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A novel decomposition of national central banks' profits in the euro area: application to the case of Banco de Portugal

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Abstract
We propose a new methodology to decompose the profits of a national central bank within the Eurosystem. Our methodology compares the income generated by the different assets and liabilities with the Eurosystem's marginal funding cost and distinguishes the income driven by monetary policy decisions taken at the aggregate level (with shared or non-shared income) from that determined by national activities not related with monetary policy. We apply this decomposition to the case of Banco de Portugal for the last two decades and show that the bulk of the central bank's profits was driven by monetary policy decisions, while income from other assets was on average close to administrative costs. (JEL: E58, E52, M41)
Keywords: central bank finances; seigniorage; monetary policy credibility; profitability analysis.

1. Introduction

Until the burst of the great financial crisis in 2008, central banks' balance sheets were relatively small and their assets mainly comprised short-term financing operations with financial institutions and short- and medium-term sovereign debt securities. On the liability side, operations were mainly financed by currency issuance, with interest-bearing reserves playing a minor role. The last decade saw however an unprecedented increase in central banks' balance sheets around the world (Figure 1). At the end of 2021, the total assets of the Eurosystem, the US Federal Reserve, the Bank of England and the Bank of Japan ranged between 38% and 134% of GDP, which compares with an interval between 6% and 21% of GDP before the great financial

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crisis.[1] Within the Eurosystem, a similar trend was observed across all NCBs despite substantial heterogeneity, especially in the first years after the great financial crisis and again after the pandemic crisis. In 2021, NCBs' total assets ranged between 44% and 137% of GDP. The increase in balance sheets resulted mostly from large purchases of sovereign debt securities, mainly with medium to long-term maturities and fixed interest rates, implying a significant increase of central banks' exposure to interest rate risk and, in some cases, to sovereign credit risk.

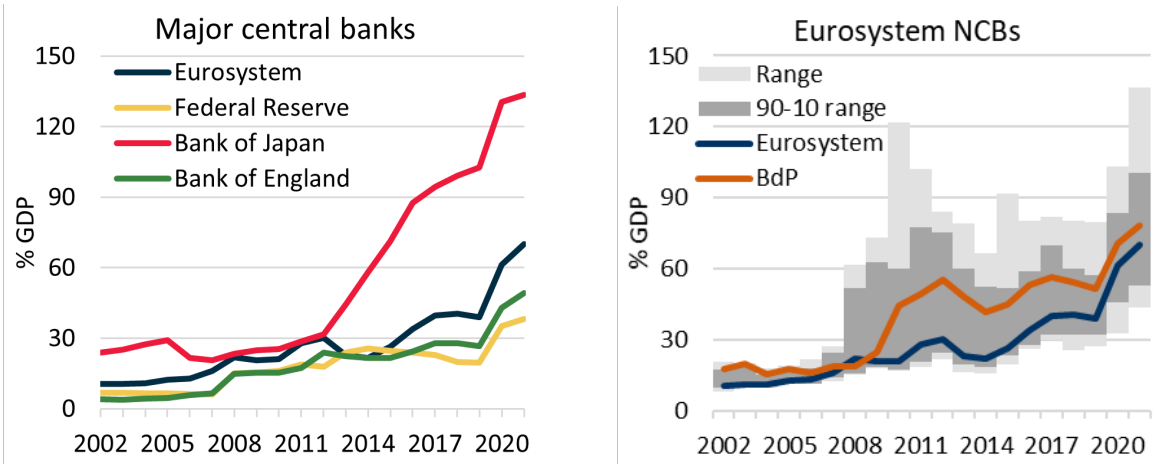

FIGURE 1: Central banks' total assets in selected advanced economies and within the Eurosystem

Notes: Eurosystem total assets do not include intra-Eurosystem claims as they net out. For NCBs, total assets include only the net position between intra-Eurosystem claims and liabilities. | Latest observation: 2021.
Sources: European Central Bank, Eurosystem, Federal Reserve, Bank of Japan and Bank of England.

The increase in central banks' balance sheets and the risks involved with outright asset purchase programmes have reignited the discussion on monetary and fiscal policies interactions. In particular, a recent strand of the literature discusses the role of central bank's solvency in supporting monetary policy credibility. Bassetto and Messer (2013), Del Negro and Sims (2015), Hall and Reis (2015) and Benigno and Nisticò (2020) discuss the case of a single monetary authority issuing liabilities in domestic currency, while Bassetto and Caracciolo (2021) study the case of a NCB within a monetary union.[2] These studies show that a central bank is capable of achieving a price stability objective if (i) fiscal policy guarantees public debt sustainability for any given price level and (ii) the fiscal authority ensures fiscal support of the central bank in case of need. In the absence of these conditions, the central bank could in principle become 'policy insolvent' (i.e. not be able to achieve its policy objectives). Although the quantitative estimates suggest that such situation is very unlikely to occur in advanced economies, it is important to monitor central banks' financial strength and design mechanisms to ensure that their financial situation does not undermine the price stability objective.

1. The Eurosystem comprises the European Central Bank (ECB) and the national central banks (NCBs) of European Union member states that have adopted the euro as their domestic currency.

2. See Cardoso da Costa (2022) for a literature review.

Some empirical studies have tried to assess the risks of central banks' balance sheets. In the case of the Federal Reserve, Anderson *et al.* (2022) have recently simulated the evolution of net income under different paths for interest rates and other financial variables, based on policy assumptions consistent with the plans defined by the Federal Open Market Committee (FOMC) in May 2022. These simulations suggest that the Federal Reserve's remittances to the US Treasury will likely be suspended for three years, but show that under more extreme scenarios the suspension could endure until the end of the decade. In the case of the Eurosystem, Debrun *et al.* (2021) presented projections for the net income between 2021 and 2030 under three alternative scenarios. In all of them, the net income remains positive over this period, despite falling gradually after 2024. The decline is more pronounced in a scenario where interest rates rise more quickly, with several NCBs temporarily facing negative net income. After the strong increase of inflation in 2022 and the tightening of the monetary policy stance with successive interest rate hikes, several central banks have already alerted that their profits may turn negative for some time.[3]

This article discusses the income generation process of a NCB in the Eurosystem. For most central banks, it is relatively easy to understand and quantify their seigniorage revenues, which generally derive from the right to issue legal tender. Profit accounting in the Eurosystem has however certain specificities that turn the analysis more complex. First, each NCB implements commonly agreed monetary policy measures within its jurisdiction and has its own balance sheet. Generally, the remuneration of assets related with monetary policy (the monetary income) is shared across all NCBs based on the Eurosystem capital key,[4] independently of the income generated by the assets and liabilities specifically held in each NCB's balance sheet. However, this general rule does not apply to all monetary policy operations. In particular, the income generated by sovereign debt securities held by NCBs for monetary policy purposes under some asset purchase programmes is not shared in any return exceeding the ECB rate for Main Refinancing Operations (MRO),[5] which leads to a first source of income heterogeneity across NCBs. Moreover, NCBs balance sheets may also comprise a significant fraction of assets not related with monetary policy, adding a second important layer of heterogeneity across NCBs. Hence, the specificity of central bank accounting in the Eurosystem implies that it is necessary to understand the drivers of central banks' aggregates both at the Eurosystem and national levels in order to fully uncover the evolution of NCBs' income.

3. In a letter recently sent to the Ministry of Finance, De Nederlandsche Bank highlights that it will likely register losses in the coming years (De Nederlandsche Bank 2022). Similarly, the National Bank of Belgium communicated to the market the expectation of recording losses in 2022, a situation that could continue until 2027 (National Bank of Belgium 2022). Kjellberg and Ahl (2022) show the negative impact of an interest rate hike scenario for the case of the Sveriges Riksbank.

4. The Eurosystem capital key is reviewed periodically to reflect each country's share in the total population and in the GDP of the euro area.

5. This is the case of the Public Sector Purchase Programme (PSPP) and the Pandemic Emergency Purchase Programme (PEPP) in its components of sovereign debt: PSPP-GOV and PEPP-GOV.

Additionally, the set of rules guiding the distribution of monetary income across NCBs were defined under the framework of a corridor system to steer short-term interest rates, where the marginal cost of funding of the Eurosystem corresponds largely to the MRO rate. Under an excess liquidity environment, as the one observed in the last decade, the monetary policy works under a *de facto* floor system, where the short-term market interest rates are closer to the deposit facility rate (DFR). This implies a difference between the remuneration of certain monetary policy operations (at the MRO rate) and the marginal cost of funding of the Eurosystem (the DFR).[6] As discussed below, this difference may further distort the generation of NCBs' income.

