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# Broad Money Growth and Post-COVID Inflation in the Euro Area: A Quantity Theory Perspective

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**Abstract**

After many months of pandemic-related restrictions and economic disruption, inflation in the Euro Area began to rise sharply in 2021. The European Central Bank (ECB) initially characterized this increase as temporary and attributed it mainly to supply-side shocks, such as energy price increases and supply-chain bottlenecks. This study revisits that narrative by examining whether monetary developments had already signaled more persistent risks. Using the framework of the Quantity Theory of Money, we analyze the divergence between broad money (M3) and real GDP growth and construct an indicator of Hidden Monetary Imbalances (HMI) that captures the portion of liquidity growth not yet absorbed by output or prices. In response to the Great Financial Crisis and the COVID-19 pandemic, the ECB implemented highly accommodative policies, resulting in an unprecedented surge in liquidity. Our descriptive evidence shows that, since 2015, the growth of the money supply has systematically outpaced the expansion of the real economy. As money velocity normalized, this excess liquidity contributed to inflationary pressures. Our results suggest that by 2020, excess liquidity would already imply a cumulative price-level adjustment of more than 30% if output and velocity remained unchanged. Inflation subsequently accelerated, with the HICP rising above 5% in early 2022 and peaking at 10.6% in October 2022, before remaining above the ECB's 2% target until late 2024. The findings highlight the limitations of relying solely on inflation targeting without monitoring monetary aggregates. Reintroducing systematic monetary cross-checks, including the tracking of broad money and diagnostics such as HMI, could improve the ECB's ability to anticipate inflationary risks.

**Keywords**
Inflation, Quantity Theory, Money supply, ECB

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## Introduction

In 2021, the European economy entered an exceptional and challenging situation. The COVID-19 pandemic had disrupted economic activity worldwide, with the Euro Area experiencing strict lockdowns, travel restrictions, and a sharp decline in output. In response, the European Central Bank (ECB) maintained highly accommodative monetary policy, keeping interest rates low and continuing asset purchases to support recovery.

As pandemic restrictions eased, signs of rising inflation have emerged, raising concerns about the impact of monetary policy. Despite the inflation increase from levels below 1%, ECB officials have repeatedly emphasized that this inflation is temporary and likely caused by several short-term factors, such as a rise in energy prices and disruptions to customer supply chains following the easing of pandemic-related restrictions (Canepa, 2021a). They argued that there was no need to take too quick and drastic steps in response to this short-term inflation (CNBC, 2021). ECB assured that it was not aiming at excessive inflation. The worst thing that the ECB expected was a transitory period in which inflation is moderately above the target (Rogal, 2021). ECB anticipated a decline in inflation throughout 2022 (Canepa, 2021b).

A growing body of literature has examined the drivers of post-pandemic inflation, exploring both supply-side shocks and demand-side factors. However, research that links the recent inflation surge to the long-term expansion of the broad money supply (M3) remains scarce. In particular, the persistent growth of M3 during the previous decade raises questions about whether excess liquidity accumulated before 2021 and later translated into sustained price growth once money velocity recovered. The Quantity Theory of Money (QTM) provides a suitable analytical framework for examining this relationship, as it links price level movements to changes in the money supply, money velocity, and real output.

While the ECB's official communications in 2021 largely downplayed the role of monetary aggregates, this study aims to assess the extent to which the inflationary pressures that emerged in 2021 could have been anticipated as persistent based on monetary developments.

By combining the QTM framework with Euro Area data, this paper evaluates the relationship between money supply growth, real economic activity, and inflation dynamics in the post-pandemic period. The findings contribute to ongoing debates on the role of monetary aggregates in contemporary central banking and provide policy insights for managing inflation in an environment of prolonged monetary accommodation.

The remainder of the paper is organized as follows. Section 2 reviews the relevant theoretical and empirical literature. Section 3 describes the data sources and methodology. Section 4 presents the empirical results. Section 5 discusses the implications. Section 6 concludes with key findings.

## Literature Review

Over the past century, two conceptual frameworks have significantly influenced the development of economics in general, as well as in the field of monetary theory: the neoclassical and Keynesian approaches (Lisý et al., 2015).

