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Are TARGET2 imbalances remunerated? The hidden mechanisms of Eurosystem monetary income

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Abstract

This paper addresses the vexed question of whether Eurosystem National Central Banks (NCBs) pay interest on their respective TARGET2 (T2) liabilities by considering the process through which all NCBs pool and are subsequently allocated an amount of "monetary income". The paper argues that NCBs with T2 liabilities do pay, but in disguised ways that are only fully revealed by unpacking the monetary income pooling/allocation process. To show how this is the case both in theory and in practice, we detail two specific mechanisms that are saddled within the monetary income pooling and allocation process – denoted as a "restitution mechanism" and a "compensation mechanism". The paper also exhibits how certain factors can influence the extent to which NCBs with T2 claims are renumerated.

JEL: E58; E63; G21.

Keywords: Eurosystem; monetary policy; monetary income; Target 2; quantitative easing.

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1. Introduction

It has been well documented that recent interest rate hikes in the wake of covid-19 have deteriorated central bank profitability (see e.g. Bell et al. 2023; Wessels 2026).[1] After the so-called "non-conventional" monetary policies adopted since 2008, the operational framework of central banks has shifted from a "scarce reserve regime" aka "corridor system" (e.g. Borio 1997) to an "ample reserve regime" or "floor system" (e.g. Schnabel 2023, 2024; ECB 2024; Borio 2023; Bouguelli 2022; Baker and Rafter 2022; Baglioni 2023; Rostagno et al. 2021). As long as the interest rate on excess reserves (i.e the deposit facility rate or DFR) was zero or even negative – as it was between the mid of last decade until mid-2022 – the floor system was costless for national central banks (NCBs). However, with the DFR returning to positive territory, these costs have become significant and controversial.

While this has been commonplace amongst the majority of central banks, specific to the Eurosystem as laid-bare by Cesaratto, Febrero and Pantelopoulos (2025) **is the process by which all NCBs pool their respective "monetary incomes" (MI);** i.e. income and expenses related to monetary operations, which includes the costs of remunerating excess reserves created through so-called balance sheet policies adopted during the Global Financial Crisis and the pandemic. These incomes compose the Eurosystem's monetary income which is reallocated amongst the NCBs according to their respective capital key. [2]

The manner in which the numerous asset-purchase programs were implemented by Eurosystem NCBs, particularly by purchasing (mainly) government assets in other jurisdictions, led to a combination of TARGET2 (T2) imbalances[3] and an uneven excess liquidity distribution in the monetary union (uneven in the sense of not being consistent with each NCB's capital key share). A dispute subsequently arose between Sinn (2019, 2020) and Perotti (2020) as to whether NCBs with T2 liabilities were paying any interest on them. Chien et al. (2025) added another dimension to the discussion on whether the (eventual) interest payments related to the T2 imbalances were enough to compensate the risk assumed by jurisdictions with T2 claims which exchanged, through QE, marketable assets (say Italian government bonds) with non-marketable debt (T2 liabilities).

In this paper we focus on this renewed controversy over T2. However, we shall examine the question within a more complete consideration of Eurosystem monetary imbalances and redistribution mechanisms by particularly including e.g. the uneven distribution of excess liquidity costs on the one hand, and of seigniorage revenues on banknotes issuances on the other.[4] **Our conclusion will be that NCBs with T2 liabilities do pay, but in disguised ways that are fully revealed only after unpacking the mechanism by which NCBs pool and are subsequently allocated an amount of monetary income.**[5] However, it will also be shown that Eurosystem NCBs with T2 claims in principle recover the

[1] For a general overview of central bank profitability frameworks, see e.g. Studener et al (2014), Bunea et al (2016) or Wessels and Broeders (2023).

[2] By capital key (CK) we mean according to the share of each respective NCB's share of the ECB's capital. There are two capital keys. The first based on all the EU countries participating to the capital of the ECB; the second restricted to the EMU countries. We are interested in the second.

[3] For an introduction to T2 imbalances see e.g. Bindseil and Konig (2012) or Febrero and Uxò (2013).

[4] In the context of banknote issuance, seigniorage constitutes income earned by a central bank. This is because while banknotes are not remunerated, the assets held generally produce income for a central bank (see also footnote no. 26 in the annex).

[5] The pooling and reallocation process concerning monetary income is part of the calculation of the Profit and Losses (P&L) accounts of the Eurosystem-NCBs and, therefore, of the computation of NCB final profits. Reallocation of income and profits along CK is necessary in an incomplete monetary union like the Eurosystem (Barba and De Vivo, 2013) where member NCBs do not report profits and/or losses to a single Federal Government like in the U.S. in the case of Federal Reserve Banks.

related revenues through the pooling and reallocation mechanism of the extra-costs of excess liquidity they bear (excess liquidity and T2 imbalances are related), but a full recovery can be hidden by e.g. the pooling and sharing of the extra seigniorage revenues these NCBs might have obtained by an extra issuance of banknotes and by other less identifiable factors.

To show how this is the case and expose the reality that Eurosystem imbalances do influence NCB profitability, we detail two specific mechanisms that are saddled within the monetary income pooling and allocation process, which we shall denote as a **(1) "restitution mechanism" and a (2) "compensation mechanism":**

- **Restitution mechanism:** as this paper will contend, **any interest paid/received over the financial year on the over-issuance/under-issuance of banknotes and/or T2 liabilities/claims is ex-post "returned"** through the process by which each NCB pools and is subsequently allocated an amount of monetary income that results in a net monetary income (i.e. an "adjustment" to the amount of monetary income pooled). In this sense, a **"restitution" mechanism exists,** where via the process of pooling/allocating monetary income, an initial redistribution which took place over the financial year is zeroed (or nullified). The restitution mechanism however – while negating any payments on T2 and/or banknote issuance imbalances – **in and of itself neglects to show that such imbalances can impact other balance sheet items that, in turn, influence net monetary income.** A more complete consideration of such interactions leads us to a second mechanism.
- **Compensation mechanism**: by intertwining the existence of the restitution mechanism into the process by which monetary income is pooled and allocated (i.e. by ignoring interest paid/received on over/underissued banknotes and T2 claims/liabilities), **this paper will show that NCBs indirectly pay for both T2 liabilities and/or overissued banknotes via a channel which we label the "compensation mechanism".** With respect to T2 imbalances, acknowledgement of the compensation mechanism is of particular importance since during the course of numerous asset-purchasing programs some NCBs (e.g. Bank of Italy) have instructed other NCBs (e.g. German Bundesbank) to act on their behalf by buying their respective (e.g. Italian) domestic bonds in their own jurisdiction (e.g. Frankfurt). As a consequence, this has resulted in the build-up of T2 liabilities for the former, and a large amount of T2 claims and excess reserves (and hence interest payments) for the latter, as described above (see also e.g. Eisenschmidt et al, 2017; Eisenschmidt, Kedan and Schmitz, 2024).

In support of both the restitution and compensation mechanism, the paper will work through some theoretical and practical examples showcasing the monetary income pooling and allocation process**.** In applying our results, we shall focus on two opposite and somewhat **complementary cases being the Bank of Italy and the Deutsche Bundesbank**.

To achieve our objectives, the paper will be structured as follows. In **section 2** we shall briefly review the prevailing literature on the preceding issues. In **section 3** we shall frame monetary income within the context of the profit and loss accounts of NCBs while **section 4** disseminates some rudimentary examples. In **section 5** we examine our theoretical suppositions against real data. Following this, **section 6** unpacks our interpretation of the Sinn-Perotti's dispute and also returns to the thesis held by Chien et al. (2025) on the presumed interest rate advantages for NCBs with T2 liabilities in operating QE in foreign ES jurisdictions. Concluding remarks then complete the paper. An **annex** then provides a dissection of monetary income and its components and functioning, integrating the exposition as provided in Cesaratto et al. (2025).

2. Do Target2 imbalances imply interest payments within the Eurosystem?

Professor Hans Werner Sinn is a well-known veteran regarding the debate on T2 imbalances having first raised the issue in the early 2010's (see e.g. Sinn, 2019 or 2020 for a summary). At that time, widening T2 imbalances were due, depending on interpretations, on the combination of underlying foreign and fiscal debt crises in some ES-countries which culminated in episodes of capital flight. Following the "whatever it takes" speech by then ECB President Mario Draghi, T2 imbalances narrowed. T2 imbalances then widened again when in 2015 the ECB took more decisive action against deflation tendencies with the Asset Purchase Program (APP), reaching their peak in 2022-2023 after the Pandemic Emergency Purchases Programme (PEPP) was executed (see e.g. https://www.eurocrisismonitor.com/). According to the prevalent opinion, the renewed widening of T2 imbalances was mainly due to the technical modalities in which some jurisdictions implemented their CK share of asset purchases in different jurisdictions (we shall return to this below in section 4).[6]

It is in this context that Sinn (2019) **raised the issue if Eurosystem NCBs were (or not) paying any interest on their respective T2 liabilities.** Sinn (2019, p. 1) concluded that while interest payments on T2 liabilities were due during the year, these were then returned via the pooling and allocation of monetary income at the end of the year, since T2 balances "formally imply interest payments among the NCBs during a year which is then nullified by the pooling and redistribution of all NCB interest income by the end of the year." (This is confirmed by Cesaratto et al, 2025). Sinn (ibid) also specified that this result is, however, only provisional given that a remuneration of T2 claims is indirectly produced by the interest payment on the correlated extra-reserves, a loss that the credit NCB shares via monetary income. In other words "the remuneration of … Target balances is … the interest rate on excess reserves" (Perotti 2020, p. 38). Therefore, Sinn concludes:

> *"As pooling eliminates the prior interest payments, it at first glance might seem to imply that there is no interest on Target balances. However, this appearance is deceptive. (…) pooling implies that interest is effectively paid and accumulated with compound interest in the balance sheets of national central banks."*

Chien et al. (2025) add another dimension to this debate. They argue that, de facto, some Southern ES countries (e.g. Italy and Spain), by purchasing assets in the midst of various asset purchase programs in other ES jurisdictions such as Frankfurt – and by paying for them via issuing T2 liabilities – **have substituted a marketable asset (the government bonds they bought back) with a non-marketable IOU (i.e. T2 liabilities)**. In their words:

> *Before the introduction of unconventional policies, core countries were already lending to the periphery, but such transactions took place at prevailing market rates. Under the new regime, the ECB has effectively become the intermediary of this cross-country lending. Unconventional monetary policies operate through large-scale swaps of marketable securities, such as government bonds, for non-marketable securities, such as reserves or Target2 claims. (ibid., pp. 1-2).*

[6] On this first phase of the T2 debate see the diverging interpretations expressed by Cesaratto (2015, 2018a/b), Febrero and Uxó and Bermejo (2018) and Lavoie (2015a/b). On the second peak Eisenschmidt et al (2017). On both see Eisenschmidt et al (2024).