In this article, we address these concerns by proposing a novel decomposition of NCBs' profits that clearly distinguishes the income generated from monetary policy decisions taken at the aggregate level, from that determined by national activities not directly related with monetary policy. In addition, monetary income is split between the component shared among all NCBs and that driven from assets with non-shared income. We further decompose the income generated by the different assets and liabilities taking into account the difference vis-à-vis the Eurosystem's marginal funding cost, an approach that could also be applied to other central banks. The proposed view over the income generating process is typically not presented in the financial statements, but may prove useful to understand the main drivers of central banks' income and to develop risk assessment exercises. We illustrate the decomposition for the case of Banco de Portugal over the past two decades.

2. The national central banks' balance sheet

The common Eurosystem accounting and reporting rules are set out in a published ECB guideline that is tailored to the needs of Eurosystem's central banks and differs in specific aspects from the International Financial Reporting Standards (IFRS).[7] The objective of this article is to give a high-level picture of how NCBs in the Eurosystem generate income rather than to give a detailed description over accounting rules within the Eurosystem.

We build on a stylised version of the balance sheet of a NCB as that presented in Table 1. On the asset side, NCBs mainly hold assets related with monetary policy, namely credits to financial institutions and securities purchased for monetary policy purposes. We distinguish between the portfolios with shared and non-shared income. As part of their monetary policy assets, NCBs may also hold intra-Eurosystem claims, mainly reflecting positive TARGET balances and the difference between actual banknotes in circulation and the allocation of banknotes according to the Eurosystem capital key.

6. In our quantitative application, we assume that the ECB policy rate equals the MRO rate until September 2008 and the DFR from October 2008 onwards, when the fixed-rate full allotment procedure was implemented and excess liquidity surpassed € 250 billion for the first time.

7. See European Central Bank (2012).

Additionally, central banks also hold other assets not related with monetary policy as part of their investment strategies.

On the liability side, the balance sheet mainly comprises responsibilities related with monetary policy, namely banknotes in circulation, banks' reserves (required and excess) and intra-Eurosystem liabilities. NCBs also hold other liabilities, including deposits from the government or from non-residents, as well as own funds, namely revaluation accounts, general risk provisions, capital and reserves and profit for the year. In the Eurosystem, these four items constitute the central bank's financial buffers and serve as different lines of defence against possible losses.

The difference between liabilities and assets related with monetary policy is usually denoted as the *gap* and plays a critical role in the sharing mechanism of monetary income across NCBs, as will become clear below. Whenever liabilities related with monetary policy are higher than assets related with monetary policy, implying a positive *gap*, the NCB is at least partly using such liabilities to finance assets not related with monetary policy. In contrast, when the *gap* is negative the NCB is implicitly using liabilities not related with monetary policy to invest in intra-Eurosystem claims. In practice, the *gap* can also be obtained by the difference between assets and liabilities not related with monetary policy, including NCB's financial buffers, which is known in the Eurosystem jargon as net financial assets (NFA). The maximum amount of NFA is regulated by the Agreement on Net Financial Assets (ANFA), which in practice sets a ceiling for the *gap*.[8]

Assets	**Liabilities**
Assets related with monetary policy	Liabilities related with monetary policy
Credit to financial institutions	Banknotes in circulation
Securities (shared income)	Minimum reserve requirements
Securities (non-shared income)	Excess reserves
Intra-Eurosystem claims (e.g. TARGET+)	Intra-Eurosystem liabilities (e.g. TARGET-)
Assets not related with monetary policy	Liabilities not related with monetary policy
	Own funds (financial buffers)

TABLE 1. Stylised balance sheet of a NCB in the Eurosystem

Notes: Securities purchased for monetary policy purposes with non-shared income include the purchases of covered bonds under the first two Covered Bond Purchase Programmes (CBPP1 and CBPP2) and of PSPP-GOV and PEPP-GOV. Securities with shared income include all other securities purchased for monetary policy purposes.

Figure 2 shows how the main balance sheet items have evolved since 2002 in the case of the Eurosystem and Banco de Portugal. At the end of 2021, assets related with monetary policy (including both credit to financial institutions and securities purchased for monetary policy purposes) were by far the main category, representing around 80% of total assets (close to 60% of GDP) in the case of the Eurosystem. This contrasts with

8. This agreement has been set up "to ensure that the Governing Council of the ECB is in full control of the size of the Eurosystem's balance sheet" and may be seen as a way to insulate the Eurosystem's balance sheet from any losses incurred by NCBs in their non-monetary policy activities. See `https://www.ecb.europa.eu/ecb/educational/explainers/tell-me-more/html/anfa_qa.en.html` for further details.

the pre-2008 period, when assets related with monetary policy represented on average only 37% of total assets (and 5% of GDP).

The composition of monetary policy assets also changed significantly in the last twenty years. Up to 2008, monetary policy assets corresponded only to credit to financial institutions, which in Portugal was often below the euro area average (in percentage of GDP). The great financial crisis and the sovereign debt crisis had a particularly strong impact in the Portuguese financial system, ultimately increasing credit to financial institutions by more than what was observed on average in the Eurosystem. This was mainly financed by higher intra-Eurosystem liabilities (negative TARGET balances).[9] In the aftermath of the sovereign debt crisis, credit to financial institutions started decreasing both in the Eurosystem and Banco de Portugal, but this effect was more than compensated by the implementation of large-scale asset purchases since early 2015, which led to a significant increase of monetary policy assets across most NCBs. In 2020, both credit to financial institutions and securities' holdings increased significantly with the response to the pandemic.[10]

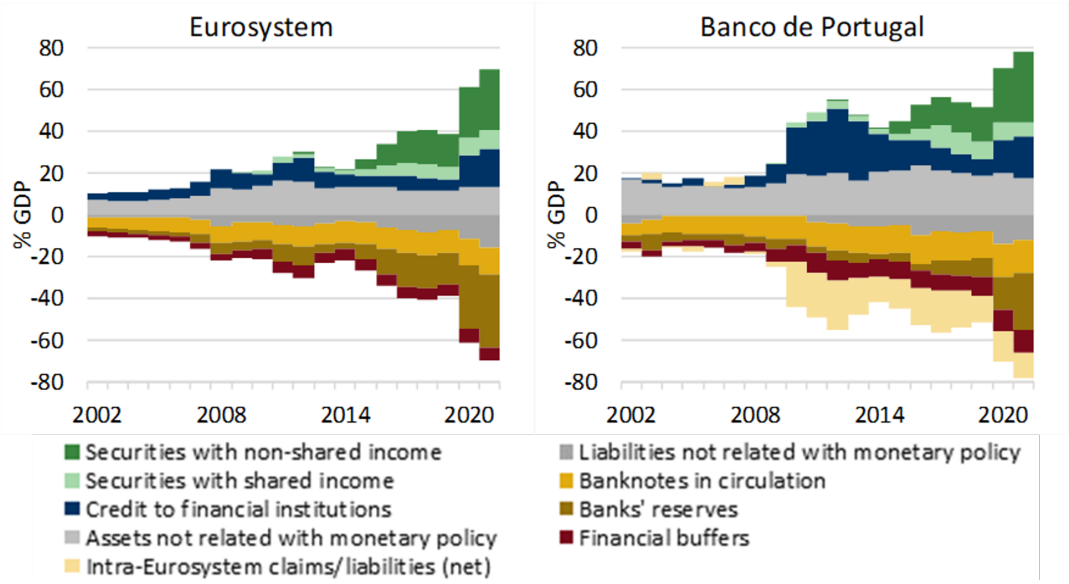

FIGURE 2: Balance sheet composition of the Eurosystem and Banco de Portugal

Notes: Eurosystem's total assets do not include intra-Eurosystem claims as they net out. Banco de Portugal's total assets include only the net position between intra-Eurosystem claims and liabilities. | Latest observation: 2021.
Sources: European Central Bank, Banco de Portugal and Eurostat (authors' calculations).