Within the neoclassical tradition, Milton Friedman placed steady money growth at the center of price stability. In 'The Optimum Quantity of Money' (1969), he discussed a constant money growth rule (initially at the level of 5 %), later clarifying in 'The Quantitative Theory of Money, a Restatement' (1956) that a lower, sustainable rate aligned with long-run real income growth at 2% was more appropriate. These approaches define the route to keep the value of money. The implication is that the central bank should maintain predictable and stable growth in the money supply, irrespective of cyclical fluctuations. Any short-term discretionary changes would introduce unnecessary instability. Because our empirical sections compare Euro Area M3 growth with such Friedman benchmarks, this monetarist thread is directly relevant to our analysis (Friedman, 1956; 1969). By contrast, John Maynard Keynes emphasized the transmission of monetary policy through interest rates, aggregate demand, and expectations. Monetary expansion could support demand during downturns, but the resulting price pressures typically required subsequent tightening, producing a new equilibrium with higher interest rates. This adjustment process, however, could devalue the currency (Keynes, 1936/1963). This perspective underpins modern practice, in which interest-rate policy and expectations management, rather than explicit money growth targets, play a central role in shaping monetary policy.

We base our analysis on the Quantity Theory of Money (QTM), originally formulated by J. Locke and J. Bodin and later formalized by I. Fischer as $M \times V = P \times y$ (variables defined in Section 3). In this paper, QTM is not cited merely as historical context; we apply it to compare the evolution of broad money (M3) with economic output, to interpret the post-pandemic normalization of velocity, and to construct a diagnostic indicator for inflationary pressures. Under the usual long-horizon assumption of relatively stable velocity, sustained excess money growth is expected to exert upward pressure on the price level (Lisý et al., 2015). The operationalization is detailed in the Methodology section.

Alongside these main schools, other theoretical traditions and policy approaches provide contrasting insights. The Austrian School warns that prolonged low interest rates foster excessive borrowing and asset bubbles. It argues that changes in the money supply relative to demand create fluctuations in the objective value of money, a relationship that, for centuries, had not been explicitly recognized (Mises, 1971). In practice, since the 1990s, many central banks have adopted inflation targeting, shifting the focus from monetary aggregates to interest-rate setting guided by inflation forecasts and an explicit target (e.g., 2% for the ECB over the medium term). The benefits include clearer communication and better anchoring of expectations. Critics, however, highlight the reduced attention to monetary aggregates and the potential for moral hazard in asset markets when rates remain below equilibrium for extended periods (Kotlebová & Sobek, 2007; Kvasnicka, 2007). In this context, macroprudential policy has increasingly addressed risks from asset-price cycles (Janáčková, 2015).

Modern Monetary Theory (MMT) represents a relatively recent approach to the interaction between money and fiscal policy. MMT advocates increasing the money supply to ensure economic growth, even if this implies significant deficit spending by the state. Proponents argue that this is acceptable as long as inflation does not rise, which would signal overheating. Stephanie Kelton (2020), a prominent MMT advocate, considers deficit management to be standard practice, noting that, unlike households, central banks can issue money. If inflation does not emerge, deficit financing is deemed sustainable, with no corrective action expected from central banks. In this framework, monetary policy plays a supportive role in fiscal management (Kelton, 2020). Mankiw (2020) acknowledges some insights of MMT but rejects its more radical conclusions. While he agrees that central banks can finance government spending, he stresses that this does not eliminate fiscal constraints. He also warns that inflation risks cannot be ignored, and while government price setting may work in theory, it does not guarantee improved welfare in practice.

While theoretical debates such as those surrounding MMT highlight the complexity of modern monetary policy, central banks must translate these ideas into actionable frameworks. In July 2021, the ECB's Governing Council introduced a revised strategy, adopting a symmetric 2 % inflation target over the medium term. This framework treats deviations above and below the target as equally undesirable. The Council emphasized that when the economy is near the lower bound of nominal interest rates, especially forceful monetary policy actions are necessary to prevent persistent undershooting. Against this background, monetary accommodation was justified as a necessary condition for supporting the post-pandemic recovery and preventing a renewed period of below-target inflation (ECB, 2021).

