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On the Weak Impact of Base Money on Broad Money in the Context of Unconventional Monetary Policy: Euro Area 2008–2024

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Abstract: In its response to the economic and financial crises of 2008, the sovereign debt and euro crisis of 2010–2015, and the COVID-19 pandemic of 2020–2023, the European Central Bank (ECB) implemented an unconventional monetary policy aimed at providing liquidity for more than a decade, through a complex set of tools and operations that make up the so-called quantitative easing. The results of all of them are being analyzed from different perspectives. This paper studies the relationship between a large base money, characterized by a voluminous concentration of liquidity in the form of excess reserves, and broad money (the broad M3 aggregate). Our econometric work shows a low elasticity of broad money with respect to base money, concluding the existence of a weak relationship between both monetary magnitudes, with a sharp decline in the money multiplier. The demand for money has remained stable relative to its determining variables, interest rates and income. At the same time, some practices related to the handling of excess liquidity by European banks through deposit facilities deserve consideration. We propose strict control by the monetary authority over the nature and origin of the funds that constitute the excess liquidity derived from the ECB's unconventional operations, and over its management.

Keywords: quantitative easing; base money; broad money; deposit facility; central bank

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1. Introduction

Following the economic and financial crisis at the end of 2007, major central banks adopted a set of unconventional monetary policy measures to address the liquidity crisis. The ECB was no exception to the new monetary policy orientation. At a time of severe instability and a marked reduction in aggregate demand, the objective of price stability lost prominence in the ECB's immediate concerns. Since the beginning of the financial crisis in late 2007, the ECB has redirected traditional monetary policy based on interest rates, to an unconventional monetary policy focused on the quantitative expansion of its balance sheet. The massive injection of liquidity into the system, known as quantitative easing (QE), occupied the ECB for a decade. Then, the COVID19 pandemic contributed to the lengthening of the unconventional monetary policy, especially during the period 2020–2023.

Along with quantitative easing, the 2022 used two other non-standard measures, within the framework of an unconventional monetary policy: First, the negative interest rate policy (NIRP)[1]. In 2014, the ECB instituted a negative interest rate that only applied to bank

deposits intended to prevent the Eurozone from falling into a deflationary spiral. Second, the ECB began using forward guidance (FG)[2] in July 2013, when the ECB's Governing Council said that it expected interest rates to remain low for an extended period.

Within the unconventional monetary policy following the 2007 financial crisis, as well as in the euro and sovereign debt crises of 2012–2013, and in the COVID19 pandemic of 2020, QE was the main instrument among those used by the ECB.

The profound change in the ECB's monetary policy stance, together with the exceptionally high volume of liquidity injected into the system between 2009 and 2023, undoubtedly form a much broader and more complex perspective of the functions of a Central Bank whose ultimate goal, as is the case of the ECB, is price stability.

A first reflection arises around the potential risk of the new and long-lasting unconventional monetary policy on the stability of money demand. Indeed, the extraordinary monetary expansion practiced by the ECB for more than a decade may have affected the stability of broad money M3. The components of M3 are currency in circulation, overnight deposits, deposits with maturities of up to two years, deposits redeemable at notice of up to three months, repurchase agreements, money market fund shares/units and MFI debt securities of up to two years.

As we will see in the section on relevant literature, studies on the stability of money demand carried out in eurozone, prior to and during the stage of unconventional monetary policy generally reveal the persistence of stability of the broad monetary aggregate M3.

However, to our knowledge, there are no studies on the stability of money demand that previously address the possible effects of quantitative easing on broad money (M3), which could, in turn, affect the stability of money demand.

Our paper attempts to shed light on the relationship between unconventional monetary policy and the behavior of the broad money (M3) in eurozone in the period 1999M1–2024M7. We also analyze the effect of the combination of the two measures, QE and NIRP, on the behavior of European commercial banks.

We must bear in mind that, from a monetary analysis perspective, broad money is relevant because it is associated with the total resources available in the economy for the purchase of goods, services and non-monetary assets as well as for investment expenditures. As the ECB itself points out, "In defining money, both the microeconomic perspective of the individual holder of money and the empirical properties of monetary aggregates resulting from the joint behavior of holders of money are relevant" (ECB, 1999, p. 31).

Thus, the broad money (monetary aggregate M3), both in the approach of the individual demand functions for the components of M3 and in a portfolio demand approach for the components of M3, must be permanently fulfilled:

The microeconomic criteria: Money serves as a medium of exchange, as the unit of account and as a store of value.

The macroeconomic criteria: Stability, Controllability, Leading indicator properties.

Stability: The usual approach is to investigate the stability of a money demand relationship, where the money stock is related to the price level, real income and interest rates.

Controllability: Is given if its growth rate can be steered over a short time horizon by the central bank using monetary policy instruments; controllability is important especially if the central announces a target for monetary growth.

Leading indicator properties. If the monetary aggregate contains information that will help to predict the price level in the future.

As we will see in Section 3, the unconventional monetary policy, in particular QE, did not provoke major movements in the broad money (M3). Since the financial crisis of 2008, the growth trend of the base money has been increasingly driven by Eurosystem monetary policy operations. However, broad money (M3) has stopped closely mimorring

developments in base money. As we will see, the elasticity of M3 with respect to base money and with respect to QE operations is low. Indeed, the response of broad money to changes in base money and QE operations is very weak after 2008. The elasticity is around 0.30, and is statistically significant in all cases.

The structure of the paper is as follows: after the introduction, Section 2 reviews the relevant literature on the effects of unconventional monetary policy on the real economy, clearing potential situations of uncertainty on the sovereign debt of some member states and on the common currency itself. In addition, the literature review also extends to the effects of the two-tier system (TTS), between 2019 and 2022, in order to show the extreme sensitivity of banks in the management of excess liquidity to changes of the key ECB interest rates. As we will see later, the TTS provides that a part of the excess reserves is exempt from the negative interest rate of deposit facility. The volume of reserve holdings in excess of minimum reserve requirements that is exempt from the negative deposit facility interest rate is determined as a multiple of credit institution's minimum reserve requirements. This is so-called as the allowance.

Section 3 deals with the evolution of base money, whose composition shows a marked change since the 2008 crisis. The strong injection of liquidity from the quantitative easing operations, between 2009 and 2023, moves the base money away from its traditional conformation as the sum of banknotes in circulation and the level of required central bank reserves.

In Section 4, we analyze the effects of the non-standard measures on broad money (M3). We study to what extent the effects of the large non-standard financing programs (APPs, VLTROs, TLTROs, PEPPs, PELTROs) have concentrated on the base money after 2007. The trends of the base money and broad money (M3) have decoupled. The expansion in base money due to non-standard measures has not supported a similar uptrend in M3. This section studies the money multiplier, which shows a strongly negative trend as a result of the reduced influence of base money on broad money. Emphasis is placed on the strong accumulation of excess reserves and the use of the deposit facility by Eurozone financial institutions. Section 5 discusses the elasticity of broad money with respect to base money, as well as the elasticity of the latter with respect to QE operations. In Section 6, we present the discussion and main conclusions. Finally, Section 7 shows the bibliographical references.

2. Literature Review

The effects of unconventional monetary policy measures have been the subject of multiple theoretical and empirical papers. Most of the references cited in this paper focus on the consequences of the large liquidity expansion between 2008 and 2023. However, at the end of this section, we include a small set of bibliographic references on the study of the stability of money demand that may be useful to the reader. Despite the wide variety of quantitative easing operations carried out by the ECB during this period, their continuity, and their enormous quantitative volume, money demand in the eurozone was not subject to notable episodes of instability.

At the onset of the crisis, the ECB focused its monetary policy on financing the markets. Some researchers refer as the market operations approach to this period. Reichlin (2014) and Pill and Reichlin (2014), considering the role of the central bank as lender of last resort, argue that these decisions contributed to a first economic recovery in the last quarter of 2009. In the same vein, Lenza et al. (2010), Peersman (2011) and Giannone et al. (2012) conclude that these liquidity injection measures prevented a more dramatic tightening of credit to the real economy. Notice that, however, at that time interest rates were still far from the zero bound.