On the liability side, up to 2008 the Eurosystem balance sheet was mainly financed by banknotes in circulation, which represented more than 50% of total assets (6% of GDP). The remaining was mostly financed by banks' reserves (mostly to comply with minimum requirements) and financial buffers, each representing close to 20% of total

9. See Soares *et al.* (2020) for an explanation of the main drivers behind the evolution of TARGET balances in the case of Banco de Portugal until 2018.

10. See Sousa-Leite *et al.* (2022) for a thorough description of the evolution of Banco de Portugal's balance sheet over the past 20 years.

assets, while liabilities not related with monetary policy represented on average only 11% of total assets. This changed with the implementation of non-standard monetary policy measures since the great financial crisis. In particular, the introduction in October 2008 of a fixed-rate full allotment tender procedure in all Eurosystem's refinancing operations allowed banks a continued access to liquidity leading to a significant increase of banks' reserves with the Eurosystem.

The implementation of large-scale asset purchase programmes from 2015 onwards further contributed to exacerbate the increase of banks' reserves. Between 2007 and 2021, these increased from around 2% to 35% of GDP, financing most of the expansion in the Eurosystem balance sheet. Liabilities not related with monetary policy, such as government deposits and liabilities against non-residents, also became more relevant, increasing from 1% of GDP in 2002 to 16% in 2021. On the other hand, banknotes in circulation and financial buffers, while increasing as a share of GDP, reduced their weight on the balance sheet, representing respectively 18% and 9% of total assets in 2021. The increase of financial buffers was mainly supported by higher revaluation accounts related with gold reserves and retained earnings in the form of general reserves and general risk provisions.

The liability structure of Banco de Portugal up to 2008 was similar to the one observed in the Eurosystem. Since 2008, the TARGET balances of Banco de Portugal became more negative to finance the additional credit to financial institutions and, at a later stage, the large-scale asset purchases. This movement was only partly compensated by an expansion in intra-Eurosystem claims related with banknotes. While this negative intra-Eurosystem position declined in the most recent years, compensated by a substantial increase in banks' reserves, it remains a relevant source of funding for Banco de Portugal.

3. The national central banks' income statement

Similarly to the previous section, we build on a stylised version of the income statement of a NCB as that presented in Table 2. The revenue of Eurosystem's NCBs can be split in three types: (i) interest income from financial assets (both related and not related with monetary policy);[11] (ii) realised gains from financial assets; and (iii) other income, which includes income from equity holdings (e.g. ECB) and commissions (e.g. fees raised from supervised institutions). Similarly, central banks' costs can be divided in (i) interest expenses from financial liabilities; (ii) realised losses from financial assets; and (iii) other costs, which include mainly administrative costs (e.g. staff costs and depreciation of fixed assets). On top of this, NCBs income includes the net result of pooling monetary income among NCBs, which can be positive or negative, as discussed below. Finally, the net profit of the year is affected by taxes, as well as by transfers to/from risk provisions that reflect the provisioning and dividend policies of each NCB. Notwithstanding, in this article we focus the analysis on income before provisions and taxes (IBPT).

11. This includes the income on intra-Eurosystem claims and liabilities, which by convention are remunerated at the MRO rate.

Figure 3 presents the evolution of the main components of IBPT for the Eurosystem and Banco de Portugal. The income shows an upward trend over the last two decades in both cases. In the Eurosystem, IBPT has increased on average from about 0.16% of GDP before the great financial crisis to close to 0.29% of GDP in the last decade. Despite a peak of 0.42% in 2012, justified by a significant increase in credit to financial institutions and the return on Securities Market Programme (SMP) purchases, the evolution has been rather stable and almost exclusively driven by interest margin.

Income	**Expenses**
Interest income from financial assets	Interest expenses from financial liabilities
Realised gains from financial assets	Realised losses from financial assets
Other income	Other costs
Net result of pooling monetary income (+)	Net result of pooling monetary income (-)

TABLE 2. Stylised income statement of a NCB in the Eurosystem

The overall trend was similar in the case of Banco de Portugal, as IBPT moved from an average of 0.20% of GDP between 2005 and 2007 to close to 0.41% of GDP over the last decade. IBPT was nevertheless more volatile in the case of Banco de Portugal, mainly reflecting fluctuations in the net result (realised gains or losses) of financial operations, which at the Eurosystem level benefit from a diversification effect. In the case of Banco de Portugal, the net result of pooling monetary income typically had a positive contribution, as Banco de Portugal's share on the Eurosystem monetary income was higher than its contribution to the pooling mechanism. This was particularly relevant in 2012, reflecting the higher cost of Banco de Portugal's liabilities in the TARGET system vis-à-vis that of Eurosystem reserves, and again in the most recent years, reflecting in addition the lower stock of assets purchased by Banco de Portugal under PSPP-GOV relative to its share in the Eurosystem capital key.

The pooling of monetary income is a distinctive feature of the Eurosystem. According to Article 32 of the Statute of the European System of Central Banks, the monetary income of all Eurosystem NCBs should be pooled and then reallocated to the NCBs in proportion to their share in the Eurosystem capital key. As a result, whenever the contribution of a NCB to the monetary income is higher (lower) than its respective share on the total, a negative (positive) net result of pooling of monetary income ought to be registered leading to a lower (higher) intra-Eurosystem net position of this NCB. The more heterogeneous is the balance sheet composition across NCBs, the larger may be the net pooling in absolute terms, something that reinforces the need to distinguish monetary and non-monetary income when analyzing NCBs income. In the case of Banco de Portugal, the net pooling of monetary income represented on average (in absolute terms) 0.03% of GDP between 2002 and 2021.

Since 2003 the pooling mechanism follows the so-called semi-direct method.[12] According to this method, each country contribution is given by the sum of the income generated by all monetary policy assets in its balance sheet less the costs associated

12. See Handig and Holzfeind (2007) for further details.

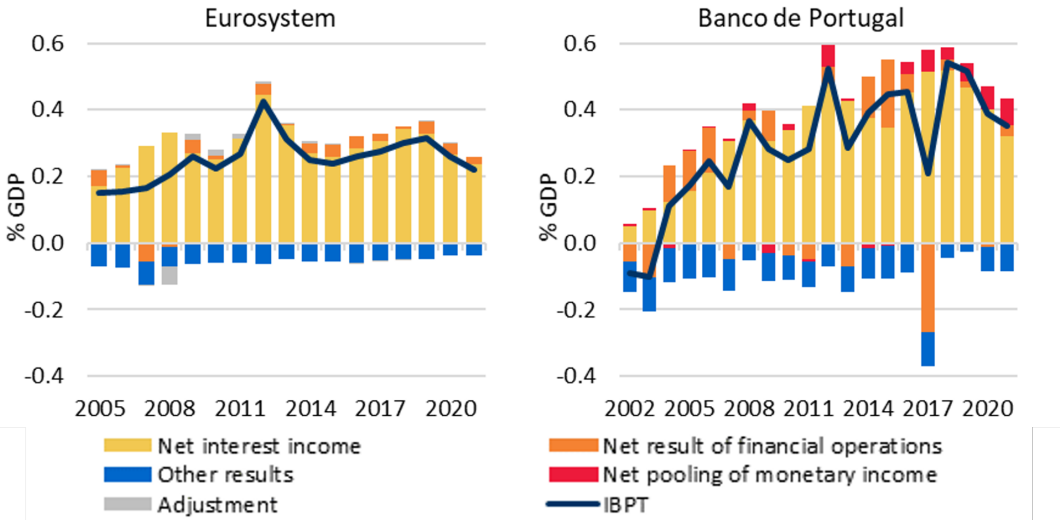

FIGURE 3: Composition of the Eurosystem's and Banco de Portugal's income before provisions and taxes (accounting view)

Notes: Adjustments in the Eurosystem decomposition mainly represent provisions related with assets related with monetary policy that were recorded in certain periods under a loss sharing mechanism, but that in most cases were eliminated in subsequent periods. | Latest observation: 2021.
Sources: European Central Bank, Banco de Portugal and Eurostat (authors' calculations).

with liabilities related with monetary policy in its balance sheet plus the revenue/costs associated with the *gap*, which is assumed to be remunerated at the MRO rate.