Building on this revised strategy, many economies adopted monetary expansion as a primary policy response to economic contractions during the pandemic. This approach was widely adopted across both developed and developing economies to stimulate aggregate demand. Recent empirical research highlights the combined roles of supply and demand in the aftermath of COVID-19. Erdogan et al. (2020) show that money supply growth and exchange rate movements were key drivers of inflation in 28 EU member and candidate countries. Buelens and Zdarek (2022) assess Euro Area inflation dynamics during the pandemic, presenting two scenarios: (i) prolonged supply-side disruptions (e.g., material shortages, logistical delays) leading to persistent but eventually subsiding price increases; and (ii) transitory inflation feeding into wage dynamics, potentially triggering a wage-price spiral if expectations become unanchored. Di Giovanni et al. (2022) estimate that over 55% of Euro Area inflation from 2019 to 2021 was driven by surging demand, with the remainder attributable to supply-side constraints.

Finally, Isabel Schnabel (2023), a member of the ECB's Executive Board, emphasizes that the Quantity Theory of Money remains a practical tool for central banks. Reflecting on recent trends, she highlights that the sharp increase in broad money growth was an early indicator that inflation would persist beyond the resolution of supply shocks. Excess money growth, she argues, can entrench cost-push shocks, thereby serving as a warning signal for price-stability risks. This consideration is particularly relevant for the future, as structural changes related to the green transition may cause inflation to deviate from central banks' targets. While money supply is no longer a standalone policy pillar for conducting monetary policy, it should nonetheless retain a place in the analytical frameworks of central bankers.

## Materials and Methods

Our analytical framework examines the components of the Quantity Theory using the broadest monetary aggregate, M3, which includes households, non-financial corporations, and non-monetary financial institutions (non-MFIs) located in the Euro Area. M3 captures the broadest scope of liquid assets relevant for spending decisions in the Euro Area and is consistent with the ECB's monetary analysis framework. Narrower aggregates (M1, M2) omit relevant components of liquidity and therefore provide a less comprehensive measure of monetary conditions.

The standard form of the QTM is expressed as (Equation 1):

$$M \times V = P \times y \tag{1}$$

Where: M is the money supply, V is the velocity of money, P is the price index, and y is the index of real output.

Table 1 provides an overview of the data and sources, while Table 2 summarizes variable definitions, units, transformations, and coverage. All series were retrieved on June 25, 2025. Processing was performed in Excel 365. Descriptive statistics for the main variables are reported in Table 3. Variables underlying the main results are sourced from the European Central Bank (2025a), supplementary indicators used to support the interpretation and discussion of the results are cited separately (European Central Bank, 2025b).

**Table 1:** Data and sources

| Variable | Symbol | Source | Series key |
|---|---|---|---|
| **Money supply** | M | ECB Data Portal | BSI.M.U2.Y.V.M30.X.I.U2.2300.Z01.A |
| **Price index** | P | ECB Data Portal | ICP.M.U2.N.000000.4.ANR |
| **Real output** | y | ECB Data Portal | MNA.A.N.I9.W2.S1.S1.B.B1GQ._Z._Z._Z. EUR_R_B1GQ.Y.GOY |

**Note**: Adapted from the European Central Bank (2025a).

**Table 2:** Variables, definitions, units, transformations, and coverage

| Variable | Definition | Unit | Transformation | Coverage |
|---|---|---|---|---|
| **M3 (M)** | Annual monetary aggregate M3 growth rate | index | 1+rate/100 | 1996 - 2024 |
| **HICP (P)** | Annual HICP overall growth rate | index | 1+rate/100 | 1996 - 2024 |
| **Real GDP (y)** | Annual real GDP growth rate | index | 1+rate/100 | 1996 - 2024 |