Their focus is, therefore, on the difference in the remuneration of marketable and non-marketable assets resulting from the modalities by which the purchase operations were carried out by some NCBs. **We are thus left with two issues:**

(a) whether those NCBs do pay or not any interest rate on their T2 liabilities;
(b) should they pay, the question is at which interest rate in order to make a comparison with what otherwise have been paid by the national Treasury on government bonds had they not been purchased from market participants (for instance if the two rates – i.e. the interest rate on T2 liabilities vs interest paid to market participants – were to be equal, the Consolidated Public Sector would have no net advantages or disadvantages).

To answer both (a) and (b), we need to turn our attention to the process by which NCBs pool and are subsequently allocated an amount of MI. It is to such issues which the next two subsequent sections are devoted towards.

3. Monetary income and a NCB's P&L account

In the present context, monetary operations include operations related to the working of the payment system – banknote issuance as well as T2 claims/liabilities which may produce incomes/expenses for NCBs as explained below – and other interventions (e.g. lending operations, outright purchases and custody of liquidity) which also generate revenues or costs. The pooling and subsequent reallocation process of these incomes/costs results in an adjustment to each NCB's initially pooled monetary income in such a way that each NCB receives back an allocated amount of monetary income which may differ from the initial monetary income pooled. The logic underpinning this is that in the Eurosystem, monetary operations guided by the ECB are not necessarily implemented by NCBs in line with respective capital keys generating disproportional revenues or costs. By collating incomes and expenses related to monetary operations and redistributing them (in this case according to capital keys), the process through each NCB pooling and subsequently receiving an allocated amount of monetary income can thereby produce an adjustment (i.e. the amount a NCB pools may differ from the monetary income received following the pooling/allocation process). In this way, **the final profits of a NCB documented in the profit and loss account are influenced by the net monetary income it receives; i.e. the difference between the monetary income the NCB has pooled and what it receives back.**

Let us begin by locating monetary income within the NCB's profit and loss accounts. **Tables 1 and 2 below present the synthetic profit and loss accounts for both the Deutsche Bundesbank and Bank of Italy for the period 2021-2025.** The effects of the rise of the costs for NCBs of excess liquidity becomes distinctive with (initial) net interest income (item 1) becoming negative from 2023 as a result of the rise in interest expenses (item 1.2). Net monetary income (item 2) – which is the result following the process by which NCBs pool and are subsequently allocated an amount of monetary income – modifies, to a degree, the initial results contributing to the determination of final profits. However, to fully appreciate the role of monetary income, the two mechanisms introduced above (i.e. the restitution and compensation mechanism) must be considered, as done below in the next section.

Table 1: A selected synthesis of the P&L account for DBB (euro millions)

		2021	2022	2023	2024	2025
1	**Net Interest Income (1=1.1+1.2)**	2,501	3,954	-13,907	-13,059	-4,167
1.1	Interest income	7,319	12,077	55,053	55,959	33,070
1.2	Interest expenses	4,818	8,124	68,960	69,018	37,238
2	**Net monetary income (2=2.2-2.1) (a)**	-1,179	-2,204	-5,182	-5,434	-1,669
2.1	Monetary income pooled	1,528	4,096	15,838	17,421	8,242
2.2	Monetary income allocated	349	1,893	10,656	11,976	6,573
3	Net (financial) income	449	-837	451	943	-147
4	Other income	1,535	126	190	187	164
5	Operative expenses	1,967	2,183	3,121	2,451	2,815
6	**Final profits (6=1+2+3+4-5) (b)**	1,339	-1,144	-21,580	-19,814	-8,634
7	Transfer from/to provision for general risks	-1,339	1,144	21,580	661	0
8	Distributable profits (8=6+7)	0	0	0	-19,153	-8,634

Notes: (a) net monetary income includes minor figures concerning the recalculation of amounts of previous years; (b) final profits are gross of financial buffers

Source: Annual accounts Deutsche Bundesbank.

Table 2: A selected synthesis of the P&L account for Bank of Italy (euro millions)

		2021	2022	2023	2024	2025
1	**Net Interest Income (1=1.1+1.2)**	7,262	5,787	-5,675	-5,306	5,023
1.1	Interest income	11,453	12,991	27,479	22,414	17,675
1.2	Interest expenses	4,191	7,204	33,155	27,720	-12,652
2	**Net monetary income (2=2.2-2.1) (a)**	2,243	2,380	-1,139	-1,876	-1,389
2.1	Monetary income pooled	-2,034	-1,162	7,999	9,087	5,343
2.2	Monetary income allocated	199	1,213	6,869	7,215	3,954
3	Net (financial) income	82	-1,360	190	-1	-772
4	Other income	1,509	916	1,620	2,016	2,369
5	Operative expenses	1,916	1,863	2,120	2,152	-2,214
6	**Final profits (6=1+2+3+4-5) (b)**	9,181	5,860	-7,125	-7,319	3,018
7	Transfer from/to provision for general risks	-2,000	-2,500	5,600	5,800	-900
8	Distributable profits (8=6+7) (c) (d)	7,181	3,360	-1,525	-1,519	2,118

Notes: (a) net monetary income includes minor figures concerning the recalculation of amounts of previous years; (b) final profits are gross of financial buffers; (c) small inconsistencies between the sums are due to approximation. (d) For the BoI they include taxes (or tax-rebates) considered as a transfer to/from the Treasury.

Source: Annual accounts Bank of Italy.

Given the construct of the monetary union**, NCB interest revenues and expenses can be of different origin:** some are related to the monetary operations which are common to the monetary union, and others are "local". Interest incomes/expenses related to "European" monetary operations arise following operations to ensure the smooth functioning of the payment and settlement system within the euro area as well as common monetary policy decisions. Some of the local operations also impact monetary policy decisions and are therefore regulated by the ES Agreement on Net Financial Assets

(ANFA).[7] The related income or expenses are hence considered for the calculation of monetary income. Other minor operations related to the management of NCBs are neither ascribable to common monetary decisions nor to ANFA.[8]

Given that it has been unpacked in detail in Cesaratto et al (2025; see also the annex below), at this stage it is simply worth divulging that each NCB pools their own monetary income which is derived exclusively from those interest income and expenses which, directly or indirectly, matter for "European" monetary operations, ascertaining to both earmarkable assets and the liability base (see Table A1 in the annex). **This pooled monetary income (item 2.1 in Tables 1 and 2) contributes towards the Eurosystem's "monetary income" that is then allocated (item 2.2 in Table 1) according to capital keys that results in each NCBs "net monetary income" (item 2 in Tables 1 and 2) – i.e. to an adjustment to the initial monetary income pooled**. Importantly, this ultimately modifies the initial impact of interest incomes/expenses related to monetary operations (items 1.1 and 1.2 in Table 1) on final profits (item 6 in Table 1). It is also worth noting that as NCBs operate within the context of a monetary union subject to common decisions, **it is logical that the related interest incomes/expenses are pooled and ultimately shared proportionally to the respective shares in the ECB's capital.**

Finally, some NCBs, like the Bank of Spain and the Bundesbank, transfer the bulk of item 6 (i.e. final profits) in total to their respective Treasuries as dividends when the outcome is positive. By contrast as they are partly owned by private actors, e.g. both the Bank of Italy and the Bank of France pay taxes out of item 6, then transfer a proportion to those private owners and, finally, send what remains to the government.[9] In recent years, after losses due to interest payments to banks on excess reserves (ER) held in each NCBs deposit facility (DF), NCBs have resorted to accumulated financial buffers.

4. The restitution/compensation mechanism in theory

Having divulged the basic schematics and rationale regarding the process by which NCBs pool and are ultimately allocated an amount of monetary income in the previous section (with further details in the annex), the purpose of this section is to unpack the two specific mechanisms that reside within the pooling/allocation of monetary incomes, namely the (1) restitution and (2) compensation mechanism. With the Bundesbank and Bank of Italy experiences over the last decade in mind, we focus over the two symmetric cases of T2 and banknotes imbalances, respectively, in which *prima facie* what NCBs pay (receive) over the year is eliminated via monetary income redistribution. In doing so, **we demonstrate that NCBs indirectly pay (are paid) albeit via the "back door" for T2 liabilities (claims) and/or overissued (underissued) banknotes.**

In the rudimentary examples below, we will adopt the following assumptions:

- All examples operate under a two NCB (NCB-A and NCB-B) framework
- Capital keys are 50% for each NCB
- Minimum reserve requirements for banks equate to zero

[7] On ANFA see ECB (2024); Deutsche Bundesbank (2016); König and Bernoth (2016); Kowalewski, Szadkowski (2024) and the annex.