There is however an important exception regarding assets with non-shared income. In this case, the income is decomposed between the MRO rate times the book value associated with these assets, which enters each NCB contribution to the shared monetary income, and the excess income. The latter impacts only each NCB income statement. In practice, monetary policy assets with non-shared income contribute to the pooling mechanism in a similar manner as assets not related with monetary policy. At the margin, NCBs asset purchases, either monetary or not, are financed through an intra-Eurosystem liability. As this is remunerated at the MRO rate, the purchased assets must contribute in equal terms in order to guarantee that these operations lead to an equal increase in NCBs contribution to the Eurosystem's pooled monetary income. In the case of assets not related with monetary policy this is achieved through the remuneration of the *gap*.

Since NCBs monetary income corresponds to the sum of the income generated by assets and liabilities related with monetary policy held in its own balance sheets, plus the net result of pooling monetary income, one cannot fully uncover the economic drivers behind monetary income by looking only to NCBs income statements. In particular, it is not possible to evaluate the contribution to monetary income from money creation and non-standard monetary policy operations (e.g. TLTRO – Targeted Long-Term Refinancing Operations – and asset purchases with shared and non-shared income). The financial statements of NCBs usually report the total contribution of all NCBs to shared monetary income, but this is insufficient to understand the drivers behind this figure and does not provide information on the contribution of non-shared monetary income.

The decomposition proposed below tries to overcome these caveats by separating the income generated by monetary policy assets and liabilities from the components not related. Also, within the monetary income, it separates the shared part that only depends on balance sheet items at the aggregate level of all NCBs, from the non-shared component.

4. A novel decomposition of national central banks' net income

We propose a novel decomposition of a NCB net income compatible with the stylised balance sheet presented in section 2. Under this decomposition, the NCB's income before provisions and taxes can be seen as the sum of four components: (i) NCB's share on total Eurosystem shared monetary income;[13] (ii) the return associated with non-shared monetary policy assets in excess of the MRO rate; (iii) the return associated with assets and liabilities not related with monetary policy; and (iv) other income and expenses:[14]

$$
\begin{aligned}
IBPT = \quad & k.MI_{EUR}^{Shared} && \text{Shared monetary income} \\
& + \left(r^{MA^{NonShared}} - MRO\right).MA^{NonShared} && \text{Non-shared monetary income} \\
& + \left(r^{NMA}.NMA - r^{NML}.NML - MRO.Gap\right) && \text{Non-monetary income} \\
& + Other && \text{Other results}
\end{aligned}
$$

where k is the NCB's share in the Eurosystem capital key, MI_{EUR}^{Shared} is the shared monetary income generated by all NCBs, $r^{MA^{NonShared}}$ is the actual average return of NCB's assets related with monetary policy with non-shared return and $MA^{NonShared}$ its respective stock (mainly comprising NCB's holdings of sovereign debt securities purchased under PSPP and PEPP), r^{NMA} and r^{NML} are the actual average returns of assets and liabilities not related with monetary policy and NMA and NML the respective stocks.

In contrast with the traditional presentation of net income, this decomposition allows us to identify the profit contribution of assets and liabilities related with monetary policy, as well as the income contribution of other investments net of the related funding costs, which includes the remuneration of the *gap*.[15] The contribution of each of these components is analysed for the case of Banco de Portugal in section 5.

13. Throughout the following exposition, variables aggregated for all NCBs (Eurosystem excluding the ECB) are denoted with the subscript EUR, while national variables have no subscript.

14. See Appendix A.1 for a derivation of the decomposition of income before provisions and taxes.

15. As noticed above, when the *gap* is positive, liabilities related with monetary policy are financing part of the non-monetary policy portfolios, so we consider the cost of funding associated with the *gap* in the non-monetary income component. Notice that assets that do not generate income except through realised gains or losses, as is the case of gold, impose a cost associated with its funding.

In order to uncover the economic drivers of shared monetary income, we further decompose it by comparing the rate of return of all assets and liabilities with a rate representative of the marginal cost of funding of the Eurosystem, which we define as the policy rate, PR. While in a liquidity shortage environment the MRO rate may be a good proxy for this rate, in an excess liquidity environment, the DFR would be a more reasonable benchmark. Considering the policy rate, we thus allow for both regimes.

We decompose shared monetary income, which is exclusively driven by Eurosystem's aggregates (excluding the ECB) and is independent of each NCB's individual positions, into four components:[16]

$$MI_{Eur}^{Shared} = \quad PR.M_{EUR} + \qquad \text{Net return from banknotes}$$

$$-(MRO - PR).MRR_{EUR} \qquad \text{Net cost of minimum reserve requirements}$$

$$+(r^{MA_{EUR}^{OtherShared}} - PR).MA_{EUR}^{OtherShared} \qquad \text{Net return from other assets with shared income}$$

$$+(MRO - PR).\left(Gap_{EUR} + IC_{EUR} - IL_{EUR} + MA_{EUR}^{NonShared}\right) \qquad \text{Net return associated with monetary income agreement conventions}$$

where M_{EUR} corresponds to the stock of banknotes in circulation, MRR_{EUR} is the stock of minimum reserve requirements, $MA_{EUR}^{OtherShared}$ is the stock of assets related with monetary policy with shared income other than intra-Eurosystem claims, with $r^{MA_{EUR}^{OtherShared}}$ being its respective return, and $IC_{EUR} - IL_{EUR}$ is the stock of intra-Eurosystem claims and liabilities (for the aggregate of all NCBs corresponds to the symmetric position of the ECB in these operations).

The first component stems from the right given to central banks to issue banknotes. Using the policy rate as a reference and assuming that the cost of issuing banknotes is zero, this contribution is positive as long as the policy rate is positive.[17] In the case of the Eurosystem, the policy rate was negative between June 2014 and July 2022, and hence this component actually represented a cost to central banks in this period.

The second component represents the cost of remunerating part of the reserves at the MRO rate, which in an excess liquidity environment as the one prevailing in the euro area since 2008 is higher than the policy rate.[18] When the policy rate is equal to the MRO rate (i.e. if there is no excess liquidity), the contribution from this term is zero.

16. See Appendix A.2 for a derivation of the decomposition of shared monetary income.

17. The cost of printing new banknotes is not zero, but it is negligible as a fraction of the amount issued. We abstract from these costs here for simplicity, but they are included in the other costs component.

18. Banks' reserves held at the Eurosystem in compliance with the minimum reserve requirement were remunerated at the MRO rate until December 2022. Since then, they are remunerated at the DFR and thus this component will no longer represent a cost. Additionally, with the introduction of the two-tier system in October 2019, excess reserves up to a multiple of the MRR were exempted from remuneration of a negative DFR whenever the DFR was negative and thus also implied a financial cost to the Eurosystem. Under our decomposition framework the cost associated with the two-tier system in 2019-2021 is included in this second component of the shared monetary income.

The third component takes into account the contribution to NCBs income from asset holdings related with monetary policy with shared income other than intra-Eurosystem claims. In our framework, this is positive (negative) whenever these are remunerated at a rate above (below) the policy rate. This may be the case for securities with shared income held under the different purchase programmes, whose return depends on the coupon rate and the price at which each security was purchased in the secondary market. Moreover, credit to financial institutions may also be remunerated at a rate different than the policy rate. This contributes positively to monetary income whenever loans are granted at the marginal lending facility rate or in the case of the traditional refinancing operations under an excess liquidity environment. Loans granted to financial institutions may also contribute negatively, namely in the case of TLTRO III, whose rate of return was on average lower than the policy rate.

Finally, our fourth component captures the fact that the policy rate may be different from the rate defined in the monetary income distribution agreement for the purpose of computing the contribution to shared monetary income from the *gap*, the intra-Eurosystem claims and the assets related with monetary policy with non-shared income. As explained above, the convention so far has been to use the MRO rate for this purpose.

Similarly to shared monetary income, it is possible to decompose non-shared monetary income, $MI^{NonShared}$, taking as reference the policy rate, in the following two components:

$$MI^{NonShared} = \underbrace{\left(r^{MA^{NonShared}} - PR\right).MA^{NonShared}}_{\text{Net return on assets related with monetary policy with non-shared income}} \underbrace{-(MRO - PR).MA^{NonShared}}_{\text{Net cost associated with monetary income agreement conventions}}$$

The first term corresponds to the income associated with non-shared monetary policy assets net of the Eurosystem marginal funding cost. Taking the latter as a proxy for the risk-free rate in the Eurosystem, one can interpret the first term as the fair market compensation for holding those assets. The second term follows from the rules defined in the monetary income distribution agreement and represents the national contribution to the fourth component of our shared monetary income decomposition, in what concerns non-shared assets.

