrinking by €15 billion per month during March–June 2023, followed by zero

reinvestment thereafter. The baseline assumption for the PEPP portfolio, in contrast, is for full reinvestment throughout. Foreign assets and gold are assumed to



⁶ The average gross public debt ratio for the euro area at end-2022 was 91 percent of GDP while that for its five largest economies was 100 percent of GDP. As such, proxying the yield for the Eurosystem as a whole from the average yield for the five largest economies may not be a wholly unreasonable assumption from a debt standpoint.

⁷ This is done to avoid second-guessing the share of banks with TLTRO balances outstanding that drew for liquidity reasons and may therefore need to refinance, and those that drew only to avail of the subsidy and may therefore not refinance.

remain constant, the former earning the rate of return on 1-year US treasury bills, observed or from forwards. Finally, other assets are assumed to have a uniform underlying growth rate (before revaluation) equal to that of banknotes, which in turn is assumed to equal its euro area-wide average in 2012–21, 6.6 percent per year. No other behavioral changes are assumed.

- **Impact of TLTRO repayments and QT on bank reserves and net T2 positions.** Each €1 of TLTRO repayment is assumed to be matched by a 70 cent reduction of bank reserves and a 30 cent reduction of government and non-EU deposits at the Eurosystem, extending a pattern observed since November 2022. Each €1 of QT drains reserves one-for-one, until each jurisdiction's bank reserves reach a floor we set at 1 percent of total bank assets, equal to the average ratio observed before the global financial crisis.⁸ Where reserves encounter this floor, any further QT reduces net T2 liabilities; this essentially represents a reversal of the process observed during QE when many bonds acquired by Banca d'Italia and Banco de España were bought from sellers in Germany. Government and non-EU official deposits, remunerated from September 2022 through end-April 2023 at the lower of €STR and the DFR and thereafter at €STR less 20 basis points per the ECB's announcements of September 2022 and February 2023, respectively, are assumed to remain constant after the conclusion of the TLTRO repayments.⁹ Finally, operating expenses together with net fees and commissions (including on securities lending) grow in line with the inflation target; both are relatively small items.

V. Baseline Results and Scenarios

24. **The quantitative results are best prefaced by some historical context.** In 2008–21, the Eurosystem's pre-provision, pre-tax net income averaged 0.3 percent of euro area GDP annually. As the negative DFR kicked in, banks paid interest to the Eurosystem on a rising stock of reserves. As QE kicked in, debt extraction helped compress yields at the long end and, with that, dampened returns on the growing bond portfolio. Banca d'Italia and Banco de España made above-average annual profits, at about 0.4 percent of GDP each, reflecting their larger holdings of higher-yielding debt. The Bundesbank and De Nederlandsche Bank made below-average profits, at about 0.15 percent of GDP each. Banque de France sat in between.

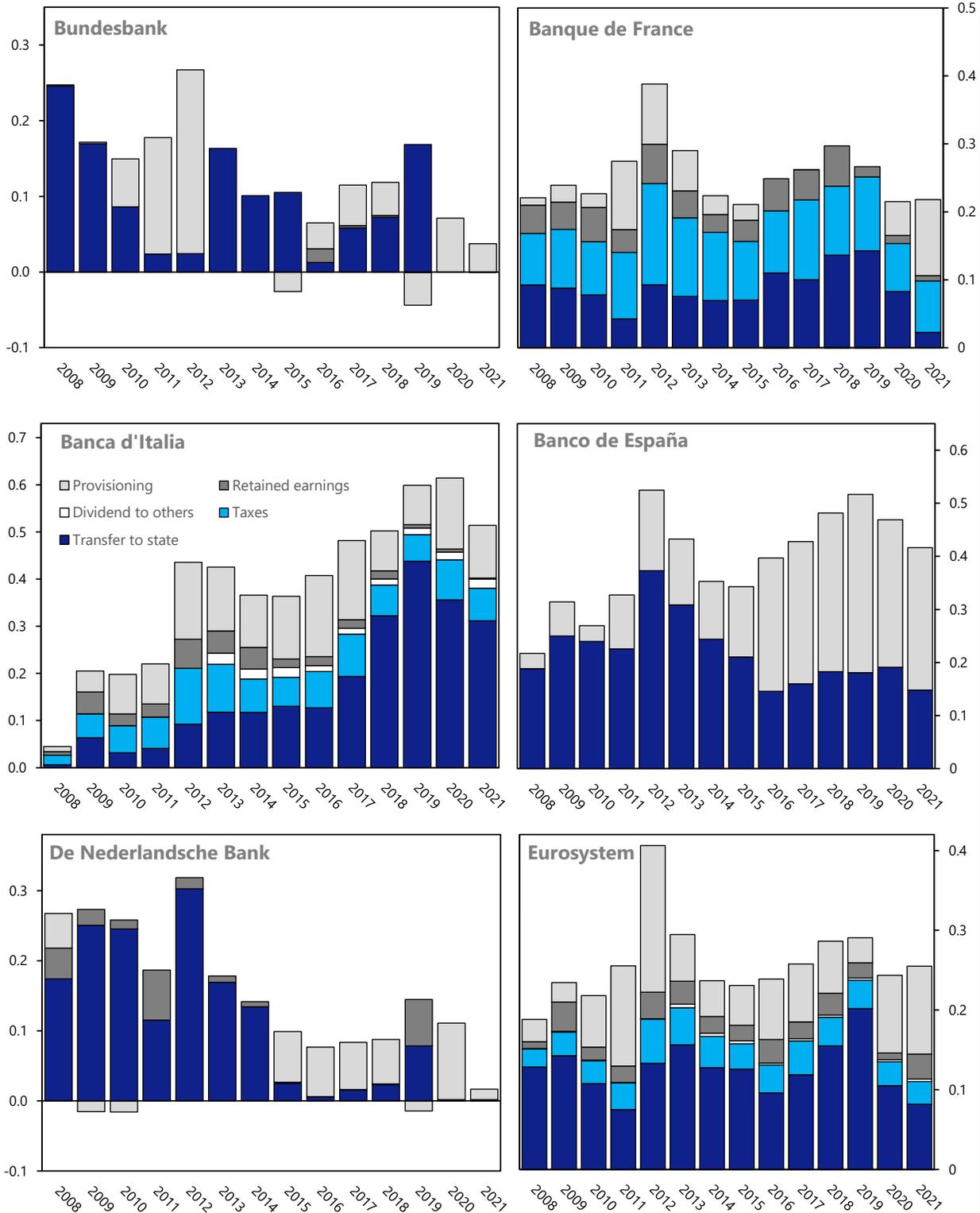
25. **Payout ratios were remarkably stable** (Figure 11). In 2008–21, an average of 40 percent of the pre-provision, pre-tax net income of the top-five NCBs flowed to provisions and retained earnings. During the same period, Banque de France paid out 46 percent of its post-provision net income as corporate tax, on average, and Banca d'Italia 22 percent (the Bundesbank, Banco de España, and De Nederlandsche Bank do not pay taxes). In the QE years of 2015–21, profit transfers to the state by Banca d'Italia averaged 0.3 percent of GDP annually, followed by Banco de España at 0.2 percent.¹⁰ Payouts peaked in 2019 before most of the top-five NCBs, most notably the Bundesbank and De Nederlandsche Bank, chose to prioritize provisioning.

⁸ Bond acquisitions by purchasers outside the euro area are assumed to be intermediated through euro area banks, hence the reduction in bank reserves rather than non-EU official deposits.

⁹ Again, and although the ECB expects these balances to fall, inflating bank reserves, no behavioral assumptions are made.

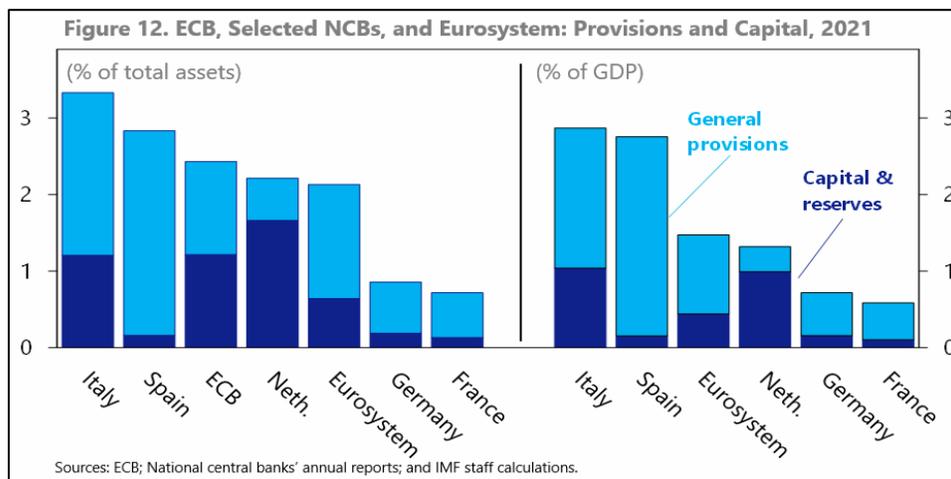
¹⁰ Banca d'Italia also paid small dividends to private shareholders. It, the National Bank of Belgium, and the Bank of Greece are the three Eurosystem NCBs with private shareholdings, involving listings and market disclosures. Private ownership is 100 percent in the case of Banca d'Italia, where Article 38 of its the statute lays out requirements for special profit distributions to the state.