**Note**: Adapted from the European Central Bank (2025a).

**Table 3:** Descriptive statistics

| Variable | N | Mean | Median | Std. dev | Min | Max |
|---|---|---|---|---|---|---|
| **M3 (M)** | 29 | 5.14% | 4.70% | 3.05% | -0.30% | 12.20% |
| **HICP (P)** | 29 | 2.04% | 1.90% | 1.73% | -0.30% | 9.20% |
| **Real GDP (y)** | 29 | 1.50% | 1.77% | 2.33% | -6.01% | 6.33% |

**Note**: Authors' calculations based on the European Central Bank (2025a).

We define Hidden Monetary Imbalances (HMI, in Equation 2) as the difference between the monetary aggregate (M) and the product of the price index (P) and the real output index (y):

$$\mathrm{HMI} = \mathrm{M} - (\mathrm{P} \times \mathrm{y}) \qquad (2)$$

This equation measures the portion of money supply growth not yet reflected in nominal GDP, conceptually similar to monetary overhang, as defined as money supply exceeding demand at prevailing prices (Hofmann & Koop, 1990; Dornbusch & Wolf, 1990).

To complement this, we define Potential Future Inflation ($P_f$, in Equation 3) as the ratio of HMI to the product of the price index (P) and the real output index (y):

$$P_f = \frac{HMI}{P \times y} \quad (3)$$

This indicator signals the magnitude of potential price-level adjustment implied by the overhang.

We assume a ten-year horizon for the diffusion of monetary impulses into prices. Analysis by Havranek and Rusnak (2012) shows that monetary policy typically begins to affect prices within 6-12 months, with the peak impact occurring, on average, after 29 months (ranging from 25 to 50 months in advanced economies). While this evidence pertains to the timing of the largest effects, research by Jordà et al. (2024) suggests that monetary policy can exert a measurable influence on output and prices for more than a decade after the initial shock. Our 10-year horizon (t–9…t) is therefore intended to encompass not only the onset and peak of the transmission, but also its extended tail, during which excess liquidity can continue to generate inflationary pressures. Additionally, this rolling window helps mitigate measurement limitations in GDP and HICP, where inaccuracies may obscure the proper absorption of monetary imbalances. As a robustness check, we replicate the construction of HMI using alternative rolling horizons of 5 years (t–4 to t) and 15 years (t–14 to t). All transformations, sources, and definitions are identical to the baseline; only the window length varies. The results are reported in Figure A5 (The letter "A" in table and figure numbering denotes Appendix section).

We apply QTM to assess the relationship between money supply growth and economic output in the Euro Area. Consistent with the long-run view that the velocity of money (V) is relatively stable, and that, despite short-term fluctuations, it tends to revert toward more stable levels over time, we fix V at 1.0 at the start of each observation period. This fixing serves two purposes: it aligns with the QTM's long-horizon application, and it enables a transparent comparison of the relative paths of M3 and real GDP (y).

Under the QTM identity, if velocity remains constant and the money supply grows at the same rate as real output, the price level remains unchanged. Deviations of M3 from y therefore signal prospective pressure on P. To operationalize this, we incorporate HICP into the QTM framework: multiplying the real GDP index (y) by the price index (P) yields nominal GDP. The residual difference, when money supply growth exceeds nominal GDP growth, is defined as Hidden Monetary Imbalances (HMI), representing cumulative excess liquidity that has not yet been reflected in prices or real output. In this analysis, HMI is treated as a diagnostic indicator of potential future inflationary pressure.