Lastly, it is also possible to decompose non-monetary income taking as reference the policy rate.[19] In this case, we split non-monetary income in four components:

The first two components capture the contributions from assets and liabilities not related with monetary policy, which in our approach correspond to the remuneration of these positions above the policy rate. The third component is the contribution from the *gap*, which is zero when the policy rate is equal to the MRO rate. When the policy

19. See Appendix A.3 for a derivation of the decomposition of non-monetary income.

$$
\begin{aligned}
NMI = \quad & \left(r^{NMA} - PR\right).NMA && \text{Net return from assets not related with monetary policy} \\
& -\left(r^{NML} - PR\right).NML && \text{Net cost from liabilities not related with monetary policy} \\
& -\left(MRO - PR\right).Gap && \text{Net cost from the gap} \\
& +PR.Buffers && \text{Net return from financial buffers}
\end{aligned}
$$

rate is lower than the MRO rate, the *gap* contributes negatively (positively) to non-monetary income if it takes a positive (negative) value, meaning that the NCB is being financed by (investing in) intra-Eurosystem liabilities (claims). The last component is the contribution from financial buffers. Similarly to banknotes, financial buffers have no funding costs and, as a result, they contribute positively (negatively) to non-monetary income whenever the policy rate is positive (negative).

The fact that the Eurosystem agreement assumes that some monetary claims are remunerated at the MRO rate, independently of market conditions, may potentially distort NCBs investment decisions not related with monetary policy. In practice, any investment decision of an individual NCB not related with monetary policy has a marginal financing cost given by the MRO rate. As a result, at the margin if the rate of return of this investment is below the MRO rate but above the policy rate, the NCB suffers a net loss, even though this contributes positively to the Eurosystem aggregate monetary income (see the fourth component of the decomposition of shared monetary income). In addition, applying the same rationale, the current mechanism may also distort the distribution of monetary income whenever non-shared assets held by each NCB are not proportional to their share in the Eurosystem capital key.[20]

In the following section, we apply these decompositions to the case of Banco de Portugal over the past 20 years.

5. Application to the case of Banco de Portugal

Figure 4 decomposes Banco de Portugal's IBPT between 2002 and 2021 as a percentage of GDP.[21] Table 3 presents some descriptive statistics on the decomposition of IBPT in the same period. During these years, Banco de Portugal's IBPT amounted on average to 0.29% of GDP with monetary income, non-monetary income and other income/cost sources contributing with 0.28, 0.10 and -0.08 percentage points, respectively. Monetary income represents thus the main source of income for Banco de Portugal, with the

20. Notice, however, that in the limiting case where all NCBs purchase the same financial asset in an amount proportional to their share in the Eurosystem capital key, all NCBs end up obtaining the same positive net return, and thus there is no such distortion. In the case of financial investments not related with monetary policy, this is merely an academic scenario. In the case of asset purchases conducted for monetary policy purposes, on the contrary, this is the rule to the extent that purchases are done according to the capital key, as is broadly the experience with APP.

21. Whenever possible the income decomposition is computed on a daily basis using the contemporaneous monetary policy rates.

income generated by investment activities not related with monetary policy being on average similar to its operating cost. Banco de Portugal IBPT fluctuated between -0.10% and 0.54% of GDP, leading to a standard deviation of 0.18 and a coefficient of variation of 0.61.

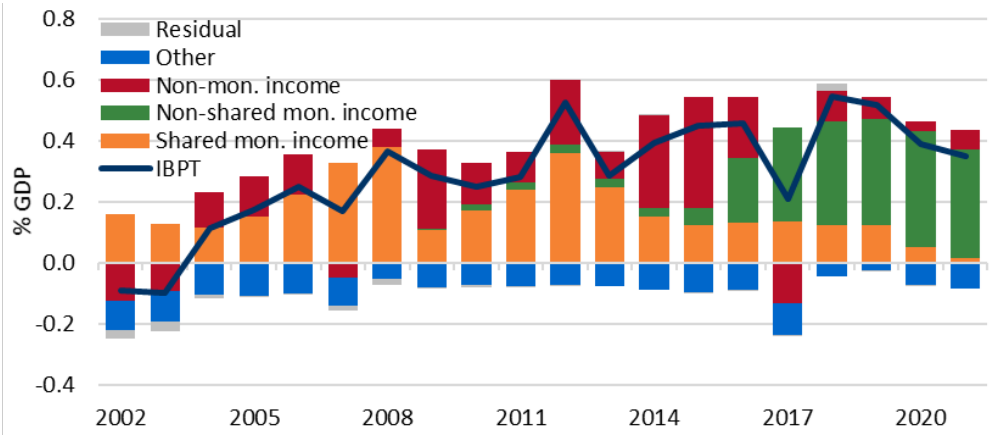

FIGURE 4: Decomposition of Banco de Portugal's IBPT

Notes: The residual results from the difference between total IBPT and the sum of the four estimated contributions, which for some components is proxied using annual average figures of interest rates and balance sheet items. | Latest observation: 2021.
Sources: Banco de Portugal and Statistics Portugal (authors' calculations).

Monetary income oscillated between 0.11% of GDP in 2009 and 0.47% in 2019. These values reflect very different contributions from shared and non-shared components. While the shared component has been responsible for almost all monetary income up to 2009, non-shared income became the main source after 2016, representing 96% of Banco de Portugal's monetary income in 2021. On average, shared and non-shared monetary income contributed with 0.17 and 0.11 percentage points per year, respectively. These numbers reflect the fact that all monetary income was shared until the introduction of the Covered Bond Purchase Programme (CBPP) in 2009. This became quantitatively more relevant in 2015 with the introduction of PSPP-GOV. Over this period, shared and non-shared monetary income have shown to be negatively correlated, reflecting the fact that quantitative easing programmes were initiated when the policy rate got close to its effective lower bound, which translated into a reduction of income associated with banknotes.

	Mean	Median	Min	P25	P75	Max	Standard deviation	Coefficient of variation
Income before taxes and provisions	0.29	0.28	-0.10	0.20	0.41	0.54	0.18	0.61
Monetary income	0.28	0.27	0.11	0.17	0.38	0.47	0.12	0.44
of which, shared	0.17	0.14	0.01	0.12	0.23	0.38	0.09	0.54
of which, non-shared	0.11	0.02	0.00	0.00	0.24	0.38	0.15	1.38
Non-monetary income	0.10	0.10	-0.13	0.05	0.37	0.37	0.13	1.31
Other	-0.08	-0.09	-0.11	-0.10	-0.03	-0.03	0.02	-0.25

TABLE 3. Descriptive statistics on Banco de Portugal's IBPT

Note: All figures presented as a percentage of GDP.
Sources: Banco de Portugal and Statistics Portugal (authors' calculations).

The income generated by investment activities not related with monetary policy oscillated between -0.13% of GDP in 2002 and 0.37% in 2015. Non-monetary income has been more volatile than monetary income, which mostly reflects the variability of the euro-dollar exchange rate and changes in sovereign debt risk premia. Monetary income and non-monetary income have shown a strong positive correlation during these years, something not surprising given that assets not related with monetary policy have corresponded mostly to short-term euro area sovereign debt securities.

5.1. Decomposition of shared monetary income

Figure 5 shows the evolution of the shared monetary income received by Banco de Portugal as a percentage of GDP and identifies the contributions from banknotes, minimum reserve requirements, shared monetary policy assets other than intra-Eurosystem claims and differences accruing from the conventions established in the monetary income distribution agreement.[22] Figure 6 presents the evolution of the main determinants of shared monetary income. As this depends on the income generated by all NCBs, we present balance sheet items for all NCBs (Eurosystem excluding ECB) expressed as a share of euro area GDP.

Shared monetary income oscillated between a maximum of 0.38% of GDP in 2008 and a minimum of 0.01% in 2021. In the period between 2002 and 2008 there was a significant increase in shared monetary income motivated almost exclusively by the income associated with banknotes. In this period, shared monetary income increased from 0.16% to 0.38% of GDP, reflecting both an increase of the policy rate (at the time, the MRO rate) from 3.2% in 2002 to 3.9% in 2008 (annual average values) and an increase of banknotes in circulation, which grew 81% in only 5 years.