Figure 11. Selected NCBs and Eurosystem: Annual Provisions, Taxes, and Profit Distributions, 2008–21 (% of GDP)

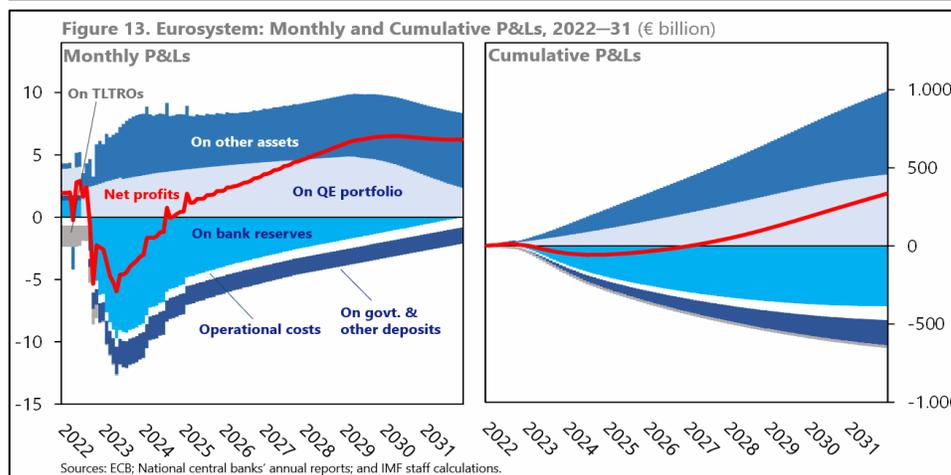


Sources: ECB; National central banks' annual reports; and IMF staff calculations.

26. **At end-2021, the Eurosystem's general provisions stood at €128 billion, mostly held at the top-five NCBs, and its capital and reserves stood at €55 billion** (Figure 12).¹¹ In addition, €555 billion was set aside in revaluation accounts, mostly linked to exchange rate-related effects on holdings of foreign currency denominated assets and to movements in the value of gold holdings. Excluding these accounts, buffers varied widely in size, reflecting different approaches to provisioning (Annex III). Among the top-five NCBs, Banca d'Italia held the largest buffers relative to unadjusted total assets.



27. **After roughly breaking even in 2022, the Eurosystem is projected to incur large losses in 2023–24 in the baseline, before returning to profit in 2025 and fully recouping the losses by 2027** (Figure 13). Cumulative losses of about €55 billion over the two years, worth 0.5 percent of euro area

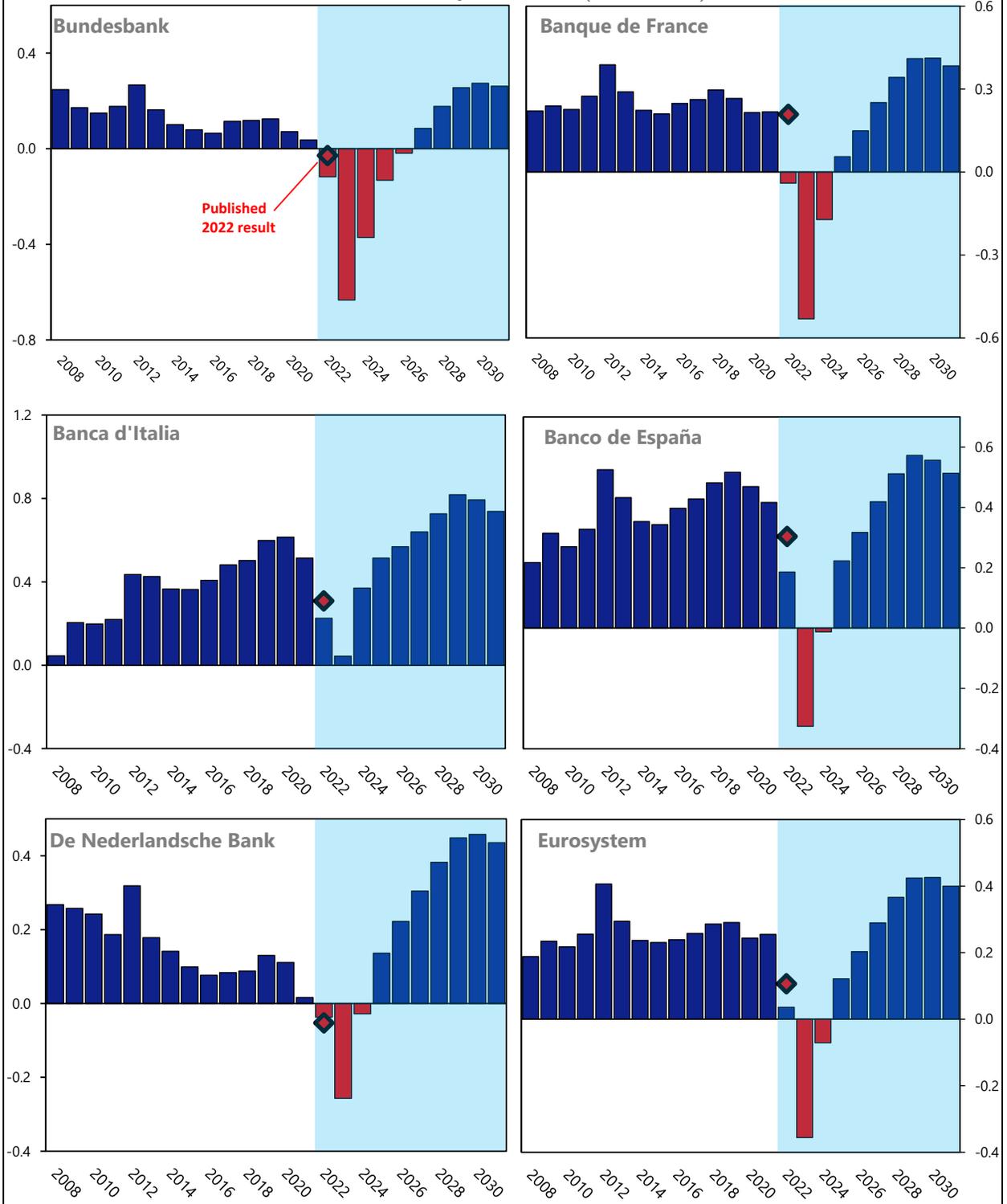


GDP, will exceed half of the Eurosystem's general provisions and, in the case of the Bundesbank and Banque de France, begin to erode capital and reserves. Although TLTRO runoff helps hasten the return to profit, the main driver of the turnaround is higher income on new assets acquired through reinvestment. For the Eurosystem as a whole, losses are fully recouped by 2027.

28. **Among the top-five NCBs, the Bundesbank is likely to see the largest and most persistent losses** (Figure 14). Cumulative losses at the Bundesbank are projected to peak at almost 1.2 percent of GDP in 2025, exceeding the sum of the €20 billion of general provisions and €6 billion of capital and reserves set aside as of end-2021. Those at Banque de France are projected to peak at 0.7 percent of GDP by 2024, fully consuming provisions and leaving capital and reserves positive but below the statutory national target. Cumulative losses at Banco de España and De Nederlandsche Bank peak at 0.2 percent and 0.3 percent of GDP, respectively, in 2024, with general provisions reduced but capital and reserves left intact. Banca d'Italia (just) avoids loss-making.

¹¹ Provisions and reserves here include only funds allocated to offset general risks, excluding items such as pension buffers.

Figure 14. Selected NCBs and Eurosystem: Annual Pre-Provision, Pre-Tax P&Ls, 2008–31 (% of GDP)



Sources: ECB; National central banks' annual reports; and IMF staff calculations.

29. **As is evident in the error bands between this paper's projections and the top-five NCBs' recently published financial results for 2022, data limitations affect accuracy** (Box 1). The value of our projections thus rests more in their direction and order of magnitude rather than in precision. Even so, as subsequent sections of the paper shall show, the projections are robust enough to draw some key conclusions.

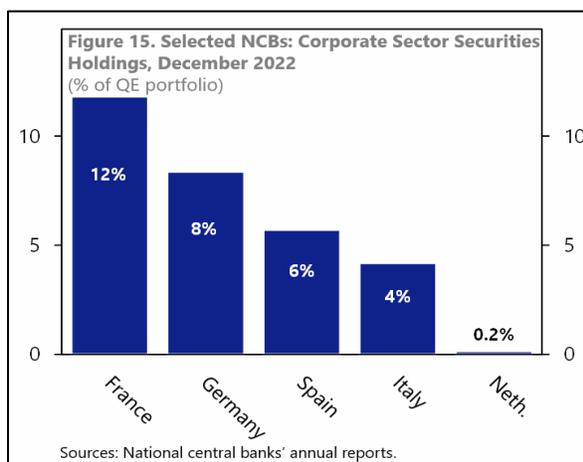
Box 1. Results for 2022 and Some Reflections on Forecast Accuracy

The projections presented in this paper kick off from 2021 data, treating 2022 as the first “forecast” year. This is done not only because 2021 was the last year before the tightening cycle began, but also because our work began in 2022. Nonetheless, by the time of going to print in mid-2023, the 2022 audited annual accounts of the top-five NCBs were out, even if those for some other Eurosystem NCBs were not.

Our projections for 2022 come close to the top-five NCBs' reported results, with the noteworthy exception of Banque de France (Figure 14). We land very close to De Nederlandsche Bank, differ but not widely from Banca d'Italia and the Bundesbank, and miss by a wider margin on Banco de España. In general, our forecast accuracy lends comfort given the complexity of the exercise and the data limitations. For Banque de France, however, net income is underestimated by a wide margin, also with a wrong sign.

Public information does not support a forensic analysis, although some observations can be drawn.

Across the board for 2022, our projections underestimate gross interest income, with an especially large miss for Banque de France, explaining the bulk of the forecast error. Reasons likely center on portfolio composition, including shorter maturities and thus faster churn into higher-yielding paper in some cases, as well as the shares of miscellaneous higher-yielding securities in non-monetary policy portfolios and of inflation-linked sovereign bonds and higher-yielding corporate bonds in the QE books (Figure 15). Our figures for gross interest expense tend to be more accurate. Generally small and varied forecast errors for net results of the pooling of monetary income are more difficult to unpack given the many moving parts.