After the Covered Bonds Purchase Programmes (CBPP1, 7 May 2009, and CBPP2, 6 October 2011), the Security Markets Programme (SMP) was designed to conduct a massive purchase of government bonds from May 2010 to December 2012, primarily targeting the debt crisis of Greece, Portugal and Spain. Ghysels et al. (2017) conclude that the purchase of Italian and Spanish bonds lowered yields 320 and 180 basis points, respectively, even though the volumes were not announced in advance. In the same field, Eser and Schwaab (2016) finds a significant impact of the SMP on yields of purchased bonds. Rate reductions are larger in those markets with lower liquidity and higher risk premium. Trebesch and Zettelmeyer (2018) and De Pooter et al. (2018) have obtained similar results.

In 2012 was activated the Outright Monetary Transactions (OMTs), a second massive public debt purchase program in the secondary sovereign bond market in the Eurozone, ending the SMP. Regarding OMTs, Altavilla et al. (2016, 2020) show that the announcement of the program reduces the interest rate on Spanish and Italian two-year bonds, while leaving those of France and Germany unchanged. In turn, the OMT is associated with significant real economic, credit and price growth in Italy and Spain, with positive effects in France and Germany. Ferrando et al. (2015) find a notable reduction in credit rationing to firms, which saw significantly improved access to credit. Other works in this line are those of Krishnamurthy et al. (2017), Aghion et al. (2017).

The ECB deployed, between 2014 and 2016, its powerful Asset Purchase Programme (APP), composed of: CBPP3, October 2014; ABSPP, November 2014; PSPP, March 2015 and CSPP, June 2016. In addition to the weak impact of APP on broad money M3, Dierks (2020) finds Eurozone GDP growing at a disappointing 1.2% in Q3 2019 compared with the same quarter of 2018.

The theoretical and empirical works on the impact of the APP on the euro area macroeconomy are numerous. Among others, Andrade et al. (2016) study the effects of the APP on yields and on the macroeconomy, and shed some light on its transmission channels. The asset purchase program, in combination with forward guidance, improves inflation and output expectations.

Altavilla et al. (2015) find that the ECB asset purchase program has significantly lowered yields in a broad set of market segments. Altavilla et al. (2016), using a standard macroeconomic model find that in absence of these measures both inflation and output would have been significantly lower.

Wieladek and Garcia Pascual (2016) use a BVAR framework to examine the impact of ECB quantitative easing on the Euro Area real GDP and core CPI in a number of ways. Weale and Wieladek (2016) examine the impact in a structural VAR framework. The results of both works, although different for each member state, suggest that Euro area real GDP and core CPI would have been 1.3% and 0.9% lower in the absence of this policy.

A paper by Gambetti and Musso (2017) points to a significant impact of the APP on both real GDP and HICP inflation. More precisely, they find that the contribution of the APP shock to real GDP was stronger in the short term, going from 0.18% during the first quarter of 2015 to a very weak 0.02% in the fourth quarter of 2016.

Under 2- and 3-year very long-term refinancing operations (VLTROs) in December 2011 and February 2012, Darracq-Paries and De Santis (2015) find that VLTROs promoted output growth and lending to non-financial firms. Garcia-Posada and Marchetti (2016) find evidence for Spain. Similar findings for the case of Portugal are found in Jasova et al. (2018). However, the huge liquidity injected to banks, through VLTROs, caused, in some cases, the effect of increasing sovereign asset purchases, partially cutting the positive effects on credit. Crosignani et al. (2020) finds effects of this nature in Portugal.

Finally, the so-called Targeted Longer-Term Refinancing Operations (TLTROs), in April 2014, Juin 2016 and March 2019 (TLTRO I, TLTRO II, TLTRO III, respectively) and

the Pandemic Emergency Longer-Term Refinancing Operations (PELTROs), on 30 April 2020 (PELTRO), helped reduce interest rates for banks that exceeded certain lending targets (Rostagno et al., 2016). Some papers show that banks that borrowed under TLTRO-I reduced their rates to a greater extent than banks that refrained from bidding (Altavilla et al. (2016). In the Spanish case, according to Castillo Lozoya et al. (2022), all banks participating in TLTROS operations have met the credit target during the period of analysis (from 28 February 2020 to 31 March 2021), and even the vast majority have exceeded it by far. Regarding the TLTRO III redemptions, Castillo Lozoya et al. (2024) state that the smooth functioning of the money market made it possible to redistribute reserves among market participants without generating tensions. The TLTRO III redemptions did not alter the granting of credit by institutions and had no negative effects on the Spanish economy.

The recent experience with TLTROs after March 2020, when the demand for loans registered unprecedented levels, indicates the heightened relevance of at least two additional mechanisms of propagation are specific to the pandemic. First, the availability of TLTRO funds contributed to mitigating a potential increase in lending rates, due to the surge in credit risk in the context of the economic disruptions brought forth by the pandemic. Second, the sharp and large increase in uncertainty about the macroeconomic outlook induced strong precautionary behavior on the part of firms and households (Barbiero et al., 2021).

On the other hand, and in this sense, Hartmann and Smets (2018) considerer that it is difficult to separate the effects of TLTROs from other measures that together make up what we know as the ECB's unconventional monetary policy.

Finally, several works address the effects of the Pandemic Emergency Purchase Programme (PEPP), March 2020. The results of Moessner and De Haan (2022) not only show that the announcement of PEPP affected government bond yields, but also suggest that the term premia of government bonds in euro area countries with higher sovereign risk, decreased more in response to the announcement of the PEPP. Pinto and Costa (2023) show that PEPP reduces corporate, covered, and sovereign bond spreads, during the implementation period and also during the implementation period, which is in line with the direct channel of monetary policy. In addition, the PEPP's impact on bond spreads is significantly higher for those issued in GIIPS (Greece, Ireland, Italy, Portugal and Spain) versus core European countries (France and Germany). Under a novel approach, Corradin et al. (2021) and Corradin and Schwaab (2023) decompose euro area sovereign bond yields into five distinct components and find that all five risk premia became sizable following the onset of the pandemic, and that both monetary and fiscal policy announcements had a pronounced and favorable effect on yields.

The effects of the two-tier system (TTS) were studied, among others, by Boucinha et al. (2022), who state that, following its implementation, the TTS effectively reduced banks' cost of holding excess liquidity and thus mitigated the risk of impairments in the transmission of monetary policy through banks. TTS supported the ECB's forward guidance on key policy rates. Baldo et al. (2022) show, that euro area banks were able to maximise the benefits of the ECB TTS by increasing net borrowing in the money market, increasing net borrowing from their banking group, and reducing holdings of marketable securities. Altavilla et al. (2022) show that euro area banks extended more credit to the real economy after the TTS was implemented. The banks benefiting the most from the TTS raised household deposit rates in contrast to banks less able to exploit the TTS.

The TTS could also have exercised upward pressure on longer-term rates if the incentive for banks to invest reserves was reduced. Ryan and Whelan (2021), Rostagno et al. (2019) and Demiralp et al. (2021) maintain that the TTS may have partially offset this effect by providing relief to banks, which then saw less need to invest their reserve holdings.

During the period 2015–2022, the deposit facility rate (DFR) was negative. The result was that the banks paid interest to the Eurosystem during that period. De Grauwe and Ji (2023, 2024), taking into account the two-tier system that was in operation during 2019–2022, obtain a total payment by banks over the period 2015–2022 of €61,000 million. Later we will see that during the 8 reserve maintenance periods of 2021, the application of the TTS allowed banks to save approximately €4707 million. In September 2022 the ECB set the DFR = 0.75. Once the TTS is abolished (September 2022), the ECB pays to banks an annual amount that De Grauwe and Ji (2024) estimate at €140,000 million on an annual basis. In September 2022, banks shifted more than €3,500,000 million from excess reserves to deposit facilities.

While this estimate is very optimistic, De Grauwe and Ji (2023, 2024) point out, in one year, banks will receive compensation, which is more than double the interest payments they made over seven years. From a critical perspective, De Grauwe and Ji state "now that the banks receive significant transfers that dwarf what they had to pay in the past, the ECB has been unwilling to impose a similar two-tier system that would exempt part of the banks' deposits from receiving interest transfers". This new proposed TTS would alleviate the burden on taxpayers, in the same way, as it was willing to alleviate the burden on banks when they were hit by a negative interest rate. In Section 3 of our paper, we make an adjusted calculation of the ECB's compensation to banks for deposit facility in 2022, 2023 and 2024.