[8] In this regard, we invite readers to ignore the annex of Cesaratto et al. (2025) based on a table from the Bank of Spain (2024, p. 58).

[9] Wessels (2026) provides a general description of such processes.

- Each NCB (unless otherwise specified) issues €100 of banknotes,[10] which is exactly equal to its assigned quota (this is because as capital keys are 50/50 – and since in total NCBs issue €200 of banknotes – each NCB's banknote assigned quota equates to €100). Also, it is important to acknowledge that just because a NCB has an assigned quota with respect to banknote issuance, this does not signify that a NCB cannot issue an amount of banknotes in excess of its assigned quota (see examples 2 and 3 below). Needless to say, this is perfectly reasonable since demand for banknotes is driven by the general public depending on local habits etc.
- The "reference rate" is, for expositional reasons, equal to 100%. This rate is uniformly applied to all operations (with some exceptions), as the Eurosystem has mostly[11] done from 1-1-2025 by uniformly applying the DFR.

Example 1: NCB-A conducts domestic QE and implements QE on behalf of NCB-B

As shown below in Table 3a reporting the stylised balance sheets of the two NCBs, in this first example each NCB has issued €100 banknotes (which as it happens is exactly equal to their assigned quota), and in the process of doing so, banks have lost €100 reserves. Both NCBs have therefore conducted €100 of repurchase agreements ("repos") through banks posting adequate forms of collateral (ignoring valuation haircuts etc.).[12] Moreover, NCB-A has instituted both "domestic" QE (creating €100 of excess reserves that are situated within its deposit facility) and also conducts some QE operations in the amount of €100 for NCB-B (that is still done according to CK).[13] This results in another €100 of excess reserves being created on the balance sheet of NCB-A, and also means that NCB-A posts a T2 claim, with NCB-B incurring a T2 liability (note that as NCB-B has not implemented any "domestic" QE operations, banks do not have any excess reserves in jurisdiction B).

Table 3a: NCB-A conducts domestic QE and implements QE on behalf of NCB-B – the balance sheets

NCB-A	
Repos 100	Banknotes 100
Securities 100	Deposits 200
T2 claims 100	

NCB-B	
Repos 100	Banknotes 100
Securities 100	T2 liabilities 100

[10] This is in reality simplification, since the ECB also participates in the issuance of banknotes, albeit via NCBs. In other words, for a slightly more realistic interpretation, it could be that the participation of NCB-A, NCB-B and the ECB with respect to issuing banknotes is say 45/45/10 respectively. Similarly, NCBs have also purchased assets on behalf of the ECB during the numerous asset purchase programs. We have chosen to omit the ECB so as to reduce complexities (we have however reproduced our theoretical examples by including the ECB, and it does not alter the conclusions etc.). We return to the interconnectivities between NCBs and the ECB in section 5.

[11] "Mostly" since there are some exceptions, namely those assets purchased during the various asset purchase programs which are subject to a "risk-sharing" clause; interest income on these items are pooled not at the deposit facility rate, but at an effective interest rate – i.e. the actual rate of return. See the annex.

[12] Strictly speaking, in the Eurosystem repo-like operations are typically referred to as "refinancing operations". The difference between repurchase agreements and refinancing operations is that in the former case, legal ownership of the underlying asset passes to the creditor, whereas in the latter case it does not. Given that each jurisdiction is free to carry out these transactions in either of the two ways, in this paper we have chosen to continue with the term "repos" for ease of interpretation by readers.

[13] This could be as banks within jurisdiction A hold say securities issued by the government which resides in jurisdiction B. This is not an abstraction from reality, as e.g. the Bundesbank purchased Italian government securities (on behalf of the Bank of Italy) that were held by German banks, or by international investment funds operating in Frankfurt having deposits at German Banks.

On the basis of the above balance sheet entries, Table 3b below exhibits both the restitution and compensation mechanisms for both NCBs (this approach will be repeated in all subsequent examples). For instance, as an interest rate of 100% is applied to each item (to avoid too small numbers and make the argument more evident), NCB-A pools an interest income of €100 for both repos and securities, whereas it pools an interest expense of €200 for the excess deposits of banks held within its deposit facility – all of which is shown in column "Pooled (A)". Further, each item in the column "Allocated (B)" is calculated by way of the amount pooled by each NCB (i.e. "Pooled (A)") for the same item being divided by two, as capital keys are 50/50. As an example, in €200 of interest income in total being pooled for repos (i.e. €100 by NCB-A, and €100 by NCB-B), the amount allocated to each NCB equates to €200/2 = €100.

Turning our attention to the total amount of monetary income pooled**, the <u>total amount of monetary income pooled (€100) is exactly equal to the amount it is allocated</u>** – i.e. the adjustment to MI pooled is also equal to zero. **This is also exhibited by the sum of column "Net (B-A)" equalling zero**.

Table 3b: Restitution and compensation mechanisms – monetary income

NCB-A	**Eurosystem**	**Pooled (A)**	**Allocated (B)**	**Net (B-A)**
Repos	200	100	100	0
Securities	200	100	100	0
Deposits	200	-200	-100	**(compensation)** 100
BKN (under/over)	0	0	0	0
T2 claims	0	100	0	**(restitution)** -100
Total	**600**	**100**	**100**	**0**
				Total net MI (adjustment to MI pooled)
NCB-B	**Eurosystem**	**Pooled (A)**	**Allocated (B)**	**Net (B-A)**
Repos	200	100	100	0
Securities	200	100	100	0
Deposits	200	0	-100	**(compensation)** -100
BKN (under/over)	0	0	0	0
T2 liabilities	0	-100	0	**(restitution)** 100
Total	**600**	**100**	**100**	**0**
				Total net MI (adjustment to MI pooled)

Legend: "restitution" refers to the deletion of a NCB's revenues/payments incurred during the year; "compensation" refers to the recovery of those revenues/payments through other channels.

It is important however to observe each of the balance sheet items individually:

- **For NCB-A:**
    - For repos, NCB-A pools €100 and receives back €100. In this way, its net MI on this item is equal to zero.
    - Likewise for securities; it pools €100 and receives €100, meaning that net MI is zero.
    - It pools €200 of interest expenses (i.e. -€200) related to paying interest on excess reserves and receives back -€100 (meaning that its net MI is equal to €100). This is because the total amount of interest expenses pooled by both NCBs is equal to €200. And since capital keys are 50/50, the expense of €200 is equally shared between the two NCBs, as in reality, NCB-A is in excess to the tune of €100 from the perspective of assigned capital keys.

- NCB-A also pools €100 of interest income from its T2 claims it received over the year, but receives back nothing on this item; i.e. its net MI is -€100.

- **For NCB-B:**
  - For repos and securities in aggregate, NCB-B pools €200 of interest income, and receives back €200; i.e. net MI is zero.
  - With regard to interest on excess reserves, NCB-B pools zero interest income/expenses, but receives back -€100; i.e. net monetary income equates to -€100.
  - NCB-B pools €100 of interest expenses on T2 liabilities it paid over the year, and receives an amount of zero in return, stipulating that its net MI is equal to €100.

In observing each item individually, the following can be surmised. With regards to T2 claims/liabilities, whatever the amount of interest earned (paid) on any T2 claims (liabilities) related to the financial year is negated through the pooling and allocation of monetary income.[14] **What can be concluded therefore is that as a "restitution mechanism" exists, as any interest received/paid on the T2 imbalances is ex-post "returned" during the monetary income pooling/allocation process.**

At the same time, **by NCB-A sharing the costs of remunerating excess reserves within its deposit facility through the MI pooling/allocation process, the remuneration (or lack thereof) of T2 balances is perfectly offset; this is the "compensation mechanism" at work.** Indeed, it is in fact only right that NCB-A should not receive any remuneration on its T2 claims given that it will indirectly receive the same amount of remuneration via sharing the costs of remunerating excess liquidity within its deposit facility. Symmetrically, NCB-B has the amount it has already paid on T2 liabilities refunded via the MI pooling/allocation process, but finds itself paying a corresponding sum to NCB-A as part of the latter sharing the costs of remunerating excess reserves. This "pure" case, where other elements (e.g. repos, QE etc.) are conducted in accordance with CK and therefore do not interfere serves as a benchmark for our subsequent analysis, in which some of these other items may no longer comply with CK. **This pure result of full compensation also depends on the assumption of a uniform rate of interest on all operations (as well as all the operations being conducted according to each NCBs respective CK),** as it is mostly plausible to assume for the Eurosystem after 1-1-2025. This is because if the interest rate NCB-A expects on its T2 claims – say equal to the rate at which the ECB conducts its so-called main refinancing operations MROR – is higher than the rate applied to excess reserves, say at the DFR (and given that in a corridor system MROR > DFR), then compensation mechanism will not operate at 100%. After 1/1/2025 DFR is applied to all items.