Going forward, there are other potential sources of inaccuracy. One could be an overestimation of valuation changes on NCBs' non-monetary policy portfolios given that, there too, some portion is held at amortized cost. Another could be an overestimation of interest on reserves if declining liquidity at some point results in a gap opening up between €STR and the DFR (i.e., a return to the corridor system). No doubt, there will be many others given the information asymmetry between the Eurosystem and the public domain.

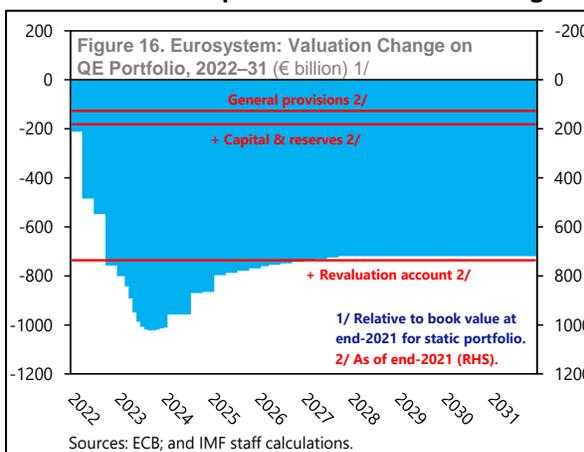
30. **Next, we briefly share some estimates of valuation effects on the Eurosystem's QE book, despite their limited relevance in our view** (Box 2). Under the applicable accounting norms, unrealized gains or losses on the QE portfolio do not feed through the income statement or reflect on the balance sheet. Nor would a decision to conduct limited volumes of outright sales require part or all of the QE book to be marked to market given that no available-for-sale concept applies. Our figures should therefore be read as an aside.

Box 2. Notional Valuation Effects on the QE Book

The paper estimates the notional impact of rising interest rates on the fair value of the Eurosystem's QE book (Annex IV). Some central banks, one prominent example being the Swiss National Bank with its especially large share of foreign assets, mark to market their full balance sheet. This can result in volatile asset values, with large valuation gains as interest rates fall and large valuation losses as rates rise. Amortized cost accounting at the Eurosystem, however, dictates that valuation effects on the QE book are realized only if securities are sold outright. Notwithstanding, we estimate valuation losses going forward, relative to book values at end-2021, on (static) QE portfolios for both the Eurosystem and its top-five NCBs, applying the baseline rate path and an assumption of orderly market conditions (no fire sale discounts).

The (moot) bottom line is that marking the QE book to market would wipe out all buffers including revaluation accounts, for both the Eurosystem as a whole and its top-five NCBs (Figure 16).

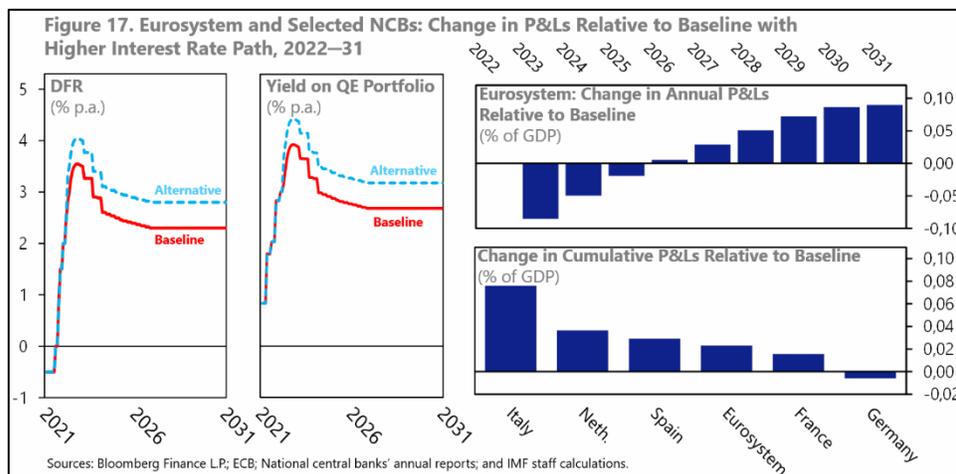
Assuming the QE book remains static in its size and composition as of end-2021, valuation losses are estimated at €758 billion at end-2022, equivalent to 5.7 percent of euro area GDP, exceeding the sum of general provisions, capital and reserves, and revaluation accounts as of end-2021. They peak at €1,015 billion, or 7.2 percent of GDP, in 2023 as interest rates peak, with the largest impacts falling on Banco de España and Banca d'Italia reflecting larger repricing on their higher-yielding QE portfolios.



Although negative equity stemming from unrealized valuation losses seems of limited relevance in the Eurosystem context, the pros and cons of enhanced reporting could be weighed. The Bank for International Settlements (2023b), for instance, argues that adopting a transparent financial framework can aid communication. The US Federal Reserve reports unrealized valuation losses as a memorandum item.

31. Our first alternative scenario quantifies the impact of a 50 basis point parallel upward shift in the rate path relative to the baseline, finding that cumulative net income improves slightly (Figure 17). Such an

upward shift is entirely plausible given the risk of high inflation proving more persistent than expected. The Eurosystem's cumulative profits in 2022–31 increase by some €19 billion, with an initial deterioration on account of reserve remuneration more than fully recouped later by higher returns

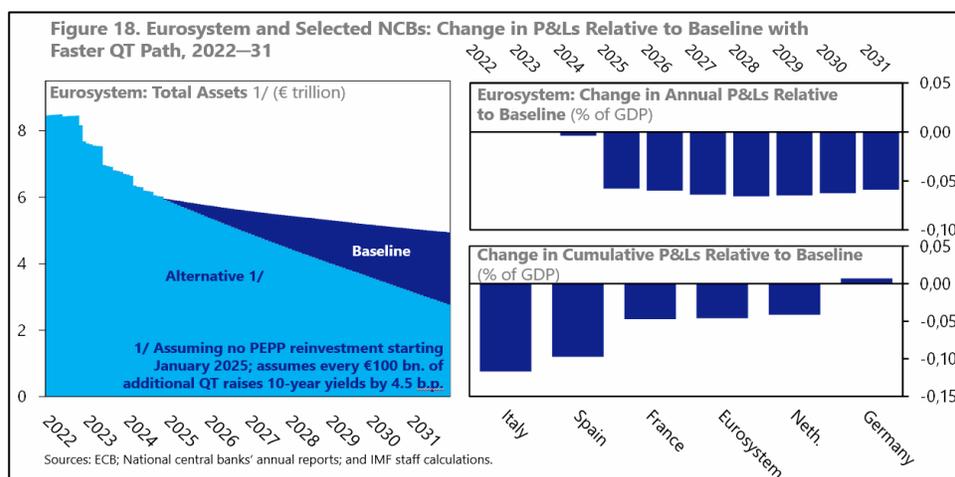


on the QE portfolio. The Bundesbank ends up worse off than in the baseline given its low bond returns and its large stock of bank reserves relative to its capital key share, with profits in 2022–31 falling by €6 billion. Banque de France, Banco de España, and De Nederlandsche Bank make a small gain. Banca d'Italia makes a gain of about €13 billion. It bears noting that a scenario that combined significantly higher interest rates in the near term with lower rates farther out would be more challenging from the profit perspective.

32. **Our second alternative scenario quantifies the impact of a faster pace of QT, finding that it would modestly reduce cumulative net income** (Figure 18). With QT having progressed smoothly thus far given strong market demand for fixed-income assets, it is conceivable that its pace could be stepped up further. This scenario assumes a cessation of PEPP reinvestment in January 2025. It also assumes that faster QT results in higher 10-year sovereign bond yields. Our estimate of this elasticity is taken from a mid-point estimate from the QE literature ([Eser et al. 2019](#) and [Altavilla, Carbonia, and Motto 2021](#)), where every €100 billion of net asset purchases reduces

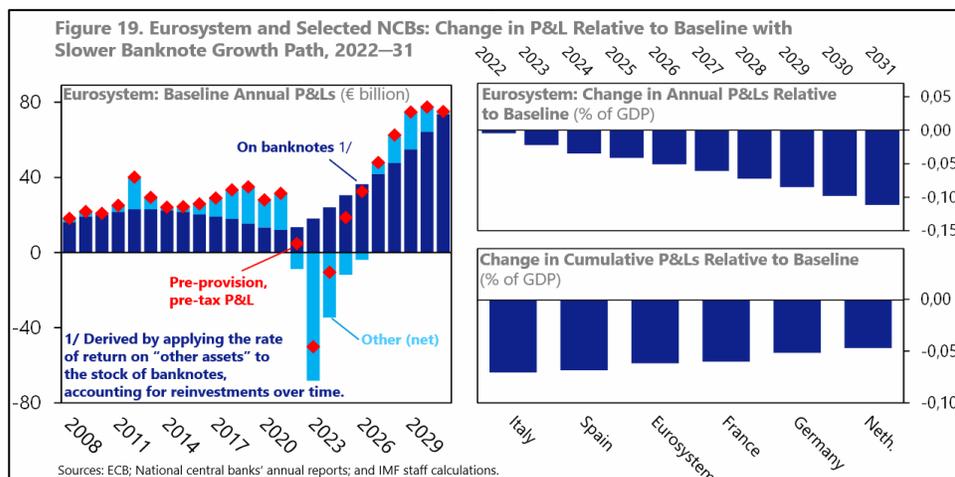
yields by 4.5 basis points. All in, the Eurosystem's cumulative net income in 2022–31 falls by €93 billion as savings from a faster reduction of bank reserves are exceeded by lost income from lower reinvestment.