However, there are arguments against such a TTS because it could lead to further restrictions and/or higher costs of bank credit to households and businesses, thereby offsetting part of the expected relief for taxpayers and economic activity

We propose a more effective alternative to limit potential undesirable practices by banks in the management of excess liquidity. This alternative would take the form of rigorous analysis by the Eurosystem on the origin of the excess liquidity that constitutes the deposit facility, especially when the DRF is high, as was the case in 2023, 2024 and early 2025, with a maximum of 4% between September 2023 and June 2024. This issue will be addressed in Section 6.

The rate on the deposit facility, is the rate which banks may use to make overnight deposits with the Eurosystem at a pre-set interest. In this context, the Governing Council of the ECB continuously reaffirms the decision to steer its monetary policy stance through this rate. Short-term money market interest rates are expected to evolve in the vicinity of the deposit facility rate with tolerance for some volatility as long as it does not blur the signal about the intended monetary policy stance

The deposit facility rate is unique for the entire euro area and normally represents the lower bound of the overnight interbank market interest rate, and therefore guides short-term interest rates in the wholesale money market. Deposit facility rate is currently 2.75%.

Numerous research papers address the analysis of the stability of money demand during the long period of unconventional monetary policy. Taken together, the theoretical and empirical papers show that quantitative easing has not significantly changed the stability of money demand in the Eurozone. With different methodologies, using the usual statistical and econometric analysis techniques, the conclusions lean towards the persistence of money demand stability in the Eurozone. Among others, see: Fischer et al. (2009); Papademos and Stark (2010); Belke and Czudaj (2010); Nautz and Rondorf (2011); De Santis et al. (2013); Dreger and Wolters (2014); Foresti and Napolitano (2014); Jung (2015); Jung (2016a, 2016b); Albulescu and Pepin (2018); Barigozzi and Conti (2018); Bahamani-Oskooee et al. (2015); Bahamani-Oskooee and Nayeri (2020); Barnett et al. (2022); Lebre de Freitas (2022); Bissoondeeal et al. (2023); Pateiro-Rodríguez et al. (2016, 2020, 2024).

In the empirical work, all the data used are from official sources: The European Central Bank (ECB Data Portal) and Spanish Central Bank. For reasons of space, we do not include the identification of each series.

3. Eurosystem Unconventional Monetary Policy Operations and Base Money

From 1999 until the economic and financial crisis of 2008, the base money is almost entirely the sum of the two essential elements that make up this macro-magnitude, i.e., currency and the minimum reserve requirements. The evolution of these two components shapes of base money trajectory between 1999 and 2008, because during that period, excess reserves have been insignificant. On average, the ratio of excess reserves to the base money did not reach 0.5% between 1999 and 2008.

However, it should be noted that currency and both the minimum reserves requirement and the credit institutions' holding reserves over and above the level of required central bank reserves form base money, or M0. During the QE period, the ratio $\frac{\text{Excess Reserves}}{\text{Base money}}$ reached very high values. For example, on average, in 2013, 2017 and 2020, reached 30%, 57% and 65%, respectively, as can be seen in the ECB statistical database.

The unconventional measures abruptly altered the evolution of base money because a relevant part of the liquidity injected into the banking system was not allocated to conventional lending operations (loans and credits) by banks, but remained stagnant in the form of excess reserves. Until 2019, excess of reserves and deposit facility were remunerated by the ECB at the deposit facility rate (DFR). Between June 2014 and July 2022, the ECB set a negative deposit facility rate (from DFR = -0.10 to DFR = -0.50). On 27 July 2022, it set DFR = 0 and on 14 September 2022, DFR = 0.75. In terms of profitability, banks held excess liquidity as excess reserves or as a deposit facility, depending on the respective interest rates. Considering the high volume of excess reserves caused by QE operations, the application of DFR < 0 to it, regardless of its consideration as excess reserves or deposit facility, was a considerable cost to the banks. As an example, the Table 1 shows the excess cost to banks of excess reserves in the 8 maintenance periods in 2021. The banking system should have paid the ECB an annual amount of approximately €18,265 million. However, in 2019 the ECB designed the two-tier system for remunerating excess reserve holdings. The TTS as of the seventh maintenance period of 2019 starting on 30 October 2019. On 27 July 2022, the ECB set DFR = 0 and on 14 September 2022, it set DFR = 0.75. On 8 September 2022 to raise the DFR to above zero, the ECB decided, on the same date, to formally suspend the two-tier system, ceasing to be effective since the fourth maintenance period of 2022.

On September 2019, the ECB Governing Council decided to set the initial multiplier for the calculation of the allowance at six, and the initial applicable remuneration rate at 0%. During the two-tier system, the non-exempt excess reserve holdings continue to be remunerated at zero percent or the deposit facility rate, whichever is lower.

If we apply the TTS to the year 2021 (DFR = -0.50), the product of the minimum reserves required by six results in an average of approximately €896,000 million for each of the 8 maintenance periods which would be exempt from remuneration. The rest of the excess reserves will have to pay the negative DFR = -0.50. With the data for the year 2021, the burden of the excess reserves for the banking system would be approximately €13,578 million, that is, €4707 million less. In the absence of the TTS, the total remuneration for excess reserves would amount to €18,265 million. In summary, the two-tier system provided banks with savings of around €5000 million in 2021. See Table 1.

Notice that deposit facility holdings are not subject to the TTS and are instead remunerated at the DFR, irrespective of whether it is zero, negative or positive.

Table 1. Cost of excess reserves in 2021 under the Two-tier system (DFR = −0.5).

Mainten. Periods 2021	Length Maintenance Period (days)	Excess Re-serves	Exempted Reserves	Non Exempted Reserves	Remunerat. Rate Allowance (0%)	Remunerat. Non Exempted. Reserves (−0.5%)	Remunerat. Excess Reserves Without TTS
First	49	3,011,200	871,400	2,139,900	593,036,111	1,456,320,833	2,049,288,888
Second	42	3,273,600	876,800	2,396,900	511,466,666	1,398,191,666	1,909,600,000
Third	49	3,443,900	879,500	2,564,500	598,548,611	1,745,284,722	2,343,765,277
Fourth	42	3,502,900	894,800	2,608,100	521,966,666	1,521,391,666	2,043,358,333
Fifth	49	3,575,300	899,200	2,675,300	611,955,555	1,820,690,277	2,433,190,277
Sixth	49	3,653,700	909,200	2,743,700	618,761,111	1,867,240,277	2,486,545,833
Seventh	49	3,689,100	919,600	2,769,500	625,838,888	1,884,798,611	2,510,637,500
Eighth	49	3,656,900	919,600	2,769,500	625,838,888	1,884,798,611	2,488,723,611
		Total			4,707,412,500	13,578,716,666	18,265,109,722

Excess reserves, exempted and non-exempted reserves are expressed in millions of euro; remuneration allowance, remuneration non exempted reserves and remuneration total excess reserves without TTS are expressed in euros. Own elaboration. Data ECB.

During 2021, banks held a monthly average of €704,000 million in deposit facilities. With a DFR of −0.50%, the corresponding annual remuneration for this facility is around €3500 million. The costs of excess liquidity, even taking into account the savings from the TTS, would amount to approximately €17,200 million in the year in question.

Currently, both the minimum reserve requirements and the excess reserve holdings are remunerated at the rate of 0%.

In contrast to these costs incurred by banks due to excess liquidity when the interest rates on deposit facility are negative (between June 2013 and July 2022), the profits obtained from this same concept when interest rates are positive are very significant. As we can see in the Table 2, in 2022, 2023 and 2024, deposit facilities allowed banks to obtain interest income of around €11,526, €126,000 and €121,000 million, respectively. As De Grauwe and Ji (2024) point out, in just one year, banks receive from ECB for excess liquidity a compensation equivalent to twice the costs incurred during the seven years of negative interest rates. From September 2022 to December 2024, this compensation is equivalent to more than four times the costs incurred in the long period of negative interest rates.

Table 2. Approximate remuneration of the ECB to banks for deposit facility in 2022, 2023, 2024.