Example 2: NCB-A and NCB-B conduct domestic QE, NCB-A overissues banknotes

In this case (Table 4a), the two NCBs have implemented QE operations (in the amount of €100) in their respective jurisdictions. However, the total amount of banknotes issued in aggregate increases to €250 (an increase of €50), as NCB-A has issued €150 of banknotes (and NCB-B €100 of banknotes). Since capital keys are 50/50, this infers that each NCB is assigned a quota of €125 of banknotes, meaning that in reality, NCB-A has issued €25 above its quota. Therefore, an additional item on the liability side of its balance sheet appears ("BKN over"). The increase in banknote issuance also has the consequence that the amount of excess reserves within the deposit facility of NCB-A following its QE

[14] For example, as it posts €100 of T2 claims (and with an interest rate of 100%), NCB-A receives €100 of interest income, which is then pooled. In being allocated nothing in return following the pooling/allocation process, in net terms this stipulates that NCB-A in fact receives in the form of monetary income allocated an amount of -€100, which exactly offsets the amount originally earned.

operations is reduced by €50 (from €100 to €50). For NCB-B, an additional item entitled "BKN under" (equalling €25) is entered on its balance sheet and appears on the asset side. This is because as NCB-A has issued €25 of banknotes above its assigned quota (which is equal to €125), an extra €25 of banknotes have been quasi-issued by NCB-B ("quasi" since in reality, NCB-B has only really issued €100 of banknotes). The Bank of Italy (2024, 63) explain this phenomenon in the following way:

> *"This item, which represents BI's share of banknotes in circulation issued by the Eurosystem…decreased by €8,877 million (from €242,975 million to €234,098 million) in 2024 owing to the reduction in BI's capital key. The value of banknotes actually put into circulation by BI, instead, rose slightly (by €273 million, from €197,692 million to €197,965 million). Since this value was lower than the notional amount assigned to BI, the difference of €36,133 million is shown as an interest-earning claim on the Eurosystem under Sub-item 9.4 on the asset side, as Net claims related to the allocation of euro banknotes within the Eurosystem."*

Table 4a: Domestic QE and NCB-A overissues banknotes – the balance sheets

NCB-A	
Repos 100	Banknotes 125
Securities 100	Deposits 50
	BKN over 25

NCB-B	
Repos 100	Banknotes 125
Securities 100	Deposits 100
BKN under 25	

Turning then our attention to the total amount of monetary income pooled and as shown below in Table 4b, **deceptively whatever the amount of seigniorage from banknotes a NCB pools it receives back** (like in the previous example, the present one is built in order that each NCB's adjustment to monetary income pooled when considered in aggregate is zero). Given that net MI in aggregate for each NCB equates to zero, **should one therefore conclude that no seigniorage is shared by NCBs over-issuing banknotes?** (the question is analogous to the one posed in the previous example with respect to T2 liabilities).[15]

[15] Recall that seigniorage is earned by central banks as the assets held on the balance sheet generally produce an income, whereas banknotes are not remunerated (see also footnote no. 26 in the annex).

Table 4b: Restitution and compensation mechanisms – monetary income

NCB-A	**Eurosystem**	**Pooled (A)**	**Allocated (B)**	**Net (B-A)**
Repos	200	100	100	0
Securities	200	100	100	0
Deposits	150	-50	-75	**(compensation)** -25
BKN (overissue)	0	-25	0	**(restitution)** 25
T2 claims/liabilities	0	0	0	0
Total	**550**	**125**	**125**	**0**
				Total net MI (adjustment to MI pooled)
NCB-B	**Eurosystem**	**Pooled (A)**	**Allocated (B)**	**Net (B-A)**
Repos	200	100	100	0
Securities	200	100	100	0
Deposits	150	-100	-75	**(compensation)** 25
BKN (underissue)	0	25	0	**(restitution)** -25
T2 claims/liabilities	0	0	0	0
Total	**550**	**125**	**125**	**0**
				Total net MI (adjustment to MI pooled)

Legend: "restitution" refers to the deletion of a NCB's revenues/payments incurred during the year; "compensation" refers to the recovery of those revenues/payments through other channels.

What can be concluded here?

- Analogous to T2 claims/liabilities, **the restitution mechanism is applicable in the context of interest paid/received on any overissued/underissued banknotes.** For example, NCB-A in overissuing €25 of banknotes pools an interest expense of €25, and, in being allocated nothing in return, its net monetary income is the equivalent of €25. **Thus – like T2 claims/liabilities – interest paid/received on any overissued/underissued banknotes is ex-post returned during the pooling/allocation of monetary income**.
- **Intertwining the restitution mechanism reveals the compensation mechanism.** In issuing additional banknotes, NCB-A's deposits have reduced, falling below CK (which has become €75 for each NCB). Correspondingly, part of NCB-B's deposits are now over CK. NCB-A will therefore support part of the costs of NCB-B's excess reserves, and this is precisely why NCB-A pays a seigniorage to NCB-B. **In this way, what the compensation mechanism implies is that NCB-B is in effect sharing the costs of paying interest on excess reserves via it not paying interest on any excess liquidity beyond its assigned capital key.**

Example 3: NCB-A conducts domestic QE, implements QE for NCB-B and overissues banknotes

In this final example (Table 5a), we amalgamate aspects of the two previous examples. In this case, NCB-A conducts QE operations both on its own accord and for NCB-B (example 1), and issues an amount of banknotes above its assigned quota in the amount of €25 by drawing down on the excess reserves within its deposit facility (example 2).

Table 5a: NCB-A conducts domestic QE, over-issues banknotes and implements QE for NCB-B – the balance sheets

NCB-A	
Repos 100	Banknotes 125
Securities 100	Deposits 150
T2 claims 100	BKN over 25

NCB-B	
Repos 100	Banknotes 125
Securities 100	T2 liabilities 100
BKN under 25	

Table 5b: Restitution and compensation mechanisms – monetary income

NCB-A	**Eurosystem**	**Pooled (A)**	**Allocated (B)**	**Net (B-A)**
Repos	200	100	100	0
Securities	200	100	100	0
Deposits	150	-150	-75	**(compensation)** 75
BKN (overissue)	0	-25	0	**(restitution)** 25
T2 claims	0	100	0	**(restitution)** -100
Total	**550**	**125**	**125**	**0**
				Total net MI (adjustment to MI pooled)
NCB-B	**Eurosystem**	**Pooled (A)**	**Allocated (B)**	**Net (B-A)**
Repos	200	100	100	0
Securities	200	100	100	0
Deposits	150	0	-75	**(compensation)** -75
BKN (underissue)	0	25	0	**(restitution)** -25
T2 liabilities	0	-100	0	**(restitution)** 100
Total	**550**	**125**	**125**	**0**
				Total net MI (adjustment to MI pooled)

Legend: "restitution" refers to the deletion I of a NCB's revenues/payments incurred during the year; "compensation" refers to the recovery of those revenues/payments through other channels. For NCB-A compensation is the algebraic summation of a positive compensation via deposits (€100) plus a negative compensation of BKN (€25). Symmetrically for NCB-B.

In observing the balance sheet items individually, NCB-A pools €150 of expenses on excess reserves and receives back -€75; i.e. its net monetary income is the equivalent of €75. The reason that this occurs is because in aggregate, the total amount of excess reserves between the two NCBs equates to €150. And with capital keys of 50/50, this implies that NCB-A should share the expenses related to the excess reserves beyond its capital key with NCB-B.

On this basis, the following can be surmised:

- *First*, as with the examples above, whatever the amount a NCB pays on T2 liabilities and/or on the overissuance of banknotes it receives back after the monetary pooling/allocation process – i.e. **the restitution mechanism**. For instance, NCB-B pays €100 of interest on T2 liabilities over the year, a cost pooled in monetary income, but, in being allocated nothing, it in net terms receives the €100 in interest expenses back (as its net monetary income for T2 liabilities is equal to €100).

- *Second*, **acknowledging the restitution mechanism reveals the compensation mechanism.** For NCB-A, the amount of net MI towards it with regards to excess reserves beyond its assigned capital key is equal to €75. **This is the exact amount that it should be compensated in net terms after it incurred €100 of expenses on the excess reserves that were created in light performing QE operations on the accord of NCB-B, less the amount of banknotes that it overissued (€25).** Said from a different perspective, NCB-B pays for its T2 liabilities in full by NCB-A sharing the costs of excess liquidity over CK, but at the same time NCB-A must pay for its overissued banknotes (in the amount of €25). As a result, NCB-B only has to compensate NCB-A to the tune of €75 in net terms, which is covered by way of NCB-A not paying interest on excess reserves beyond its assigned capital key.

5. The restitution and compensation mechanisms in practice

Having divulged some theoretical examples in the previous section to exhibit both the restitution and compensation mechanisms in theory, we can now move to explore both in practice. Prior to presenting some observations on the real data, **it is worth taking stock of what has been established thus far, and to then also disseminate some other additional points:**

- *First*, the **restitution mechanism** implies that for both over/underissued banknotes and/or T2 imbalances, whatever the amount of interest a NCB accrues (pays) during the course of the year is in-effect returned during the monetary income pooling/allocation process.
- *Second,* the **compensation mechanism** instils that even though any interest on over/underissued banknotes and/or T2 imbalances is returned as per the restitution mechanism, NCBs do indeed pay for any overissued banknotes and/or T2 liabilities during the monetary income pooling and allocation process, albeit through other items on the balance sheet, namely by those NCBs with T2 claims passing on the costs with an associated stock of excess reserves beyond their assigned capital keys (which however can be somewhat mitigated if the same NCB with T2 claims and excess reserves has simultaneously issued banknotes beyond its assigned capital key share).

The above points were showcased in the rudimentary examples in the previous section. **There are however a few additional elements to consider which were not included in the examples** (see also the annex), namely that:

1. **T2 imbalances are generated also when NCBs operate on behalf of the ECB**; this includes T2 imbalances instituted either when NCBs purchase assets on behalf of the ECB during QE (which create T2 claims towards the ECB), or, when NCBs issue banknotes on behalf of the ECB (that lead to T2 liabilities).[16] **There is however no restitution mechanism for T2 imbalances generated when NCBs operate on behalf of the ECB**, meaning that any interest accrued on T2 claims by NCBs is not returned to the ECB during the monetary income pooling/allocation process.
2. **Should the amount of earmarkable assets be larger in value than a NCB's liability base (see Table A1), a "GAP" item will be generated** which will be pooled as an expense at an interest rate equivalent to the ECB's policy rate (i.e. the DFR). On the flipside, should a NCB's

[16] If for instance a NCB were to issue an amount of banknotes for the ECB (creating T2 liabilities) that was equal to the amount of assets purchased for the ECB during QE operations (creating T2 claims), then the two would mutually offset one another.

earmarkable assets be smaller than its liability base, the NCB will pool a positive amount of income (with interest accrued again in accordance with the ECB's policy rate). Should EA < LB or vice versa (i.e. EA > LB), a NCB has created (absorbed) liquidity by initiatives not included among common monetary policy operations, and as a result, the NCB shares the interest revenues received (paid) such initiatives.