Banca d'Italia sees its cumulative net income in 2022–31 reduced by the most among the top-five NCBs, while De Nederlandsche Bank records the smallest hit over the decade.



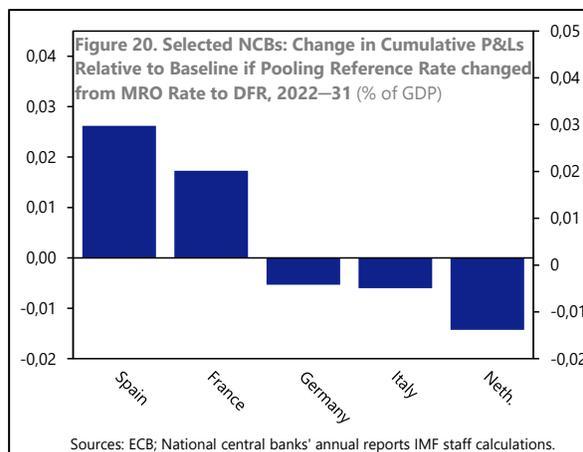
33. **Our third alternative scenario assesses the impact of a growth rate of currency in circulation half as fast as in the baseline, predictably finding that this would reduce net income** (Figure 19).

Lower demand for currency, potentially as a result of the introduction of a digital euro, for instance, would entail smaller holdings of interest-earning assets, reducing seigniorage.



Assuming uniform annual banknote growth of 3.3 percent in lieu of the robust 6.6 percent used in the baseline reduces the Eurosystem's cumulative net income in 2022–31 by €118 billion.

34. **Finally, the paper finds that setting the DFR as the reference rate in the pooling rules in place of the MRO rate would have a modest distributional impact** (Figure 20). Conceptually, such a change would have the merit of charging NCBs for the monetary base at a rate better aligned with the cost of money market funding given the floor system fully in effect since early 2016. This simulation is relevant to the extent that the rule change would affect individual NCBs' financial results. After factoring in the multiple offsetting items in the pooling rules, we find that the net impact of such a redefinition would be modest. Banque de France and Banco de España cumulate marginally higher net income in 2022–31, about €5 billion and €4 billion, respectively. The Bundesbank, Banca d'Italia, and De Nederlandsche Bank register similarly modest profit reductions.



VI. Policy Discussion

35. **One key message from our projections is that some Eurosystem NCBs will see their general provisions fully depleted and their capital and reserves turning negative as early as in 2024.** Capital and reserves are projected to remain negative at the Bundesbank for seven years and at Banque de France for four years. In more adverse scenarios, a larger number of NCBs could dip into such a situation.

36. **The ECB, in its role as rule-maker for the Eurosystem, has taken a strict view until quite recently.** In its Convergence Report of June 2022, it noted that "... any situation should be avoided whereby for a prolonged period of time an NCB's net equity is below the level of its statutory capital or is even negative ... Any such situation may negatively impact the NCB's ability to perform its ... tasks. Moreover, such a situation may affect the credibility of the Eurosystem's monetary policy. Therefore, the event of an NCB's net equity becoming less than its statutory capital or even negative would require that the respective member state provides the NCB with an appropriate amount of capital at least up to the level of the statutory capital within a reasonable period of time ... to comply with the principle of financial independence" ([ECB 2022b](#)).

37. **It is well known, however, that central banks can function credibly with negative equity for prolonged periods, and in several cases do.** In the EU, a prominent example is the Czech National Bank, which has defended its position in letters to the ECB ([Czech National Bank 2010](#)). Within the Eurosystem, the National Bank of Slovakia is another. Farther afield, the Central Bank of Chile is a case more typical of emerging markets, having had a negative equity position that reflected a structural mismatch between its returns on foreign reserves and sterilization costs. Clearly, there is a risk that negative equity can grow ever larger, requiring new base money issuance to fund interest-earning assets, distracting from the core tasks of monetary policy, and *in extremis* eroding confidence in a fiat currency; empirical evidence shows that central bank finances can affect monetary policy ([Schwartz et al. 2014](#)). This is not the case for the examples listed here.

38. **The examples underscore that delivering on the primary mandate is central.** Provided negative equity is not on an explosive path and is not allowed or seen to unduly influence monetary policy decisions, it need not be problematic. Some wrap these arguments into a concept they name “policy solvency,” which argues that what matters most is the strength of institutions and the monetary policy framework, not the financial condition of the central bank *per se*, although there is acknowledgement that a central bank in weak financial standing may be exposed to political pressures in achieving its mandate ([Stella and Lönnberg 2008](#)). In the case of the Eurosystem, equity including revaluation accounts will remain positive, instances of negative capital and reserves will be temporary, losses will be fully recouped from subsequent net income, and the Governing Council structure ensures that monetary policy decision-making is insulated from NCB-specific considerations.

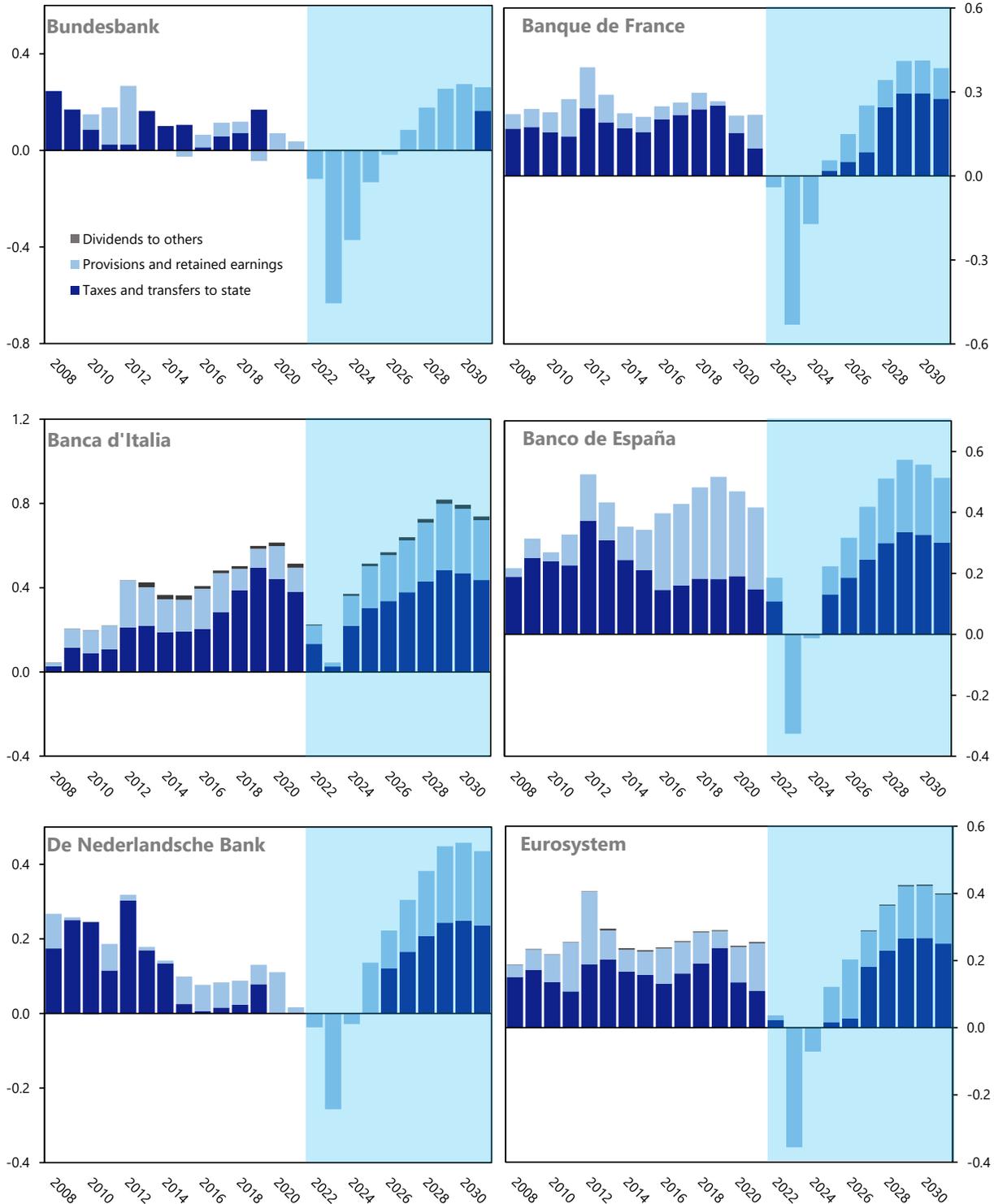
39. **Current approaches to central bank loss-making can be boiled down to three, as employed among others by the Swedish Riksbank, the Bank of England, and the US Federal Reserve.** The Swedish model explicitly contemplates the possibility of capital calls on the state in some situations ([Sveriges Riksbank 2022](#)). Typically, a government will transfer interest-earning securities to its central bank and take equity as consideration. This may be desirable if negative equity is on an explosive path and outside intervention is needed to restore sustainability. The UK model involves a standing indemnity from the state. This eliminates any need to call for one-off support, but at the cost of tightening links between central bank net income and the national budget. Finally, the US model looks through negative capital by cumulating losses as an accounting entry to be wound down by future profits. Arguably, this approach is best suited to situations of temporary loss-making.

40. **Appropriately in our view, the ECB appears to be leaning toward the third solution.** In an opinion on draft amendments to the Hungarian National Bank statute dated November 2022, the ECB noted that the spirit of the changes was that “room for maneuver may be increased by giving a longer period of time to the state to fulfil the reimbursement obligation” and suggested that periods “in excess of” five years could be problematic ([ECB 2022g](#)). Then, in an “explainer” updated in February 2023, it noted that in its own case any remaining losses after indemnities from NCBs “may be recorded on the ECB’s balance sheet, to be offset against any net income received in the future” ([ECB 2023a](#)). The ECB may thus be converging to the US approach. The NCBs, in consultation with their governments and the ECB, should consider doing likewise.