2022 [1]	Deposit Facility (Millions) [2]	DFR % DFR	Length Period (Days) Same DFR	Remuneration (Millions)
14/09–30/09	707,017	0.75	17	250.4
01/10–31/10	4,490,010	0.75	31	2899.8
01/11–30/11	4,490,010	1.5	30	5612.5
01/12–20/12	4,521,540	1.5	20	3768
21/12–31/12	4,521,540	2	11	2763.2
Total days and approximate compensation 2022			109	11,526

Table 2. *Cont.*

2023	Deposit Facility (Millions) Annual Average [3]	DFR % DFR	Length Period (Days) Same DFR	Remuneration (Millions)
01/01–07/02	3,773,860	2	38	7967
08/02–21/03		2.5	42	11,007
22/03–09/05		3	49	15,409
10/05–20/06		3.25	42	14,309
21/06–01/08		3.5	42	15,409
02/08–19/09		3.75	49	19,262
20/09–31/12		4.00	103	43,189
Total days and approximate compensation 2023			365	126,555
2024	**Deposit Facility (Millions) Annual Average [3]**	**DFR % DFR**	**Length Period (Days) Same DFR**	**Remuneration (Millions)**
01/01–11/06	3,202,379	4	163	57,999
12/06–17/09		3.75	98	32,691
18/09–22/10		3.5	35	10,897
23/10–17/12		3.25	56	16,190
18/12–31/12		3	14	3736
Total days and approximate compensation 2024			366	121,513
Deposit facility total compensantion years 2022, 2023, 2024 2024				259,594

([1]) 01/01/2022 to 09/14/2022 DFR is zero or negative. ([2]) Average. Millions of euro (ECB series: ILM.M.U2.C.L020200.U2.EUR). ([3]) The volume of DF at the end of the period, during 2023 and 2024, is very stable. We use the annual average. Own elaboration. Data ECB.

Figure 1 clearly shows the behavior of excess reserves and deposit facility after the end of the two-tier system. In September 2022, excess reserves fell by €3,614,000 million to just €160,000 million. The following month, deposit facilities increased by €3,902,000 million to reach a record high of €4,609,000 million. This is a clear reflection that eurozone banking system manage the excess liquidity based on the interest rate policy that the ECB applies to the above-mentioned excess liquidity.

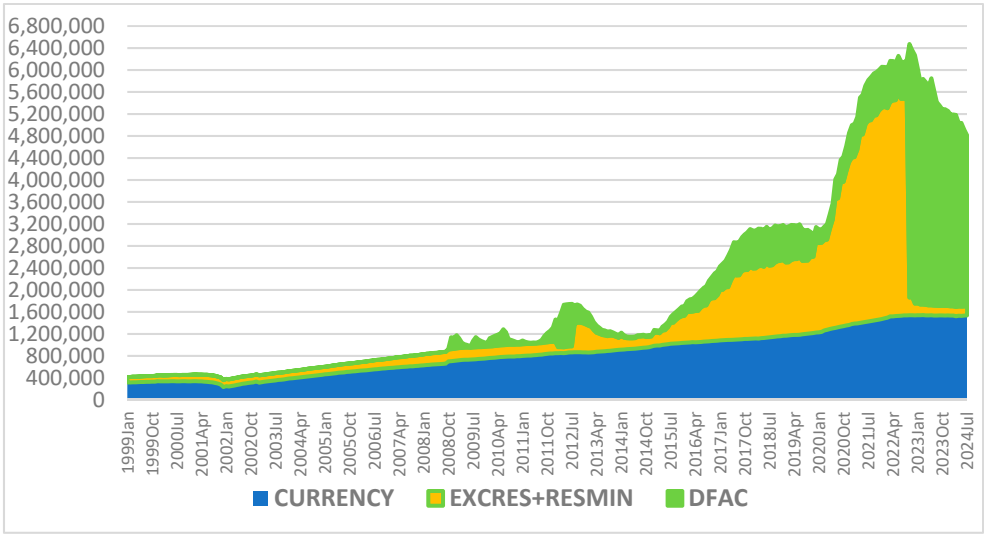

Figure 1. Base money: Currency, Reserves and Deposit facility: 1999–2024. Own elaboration. Data ECB.

4. Quantitative Easing, Base Money, Broad Money (M3) and Money Multiplier

Between 2009 and 2021, the ECB implemented an extensive set of non-standard measures, all of which focused on strong monetary easing programs.

As Cour-Thimann and Winkler (2013) point out, as a complement to rather than a substitute for standard interest rate decisions. The non-standard measures are aimed at supporting the effective transmission of monetary policy to the economy rather than at delivering additional direct monetary stimulus. The flow-of-funds analysis proposes an interpretation of central banks' crisis responses as fulfilling their traditional role as lender of last resort to the banking system.

Somehow, the strategy to maintain in the Euro Area price stability was temporarily, relegated to the background. After the 2008 crisis, aggregate demand suffered a long period of depression. Inflation remained very close to the ECB's target, with some worrying episodes of deflation. Among others, inflation was negative in the second half of 2009 and in the period December 2014–March 2015; between zero and negative, between February 2016–May 2016; close to zero at the end of 2019; and negative again in the period August 2020–December 2020. The succession of the aforementioned crises required the monetary authority to respond to serious problems of liquidity, solvency of some banks, sovereign debt and even a crisis of the common currency. The lasting containment of inflation allowed the ECB to address one-off problems of a different nature to its ultimate objective of price stability, without triggering major inflationary rebounds, until mid-2021, when inflation exceeded the ECB's target and reached record highs of 10.6% in October 2022. Following a change in the ECB's monetary policy tone (containment of unconventional monetary easing measures and sharp interest rate hikes), the inflation rate was close of the target two years later.

As of July 2009, the Covered Bonds Purchase Programme (CBPP1, 7 May 2009; CBPP2, 6 October 2011); the Securities Markets Programme (SMP), 10 May 2010; the Asset Purchase Programme (APP), composed of: CBPP3, October 2014; ABSPP, November 2014; PSPP, March 2015 and CSPP, June 2016; the PEPP, March 2020. In the field of unconventional LTROS: 2 Very-long-term, (VLTROs) December 2011 and February 2012; a series of ten Targeted Longer-Term Refinancing Operations (TLTROs): TLTRO I, TLTRO II. TLTRO III, 2014, 2016, 2019, respectively, each with a maturity of three years; the Pandemic Emergency Longer-Term Refinancing Operations (PELTROs), on 30 April 2020 (a series of seven operations) and 10 December 2020 (a series of four additional operations) to serve as a liquidity backstop to preserve the smooth functioning of the money market. The end-of-month holdings of these unconventional monetary policy operations will reach a balance in excess of €7 trillion (€7.1012) by the end of 2022.

Interest rates began a rapid decline from mid-2008 to June 2022. The ECB used the tool NIRP within the framework of an unconventional monetary policy. In view of the inflationary resurgence that started in mid-2021, the ECB decided to raise the three key ECB interest rates by 50 basis points in July 2022 (ECB, 2022b). Ten increases in the main refinancing operations rate (MRO), from 0 to 4.5 percent, between July 2022 and September 2023. The first decreases of the three key ECB interest rates occurred in June 2024 (−25 basis points) and in September 2024 (−60 basis points).

With its forward guidance from July 2013, the ECB expected interest rates to remain low for an extended period of time. Since then, the formulation of the ECB's forward guidance has been adapted on a number of occasions. However, as late as March 2022, the Governing Council "expects the key ECB interest rates to remain at their present levels. . .". (ECB, 2022a). In our view, the ECB's persistence with its FG communication policy has

not contributed to the containment of inflation expectations in the last years of the period under study.

As Figure 2 shows, from 1999 to the financial crisis base money and broad money developments were unfolding along similar trends. The 1999=100 index of both series reached 200 in September 2008. After September 2008, the volume of unconventional monetary policy operations implemented by the Euroystem increased substantially.