Shared monetary income fell significantly in the midst of the great financial crisis, to only 0.11% of GDP in 2009. This decrease resulted mostly from the decrease in the policy rate to an annual average of 0.4%, which implied a substantial decrease of the income associated with banknotes. The decrease in the policy rate reflected the ECB Governing

22. As Banco de Portugal's share in the Eurosystem capital key is higher than Portugal's share on euro area's GDP, the shared monetary income received by Banco de Portugal as a share of GDP is slightly higher than the total shared monetary income as a share of euro area GDP.

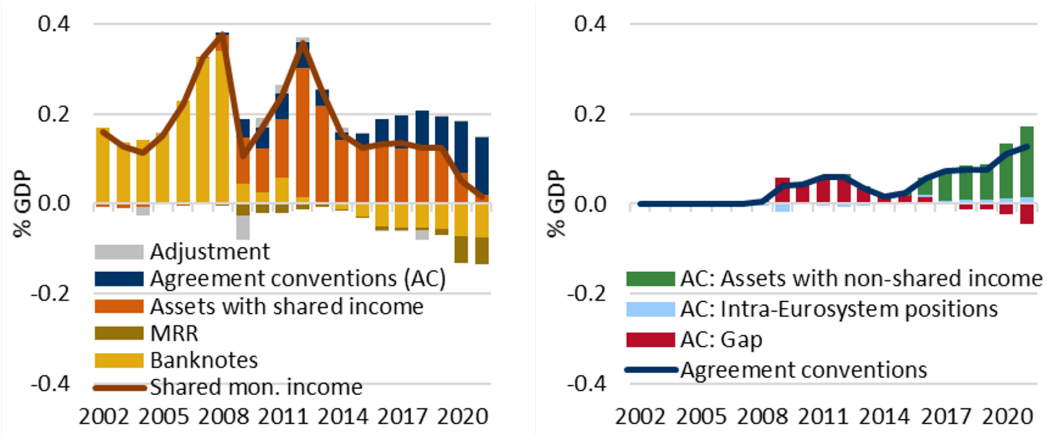

FIGURE 5: Decomposition of shared monetary income

Notes: The adjustment results mainly from annual corrections in the application of the semi-direct method. The cost with the MRR also includes the cost with excess reserves exempted from remuneration of a negative DFR since the introduction of the two-tier system in October 2019, assuming that all credit institutions have sufficient reserves to maximise this exemption. The right panel further decomposes the contribution from monetary income agreement conventions in three components. | Latest observation: 2021.
Sources: Banco de Portugal, European Central Bank and Statistics Portugal (authors' calculations).

council decisions regarding all key interest rates, but also the fact that the euro area started operating in an excess liquidity environment, where we assume that the policy rate is given by the DFR instead of the MRO rate. As a result of this change, all credit to financial institutions at the MRO rate became a net contributor to shared monetary income under our decomposition framework. The fact that some monetary claims are by convention remunerated at the MRO rate independently of market conditions also contributed positively to avoid a deeper reduction in shared monetary income. This is the case of the *gap*, which by 2009 accounted for roughly 5% of euro area GDP (Figure 6).

Amidst the sovereign debt crisis, the increase of credit to financial institutions and the asset purchases conducted under the SMP to address market fragmentation led to an increase in shared monetary income in 2011 and, especially, in 2012. Since this credit was granted at a rate above the policy rate, we identify it as a contribution from shared assets.

With the normalisation of interbank money markets in subsequent years, the contribution of assets with shared income gradually declined, stabilising at a level slightly above 0.10% of GDP between 2014 and 2019. In this period, monetary policy was characterised by the implementation of additional non-standard measures, namely the adoption of negative policy rates that justifies the negative contribution from banknotes in circulation and the implementation of large-scale asset purchases, mostly with non-shared income, which also implies an increase of some shared income under the pooling agreement that largely compensated the negative contribution of banknotes.

In the most recent years, shared monetary income has benefitted from an even more substantial contribution of the pooled component associated with sovereign debt securities purchased under PSPP and PEPP. This was more than offset by a significant

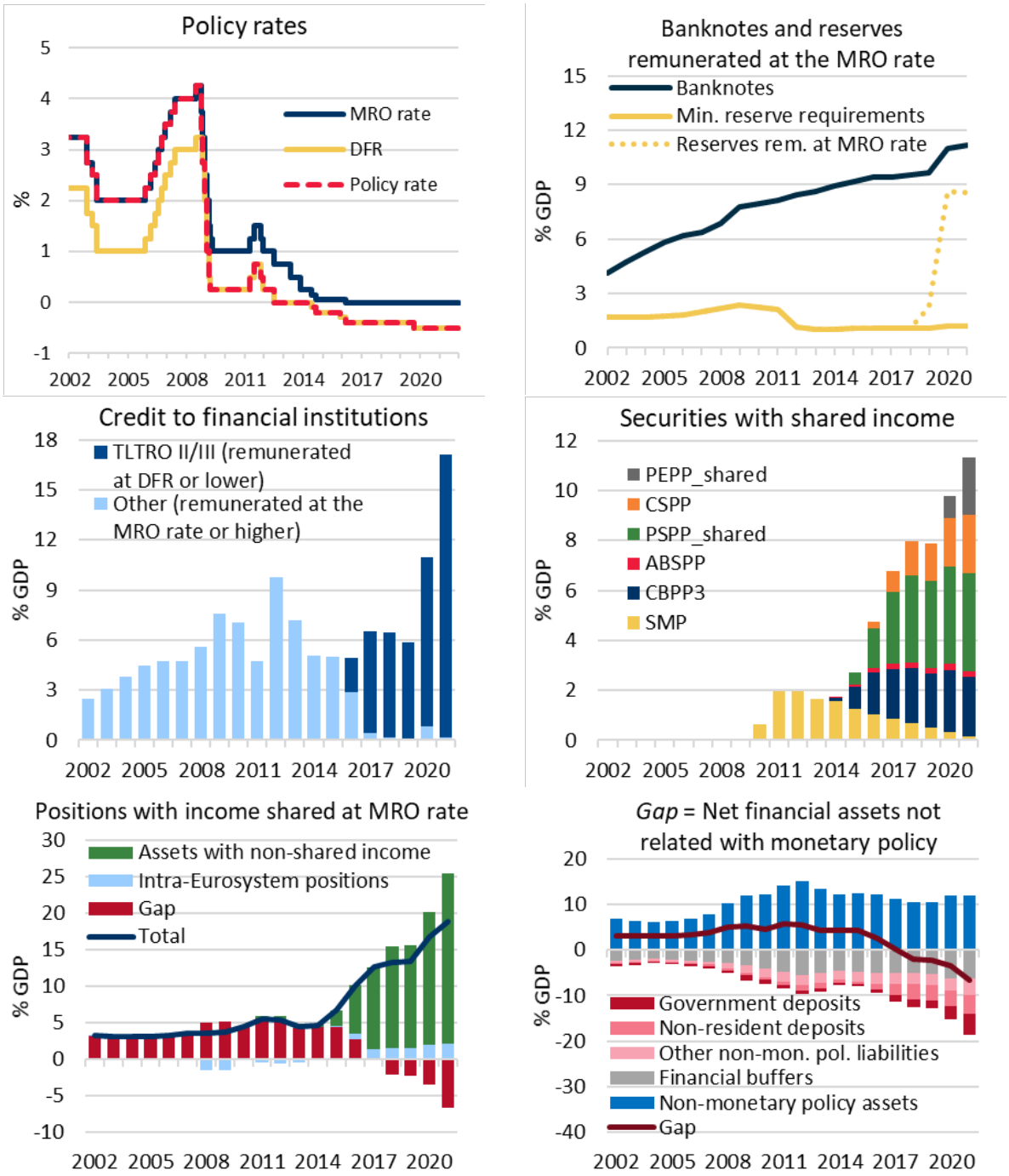

FIGURE 6: Main drivers of shared monetary income in the Eurosystem

Notes: Aggregates for all NCBs (Eurosystem excluding the ECB) expressed as a share of euro area GDP. Reserves remunerated at the MRO rate include MRR and excess reserves exempted from negative DFR since the introduction of the two-tier system in October 2019, assuming that all credit institutions are able to maximise this exemption. SMP – Securities Market Programme. CBPP3 – Covered Bond Purchase Programme 3. ABSPP – Asset-Backed Securities Purchase Programme. PSPP – Public Sector Purchase Programme. CSPP – Corporate Sector Purchase Programme. PEPP – Pandemic Emergency Purchase Programme. PSPP (PEPP) with shared income corresponds to 20% of total PSPP (PEPP) holdings (of public debt securities). Intra-Eurosystem positions correspond to the symmetric position of the ECB. | Latest observation: 2021.
Sources: European Central Bank and Eurostat (authors' calculations).

decline of the average return on shared assets, which was negatively affected by the specific conditions of TLTRO III, and the increasing cost of central banks' reserves with the implementation of the two-tier system.