41. **Having argued that our projections do not make the case for capital support from the state, we turn to tax payments and profit transfers as the key links to national budgets.** As noted earlier, taxes and transfers already declined for all of the top-five NCBs in 2020–21, to zero in the case of the Bundesbank and near zero for De Nederlandsche Bank. In 2020, Banque de France set aside additional provisions for the first time in five years and continued to channel retained earnings to its “fund for general risks,” pushing its payments to the state to a low of 0.02 percent of GDP in 2021. Banco de España and Banca d’Italia continued to provision steadily, at annual average rates of about 0.3 percent and 0.1 percent of GDP, respectively, in 2020–21, even as strong profitability and risk management allowed both NCBs to keep making payments to the state.

42. **Conceptually, our projection period can be divided into three phases: loss-making, buffer replenishment, and a new steady state** (Figures 21–22 and Table 3). Including 2022, annual losses are projected for five years in Germany, three years in France and the Netherlands, and two years in Spain, with only Italy avoiding loss-making. The second phase begins when profits resume (which also allows Banque de France to restart tax payments). This phase is assumed to continue until both capital and reserves and general provisions are restored to their end-2021 nominal levels, with no profit transfers in the interim. Full replenishment is reached in 2025 in Spain, 2026 in the Netherlands, 2028 in France, and 2031 in Germany. Thereafter, historical payout ratios are applied, capital and reserves are assumed constant, and profits not distributed flow to provisions.

Figure 21. Selected NCBs and Eurosystem: Annual Taxes and Transfers to State, 2008–31 (% of GDP)



Sources: ECB; National central banks' annual reports; and IMF staff calculations.

Figure 22. Selected NCBs and Eurosystem: Financial Buffers and Cumulative Annual Pre-Provision, Pre-Tax P&Ls, 2022–31 (% of GDP)

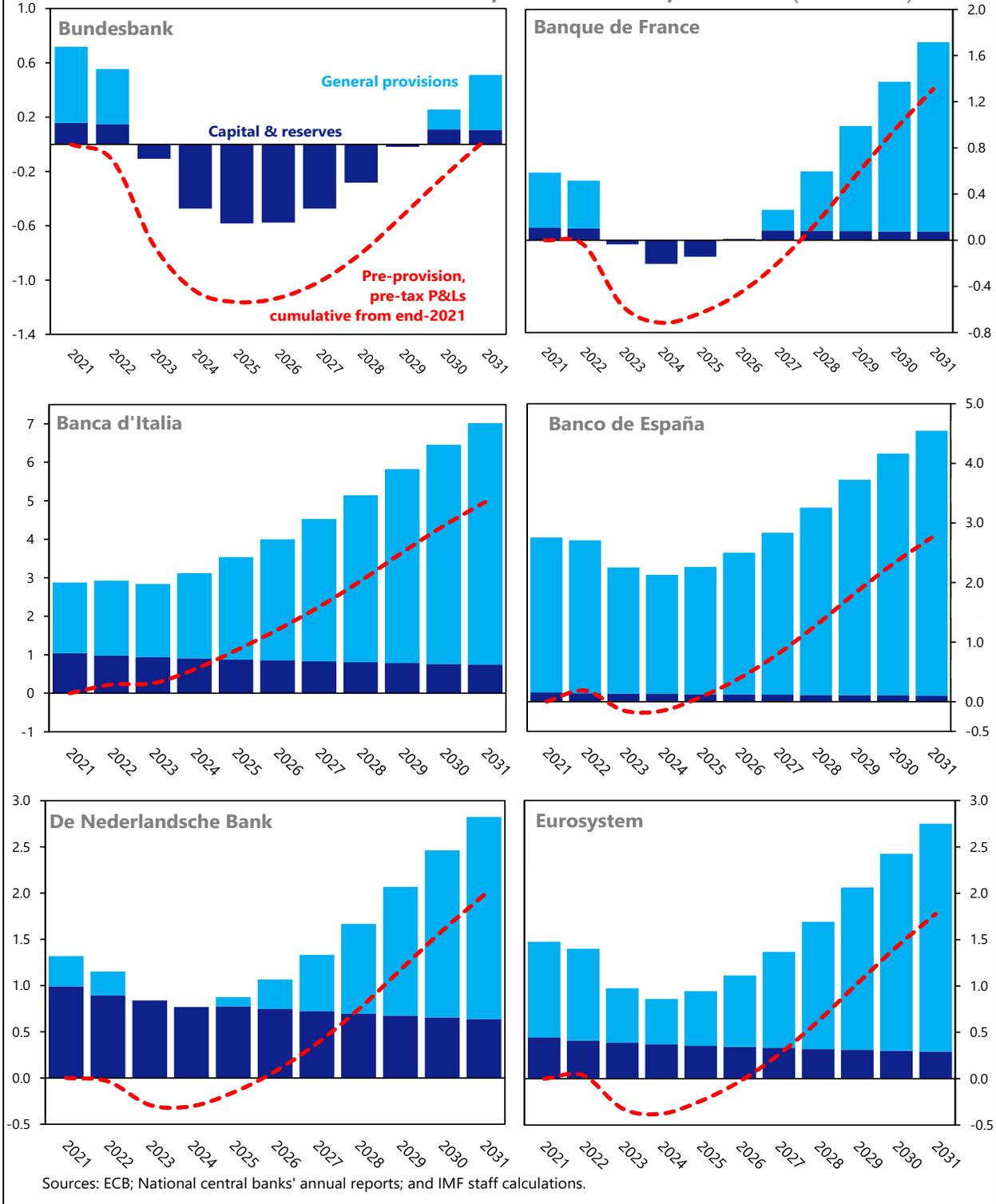


Table 3. Selected NCBs: Average Annual Tax Payments and Transfers to State, 2008–31
(Percent of GDP unless otherwise indicated)

	Old steady state 2008–22 1/	Period of loss-making 2023–24 1/	Replenishment & resumption 2025–31 1/	No. of yrs. without tax or transfer
Bundesbank	0.08	0.00	0.03	11
Banque de France	0.17	0.00	0.19	3
Banca d'Italia	0.23	0.12	0.41	0
Banco de España	0.21	0.00	0.26	2
De Nederlandsche Bank	0.09	0.00	0.18	4

Sources: IMF staff estimates and projections.
1/ P&L periods as applicable to Eurosystem as a whole; periods for individual NCBs vary.

43. **In sum, it becomes clear that the current QE–QT cycle will likely result in long interruptions to some NCBs' tax and profit payments to national budgets.** This is most notably the case for the Bundesbank, which looks unlikely to make any payments to the German government for a total of 11 years (this includes 2020–21). For the Netherlands, the gap would be four years, for France three, and for Spain two. In Italy, corporate tax payments and profit transfers would dip to minimal levels in 2023 but avoid interruption.

44. **One parting policy suggestion, therefore, would be for NCBs to consider adopting more-conservative profit distribution policies in the future steady state.** Already the current cycle is demonstrating how Banca d'Italia, Banco España, and De Nederlandsche Bank, having set aside relatively generous financial buffers as a ratio to total assets, are better placed to smooth their transfers to the state than some other NCBs. Looking ahead to the next balance sheet cycle, this paper would argue that paying more-moderate dividends when net income is positive can help NCBs maintain some dividends when pre-provision net income is negative. Adopting a more-conservative profit distribution policy for the future steady state would, among other benefits, assist in the formulation of medium-term national budgetary plans.

VII. Conclusion

45. **This paper has sought to put numbers on the increasingly public fact that the Eurosystem and most of its NCBs will dip into loss-making this year.** Its basic finding is that losses will be large and persistent at some NCBs, yet not so large and persistent as to necessitate capital support from member states. Its alternative scenarios, in turn, find that parallel upward shifts in yield curves improve net income slightly on a ten-year basis; that faster QT modestly reduces the same; that lower demand for banknotes has a predictably negative impact on seigniorage; and that switching the reference rate in the Eurosystem's income-pooling formulae from the MRO rate to the DFR would have a modest distributional effect across NCBs.

46. **The paper finds a wide dispersion of financial results across NCBs, stemming in no small part from the Eurosystem's mutually agreed safeguards.** Capital key constraints keep QE focused on the monetary policy stance. Per-issue and per-issuer limits preserve fiscal incentives. Pooling rules ensure the equitable sharing of monetary income. Finally, the bond allocation and risk-sharing rules dictate a home bias in NCBs' sovereign debt holdings. This, even after applying the pooling formulae, results in a home bias in NCBs' interest earnings.

With coupon income from the home sovereign as the key driver of the projected return to profits, NCBs in lower-debt countries with lower funding costs will, barring other factors, tend to see lower net income.

47. **Our policy conclusions are fourfold.** First, the temporary nature of losses in this cycle suggests the ECB should encourage NCBs to look through negative capital. Second, even without capital support from the state, fiscal impacts will be material, with annual taxes and transfers of 0.1–0.2 percent of GDP facing interruptions, in one case for as long as 11 years. Third, more-conservative profit distribution norms in the future steady state could help mitigate the on-off pattern of dividends. Finally, the loss-making must remain orthogonal to monetary policy decision-making, as indeed it is at the ECB. Should policymakers come to favor a faster pace of QT, for example, be it to further tighten the stance, help adjust the operational framework, or support transmission, the specter of realizing valuation losses in outright bond sales should not be a consideration. Similarly, if other tools to reduce excess liquidity were to come into focus, it should be for monetary policy reasons alone.