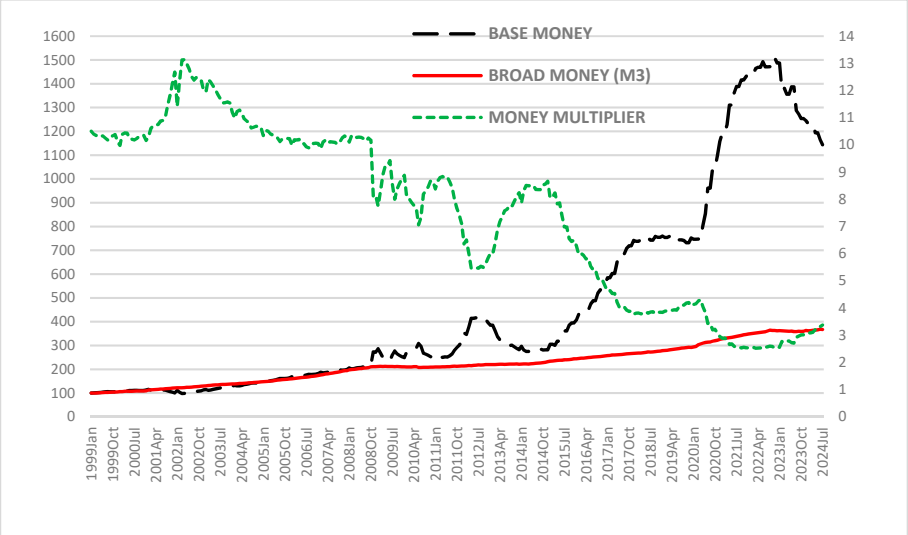

Figure 2. Broad money (M3), base money and money multiplier: Euro area 1999M1–2024M7. Left-hand side: Broad money and base money. Index 1999=100. Right-hand side: Money multiplier. Own elaboration. Data ECB.

Then, with the first purchase programmes CBPP1 (2009), CBPP2 (2011) and the non-regular longer-term refinancing operations (VLTROs) of 2011 and 2012, broad money has stopped closely mimicking developments in base money (ECB, 2017).

In mid-2014, trends in base money and broad money converged somewhat as banks made use in 2013 of the ECB's option of voluntary early repayment of VLTROS issued in 2011 and 2012. The combined development of the base money and broad money (M3) led to a significant increase in the money multiplier, as can be seen in Figure 2.

With the APP Programme in 2014, 2015 and 2016; the Targeted Longer-Term Refinancing Operations (TLTROs): TLTRO I, TLTRO II, TLTRO III, in 2014, 2016 and 2019; the Pandemic Emergency Longer-Term Refinancing Operations (PELTROs) in 2020, the divergence between the trends of base money and broad money grew uninterruptedly until November 2022. In that month, Index 1999=100 of the base money and broad money are 1508 and 363, respectively. As a result, the money multiplier reaches its lowest value (2.53) of the entire period studied. During 2023 and the first half of 2024, base money and the money multiplier reverse their respective trends, while broad money remains stable.

Non-residents and Banks have so far been the main sellers of government bonds under the PSPP (PSPP exceeds 80% of total APP). Transactions with non-residents and banks will leave M3 unchanged at the time of settlement. When central banks purchase securities, they create new central bank reserves, which can only be held by commercial banks, which use them to settle payments among themselves. These reserves are part of the base money (M0) together with currency in circulation. In our work, reserves include the credit institutions' holding reserves over and above the level of required central bank reserves.

Because of QE, the money base increased in a mechanical way one-for-one after 2015, (APP), again during the pandemic (PEPP). The TLTROs further added to the large increase in base money. These operations have no direct impact on M3. They only contribute to

broad money growth to the extent that banks responded to the incentives provided for in the design of these operations.

The sales by the domestic money-holding sector have been moderate, implying a contained direct impact of the QE on broad money.

As Schnabel (2023a) points out, "The purchase of a bond by the central bank will result in a one-for-one increase in M3 if the ultimate seller of a security is a euro area household, non-financial firm or non-bank financial firm. In these cases, the proceeds from the sale are credited to the seller's deposit account, raising broad money".

In view of the absence of a close relationship between base money and broad money, it is necessary to look for the effects of QE on broad money through indirect effects.

The money multiplier, which is the ratio of broad money to base money, allows us to see the strength of the indirect effects of the impact of QE on M3. Between 1999 and 2008, the multiplier reached an average value of 10.5 and did not show large oscillations until the beginning of the financial crisis in 2008, standing at around 10.4. For that reason, M0 and M3 were expanding with a similar train.

After the start of the APP, and later when ECB launched the PEPP, the multiplier fell persistently. In early 2023, it reached its minimum value (2.5). This reflects the fact that, with QE, the quantity of reserves is, by and large, determined by the Eurosystem, resulting in a large amount of reserves in excess of banks' liquidity needs (Schnabel, 2023b).

The banking system as a whole cannot escape the addition of new reserves, since asset purchases are always settled through banks, regardless of who the ultimate seller is. The expansion of the monetary base does not always translate into broad money. If there is no demand for credit, or if banks do not want to lend due to risk considerations, asset purchases by the ECB will not, on their own, affect broad money growth. Indeed, as McLeay et al. (2014) point out, extra reserves are not multiplied up into new loans and broad money. The newly created reserves do not, by themselves, meaningfully change the incentives for the banks to create new broad money by lending.

The effects of QE on broad money may arise indirectly: QE compresses the yields on long-term debt securities, stimulating loan demand and supply as well as economic activity. In net terms, the impact of QE on M3 fundamentally depends on the strength of these indirect effects, which may vary over time (Schnabel, 2023a). They will only affect broad money through their direct mechanical impact, which is more limited.

Despite its persistence in textbooks, the traditional model in which reserves are "multiplied" to deliver larger increases in the broad money supply was out of fashion in academic and policy circles prior to QE unconventional monetary policy (Ryan & Whelan, 2021).

The uneven evolution of the monetary multiplier that we observe in Figure 1 deviates from the expected behavior of the monetary multiplier that is studied in textbooks to relate the variations of a broad monetary aggregate when the central bank takes its decisions in a framework of economic and financial stability. A decrease in the required reserve requirement ratio is a measure of expansionary monetary policy. Indeed, in Equation (1), a decrease in w causes an increase in the monetary multiplier and an increase in broad money proportionally larger than the increase in base money.

$$\mathrm{M} = \mathrm{BM}\frac{1+\mathrm{a}}{\mathrm{a}+\mathrm{w}} \tag{1}$$

where BM is base money, a is ratio between currency and deposits and w is the ECB minimum reserve ratio: $a = \frac{\text{Currency}}{\text{Deposits}} > 0$ $\mathrm{w} = \frac{\text{Reserves}}{\text{Deposits}} < 1$. We denote m as the money multiplier: $\mathrm{m} = \frac{1+\mathrm{a}}{\mathrm{a}+\mathrm{w}} > 1$.

Differentiating in (1) we obtain (2)

$$dM = dBM\frac{1+a}{a+w} \quad (2)$$

In (1), $m = \frac{1+a}{a+w} = \frac{M}{BM}$; $M > BM$.

In (2), after the 2008 crisis, during the whole period of unconventional monetary policy, dBM > dM. The money multiplier then shows a strong downward trend in this period, as can be seen in Figure 2.

In periods of severe disruption and uncertainty in financial markets, the monetary multiplier can adopt behaviors such as those described here. As Froyen (2013) points out, during the Great Depression in the United States, the monetary multiplier experienced a notable decline between 1929 and 1934. This period saw an increase in the monetary base and a sharp decline in the monetary aggregate M1. In the period 2007–2010, the monetary multiplier also declined, although on this occasion, along with a sharp increase in the monetary base, there was an increase in money supply (M1). In periods of severe economic, financial, and banking disruption, both the ratio of currency to deposits and the ratio of excess reserves to deposits tend to increase. An increase in either or both of them causes a reduction in the multiplier.

Similarly, in the eurozone, between 2008 and 2023, except between mid-2013 and 2015, the monetary multiplier experienced sharp declines in a context where a strong increase in the monetary base (particularly excess reserves) and a gently rising trend in broad money coexisted. Meanwhile, the ratio between currency and deposits remained very stable, and the ratio between excess reserves and deposits grew sharply.

In January 2012, the ECB lowered the reserve ratio for the first time (from 2% to 1%) and, as Figure 3 shows, the multiplier increased instantaneously. Before the 2008 crisis, currency and minimum reserve requirements were the core of base money. The change in the multiplier in January 2012 is clear in Figure 3, but not in Figure 2. The ratio $a = \frac{\text{Currency}}{\text{Deposits}}$ has not changed much since the ECB has been conducting monetary policy. This ratio is between 0.09 and 0.11.