3. The extent to which **repos** are undertaken by NCBs are – analogous to banknotes – driven by demand factors outside of the control of NCBs, **instilling that repos may not be in line with CKs.**[17] For instance, when say issuing banknotes, NCBs with scarce liquidity will be required to conduct refinancing operations whose revenues they must share, thereby compensating those NCBs remunerating any above-CK excess liquidity.

Recalling that T2 imbalances via QE operations are related to excess reserves, considering the role of banknote issuance beyond assigned capital keys, and integrating points (1)-(3), **we are now at a point that we can bring across the following theses with respect to the compensation mechanism for NCBs with T2 claims/liabilities:**

- **(a)** NCBs with significant T2 claims and an abundance of excess reserves inherent a seigniorage from other NCBs and do not pay interest on excess liquidity beyond their respective capital keys. All else equal – and on the presumption of a uniform rate of interest on all items – should interest earned on T2 claims be equivalent to the extent of beyond-CK interest accrued on excess reserves, the NCB will be fully compensated vis-à-vis its T2 claims.[18]
- **(b)** When issuing banknotes beyond their assigned CK-share, NCBs with large T2 claims and excess reserves do not necessarily need to implement any liquidity-introducing operations in the form of repos (or, in the parlance of the Eurosystem, refinancing operations). In this way, the NCB is not required to share the seigniorage on the over-issue of banknotes, and thus, the amount of net MI the NCB will receive on the excess reserves will be lower than it otherwise would, meaning that the NCB will be "under" compensated vis-à-vis its T2 claims.[19]
- **(c)** On the flipside, nations with large T2 liabilities and relatively scarce reserves may resort to repos beyond their CK-share when issuing additional liquidity to domestic counterparties,[20] or implement operations not included as common monetary policy operations (thereby creating a GAP – albeit still regulated by ANFA). In this case, both the over-CK repos and the GAP need to be shared, which could result in a negative net MI on both these items, and subsequent "over" compensation with regards to the amount that a NCB pays to cover off its T2 liabilities.

[17] This is in contrast with the theoretical examples above, where it was assumed that repos were undertaken in line with CKs.

[18] This was the result of example 1 above; while NCB-A was not directly remunerated on its T2 claims, it at the same time shared the costs of the excess reserves (beyond CK) with NCB-B, which precisely matched the amount of interest it accrued on T2 claims.

[19] Reflecting on example 3 in the previous section, if NCB-A were to issue an additional stock of banknotes even further beyond its CK-share, NCB-A would absorb excess reserves from its deposit facility. The result would be that NCB-A would not be required to share the seigniorage on these newly issued banknotes. However the amount of net MI received on the excess reserves would fall, constituting a degree of under compensation for NCB-A with respect to its T2 claims.

[20] If for instance NCB-B were to undertake QE operations through NCB-A (as per examples 1 and 3 above), it could be that NCB-B may still be required to conduct repos to domestic banks particularly after the latter became accustomed to an ample reserve regime. When it comes time for NCB-B to pool its monetary income associated with repos, it may be the case that NCB-B has undertaken repos beyond its assigned capital key share, resulting in a distribution of monetary income towards NCB-A that has conducted repos under its capital key share.

Taking stock of points (1)-(3) and (a)-(c), we can now move to showcase the real data for both the Bundesbank and the Bank of Italy (whose respective Eurosystem capital keys for 2025 equate to 26.6% and 16.02%) as presented in Tables 6 and 7 below.

Table 6: Breakdown for the Bundesbank – net result of pooling monetary income

	DBB Breakdown of the net result of pooling of monetary income, 2024 and 2025	2024				2025			
	Stimations in bold,	Eurosystem total (EU) (1)	Pooled by DBB (A)	Redistributed to DBB (B) (3)	Net result (C=B-A)	Eurosystem total (EU) (1)	Pooled by DBB (A) (2)	Redistributed to DBB (B) (3)	Net result (C=B-A)
1	Lending to euro-area credit institutions	6,710	1,130	**1,787**	**657**	587	103	**156**	**53**
2	Securities held for monetary policy purposes (subject to risk sharing) (4)	8,202	1,388	**2,184**	**796**	8,081	1,261	**2,152**	**891**
3	Securities held for monetary policy purposes (not subject to risk sharing) (5)	130,281	**33,495**	**34,694**	**1,199**	63,406	**16,401 (6)**	**16,885**	**484**
4	Intra-Eurosystem claims equivalent to the transfer of foreign reserves to the ECB	1,448	386	**386**	**0**	790	210	**210**	**0**
5	Net intra-Eurosystem /liabilities/claims related to the allocation of euro banknotes	-5,232	-22,934	**-1,393**	**21,541**	-2,900	-13,158	**-772**	**12,386**
6	Deposits held by euro-area credit institutions	-120,847	-41,147	**-32,182**	**8,965**	-62,060	-21,306	**-16,527**	**4,779**
7	Intra-Eurosystem liabilities/claims resulting from TARGET transactions	15,609	45,056	**4,157**	**-40,899**	7,689	24,496	**2,048**	**-22,448**
8	Gap	8,864	47	**2,360**	**2,313**	9,091	237	**2,421**	**2,184**
9	**Total (our calculations) (6)**		17,421	**11,993**	**-5,428**		**8,244**	**6,573**	**-1,671**
10	**Total (official figures)**	45,035	17,421	11.976	-5,434	24,684	8,242	6,573	-1,669

Notes: (1) Column (EU): source BoI (2026). (2) Column (A): source DBB (2026) except row 3 which is obtained by default, as algebraic result of the other figures and the net. (3) Column DBB capital key: the value of column (EU) times the DBB capital key (2025 and 2024=0.266301; 2023=0.261494). (4) For the distinction between risk-sharing and non-risksharing assets, see Bank of Italy 2026, p. 10. (5) Conventional income calculated at the rate on the MRO until 2024; from 2025 at the rate on DF. (6) The discrepancy from our calculations and the official figures (only the totals being available from the main text of DBB AnAc 2025) are of secondary magnitude.

Sources: DBB (2026; BoI (2026); our calculations.

Table 7: Breakdown for the Bank of Italy – net result of pooling monetary income

	BoI Breakdown of the net result of pooling of monetary income, 2024 and 2025	2024				2025			
		Eurosystem total (EU)	Pooled by BoI (A)	Redistributed to BoI (B)	Net result (C=B-A)	Eurosystem total (EU)	Pooled by BoI (A)	Redistributed to BoI (B)	Net result (C=B-A)
1	Lending to euro-area credit institutions	6,710	2,741	1,075	-1,666	587	387	94	-293
2	Securities held for monetary policy purposes (subject to risk sharing)	8,202	635	1,314	679	8,081	523	1,294	771
3	Securities held for monetary policy purposes (not subject to risk sharing)	130,281	24,329	20,871	-3,458	63,406	11,660	10,158	-1,502
4	Intra-Eurosystem claims equivalent to the transfer of foreign reserves to the ECB	1,448	232	232	0	790	127	127	0
5	Net intra-Eurosystem /liabilities/claims related to the allocation of euro banknotes	-5,232	1,526	-838	-2,364	-2,900	927	-465	-1,392
6	Deposits held by euro-area credit institutions	-120,847	-5,498	-19,360	-13,862	-62,060	-2,096	-9,942	-7,846
7	Intra-Eurosystem liabilities/claims resulting from TARGET transactions	15,609	-19,797	2,501	22,298	7,689	-8,938	1,232	10,170
8	Gap	8,864	4,919	1,420	-3,499	9,091	2,753	1,456	-1,297
9	**Total**	**45,035**	**9,087**	**7,215**	**-1,872**	**24,684**	**5,343**	**3,954**	**-1,389**

Notes:

Sources: BoI (2026).

Observation of the data for 2025 reveals the following aspects:

- For all items, **the amount of *net* monetary income allocated for each NCB is consistent with its capital key** (as also explained in the annex). For instance in the case of excess reserves, the Bundesbank in reality pools a monetary income of -€21,306. With a capital key of 26.6%, it should in theory pool a monetary income of -€16,507 (calculated by 0.266 x the total amount of Eurosystem monetary income on excess reserves, which equates to 0.266 x -€62,060 = -€16,507), but pools -€21,306. As a result, its net monetary income on this item is equal to the difference between the actual amount of monetary income pooled (-€21,306) and the amount of monetary income pooled consistent with its capital key (-€16,507); i.e. €4,779.
- **The restitution mechanism as applied to T2 is evident**, with the amount of monetary income allocated down to the net actions of NCBs vis-à-vis the ECB. For instance, in the case of Bundesbank, the difference between the amount of interest accrued on its T2 claims that is subsequently pooled (€24,496) and allocated (€2,048) equates to a net result of -€22,448. Even so – setting aside the Bundesbank's actions for the ECB – the interest accrued by the Bundesbank on its T2 claims was returned (i.e. the €22,448). Likewise for the Bank of Italy;

during the course of the year it paid interest on T2 liabilities and hence pooled expenses or monetary income to the tune of -€8,938. By receiving an allocated amount of monetary income equating to €1,232, in net terms any interest paid by the Bank of Italy on T2 liabilities was returned to it (i.e. the €10,170).