48. **In the final analysis, the ECB's credibility will rest on its ability to deliver on its primary objective of price stability.** And, as regards the fiscal effects of the ECB's balance sheet policies in the period since the global financial crisis, it bears noting that, while the budgetary impacts from temporary Eurosystem loss-making are indeed projected to be material in the years ahead, absent those policies a weaker macroeconomic environment might well have had a larger negative impact on the public finances.

Figure 23. Selected NCBs and Eurosystem: Annual Balance Sheets, 2008–31
(% of GDP)

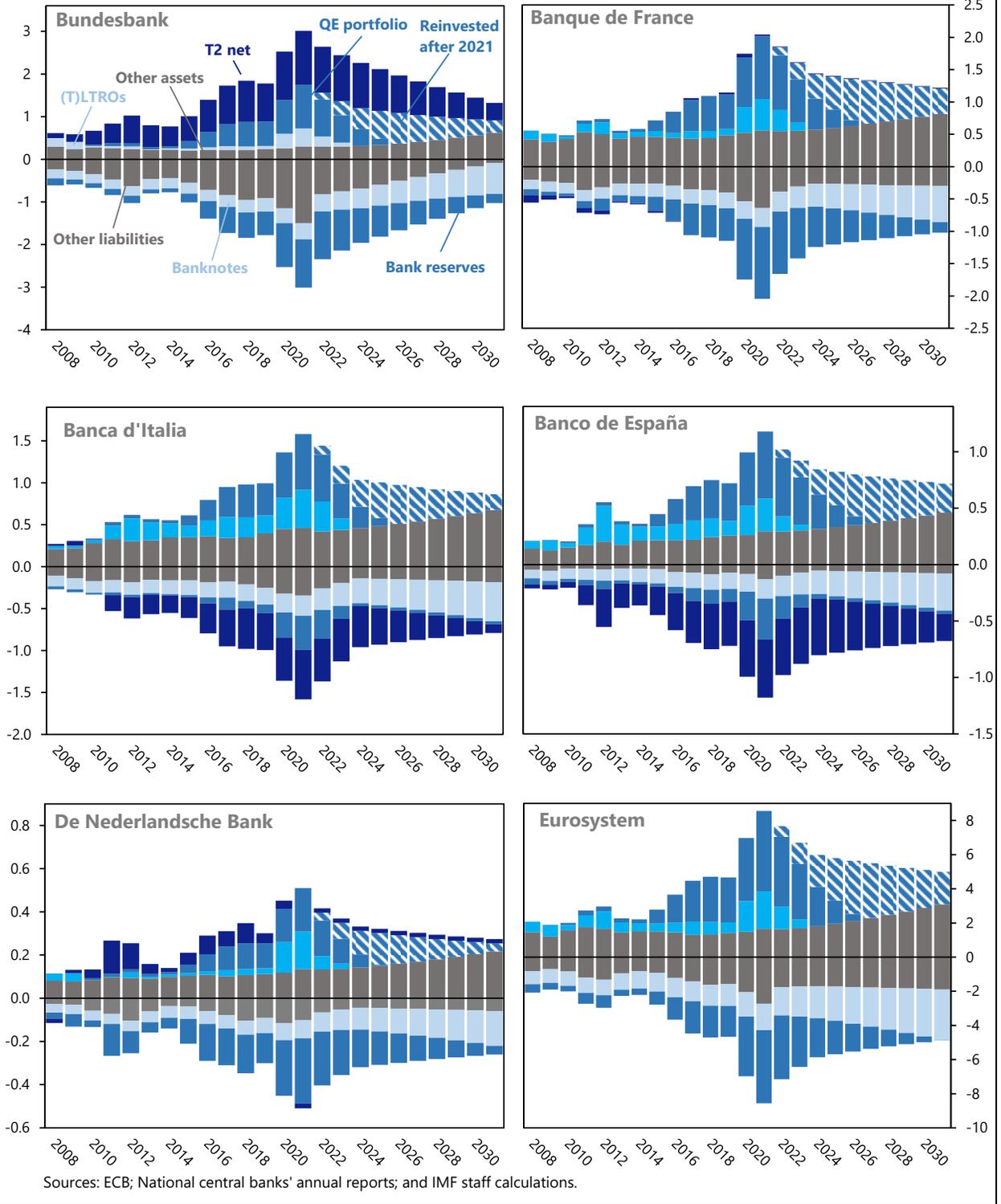


Figure 24. Selected NCBs and Eurosystem: Monthly P&Ls, 2022–31
(€ billion)