Going forward, these negative effects on shared monetary income will likely be dissipated, mainly as a result of the higher policy rate, which directly benefits the income associated with banknotes. In addition, the ECB's decision to change the remuneration of TLTRO III operations from November 2022 onwards will reduce the negative contribution of these operation and will likely accelerate their redemption. However, this will be largely offset by a substantial decline of non-shared monetary income, which will likely turn negative for most NCBs, as the increase in the policy rate will in most cases surpass the average yield on sovereign securities purchased under the PSPP-GOV and PEPP-GOV.

5.2. *Decomposition of non-shared monetary income*

Figure 7 shows the evolution of Banco de Portugal's non-shared monetary income and identifies the contributions from the market return of non-shared assets and the net cost of holding these assets associated with monetary income agreement conventions.

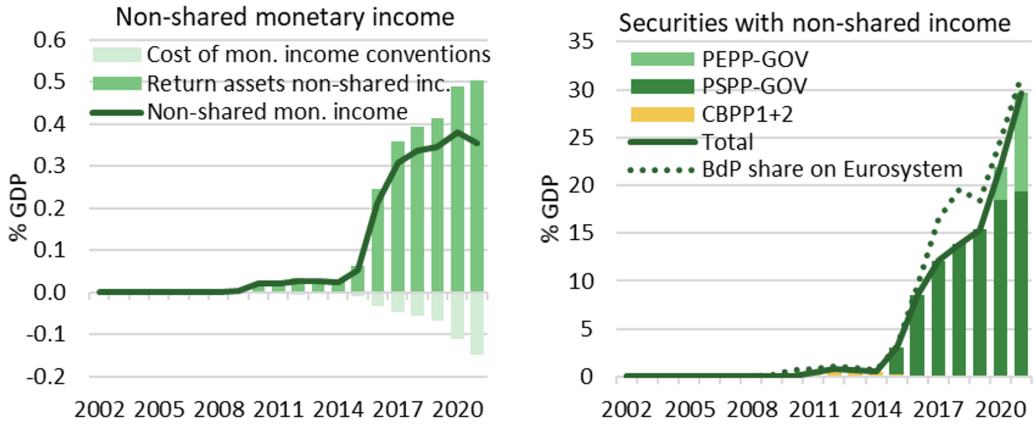

FIGURE 7: Decomposition and main drivers of Banco de Portugal's non-shared monetary income

Note: Latest observation: 2021.
Sources: Banco de Portugal and Statistics Portugal (authors' calculations).

The significant increase observed between 2015 and 2017 was driven by the implementation of large-scale purchases of sovereign debt securities under the PSPP-GOV at a rate substantially higher than the policy rate. Since then, the income generated from these assets remained relatively constant as a share of GDP, despite additional purchases under the PEPP-GOV, as the yield of new purchases was lower and not significantly higher than the MRO rate.

Interestingly, the cost of holding assets with non-shared income resulting from the monetary income agreement conventions (light green bars in Figure 7, left panel) was slightly lower than the contribution obtained from the share of Eurosystem's monetary income associated with these assets (green bars in Figure 5, right panel), which results

from the fact that Banco de Portugal's holdings under PSPP-GOV were lower than what would be given by the Eurosystem capital key (dotted line in Figure 7, right panel).

5.3. *Decomposition of non-monetary income*

Figure 8 shows the evolution of Banco de Portugal's non-monetary income and identifies the contributions from assets and liabilities not related with monetary policy, the *gap* and the financial buffers. Financial assets not related with monetary policy have contributed positively in most years, especially in the aftermath of the global financial crisis, which is likely related with the higher risk premia and higher stock of these assets observed at the time. More recently, this contribution has remained more contained given that the margin between the return on sovereign debt securities and the policy rate has been compressed. Nonetheless, the contribution remained above its historical average.

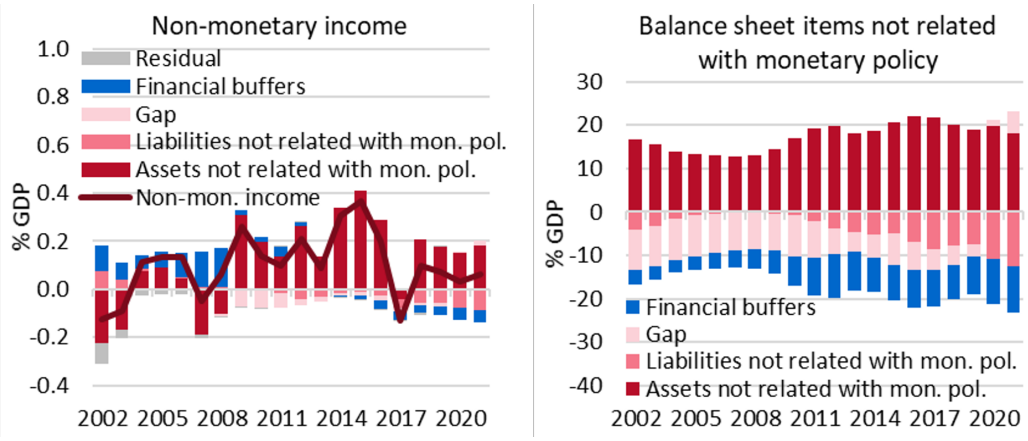

FIGURE 8: Decomposition and main drivers of Banco de Portugal's non-monetary income

Note: The residual results from the difference between total non-monetary income and the sum of the four estimated contributions, which for some components is proxied using annual average figures of interest rates and balance sheet items. | Latest observation: 2021.
Sources: Banco de Portugal and Statistics Portugal (authors' calculations).

The contribution from liabilities not related with monetary policy was relatively small up to 2011. This changed with the financial assistance program, mainly as a result of the significant increase of government deposits at Banco de Portugal. As these were largely remunerated above the policy rate, they imply a cost for the central bank that is highlighted under our decomposition framework. This was further intensified with the pandemic crisis.

As noted above, the contribution of the *gap* is only relevant in an excess liquidity environment, when the policy rate is different from the MRO rate, which we assume to have occurred only from late 2008 onwards. In this period, the contribution of the *gap* was almost always negative, especially between 2009 and 2011, when intra-Eurosystem liabilities were financing a substantial share of assets not related with monetary policy. This declined significantly thereafter, as other liabilities, namely government deposits, started playing a larger role. In particular, they turned positive in 2020-21, when the *gap* turned negative.

Finally, financial buffers typically contributed positively when the policy rate was positive but, similarly to banknotes in circulation, started having a negative contribution as the policy rate turned negative from 2014 onwards.

6. Concluding remarks

This article provides a novel decomposition of the profits of a NCB in the Eurosystem that clearly distinguishes the income generated from monetary policy decisions taken at the aggregate level, from that determined by national activities not directly related with monetary policy. Monetary income is also split between the component shared among all NCB's according to the Eurosystem capital key and that driven from assets with non-shared income. Finally, we decompose shared monetary income, non-shared monetary income and non-monetary income by comparing the return/cost of their components with the contemporaneous policy rate. These insights are useful to complement the usual income statement where the reported interest margin aggregates income related and not related with monetary policy.

When applied to the case of Banco de Portugal over the past 20 years, this decomposition clarifies that on average earnings were mainly determined by monetary income, while income from assets not related with monetary policy was of the same order of magnitude of other expenses, mainly administrative costs. Since the onset of large-scale asset purchases, we show that (i) the above-average Banco de Portugal profits have been mostly due to non-shared monetary income; (ii) shared monetary income has remained only slightly below historical average level despite the low interest rate environment; and (iii) income from activities not related with monetary policy remained similar to the historical average despite a gradual reduction.