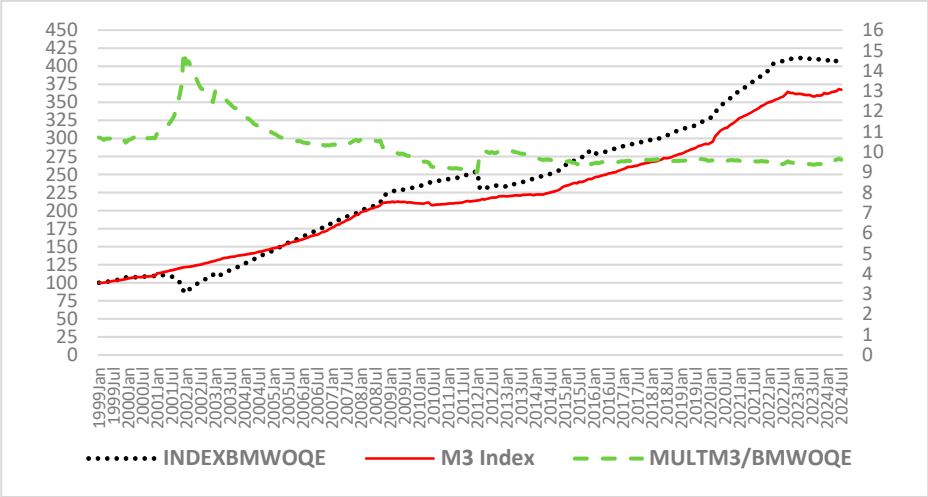

Figure 3. Broad money, base money and money multiplier a stability scenario. Own elaboration. Data ECB. BMWOQE = Base money without QE operations.

The line representing base money in Figure 3 is devoid of the unconventional monetary policy measures: APP, TLTROs, PEPP, PELTROs, etc. Considering that the relationship between broad money and base money between 2008 and 2024 is weak, except in small periods such as mid-2021–mid-2022, the multiplier presents violent oscillations within a

strong negative trend during the whole period of quantitative easing. This is the reason why Figure 2 does not allow us to see clearly the effect of the 50% reduction in the reserve ratio in January 2012. And the negative trend is because the ECB's discretionary quantitative easing decisions caused large increases in base money versus much smaller increases in broad money.

In Figure 3, we try to analyze the trajectories of base money (and money multiplier) in the absence of the unconventional monetary policy measures implemented by the ECB between 2008 and 2023. The construction of the indexes is different, since the index 1999=100 of broad money is obtained from the real data of M3 provided by the ECB's statistical database (as in Figure 2), while the index 1999=100 of the base money (BMWOQE) is the base money without QE. That is, excess reserves have been subtracted. This approach allows us to approximate a base money that, even in the presence of QE operations, would also be demand-driven, as in the period 1999–2008. In this situation, the money multiplier, $m = \frac{M3}{BMWOQE}$, is in the interval 9.5–10. However, an adequate estimate of the effects, although weak, of QE on M3 would imply a very slight decline in the money multiplier represented in Figure 3.

This approach allows us to make projections about the expected value of the money multiplier at the end of the quantitative tightening (QT) period, planned for the immediate years, barring further economic or financial disturbances.

5. Elasticity of Broad Money with Respect to Base Money in the Presence of QE Operations

As indicated, base money and broad money followed similar trends from 1999 until the onset of the 2008 financial crisis. With the economic and financial crisis of 2008, the sovereign debt and the euro crisis, between 2010 and 2016, COVID-19 pandemic and the war in Ukraine, in 2020 and 2022, respectively, increased the divergence between the evolution of base money and broad money.

Figure 4 shows a similar trend between total financing unconventional operations (totunfin) and base money from the 2008 crisis to the end of the period studied. The latter responds in time and size to the measures of unconventional monetary policy, while broad money does not reflect the impulses of the aforementioned measures either in time or intensity.

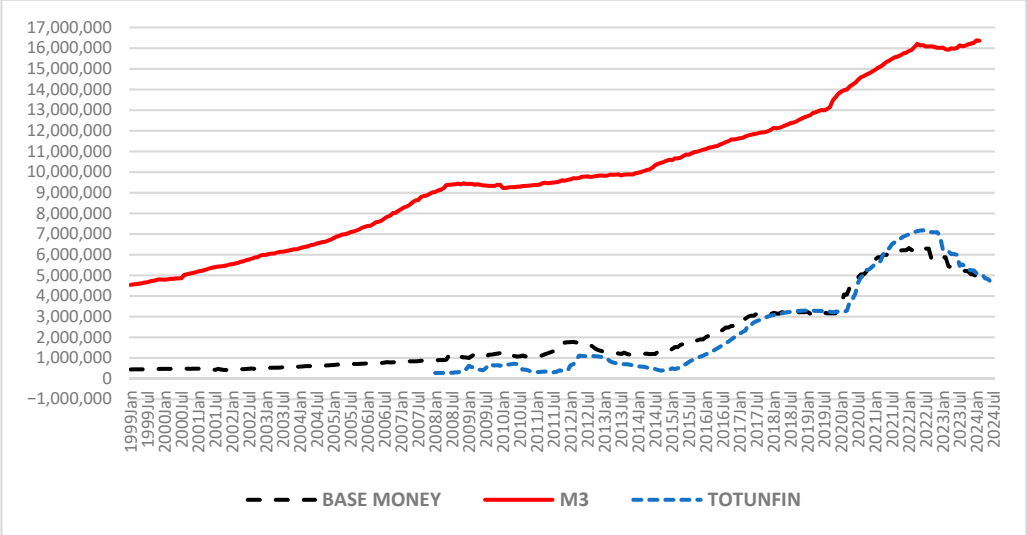

Figure 4. Broad money, base money and total unconventional operations. Eurozone 1999–2024, (Millions €). Own elaboration. Data ECB.

The regression Equations (3)–(5) estimated by ordinary least squares (OLS), with all variables in logarithms, allow obtaining the elasticity of the dependent variable with respect to the independent variable.

$$M3 = \beta_0 + \beta_1 BM + \epsilon \quad (3)$$

$$BM = \lambda_0 + \lambda_1 QE + \epsilon \quad (4)$$

$$M3 = \gamma_0 + \gamma_1 QE + \epsilon \quad (5)$$

M3, broad money; BM, base money; QE, total quantitative easing measures. Variables in logarithms.

We performed the Augmented Dickey-Fuller test (ADF) (Dickey & Fuller, 1979), the non-parametric Phillips-Perron (PP) test (Phillips & Perron, 1988), and the KPSS test (Kwiatkowski et al., 1992) for unit roots. The null hypothesis of the latter test is the stationarity of the series, while the null hypothesis of the first two is the existence of unit roots (non-stationary series). In our work, we consider a variable to contain a unit root or be unit-root non-stationary if the null hypothesis of non-stationarity is not rejected by the ADF and PP tests but the null hypothesis that the variable is mean stationary is rejected by the KPSS test.

Table 3 shows the results of the three tests, in levels and first differences. The series used in this section are integrated series of order one, that is, they are I(1) series.

Table 3. Unit root tests.

	ADF		**PP**		**KPSS**	
	Levels	**1st Diff.**	**Levels**	**1st Diff.**	**Levels**	**1st Diff.**
M3	−1.30	−5.61	−1.16	−14.62	0.27	0.106
BM	−1.37	−5.90	−1.80	−16.78	0.41	0.07
QE	−2.21	−4.24	−1.76	−12.43	0.416	0.09

ADF and PP: Critical values: −3.98 (0.01), −3.424 (0.05), −3.135 (0.10). KPSS: constant, linear trend. Critical values: 0.216 (0.01), 0.146 (0.05), 0.119 (0.10).

The usual normality tests (Kolmogorov-Smirnov, Shapiro-Wilk, Anderson-Darling, and Jarque-Bera) confirm the normality of the residuals. We find very limited exceptions in the case of regression Equation (5). As we have seen, QE consists of very large, and sometimes unexpected, liquidity injections. They are subject to the ECB's discretion. This QE behavior complicates the heteroskedasticity tests in Equation (5). The values of the γ_1 coefficient in Table 4 and the *p*-values should be taken with caution.

Broad money and base money exhibit elasticity close to unity, between 1999 and 2008. This result is consistent with the ECB's assertion: "prior to the financial crisis, base money and broad money developments were unfolding along similar trends" (ECB, 2017, p. 62). Indeed, the econometric work shows that the elasticity of broad money with respect to base money, between 1999 and 2008, is $\beta_1 = 0.82$. On the contrary, between 2009 and 2024 there is a weak relationship between broad money and base money ($\beta_1 = 0.31$). The same applies to the link between broad money and the volume of unconventional (QE) monetary policy operations (γ_1 = 0.17).