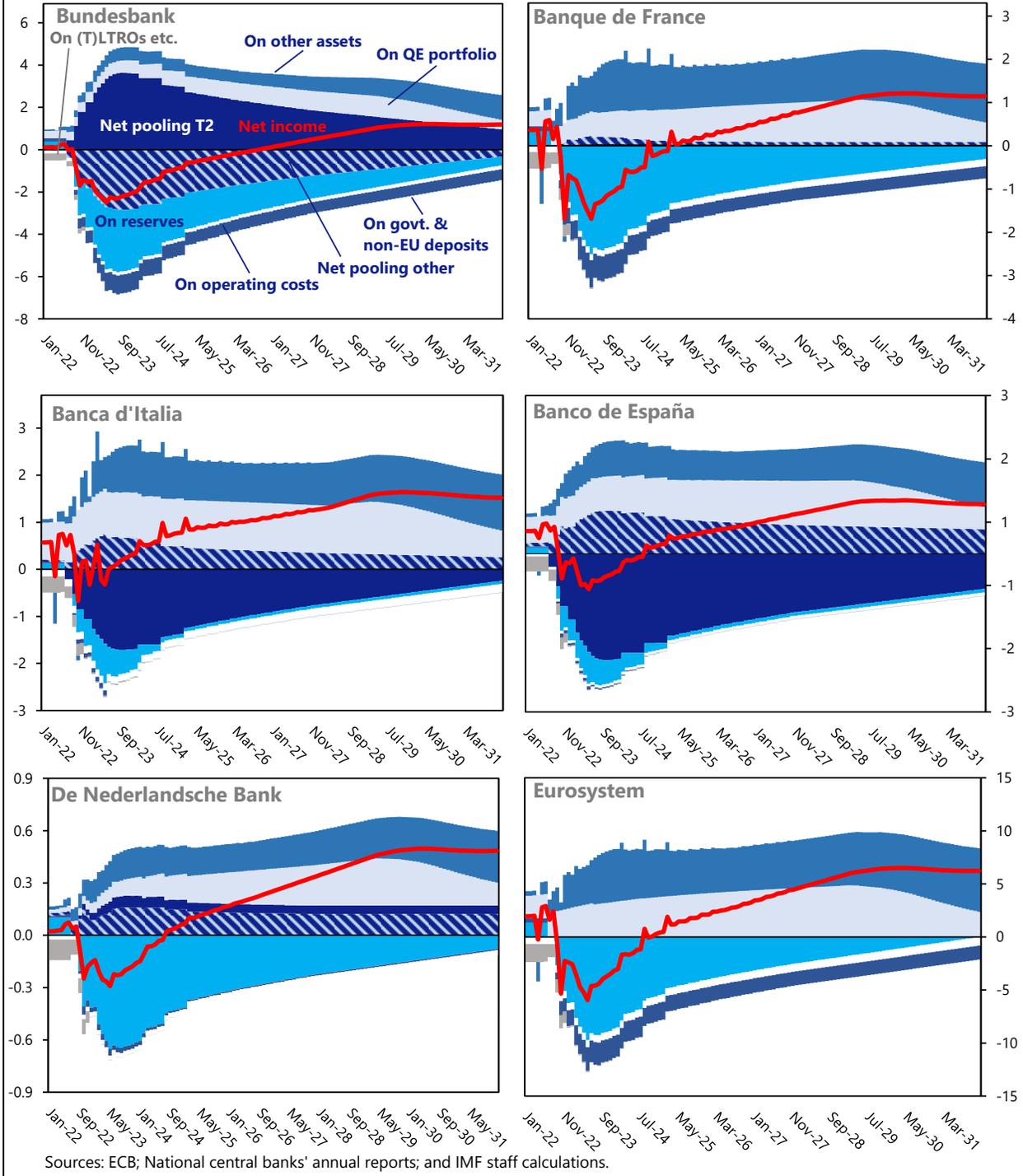
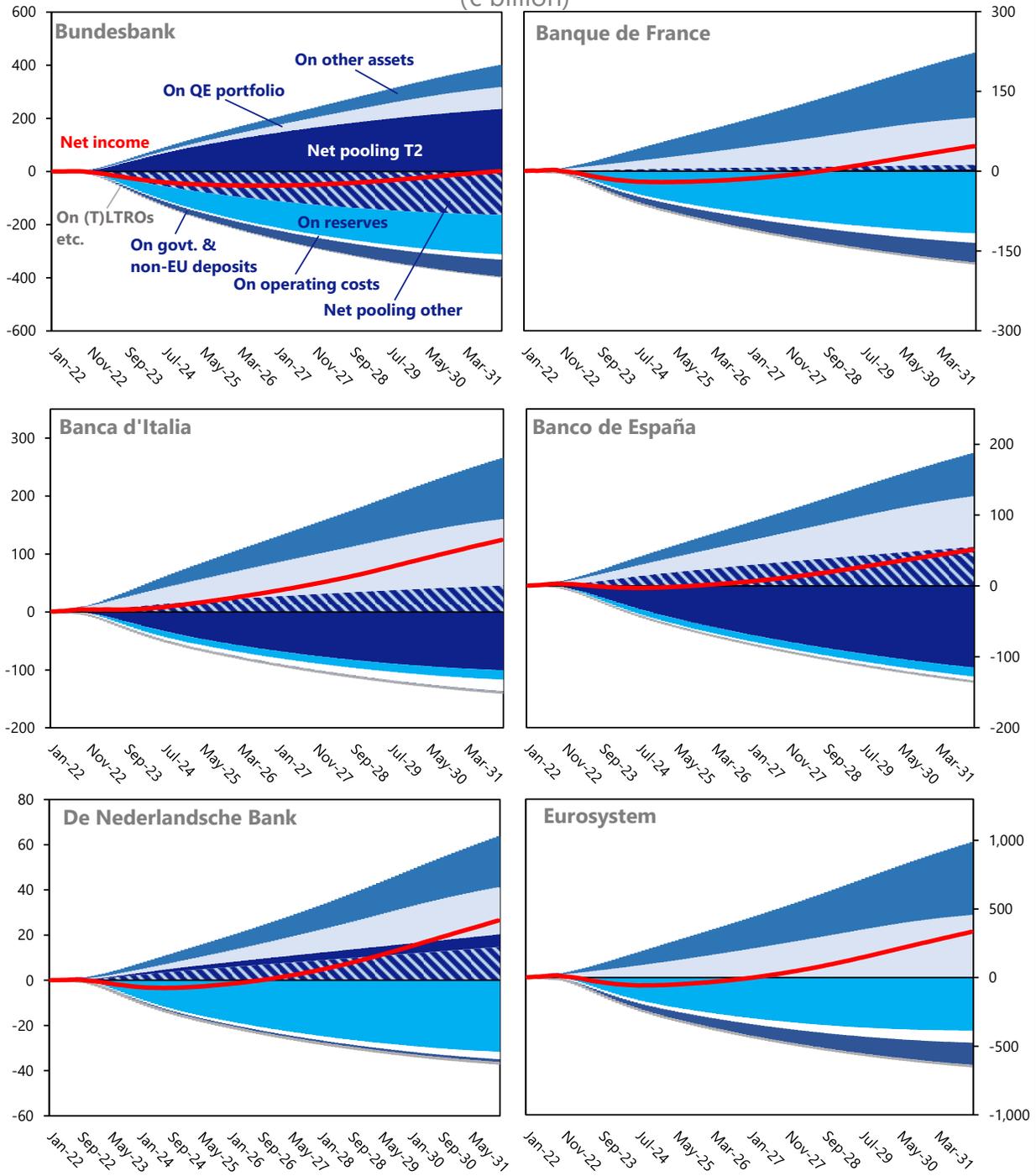
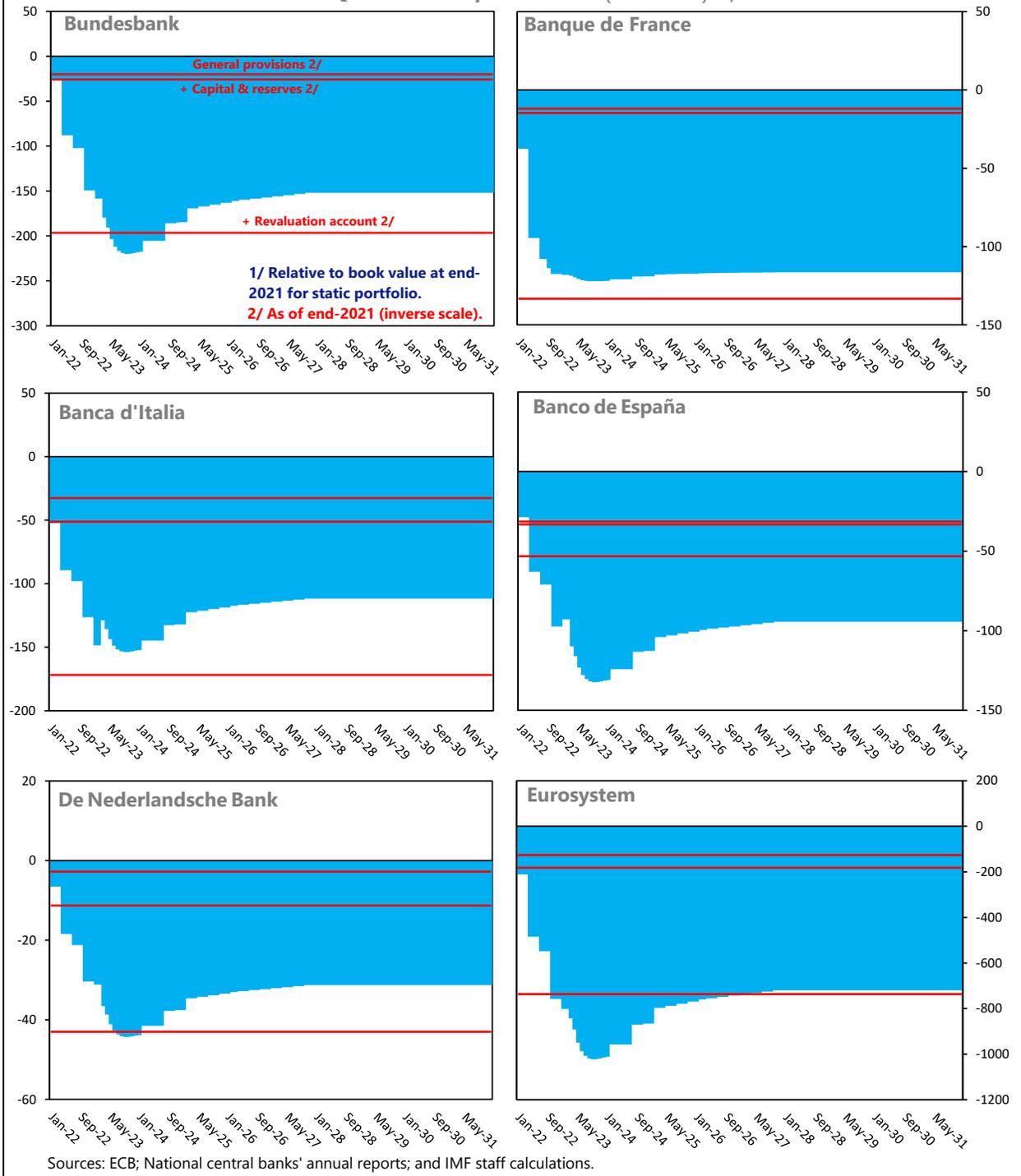


Figure 25. Selected NCBs and Eurosystem: Cumulative Monthly P&Ls, 2022–31
(€ billion)



Sources: ECB; National central banks' annual reports; and IMF staff calculations.

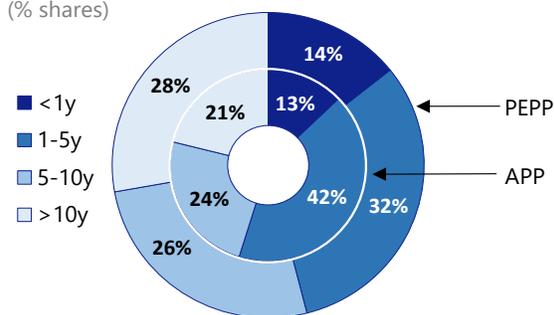
Figure 26. Selected NCBs and Eurosystem: Valuation Change on QE Portfolio, 2022–31 (€ billion) 1/



Annex I. Estimating the Maturity of the QE Portfolio

The maturity of the Eurosystem's QE portfolio is a key input to the net income projections and for bond valuation (Figure 27 and Table 4). Maturity-bucket data for the ECB's solo APP and PEPP portfolios are taken from the [Annual Accounts of the ECB 2021](#). A remaining weighted average maturity (WAM) is calculated from the mid-points of the four available maturity intervals on the two portfolios. The resulting overall remaining WAM on securities held for monetary policy purposes comes out at 7.1 years. This is assumed to remain constant going forward, and to apply uniformly to the top-five NCBs and the Eurosystem as a whole.

Figure 27. ECB: Maturity Profile of APP and PEPP, December 2021 (% shares)



Source: ECB.

Table 4. Eurosystem: Weighted Average Maturity Calculations, December 2021

Maturity bucket	APP maturity distrib. (% share)	PEPP maturity distrib. (% share)	APP balance (€ million)	PEPP balance (€ million)	Total weighted maturity (€ million)	Mid-point maturity assumption (years)
< 1 year	12.8	14.3	402,204	242,689	322,447	0.5
1–5 years	42.0	31.7	1,319,733	537,989	4,644,305	2.5
5–10 years	24.1	26.2	757,275	444,647	9,014,419	7.5
> 10 years	21.1	27.8	663,009	471,801	20,426,579	18.0
Total			3,142,221	1,697,127		
WAM						7.1

Sources: ECB; and IMF staff calculations.

Annex II. TLTRO III Rate and Repayment Assumptions

TLTRO interest rates were intended to incentivize banks to lend. For the third series under the program (TLTRO III), seven quarterly tenders were initially announced and took place between September 2019 and March 2021. On December 10, 2020, the ECB Governing Council added three additional tenders to be conducted between June and December 2021. All TLTRO III operations carry a three-year maturity. The interest rate for each operation can vary between the average MRO rate and the average DFR, with the exception of a “special interest rate period” from June 24, 2020 to June 23, 2021 and an additional such period from June 24, 2021 to June 23, 2022 during which the interest rate was reduced by 50 basis points. For banks that reached the lending threshold during these special periods, the interest rate could not go higher than –1 percent ([ECB 2022e](#)). Starting in September 2021, participants in TLTRO III operations were given the option, on a quarterly basis, of repaying or reducing their TLTRO III drawings ahead of maturity, provided at least one year had elapsed since initial settlement date. Finally, on October 27, 2022 TLTRO conditions were recalibrated to incentivize early repayments by indexing the interest rates on all remaining TLTRO III operations to the average applicable key ECB interest rates, to take effect on November 23, 2022.