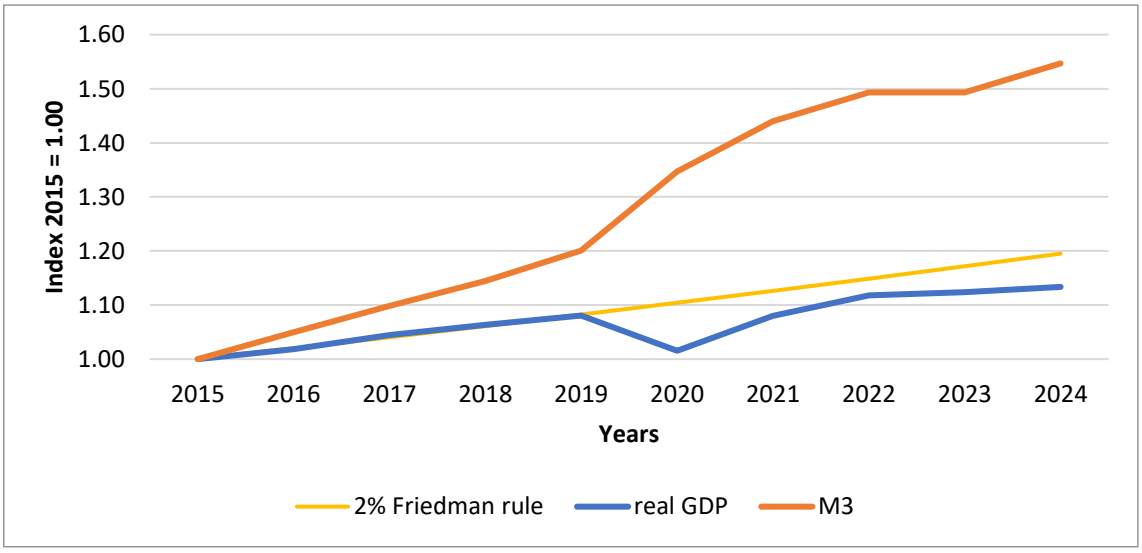
Recognizing the known measurement limitations of GDP and HICP, we adopt the working assumption that a ten-year horizon is sufficient for monetary expansion to transmit fully through the economy. The HMI indicator for year *t* is capturing the cumulative excess of M3 growth over nominal economic activity not yet absorbed by prices or real output. For example, the HMI reported for 2005 reflects developments from 1996 through 2005. Each annual HMI value thus provides a forward-looking indicator of inflationary risk.

This operationalization enables the identification of periods when money supply growth generates future inflationary pressures. All time-series dynamics are illustrated using graphical methods, with observational results presented in the Results section.

## Results

Our analysis examines whether the recent surge in inflation, as measured by the Harmonized Index of Consumer Prices (HICP), could have been reasonably anticipated based on monetary developments. The European Central Bank (ECB) attributed the post-COVID-19 inflation primarily to supply-side factors, including energy price shocks and disruptions to the supply chain. At the time, the ECB described the episode as temporary, projecting that inflation would decline in 2022 and stabilize moderately above target. By examining the evolution of money supply, output, and prices through the lens of the Quantity Theory of Money (QTM), we assess whether underlying monetary conditions also foreshadowed the persistence of inflation.

**Figure 1**: M3 to real GDP – the relationship of development between the growth of money supply M3 and the growth of real GDP in the Euro Area from 2015