The only period in Table 4 that shows a closer relationship between broad money and base money is the period from June 2021 to June 2022. As Schnabel (2023a) states, "in sharp contrast to the experience before the pandemic, the money multiplier fell only briefly". Indeed, the money multiplier remained stable from April 2022 to January 2023 and began a new upward trend until July 2024, the end of the period analyzed. From mid-2021 to mid-2022, broad monetary aggregates were increasing at the same pace as the monetary

base. This was the case although asset purchases were still being conducted on a scale that led to an increase in the monetary base that was significantly larger than during the previous QE episode (Schnabel, 2023a).

Table 4. The elasticity of broad money and base money in presence of QE.

Period	β_1	(*t*)	λ_1	(*t*)	γ_1	(*t*)	*p*-Value (β_1,λ_1,γ_1)
1999–2008	0.82	35.51					(0.000)
1999–2024	0.41	61.24	0.48	96.3			(0.000)
2009–2024	0.31	57.04	0.84	70.9	0.17	37.14	(0.000)
2016–2023	0.34	36.6	0.80	58.6	0.26	27.3	(0.000)
2018–2023	0.35	25.9	0.90	53.2	0.31	22.3	(0.000)
2019–2023	0.30	23	0.91	42.1	0.27	17.5	(0.000)
2020–2023	0.26	14	0.93	25.4	0.22	9.29	(0.000)
2021/6–2022/6	0.72	16.9					(0.000)

β_1 is the elasticity of M3 with respect to the BM; λ_1 is the elasticity of BM with respect to the QE; γ_1 is the elasticity of M3 with respect to the QE; *t* is the *t*-student statistic. Own elaboration, Data ECB, (Software used Eviews8).

In effect, the transmission of monetary policy was a lot more powerful during that period. At the height of the pandemic, this was critical to safeguard financial stability and mitigate the social costs of the crisis.

Even so, the elasticity between broad money and base money in the period from mid-2021 to mid-2022, although it experiences a strong increase to 0.72 (compared to that of four 4-year periods, between 2016 and 2023 (0.26; 0.34; 0.35; 0.30), is still slightly far from unity.

In the same period (2009–2024), the elasticity of the base money with respect to QE operations stands at (λ_1 = 0.84). As Schnabel (2023a) points out, "because of QE, the monetary base increased in a mechanical way one-for-one after 2015 when the ECB launched its APP programme, and again during the pandemic when we created the PEPP programme and conducted further purchases under the APP". This elasticity stood above 0.90 between 2015 and 2024, As the ECB created new QE measures (APP, TLTROs, PELTROs, PEPP), the elasticity of base money with respect to QE increased, as shown by the values of λ_1 in Table 3.

6. Discussion

Part of the excess reserves may originate from the periodic allocations of the main refinancing operations (MRO) and longer-term refinancing operations (LTROs) and, to a lesser extent, from the marginal lending facility (MLF). Open market operations MRO and LTROs are regular open market operations. MRO and LTROs consist of one-week liquidity-providing operations in euro and three-month liquidity-providing operations in euro, respectively.

The interest rates of the MROs and MLFs are higher than the DFR. In this case, the investment of the excess liquidity from MROs, LTROs, and MLFs in the form of a deposit facility is unattractive.

During the sovereign debt crisis and, above all, with the arrival of COVID-19, regular open market operations have been complemented by longer-term refinancing operations in euro with maturities of up to 12 months, 18 months, 3 and 4 years. These are the non-regular

open market operations TLTROs (TLTRO I in 2014, TLTRO II in 2016, and TLTRO III in 2019) and PELTROs (in 2021 and 2022).

TLTROs have been used by the ECB to offer longer-term loans to banks at favorable costs. This supports banks in lending to firms and households, which in turn makes sure that our monetary policy reaches people all across the euro area. For example, TLTRO III was one of the key measures of the ECB to fight the impact of the coronavirus crisis on the economy. These funds were offered at 0.5 percentage points below the ECB's deposit facility rate. Banks were rewarded with this lower interest rate if they kept lending to firms and households. The incentive to invest excess liquidity from TLTROs in a deposit facility, although it exists, is low.

The ECB (2020) establishes that the PELTROs will be conducted as fixed-rate tender procedures with full allotment. The operations will be offered at accommodative terms. The interest rate will be 25 basis points below the average rate applied in the Eurosystem's MRO over the life of the respective PELTRO. Between December 2019 and June 2024, the main refinancing operations rate (MROR) is 50 basis points higher than the DFR. Between September 2024 and January 2025, this difference is reduced to 15 basis points.

The potential profitability of excess liquidity from PELTRO operations via the deposit facility may be significant, but by September 2023 both MROR and DFR had reached their highest values for the 2003–2025 period: 4.5% and 4%, respectively.

Between July 2019 and September 2023, the ECB increased the main refinancing operations rate (MROR) 10 times, from 0.50% to 4.50% (DFR from 0% to 4%). Subsequently, after 5 decreases, MROR and DFR stood in January 2025 at 2.90% and 2.75%, respectively.

Given the sharp rise in the ECB's key rates from July 2022, it is interesting to know whether the interest rates that banks pay on household and corporate savings in overnight deposits and short-term and medium-term deposits have followed a similar path. Eurozone banks raised interest rates on short and medium-term deposits as the ECB raised its key interest rates. Some large banks raised deposit rates slowly and smoothly. Smaller banks were more agile. In some Eurosystem countries, such as Spain (Muñoz, 2024), the increase was clearly smaller and extremely slow, especially by the large banks. From September 2023, the expectation of a decline in the ECB key interest rates led to an accelerated reduction in deposit rates for all terms. Some recent publications are sensitive to the discrepancy between ECB key interest rates, in particular, the DFR, and the interest rates that banks pay on savers' deposits. That is a clear question: Is it possible that banks could have used the deposit facility with a portion of the sum of overnight, short- and medium-term deposits to capitalize on interest rate differentials between the DFR and the deposit interest rates? In some ways, this question underlies the proposal by De Grauwe and Ji (2023, 2024) for a new TTS in the case of a positive deposit facility rate.

Once the ECB started lowering rates in June 2024 (Muñoz, 2024), Spanish banks implemented intense cuts in deposit interest rates, that were already comparatively very low. Figure 5 shows the weighted average interest rate of time deposits (solid line) in Spain, from January 2003 to January 2025. The volume of overnight deposits represents a high percentage of all deposits. With €862,203 million, in September 2023 they represented 89.5% of total household deposits (Carbó Valverde & Rodríguez Fernández, 2023). As can be seen, the overnight deposit rate does not reach 25 basis points at any time between 2012 and 2024. The weighted average interest rate of deposits, including overnight, does not reach 1%. Figure 5 shows an exceptional situation since the creation of the ECB: The DFR is significantly higher than the rates for all deposits of households and non-profit institutions serving households (NPISHs), between September 2022 and January 2025.

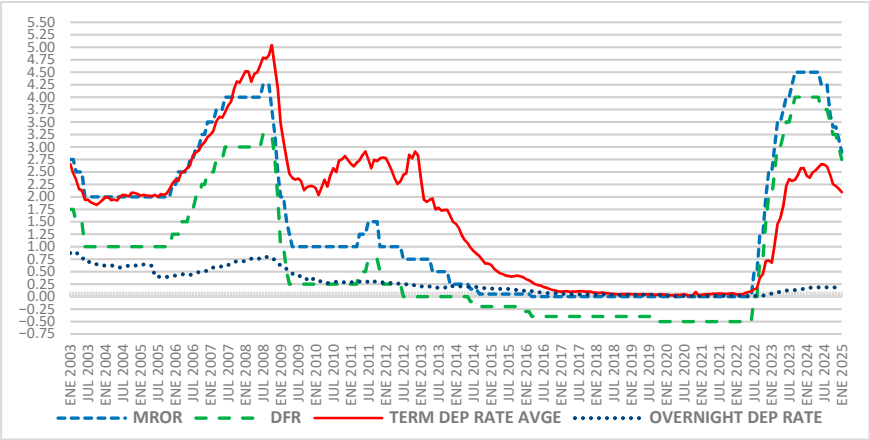

Figure 5. Deposit interest rates in Spain, MROR, and DFR: 2033M1–2025M1. Own elaboration. Data ECB and Spanish Central Bank.