This paper takes as given that remaining TLTRO III balances will roll off on their final maturity dates and makes several assumptions on TLTRO III interest rates (Table 5). Specifically, TLTRO III rates remain negative throughout 2022: at a rate derived from actual payments in 2021 (–0.93 percent) until end-June, when the additional special interest rate period ended; at the average observed DFR over the life of each operation until end-November 2022, when the “main interest rate period” ended; and at the average of the observed and forward DFRs over the life of each operation thereafter.

Table 5. Eurosystem: TLTRO III Balances, May 2023

Operation	Date of operation	Drawings (€ bn.)	Earliest possible repayment date ^{1/}	Repayments to date (€ bn.)	Final maturity date	Amount outstanding (€ bn.)
1	September 25, 2019	3	September 29, 2021	3	September 28, 2022	0
2	December 18, 2019	98	September 29, 2021	98	December 21, 2022	0
3	March 25, 2020	115	September 29, 2021	83	March 29, 2023	32
4	June 24, 2020	1,308	September 29, 2021	759	June 28, 2023	549
5	September 30, 2020	175	September 29, 2021	84	September 27, 2023	90
6	December 16, 2020	50	December 22, 2021	5	December 20, 2023	45
7	March 24, 2021	331	March 30, 2022	40	March 27, 2024	290
8	June 24, 2021	110	June 29, 2022	34	June 26, 2024	76
9	September 29, 2021	98	June 29, 2022	6	September 25, 2024	91
10	December 22, 2021	52	June 29, 2022	8	December 18, 2024	44
Total		2,339		1,121		1,218

Sources: ECB; and IMF staff calculations.

^{1/} In October 2022, the ECB announced three early repayment windows: November 23, 2022; January 25, 2023; and February 22, 2023.

Annex III. Provisioning, Capital, and Profit Distribution Norms

	Rules for provisioning and profit allocation	Target level of capital and reserves above which dividend payments are unrestricted (data as of end-2021)	Rules for allocating losses	Rules for capital injection	References
ECB	An amount up to 20 percent of net profit for any year, as determined by the Governing Council, is transferred to the General Reserve Fund (GRF), subject to a limit equal to 100 percent of capital. The sum of general risk provisions and the GRF may not exceed the value of paid-up capital. The GRF balance stood at zero at end-2021 while general risk provisions stood at €8.2 billion. The remaining net profit is distributed to the NCBs in proportion to their paid-up shares.	Capital (€8.2 billion) + general risk provisions (€8.2 billion) = €16.4 billion. Dividend payments are not legally restricted even below this threshold.	In the event of a loss, the shortfall may be offset against: (a) The GRF; and (b) If necessary, the monetary income of the NCBs for the relevant financial year, following a decision by the Governing Council. Any remaining net loss may be recorded on the balance sheet as a loss carried forward and may be offset against any net income received in subsequent years.	The ECB can make calls on the NCBs to contribute to the ECB's capital.	Protocol (No. 4) on the Statute of the European System of Central Banks and of the European Central Bank , profit and loss allocation Art. 33; capital increase Arts. 28.1 and 30.4.
Deutsche Bundesbank	The bank may transfer funds to its general risk provision without a specific limit. Provisions for statutory reserves are the maximum of 20 percent of operating surplus and €250 million, until statutory reserves reach €2.5 billion. Dividends to the state are paid after provisions for statutory reserves.	Capital (€2.5 billion) + statutory reserves (€2.5 billion) = €5 billion.	In 2021, the Bundesbank made an operating loss and was allowed to offset it using its reserves.	n.a.	Bundesbank Act , Art. 27. 2021 Annual Report .

	Rules for provisioning and profit allocation	Target level of capital and reserves above which dividend payments are unrestricted (data as of end-2021)	Rules for allocating losses	Rules for capital injection	References
Banque de France	5 percent of net profits are transferred to the statutory reserve, until twice the capital is reached (target level of reserves is €2 billion). There is no rule for allocations to extraordinary reserves. The General Council of the Banque de France can decide either to channel profits to reserves or to distribute them to the state.	Capital (€1 billion) + statutory reserves (€2 billion) = €3 billion.	n.a.	n.a.	Code monétaire et financier , Art. R. 144-4.
Banca d'Italia	20 percent of net profits are distributed to ordinary reserves, another 20 percent to extraordinary reserves, and up to 6 percent of capital to shareholders. The remaining net profits are transferred to the state. Banca d'Italia shares are owned by the private sector.	Capital = €7.5 billion. The ordinary reserve, standing at €6.5 billion, if reduced to offset losses, must be reconstituted entirely before proceeding to any profit distributions.	n.a.	n.a.	Banca d'Italia statutes , Art. 38, 37.2 and 39.2.
Banco de España	The central bank estimates its provisioning needs, including for financial risk, and allocates profits accordingly, with the remainder paid to the Treasury.	Capital = €1 billion.	n.a.	n.a.	Royal Decree 2059/2008 , Art. 1.1.
De Nederlandsche Bank	The bank makes or releases provisions for financial risks ("VFR") based on a methodology agreed with the finance ministry (up to a maximum of 50 percent of profit, or 100 percent in case of a buffer shortfall, i.e., when total risks are higher than the sum of the capital and the VFR). A share of profits is paid as dividend or goes to increasing the capital (general reserve) by 3.4 percent per year up to a maximum of 50 percent of profit.	Capital = €8.5 billion.	n.a.	n.a.	DNB Statutes , Art. 19/22 for reserves and dividend; 2019 capital policy review and 2019 annual report .

Annex IV. Valuing the QE Portfolio

The standard bond pricing formula is the starting point to calculate the impact of rate hikes on the value of bonds:

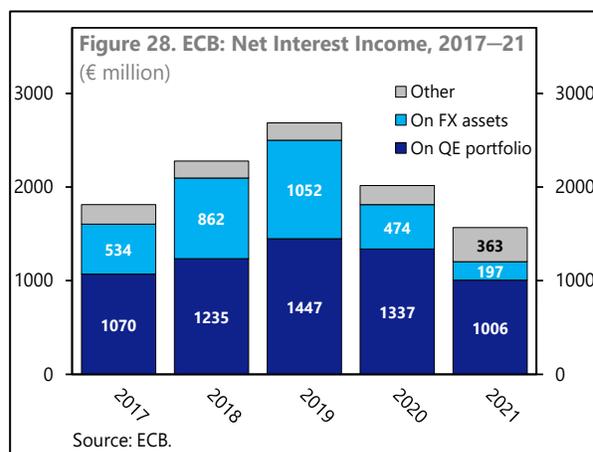
$$\text{Bond price} = \sum \frac{C_n}{(1+i)^n} + \frac{P}{(1+i)^n}$$

Where

- n = periods over which the coupon is paid until the maturity of the bond
- C_n = Coupon payment in the n th period
- i = interest rate or required yield
- P = Par value of the bond (also known as the face value).

There is no publicly available information regarding the par value of bonds held by the Eurosystem, the coupon payments on these securities or disaggregated data on their maturity. Some simplifying assumptions are adopted, illustrated using the consolidated Eurosystem amounts:

- The stock of bonds held by the Eurosystem for monetary policy purposes as of December 2021, amounting to €4.7 trillion, is assumed to represent one unique portfolio of similar bonds to which a 5 percent correction is applied to obtain its par value. This correction was obtained by approximating QE purchases each month by the value of similar bonds using aggregate Bloomberg data, averaged from the start of QE.
- The yearly interest income reported in the [2021 ECB Annual Report](#), which amounted to €1.006 billion, is assumed to reflect the coupon payment of this aggregate representative bond (Figure 28). Since the ECB held €445.5 billion in securities for monetary policy purposes, the interest rate on the bond would equal 0.23 percent.
- A weighted average maturity of debt of 7 years is used (see Annex I).



Valuing the QE portfolio and the income effects can be formalized as follows. With unchanged reserves' remuneration policies, central bank balance sheet accounting equation can be written as:

$$\text{Securities} + \text{TLTRO} + \text{OthAssets} = \text{Banknotes} + \text{Min.reserves} + \text{Excess.reserves} + \text{Equity} + \text{OtherLiab}$$

The profit equation is given by:

$$\pi = \text{Securities} * i_{7Y} + \text{TLTRO} * i_{tltro} - \text{Min.reserves} * i_{mro} - \text{Excess.reserves} * i_{exc}$$

For non-exempt excess reserves when deposit rates are negative by the tiering system, and given that banks can switch funds from excess reserves to deposit accounts, we can write:

$$i_{exc.1} = \max(i_{dfr}, \min(0, i_{dfr})) = i_{dfr} = i_{mro} - 0.5.$$

Given that $i_{dfr} \geq 0$ as of July 2022, the non-linearity induced by the tiering can be ignored in the formula.¹²

Assuming that $i_{7Y} = constant$; $i_{ultra} = constant$; $i_{exc} = i_{exc.1} = i_{mro} - 0.5$, the change in profit following a variation in i_{mro} will be given by

$$\frac{\partial \pi}{\partial i} = \frac{\partial \text{Securities}}{\partial i} - \frac{\text{Min. reserves} * i_{mro} + \text{Excess. reserves} * i_{exc}}{\partial i} = \text{valuation} + \text{remuneration}$$

As $\text{Securities} = \frac{SEC_0}{(1+i)^n}$ (Annex 1), this implies that:

$$\text{valuation} = \frac{\partial \text{Securities}}{\partial i} = -n \frac{SEC_0}{(1+i)^{n+1}}$$

And since $\text{remuneration} = -\text{Min. Reserves} - \text{Excess. reserves}$, then:

$$\partial \pi = \partial i * \left(-n * \frac{SEC_0}{(1+i)^{n+1}} - \text{Min. Reserves} - \text{Excess. Reserves} \right).$$

¹² For excess reserves exempted by the tiering system, $i_{exc.2} = \max(i_{dfr}, 0) = i_{dfr} * 1_{i_{dfr} \geq 0} + 0 * 1_{i_{dfr} < 0}$.

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