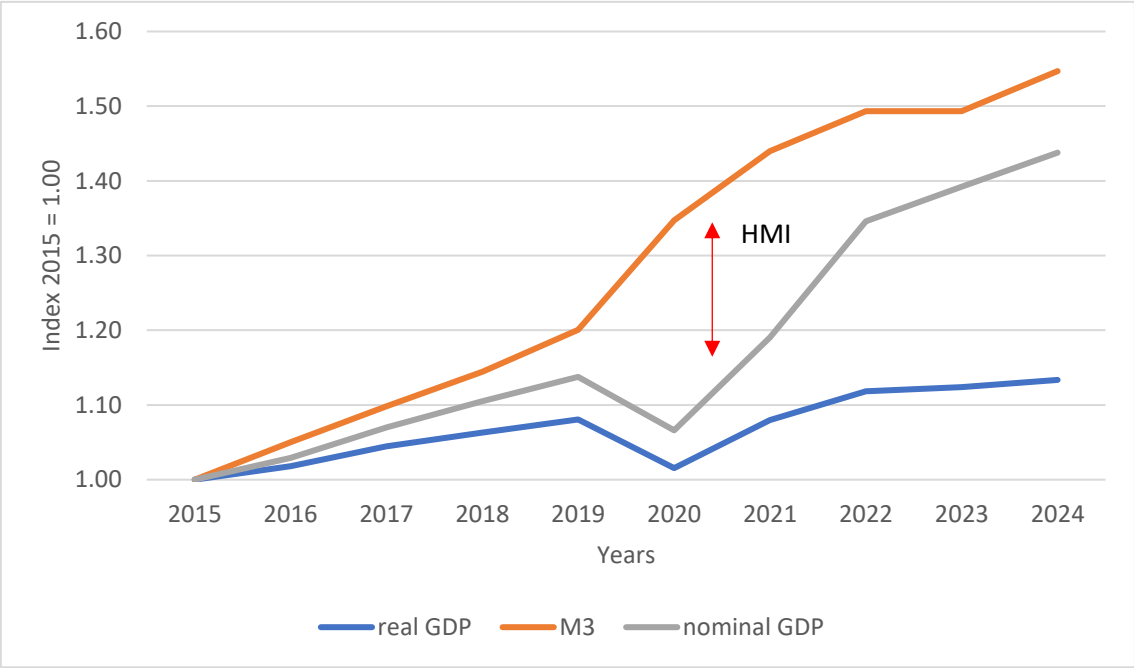

**Note**: Adapted from European Central Bank (2025a).

We begin by comparing the growth of broad money (M3) with real GDP in the Euro Area (Figure 1). Throughout the period from 2015 to 2024, M3 consistently expanded at a rate faster than the real economy. This pattern is visible even before the pandemic, but became especially pronounced during 2020. In that year, M3 increased by 12.2% year-on-year, while real GDP contracted by 6.0%. Domestic demand declined by 5.7%, with both consumption and investment reduced. These developments reflected the severe economic shock of the COVID-19 lockdowns.

The ECB's policy stance at the time prioritized avoiding deflation and supporting recovery. Accordingly, large-scale asset purchases and other unconventional monetary tools were deployed to support liquidity and credit flows. As a result, monetary expansion reached double-digit rates. For reference, we also compare M3 dynamics with Friedman's rule of steady 2% money growth. Figure 1 shows that actual money supply growth consistently exceeded this benchmark, particularly during crisis episodes.

By 2023, tighter monetary conditions had slowed the growth of M3. Nonetheless, the cumulative divergence between money supply and real output remained substantial, highlighting a persistent imbalance between liquidity creation and real economic absorption capacity.

**Figure 2:** M3 to nominal GDP – the relationship of development between the growth of money supply M3 and the growth of real GDP adjusted by the development of HICP in the Euro Area from 2015



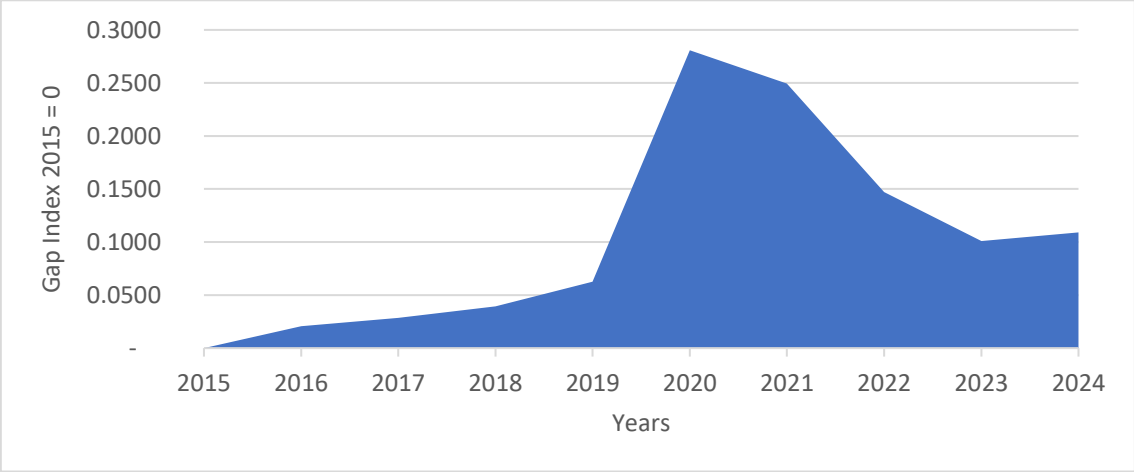

**Note**: Adapted from European Central Bank (2025a).

To align the analysis with the QTM framework, we next adjust real GDP with the price level, using HICP to obtain nominal GDP (Figure 2). Prior to the pandemic, the velocity of money had gradually declined (see Table A1), which allowed the ECB to accommodate monetary growth without generating proportionate inflation. However, following the end of lockdowns and travel restrictions, the velocity of money returned to its pre-pandemic levels. This recovery implied that excess liquidity accumulated in 2020-2021 could begin circulating more actively, raising the risk of sustained upward pressure on prices.