Assessing the drivers of central banks' profits is important, especially at a time when these may come under pressure given the detrimental impact of higher interest rates. In our decomposition this will imply a significant decline of non-shared monetary income, which recently turned negative as a result of policy rates rising above the average return of sovereign debt securities in the balance sheet, and also of the net return of assets with shared income. This will be only partly compensated by higher income associated with banknotes that benefits from a higher policy rate.

In the Eurosystem, the primary objective of monetary policy is price stability. A consistent risk management framework is important to safeguard the credibility of the central bank in the long run, and avoid that other considerations, including concerns over short-term income losses, unduly affect monetary policy decisions. Clearly distinguishing the different sources of income, in particular those stemming from monetary policy decisions, may simplify modelling efforts that allow us to better project future income and assess risks going forward.

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Appendix: Derivation of a novel decomposition of national central banks' profits

A.1. Decomposition of income before provisions and taxes

Starting from the stylised versions of the balance sheet and the income statement presented in sections 2 and 3, the income before provisions and taxes of a NCB can be written as:

$$\begin{aligned} IBPT = & r^{MA^{Total}}.MA^{Total} - r^{ML^{Total}}.ML^{Total} + MI^{NetPooling} \\ & + r^{NMA}.NMA - r^{NML}.NML + Other \end{aligned}, \tag{A.1}$$

where MA^{Total} and ML^{Total} denote the book value of assets and liabilities related with monetary policy in the NCB balance sheet, NMA and NML denote the book value of assets and liabilities not related with monetary policy, $r^{MA^{Total}}$, $r^{ML^{Total}}$, r^{NMA} and r^{NML} represent, the rate of return of each of these aggregates, $MI^{NetPooling}$ represents the net result of the pooling of monetary income and, finally, $Other$ aggregates all other results.

The net result of the pooling of monetary income corresponds to the difference between the NCB rightful share on the Eurosystem shared monetary income, corresponding to its share in the Eurosystem capital key, k, multiplied by the Eurosystem shared monetary income, MI_{EUR}^{Shared}, less the national contribution to this income, which we denote by C. The latter is already registered in the NCB income statement before the net pooling income is computed. Substituting $MI^{NetPooling}$ by $k.MI_{EUR}^{Shared} - C$, one obtains,

$$\begin{aligned} IBPT = & r^{MA^{Total}}.MA^{Total} - r^{ML^{Total}}.ML^{Total} + k.MI_{EUR}^{Shared} - C \\ & + r^{NMA}.NMA - r^{NML}.NML + Other \end{aligned}. \tag{A.2}$$

Following the semi-direct method presented in section 3, each national central bank contribution to the Eurosystem shared monetary income is given by

$$C = r^{MA^{Shared}}.MA^{Shared} + MRO.MA^{NonShared} - r^{ML^{Total}}.ML^{Total} + MRO.Gap, \tag{A.3}$$

where $r^{MA^{Shared}}$ represents the rate of return on assets with shared income held by the NCB and MA^{Shared} denotes its book value.

Adding and substracting $r^{MA^{NonShared}}.MA^{NonShared}$, in order to aggregate the total income from assets related with monetary policy, and factoring out the assets with non-shared income, this can be written as

$$\begin{aligned} C = & r^{MA^{Total}}.MA^{Total} - \left(r^{MA^{NonShared}} - MRO\right).MA^{NonShared} - r^{ML^{Total}}.ML^{Total} \\ & + MRO.Gap \end{aligned}. \tag{A.4}$$

Substituting equation A.4 in equation A.2, and cancelling out the income from all assets related with monetary policy and costs with all liabilities related with monetary policy one obtains:

$$\begin{aligned} IBPT = k.MI_{EUR}^{Shared} + \left(r^{MA^{NonShared}} - MRO\right).MA^{NonShared} \\ + \left(r^{NMA}.NMA - r^{NML}.NML - MRO.Gap\right) + Other \end{aligned} . \quad (A.5)$$

A.2. Decomposition of shared monetary income

We start by noting that the contribution of each NCB for the pooling of monetary income (equation A.3) can be broken between the income generated by intra-Eurosystem claims, remunerated at the MRO rate, and the income generated by all other assets related with monetary policy, which may have different returns. In particular, the return on securities depends on the coupon and price at which they are purchased in the secondary market, while TLTRO may be remunerated below the MRO rate. We denote intra-Eurosystem claims by IC, other shared assets by $MA^{OtherShared}$ and the average remuneration of other shared assets as $r^{MA^{OtherShared}}$.

Regarding monetary policy liabilities, these can be broken between banknotes, intra-Eurosystem liabilities, minimum required reserves and excess reserves. These are denoted by M, IL, MRR and EL. Banknotes are not remunerated. Intra-Eurosystem liabilities and required reserves are remunerated at the MRO rate. Excess reserves are remunerated at the DFR rate.[23] Substituting these terms in equation A.3 one obtains,

$$\begin{aligned} C = MRO.IC + r^{MA^{OtherShared}}.MA^{OtherShared} + MRO.MA^{NonShared} \\ - [0.M + MRO.IL + MRO.MRR + DFR.EL] + MRO.Gap \end{aligned} . \quad (A.6)$$

Collecting most terms pooled at the MRO rate, we have:

$$\begin{aligned} C = MRO.\left(Gap + (IC - IL) + MA^{NonShared}\right) + r^{MA^{OtherShared}}.MA^{OtherShared} \\ - [0.M + MRO.MRR + DFR.EL] \end{aligned} . \quad (A.7)$$

Noting that the gap is the difference between liabilities and assets related with monetary policy, and thus $ML^{Total} - MA^{Total} - Gap = 0$, one may write:

$$\begin{aligned} C = MRO.\left(Gap + (IC - IL) + MA^{NonShared}\right) + r^{MA^{OtherShared}}.MA^{OtherShared} \\ - [0.M + MRO.MRR + DFR.EL] + PR.\left(ML^{Total} - MA^{Total} - Gap\right) \end{aligned} . \quad (A.8)$$

23. Since 2019, with the introduction of the two-tier system, a significant fraction of excess reserves were exempted from a negative DFR and thus effectively remunerated at 0. As the MRO rate was equal to 0 in this period, we lump this fraction of excess reserves with the minimum reserve requirements.

Then, collecting terms we obtain:

$$\begin{aligned} C = & PR.M + (PR - MRO).MRR + (PR - DFR).EL \\ & + \left(r^{MA^{OtherShared}} - PR\right).MA^{OtherShared} \\ & + (MRO - PR).\left(Gap + (IC - IL) + MA^{NonShared}\right) \end{aligned} . \quad \text{(A.9)}$$

Summing all NCBs contributions, we can define the aggregate Eurosystem shared monetary income as:

$$\begin{aligned} MI_{EUR}^{Shared} = & PR.M_{EUR} + (PR - MRO).MRR_{EUR} + (PR - DFR).EL_{EUR} \\ & + (r^{MA_{EUR}^{OtherShared}} - PR).MA_{EUR}^{OtherShared} \\ & + (MRO - PR).\left(Gap_{EUR} + (IC_{EUR} - IL_{EUR}) + MA_{EUR}^{NonShared}\right) \end{aligned} . \quad \text{(A.10)}$$

In the main text, the term on excess liquidity disappears because we assumed that in case of excess liquidity the policy rate is equal to the DFR. Excess liquidity represents an additional source of monetary income when it is positive and the policy rate is above the DFR, which may occur in the transition between the corridor and floor systems.

A.3. Decomposition of non-monetary income

Non-monetary income can also be further decomposed to highlight the contributions of portfolio investments, liabilities not related with monetary policy, the gap and financial buffers. We start with the split of non-monetary income included in equation A.5 above, simply noting that the cost of financial buffers is 0:

$$NMI = r^{NMA}.NMA - r^{NML}.NML - MRO.Gap - 0.Buffers. \quad \text{(A.11)}$$

Just as we did for the decomposition on shared monetary income, in order to understand the economic contribution of each component, we compare its remuneration with the policy rate. In order to do that, simply notice that $NMA - NML - Gap - Buffers = 0$, so we can subtract this expression, multiplied by the policy rate, to the previous equation, to obtain:

$$\begin{aligned} NMI = & \left(r^{NMA} - PR\right).NMA - \left(r^{NML} - PR\right).NML - (MRO - PR).Gap \\ & + PR.Buffers \end{aligned} . \quad \text{(A.12)}$$