- **The restitution mechanism is also apparent with respect to banknote issuance imbalances.** The Bundesbank during the course of the year issued banknotes beyond its capital key (setting aside the Bundesbank's issuance of banknotes on behalf of the ECB), whereas the Bank of Italy underissued banknotes with respect to its capital key. This is why for the Bundesbank, the amount of net monetary income on banknotes equates to €12,386, while for the Bank of Italy the net monetary income on banknotes equals -€1,392.

With regards to 2025, consideration toward items on the balance sheet that are explicitly linked to T2 claims/liabilities and banknote imbalances reveals the following:

- For the Bundesbank, the net monetary income it receives on T2 claims equates to -€22,448, as noted above. As its net monetary income on overissued banknotes equals €12,386, **then theoretically the Bundesbank should receive €10,062 as a way to cover off its T2 claims** (i.e. -€22,448 + €12,386 = €10,062). In reality however, **the Bundesbank only receives €4,779 in net MI on sharing the costs of excess reserves** (item 6 in Table 6), stipulating that it is under compensated by €5,283.
- Regarding the Bank of Italy, the interest returned on T2 liabilities equals €10,170. Subtracting for the amount of net monetary income on underissued banknotes (€1,392) instils that **the Bank of Italy should pay €8,778 to close off its T2 liabilities.**
- In this way, the Bundesbank and the Bank of Italy are, respectively, under- and over-compensated for their T2 positions (needless to say, the symmetry of the under/over-compensation cannot be perfect as there are, of course, other NCBs involved). Point (c) presented above may be an avenue to explain (at least partially) such a phenomenon. Inspection of item 1 in Tables 6 and 7 reveals that the Bank of Italy shared its income from over-CK lending operations while the Bundesbank was a net receiver (as net MI on repos for the Bank of Italy is negative, with the net MI on repos for the Bundesbank positive, albeit in modest amounts). Similarly, the Bank of Italy was required to share income from the GAP, as net MI on the GAP for the Bank of Italy was negative (item 8 in Table 7), with net MI on the GAP positive for the Bundesbank (item 8 in Table 6). Since the related figures do not fully explain the under/over-compensation, we guess that there may be other factors at play, but more research is needed in this regard.[21]

6. Some reflective remarks on the T2 debate

Having disseminated some rudimentary examples in section 4 in addition to comparing these with real data in the previous section, **we can now return to the debates posed above namely as to whether (a) NCBs pay interest on T2 liabilities and (b) at what interest rate.**

Perotti (2020, p. 38) explains that for Sinn the remuneration of T2 claims coincides with the corresponding interest payment on the extra-reserves, a loss that a credit NCB (i.e. a NCB with T2

[21] Prior to 2025, interest rate differentials may have played a role in influencing the compensation mechanism, since both T2 and banknotes were pooled at MROR, whereas excess reserves were pooled at DFR (with MROR > DFR). But since 2025, all three items (T2, banknotes and excess reserves) are pooled at the same interest rate (i.e. DFR), stipulating that interest rate differentials no longer play a role in this regard.

claims) shares via monetary income. In lieu of the arguments in the previous two sections, summed up below, Sinn is basically correct, although incomplete:

- step 1: a credit NCB receives a payment on its T2 claims over the year;
- step 2: by pooling the interest payments received over the year the credit NCB is deprived of the remuneration on its T2 claims;
- step 3: via the monetary income pooling and allocation process, the credit NCB receives a corresponding amount of net monetary income on its excess reserves. Combining step 1 and step 2 results in a net interest payment of zero on T2 claims. Nonetheless, by incorporating step 3, **a credit NCB is in fact remunerated on its T2 claims through other items on the balance sheet, namely by not paying interest on excess reserves beyond its respective CK-share.**

Steps 1-3 are the essence of the controversy. Redistribution of the costs of excess liquidity via the process of pooling/allocating monetary income is however in reality more complicated, as shown in the paper. In this way, we have in a sense completed Sinn's argument by taking other components of monetary income into account and have tested our reasoning against the empirical data.

Perotti criticises Sinn by noting that: "as I have shown…this is not the whole effect: taking into account also the monetary income received, the remuneration of Target balances is 0." (p. 38). Perotti's argument is that if a credit NCB pools €10 as an income on a T2 claim and correspondingly pools €10 as a loss on excess liquidity, then (assuming the same interest rate) it will receive nothing. So, he concludes, Sinn is wrong: "Thus, after pooling, the effective remuneration of Target balances to the NCB is 0" (pp.25-26). **This is true but incomplete, as Perotti considers only the combination of step 2 and step 3 made above (and therefore omits step 1).**

Having argued and shown that T2 imbalances are remunerated, **let us return to the question as to what interest rate T2 imbalances are remunerated.** Recall that the reason for considering such a question is that due to QE, NCBs earn the spread between (i) coupon payments (and hence the amount which Treasuries would have continued to pay without quantitative easing) on the one hand and capital gains on securities (which the NCB returns to the Treasury) on the other *versus* (ii) the interest rate applied on T2 liabilities still paid by NCBs and therefore by the consolidated public sector. As Chien et al (2025, p. 29) conclude:

> *"Target2 does not provide the public sector in periphery countries with a technology to borrow risk-free from the core. Instead, Target2 is a technology for transferring risk to taxpayers in the other Eurozone countries without compensation. If the return on Italian NCB's Target2 liabilities exactly matches the yield on Italian sovereign bonds, then financing debt through the Target2 mechanism does not alleviate Italy's debt burden."*

Let us note first that Chien et al. (2025, pp. 51) assume that – all else equal – after the monetary income process of pooling and sharing nothing is eventually paid or received on T2 imbalances. If nothing, directly or indirectly, is paid on T2 liabilities, implementing QE operations in other ES jurisdictions would of course quite advantageous for NCBs in highly indebted countries by buying back costly government assets by issuing zero-cost IOUs. As Chien et al remark (ibid, p. 29/f. 17): "Within a monetary union (…) the cost [of public debt] can be shifted from domestic to foreign households if the returns on Target2 liabilities are lower than the yields on sovereign debt".

Assuming instead, as we have done above, **that interest on the T2 liabilities is indirectly paid, a comparison between this rate and those on government bonds is open and interesting.** In our opinion, the *sign* of the spread between the interest rate paid on the T2 liabilities and the rate of return on government bonds depends on the period considered. Chien et al. (2025) examine events

until 2022, after a decade of low or even negative interests on excess liquidity/T2, with yields on e.g. Italian Treasuries certainly higher. In this vein, it is logical for Chien et al (2025, p. 1) to conclude that "the rate of return on that claim (T2) is lower than the rate of return on equivalent marketable claims." (ibid, p. 1/f. 3)

However, **this has unlikely been true after mid-2022 with the rise of policy rates**. Indeed, NCB losses in 2023 and 2024 are often attributed to yields on assets being lower than the cost of the deposit facility. For instance, the Bank of Italy (2025, p. 27; see also Bank of Italy, 2026, pp. 26-27) reports that:

> *"In 2024, as in the previous year, net interest income was negative (-€4,241 million) owing to a higher average rate of remuneration on liabilities denominated in euro (e.g. bank deposits and the negative TARGET balance) than on assets denominated in euro, which are largely fixed-rate and longer-term assets (especially securities held for monetary policy purposes). (…) The net result of pooling monetary income was negative too, by €1,872 million in 2024 (-€1,130 million in 2023 (…). The overall impact of monetary policy, arising from the combination of net interest income earned on interest-bearing assets and costly liabilities on the balance sheet and the net result of pooling the Eurosystem's monetary income, was negative by €10,432 million in 2024 (-€9,764 million in 2023 (…))."*

By purchasing government bonds issued by the most heavily indebted countries on secondary markets from foreign investors, NCBs have satisfied the latter's greater preference for risk-free liquidity. It is unclear whether this liquidity should yield a return.[22] This debate however is beyond the aim of this paper, and we expect that further research will put additional light on these aspects.

7. Conclusion

Our story has been a bit complicated. **A step-by-step summary is as follows:**

1. **The background has been constituted by the modalities some Eurosystem NCBs adopted to implement QE between 2015 and 2022 which led to T2 imbalances;** the Sinn-Perotti debate follows on as to whether T2 claims should be remunerated, plus Chen's argument that it is right for them to be remunerated.
2. Having introduced the nature and role of monetary income in relation to the NCBs' balance sheets and their profit and loss accounts, we showed that, *prima facie*, T2 balances are not remunerated (where we define the "restitution mechanism" as the peculiar mechanism whereby NCBs first pay, but then recover, the amount paid via the process of pooling and being subsequently allocated an amount of monetary income). T2 claims are, however, associated with excess reserves. The costs of remunerating excess reserves are nonetheless passed on, via the monetary income pooling/allocation process, to the other NCBs with T2 liabilities. Thus, commercial banks in jurisdictions with T2 claims receive remuneration from

[22] To be sure, had the liquidity created by the BoI via domestic outright purchases (in accordance with CK) stayed in Italian banks, the rising expenses related to the remuneration of excess reserves would have affected its capacity to return the profits related to the purchased assets to Treasury. The consolation however on the flipside is that by doing so the BoI would in-effect subsidize domestic and no other European (say German) banks or investors (as is currently the case). Be this as it may, by the BoI operating (via DBB) in Frankfurt through buying Italian treasuries from foreign investment funds, the BoI avoided buying bonds from Italian banks. This is what Rostagno et al (2021, p. 246) frame as a "gamble for resurrection": as Italian banks hold large stocks of Italian treasuries, the probability of Italian banks losing faith in the solvency of the Italian government may be minimised.

their respective NCBs, which are, in turn, refunded by the other NCBs with T2 liabilities. It is therefore as if the T2 claims are remunerated albeit through other items on the balance sheet, which we have defined as the "compensation mechanism".