Figure 6 shows the monthly volume (end of period) of deposit facilities in Spain between June 2016 and January 2025. Before September 2022, they stood at around €5000 million. Deposit facilities suddenly increased to €348,841 million in September 2022 (peaking at €362,008 million the following month). With the decline in the DFR, the deposit facility declined continuously to €186,256 million in December 2024.

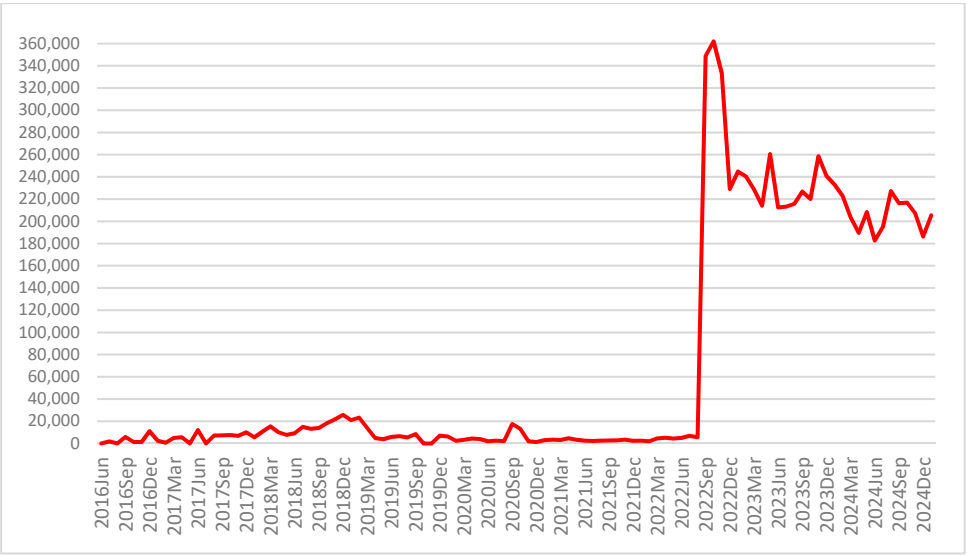

Figure 6. Deposit facility: Spain 2016–2024 (Millions €). Own elaboration. Data ECB. Series (ILM.M.ES.N.L020200.U2.EUR).

Bayona (2023) emphasizes the fact that European commercial banks as a whole held €4,080,000 million at the ECB in the form of a deposit facility, which could generate compensation of €140,000 million on an annual basis. As Table 2 shows, between September 2022 and December 2024, once the two-tier system is abolished, European commercial banks could have obtained €259,594 million from the ECB by using a deposit facility.

The amount of deposit facility held by Spanish banks in October 2022 amounted to €362,000 million (8.8% of total DF). In September 2023, when the DFR was at its peak of 4%, this volume fell to €226,721 million, which represented 6.22% of the €3,647,438 million held by European banks as a whole. The amount parked in DFs declined as the DFR did. Using the ECB data in Figure 6, we estimate that placing the latter amount in the form of a deposit facility could provide Spanish banks with additional revenues of €9069 million, on an annual basis.

We establish two assumptions, with different proportions of the components that make up the deposit facility. We calculate the average interest rate that banks should pay for the different components. By doing so, we can estimate the net income that Spanish commercial banks could have obtained through the deposit facility, using data from September 2023, on an annual basis. Table 5 presents the proportions of the two assumptions and their respective average interest rates.

Table 5. The cost of deposit facility.

Source of Excess Liquidty	Rate	Share 1 (%)	Share 2 (%)
OD	0.131	10	75
MRO	4.5	5	5
QE	2.83	55	10
Term DEP.	2.341	30	10
Average rate		2.497	0.84

Own elaboration. Data ECB and Spanish Central Bank.

In our first assumption, with share 1, we estimate that the annual net income (after costs[3]) could be close to €3408 million if the share of overnight deposits is zero or insignificant. The remaining €5661 million would be the gross income received by households and NPISHs from their savings deposited in banks, on an annual basis. However, the banks did not align their term deposit interest rates with the ECB key interest rates, either in time or intensity.

In the second assumption, share 2, overnight deposits are included in the deposit facility in a high proportion. The cost can be reduced considerably. The higher the share of overnight deposits, the lower the cost for banks and the higher their net income. The weighted average deposit rate[4] could be significantly below 1%. In this case, the net income of banks could increase considerably, up to €7164 million, on an annual basis, to the detriment of savers.

In the absence of rigorous and contrasting research work, the controversy surrounding the use of deposit facilities as a temporary refuge for funds from overnight deposits and short- and medium-term deposits of savers seems to be a suspicion firmly established in public opinion.

We propose that the ECB should carry out strict ongoing monitoring of the nature and origin of the components of banks' excess liquidity, as well as the origin of the funds that banks park in the deposit facility. In order to protect savers, the differentials between deposit facility rates and deposit rates at different maturities deserve supervision by the Eurosystem. This control is aimed at limiting potential practices that could modify the intertemporal choice of agents (households and business) between consumption and savings, as well as any type of interested use of the differentials between official and market rates. Without a doubt, this control will contribute to the transmission of monetary policy through the interest rate channel.

Restrictive monetary policies, through increases in official interest rates, must be transmitted to all market rates, both for active operations (loans and credits) and passive operations (deposits) of banks. In this way, the opportunity cost of maintaining liquidity is correctly formed, the intertemporal choice of consumption and savings is conveniently modified, and it contributes to containing aggregate demand when monetary policy is aimed at reducing inflation.

As we have indicated, with very limited exceptions, contributions to occasional excess liquidity do not have zero cost. Believing that extra reserves are "free money" for banks is

the first of two misconceptions about how QE works, as McLeay et al. (2014, p. 24) point out. Consequently, in order to obtain net income, it is necessary to subtract the costs of excess liquidity. In a high proportion of cases, the DFR and the costs of excess liquidity tend to adjust over time.

Containing interest rates on savers' deposits and their potential refuge in the form of a deposit facility when ECB key interest rates are high is a practice that, if it exists, the Eurosystem must strictly monitor. Doing so contributes to strengthening the transparency of the interest rate transmission channel.

7. Conclusions

The unconventional monetary policy measures that make up the so-called quantitative easing, together with the negative interest rate policy and forward guidance, were constructed to deal with a succession of crises: the 2008 economic and financial crisis, the sovereign debt crisis of some member states (2010–2015), the Brexit process (2016–2020), the COVID19 pandemic crisis (2020–2023) and, finally, the unfinished war in Ukraine (2022).

The various quantitative easing decisions had favorable effects on the solvency of banks because they eliminated or clearly reduced the risks of insolvency derived from the potential lack of liquidity. Another favorable outcome was economic growth, reducing the pernicious uncertainties that the various crises have generated. The increase in resources available for project financing and low interest rates contributed to this.

In terms of the stability of the sovereign debt of some countries with high debt-to-GDP ratios, the unconventional monetary policy measures undoubtedly contributed to the reduction of risk premia, enabling several eurozone countries to finance their deficits by issuing government bonds at low interest rates. At the same time, the QE measures as a whole brought stability to the common currency in the foreign exchange markets.

However, the enormous volume of financing provided by the ECB through the different figures adopted largely shifted to excess reserves of European banks, with little impact on the broad monetary aggregate M3.

The extreme reduction of the money multiplier, especially in the periods from September 2017 to June 2019 ($m < 4$), and from December 2020 to October 2023 ($m < 3$), ostensibly limited the expansionary effect of the monetary base on the money supply, separating from the close relationship established by the traditional academic approach between base money and broad money, as shown in Section 4.

Finally, regarding the debate surrounding the two-tier system, one branch of current literature considers that ECB proposals when the DFR is negative versus those when the DFR is positive suffer from a certain asymmetry. Further research will continue the analysis and search for alternative proposals.

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Notes

[1] A negative interest rate policy (NIRP) occurs when a central bank sets its target nominal interest rate at less than zero percent.
[2] FG means the ECB is providing information about its future monetary policy intentions, based on its assessment of the outlook for price stability.
[3] We use average rate = 2.497%.
[4] We use average rate = 0.84%.

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