3. The notion that NCBs with T2 claims are compensated is not immediately reflected in the data, as there exists an influential factor: **the imbalances (with respect to the CK) relating to the issuance of banknotes.** In the specific case of the German Bundesbank, T2 claims (and excess reserves) coexist with an above-CK banknote issuance.
4. As with T2 claims/liabilities, imbalances relating to banknotes are, *prima facie*, unremunerated (taking into account, in this case too, the restitution mechanism). There is, however, an indirect transfer of **seigniorage** profits from the over-issuance of banknotes to the other NCBs. In the specific case of the Bundesbank, this consists of using excess reserves to facilitate the extra banknote issuance.
5. Rather than resorting to lending operations (which normally replenish the reserves that banks lose when exchanging reserves for banknotes at the public's request), in order to issue extra-banknotes in a situation of excess liquidity the additional issuance of banknotes results in a reduction of excess reserves. In this case, the remuneration or "compensation" received by the jurisdiction with T2 claims and excess liquidity decreases, but at the same time it does not have to share any seigniorage on the over-issue of banknotes.
6. In total, if no other factors were at play or if these were secondary, **we would expect most or all T2 claims to be remunerated, either through the sharing of excess liquidity costs or through the non-sharing of profits on the extra issuance of banknotes – i.e. the compensation mechanism.** The empirical data shows that this is indeed somewhat the case, although there is a portion of T2 claims that are not remunerated that we are still unable to justify. In any case, the empirical evidence does not contradict our argument but rather buttresses it.

Against a backdrop of what we have presented, one policy question has remained: should T2 imbalances be remunerated? (see also e.g. Perotti, 2020; Cesaratto,2021). As long as T2 imbalances are due to the modalities of some ES NCBs carrying out their QE operations, one would have to answer yes, since these operations by creating excess liquidity in foreign jurisdictions also generate costs for NCBs. As mentioned above, the preference for liquidity on the part of investors who have sold off securities from the most indebted countries may not, in and of itself, automatically warrant remuneration. The reasons for such remuneration are to be found rather in the ample reserve regime (or floor system) that has taken hold following the so-called unconventional monetary policies adopted over the past decade. De Grauwe and Ji's (2023, 2024) proposal for a two-tier system that does not remunerate excess liquidity clashes with the functioning of the floor system, whilst a return to the traditional corridor system (Borio 2023) is hampered by banks' habit of maintaining ample liquidity buffers. Whether this should be borne by the taxpayer however for the benefit of banks and investors is debatable, and goes beyond the scope of this paper.

Aside from if T2 imbalances should be remunerated, **a further query that arises is why the ES first enforce payments over the year related to both T2 and/or banknote imbalances, then zero such payments via monetary income (what we named "restitution mechanism").** Cour-Thinmann (2013, p. 29) suggested some time ago that the rationale for this rule is that, in the case where a country with T2 liabilities leaves the union during the year – thereby reneging its T2 debt – it would have at least paid an interest on its T2 liabilities during the year (which is "returned" if it doesn't eventually leave). The same argument can be extended to seigniorage: a country with the intention to leave the

monetary union might be temped to over-issue banknotes and it is therefore penalised, over the year, for doing so. A second reason why payments are eventually returned via monetary income is that mechanisms exist as unveiled in this paper whereby these payments are indirectly done by way of the compensation mechanism, so a duplication of payments must be avoided.

All in all, it is envisaged that the methodology and arguments presented in this paper will provide more clarity with respect to the monetary income pooling and allocation process, and by doing so, shed more light on debates predominantly regarding the nature and repercussions of T2 imbalances.

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Annex: The pooling/allocation of monetary income – a brief redux

To provide some clarity with regard to what items represent earmarkable assets and/or are contained within the liability base, Table A1 below details the components. Readers will note that the list of earmarkable assets and the liability base are a strict derivation from the main components of a NCB's balance sheet. In addition, Table A1 details the respective "reference" interest rate at which the income to be pooled is calculated. This rate is for most items conventionally set to equal to the policy rate – being the MROR until 31/3/2024, and the rate at which NCBs remunerate excess reserves or DFR thereafter – i.e. the deposit facility rate.

Table A1: Earmarkable assets/liability base

Earmarkable assets		**Liability base**
(a) lending to euro-area credit institutions relating to monetary policy operations (*effective* interest rate on refinancing operations)		(a') banknotes in circulation ($i = 0$)
(b) securities held for monetary policy purposes (public securities*: policy* rate; corporate bonds: *effective* interest rate)		(b') liabilities to euro-area credit institutions related to monetary policy operations denominated in euros (*effective* interest rate: i_{RR} and i_{DF} on required and excess reserves, respectively).
(c) intra-Eurosystem claims arising from the transfer of reserves to the ECB (0.85 x *policy* rate)		
(d) net intra-Eurosystem claims resulting from TARGET2 transactions (*policy* rate)		(d') net intra-Eurosystem liabilities resulting from TARGET2 transactions (*policy* rate)
(e) net intra-Eurosystem claims related to the allocation of euro banknotes within the Eurosystem (*policy* rate)		(e') net intra-Eurosystem liabilities related to the allocation of euro banknotes within the Eurosystem (*policy* rate)
(f) a pre-set amount of gold holdings and gold receivables in proportion to each NCB's subscribed capital key ($i = 0$)		GAP (*policy* rate)

Legend: the "policy rate" coincided with the MROR until 31/12/2024 and with the DFR later.

Source: Cesaratto et al (2025) and references therein

Looking at the most relevant items, d, e, d' and e' (with a reference rate not preset at zero) are related to the payment-system operations; items a, b and b' to monetary policy operations. The interest perceived or paid in relation to monetary policy operations are thus pooled and reallocated via monetary income, entailing a redistribution whenever those operations assumed proportions unaligned with capital keys. A redistribution will take place also whenever income and losses are calculated at actual rates that differ between jurisdictions.

While we do refer the reader to Cesaratto et al. (2025) for more detailed explanations, some principles regarding the main items contributing to NCBs net profitability are conveyed here. Tables A2a-b below (a duplicate of Tables 6-7 in the main text) the breakdown of the process by which both the Bundesbank and the Bank of Italy pool and are subsequently allocated an amount of monetary income for both 2024 and 2025**.**

Table A2a - Breakdown of the Bundesbank net result of pooling monetary income (millions of euros)

	DBB Breakdown of the net result of pooling of monetary income, 2024 and 2025	2024				2025			
	Stimations in bold,	Eurosystem total (EU) (1)	Pooled by DBB (A)	Redistributed to DBB (B) (3)	Net result (C=B-A)	Eurosystem total (EU) (1)	Pooled by DBB (A) (2)	Redistributed to DBB (B) (3)	Net result (C=B-A)
1	Lending to euro-area credit institutions	6,710	1,130	**1,787**	**657**	587	103	**156**	**53**
2	Securities held for monetary policy purposes (subject to risk sharing) (4)	8,202	1,388	**2,184**	**796**	8,081	1,261	**2,152**	**891**
3	Securities held for monetary policy purposes (not subject to risk sharing) (5)	130,281	**33,495**	**34,694**	**1,199**	63,406	**16,401 (6)**	**16,885**	**484**
4	Intra-Eurosystem claims equivalent to the transfer of foreign reserves to the ECB	1,448	386	**386**	**0**	790	210	**210**	**0**
5	Net intra-Eurosystem /liabilities/claims related to the allocation of euro banknotes	-5,232	-22,934	**-1,393**	**21,541**	-2,900	-13,158	**-772**	**12,386**
6	Deposits held by euro-area credit institutions	-120,847	-41,147	**-32,182**	**8,965**	-62,060	-21,306	**-16,527**	**4,779**
7	Intra-Eurosystem liabilities/claims resulting from TARGET transactions	15,609	45,056	**4,157**	**-40,899**	7,689	24,496	**2,048**	**-22,448**
8	Gap	8,864	47	**2,360**	**2,313**	9,091	237	**2,421**	**2,184**
9	**Total (our calculations) (6)**		17,421	**11,993**	**-5,428**		**8,244**	**6,573**	**-1,671**
10	**Total (official figures)**	45,035	17,421	11.976	-5,434	24,684	8,242	6,573	-1,669

Notes: (1) Column (EU): source BoI (2026). (2) Column (A): source DBB (2026) except row 3 which is obtained by default, as algebraic result of the other figures and the net. (3) Column DBB capital key: the value of column (EU) times the DBB capital key (2025 and 2024=0.266301; 2023=0.261494). (4) For the distinction between risk-sharing and non-risksharing assets, see Bank of Italy 2026, p. 10. (5) Conventional income calculated at the rate on the MRO until 2024; from 2025 at the rate on DF. (6) The discrepancy from our calculations and the official figures (only the totals being available from the main text of DBB AnAc 2025) are of secondary magnitude.

Sources: DBB (2026; BoI (2026); our calculations.

Table A2b - Breakdown of the Bank of Italy's net result of pooling monetary income (millions of euros)

	BoI Breakdown of the net result of pooling of monetary income, 2024 and 2025	2024				2025			
		Eurosystem total (EU)	Pooled by BoI (A)	Redistributed to BoI (B)	Net result (C=B-A)	Eurosystem total (EU)	Pooled by BoI (A)	Redistributed to BoI (B)	Net result (C=B-A)
1	Lending to euro-area credit institutions	6,710	2,741	1,075	-1,666	587	387	94	-293
2	Securities held for monetary policy purposes (subject to risk sharing)	8,202	635	1,314	679	8,081	523	1,294	771
3	Securities held for monetary policy purposes (not subject to risk sharing)	130,281	24,329	20,871	-3,458	63,406	11,660	10,158	-1,502
4	Intra-Eurosystem claims equivalent to the transfer of foreign reserves to the ECB	1,448	232	232	0	790	127	127	0
5	Net intra-Eurosystem /liabilities/claims related to the allocation of euro banknotes	-5,232	1,526	-838	-2,364	-2,900	927	-465	-1,392
6	Deposits held by euro-area credit institutions	-120,847	-5,498	-19,360	-13,862	-62,060	-2,096	-9,942	-7,846
7	Intra-Eurosystem liabilities/claims resulting from TARGET transactions	15,609	-19,797	2,501	22,298	7,689	-8,938	1,232	10,170
8	Gap	8,864	4,919	1,420	-3,499	9,091	2,753	1,456	-1,297
9	**Total**	**45,035**	**9,087**	**7,215**	**-1,872**	**24,684**	**5,343**	**3,954**	**-1,389**

Notes:

Sources: BoI (2026).

More specifically: the first column reports the Eurosystem aggregated monetary income (the net result of income and expenses from the NCBs); the second column lists the actual income or losses the NCBs realised on the monetary operations pooled via monetary income; the third column represents the same entries based on assigned capital keys (where in practice they are obtained by multiplying the total Eurosystem values times the NCBs' respective CKs). The fourth column shows the net result: if an NCB pooled more (less) that it receives, it realises a negative (positive) monetary income result.

In what follows we place focus on:

- (A) items 1, 2, 3 and 6 concerning monetary policy operations;
- (B) items 5 and 7 concerning the payment system; and
- (C) item 8 (for item 4 we refer the reader to Cesaratto et al. 2025).

(A) Monetary policy operations creating liquidity

Item 1: *Refinancing operations* or "repos" are not made according to respective capital keys, but on demand of the counterparties. Revenues and eventual losses (if conducted at negative rates) are therefore pooled and redistributed via monetary income.

Item 2: Actual revenues from the *corporate bonds* (CSPP) purchased through APP and PEPP,[23] which were made according to capital keys and subject to risk-sharing, are also pooled.

Item 3: The bulk of the outright purchasing under those programmes were of *public sector securities*, also (basically) made according to capital keys, but are not subject to risk-sharing. The actual revenue from public sector securities, therefore, is retained by each NCBs.[24]

Item 6: Concerning the monetary policy operations concerning the custody of liquidity, *deposits* on the accord of counterparties (predominantly commercial banks) are also unevenly distributed depending on the factors influencing the excess reserves distribution among the Eurosystem jurisdictions (see section 3). NCB's income or expenses (respectively when banks' deposits receive negative/positive remuneration) are therefore pooled and redistributed via monetary income.

(B) Operations concerning the payment system

Item 7: *T2 imbalances* and the *over-under issue of banknotes* (relative to respective capital keys) (item 5) generate, *prima facie*, income or losses for NCBs. More specifically, NCBs pay monthly interest on their T2 liabilities – calculated until 31/12/2024 at the MROR and later at the DFR – which are received by the NCBs with symmetric claims. These payments were zero when, between 2017 and 2021, the MROR was zero, but became positive with the rise of the MROR from 2022. *Prima facie* the related earnings (expenses) affect net interest income (Tables 1 and 2 above). However, the process of pooling monetary income *de facto* cancels these symmetric incomes and expenses – i.e. what we infer to as the "restitution mechanism". To put it simply, through pooling monetary income NCBs with T2 liabilities pool the related expenses to the ECB, while NCBs with T2 claims confer their income. Since these two items are symmetrical, the ECB has nothing to redistribute. In the meantime, however, the process of pooling allows each NCB to erase *de facto* the income/expenses related to T2. Given that there is nothing to redistribute, one would also expect a zero value on item 7 (first column) in Tables A2a-b corresponding to the Eurosystem total. The actual €15,609 million for 2024 corresponds indeed to the remuneration, conventionally calculated at the policy rate, on the ECB's T2 liabilities to the NCBs. These were generated by the purchases of securities by the NCBs on the behalf of the ECB, following the latter's participation to both APP and PEPP.[25]

[23] The Asset Purchase Programme (APP) began in 2015 and was terminated in 2022; reinvestment ceased from 2023, thus reducing the NCBs' securities portfolio. The Pandemic Emergency Purchase Programme (PEPP) was introduced in 2020 and was discontinued in 2022; reinvestment ceased at the end of 2024. The Covered Securities Purchase Programme (CSPP) includes the Covered Bonds Purchasing Program 3.

[24] Regarding the public sector securities (not subject to risk-sharing), while the NCBs retain the related actual revenues, nonetheless there is a sort of fictional pooling and redistribution: the NCBs confer to MI a revenue on public securities (bought according to CK) conventionally calculated at the policy rate (currently the DFR), but this amount is exactly returned by redistribution (which is also according to CK). The net value for item 3 should then be zero, but it is not. The BoI, for instance, received a net negative monetary income (€-3,458 million in 2024). This is due to permitted temporary violations of the CK criterion during PEPP: supposedly the BoI (and the BoF) had to share the temporary earnings on these extra-purchases.

[25] For instance, in 2024 the ECB distributed pro-quota to the NCBs €15,609 million (Tables A2a-b, item 7/first column). Correspondingly, all NCBs show a positive net result (e.g. the Bank of Italy of €2,501 million). With regard to the ECB, in 2024, against an actual revenue of €3,850 million from these securities, this led the ECB to a loss. We note that: (i) when the NCBs bought securities for the ECB - which cannot directly operate in the financial markets - this generated a T2 liability for the latter; (ii) correspondingly, extra liquidity was created in each jurisdiction which, after mid-2022, became particularly costly for NCBs; (iii) by remunerating its T2 liabilities the ECB is thus refunding the NCBs the costs of this extra liquidity; (iv) since the rate of return on the securities is lower than the MROR (from 1/1/2025 DFR), the ECB is then incurring in a loss: In the words of the ECB (ECB, 2025, 17-18): "In 2022 and 2023 [and later] the reduction in the ECB's result was primarily due to the materialisation of interest rate risk, as the rise in interest rates in the euro area led to an immediate increase in

Item 5: Considering the issuance of *banknotes*, NCBs issue them on demand and not according to capital key. The discrepancy between capital keys and actual issuance is therefore known only *post-factum*, when single NCB and, therefore, aggregate issuances are known. NCBs that over the year have over-issued banknotes will then pay a "penalty", while those that have symmetrically under issued will be remunerated. The related expenses/income are reported (item 5 of Tables 2a-b). Analogous to the T2 "restitution mechanism", these symmetric expenses and revenues are pooled and, therefore, since they cancel each other, the ECB has nothing to redistribute. Given that there is nothing to redistribute one would expect a zero value on item 5 of Tables 2a-b corresponding to the Eurosystem total. The residual €-5,232 million (for 2024) corresponds to the restitution that the NCBs operate via pooling their respective monetary incomes in favour to the ECB of the seigniorage[26] NCBs obtained on the 8% of banknotes they issued on the behalf of the ECB. We see therefore that, as much as in the case of T2, also in this case the pooling/allocation of monetary income is a vehicle for settling some ECB/NCB credit/debit positions.

(C) GAP

Item 8: Regarding the *GAP*, the Bank of Italy (2025, p. 76) states that when the value of an NCB's earmarkable assets (EA) is higher (lower) than the value of its liability base (LB), the difference (GAP) is considered to bear negative (or positive) interest based on the policy rate. In other words:

- EA > LB → the NCB pools a negative income (a cost) on the GAP
- EA < LB → the NCB pools a positive income on the GAP

Should EA < LB (EA > LB), the NCB has created (absorbed) liquidity by extra-operations not included among the common monetary policy operations.[27] Therefore it shares the interest revenues received (paid) on those extra-operations. Readers may identify the GAP with the NCB's balance sheet components regulated by ANFA, also coincident with the balance sheet's "autonomous factors" with the exclusion of banknotes.[28]

To sum up, the calculation of monetary income does refer to the magnitudes of an NCB's balance sheet related to monetary policy, all under the direct (monetary policy decisions) or indirect (regulated by ANFA) control of the Eurosystem.

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the interest expense paid by the ECB on its net TARGET liability, which was remunerated at the rate on the main refinancing operations..."

[26] "Seigniorage is the income earned by a central bank related to the issuance of banknotes. Although banknote liabilities are not remunerated, in general the assets held against banknotes in circulation are interest-bearing and generate income for central banks. In practice, euro banknotes are physically put into and withdrawn from circulation only by euro area NCBs. From the legal perspective, however, both the ECB and the NCBs can issue euro banknotes. (…) an 8% share of the total value of euro banknotes in circulation is deemed to be issued by the ECB and is disclosed as a liability in its balance sheet under 'Banknotes in circulation' (…). Claims against the NCBs equivalent to the value of these banknotes are disclosed as an asset in the ECB's balance sheet under 'Claims related to the allocation of euro banknotes within the Eurosystem'. (…) these claims are remunerated at the applied to the deposit facility offered by the Eurosystem (…). The remuneration earned by the ECB on these claims is the ECB's seigniorage income and is disclosed in the profit and loss account under 'Interest income'" (ECB 2025, pp. 2-3). For NCBs seigniorage is included in the income ascertained from lending operations.

[27] In Cesaratto et al (2025, footnotes 16 and 17) we inadvertently inverted the signs of the inequalities.

[28] On the "autonomous factors" of a NCB's balance sheet, see Mercier (2014).