To focus on this dynamic, we set the velocity index to 1 at the beginning of the observation period. This assumption, consistent with the long-run application of QTM, facilitates transparent comparison of money growth and nominal GDP.

Figure 3 illustrates the development of HMI. During the pre-pandemic period, HMI gradually accumulated but remained moderate. In 2020-2021, however, HMI reached its highest level in the observed period. Notably, this was precisely the moment when the ECB communicated that inflationary pressures were temporary. From a monetary perspective, the magnitude of HMI suggested otherwise: substantial liquidity had been created but had not yet translated into prices, leaving significant potential for future adjustment. The Gap Index is normalized to zero in 2015 for comparability.

**Figure 3:** Development of hidden monetary imbalances as the gap between the growth of M3 and real GDP adjusted by HICP in the Euro Area from 2015




**Note**: Adapted from European Central Bank (2025a).

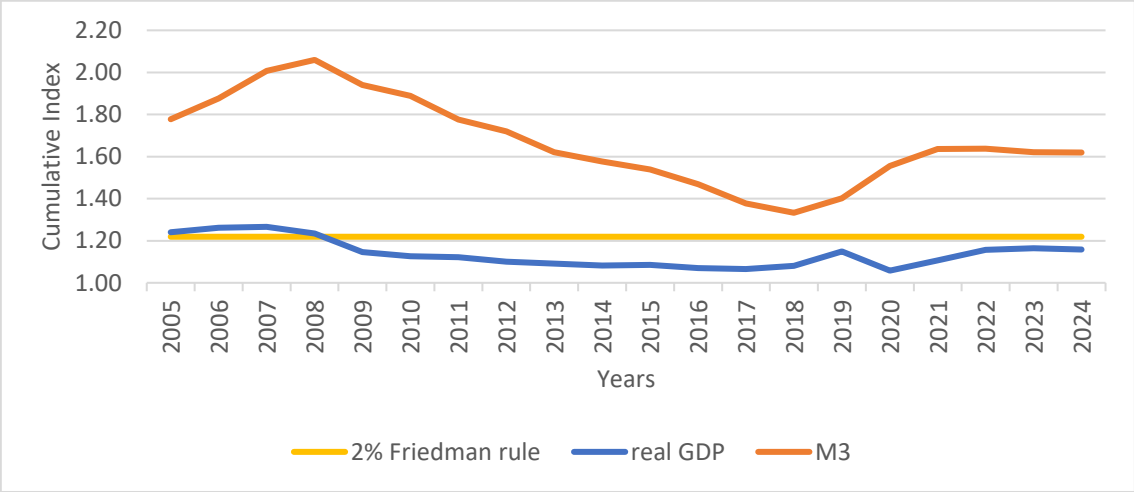
The subsequent inflation path coincided with this assessment. HICP inflation crossed the 2 % mark in July 2021, rose to 5.1 % by January 2022, and reached 10.6% in October 2022. While multiple drives contributed, including energy shocks and supply chain disruptions, the sharp acceleration followed the period of peak HMI. Our analysis does not establish causality,

but the observed trends suggest that excess monetary growth likely contributed to the persistence of inflation, complementing supply-side explanations.

To address the known measurement limitations of GDP and HICP, we calculate HMI on a rolling ten-year basis (Figures 4 and 5). Each value, therefore, represents the cumulative gap between money supply and nominal GDP over the preceding decade. For example, the 2024 observation spans the period from 2015 to 2024. This approach smooths temporary fluctuations and provides a long-run perspective on sustained liquidity trends.

The results indicate that the monetary imbalances accumulated during the COVID-19 episode peaked in 2021 and were gradually reduced by 2024, absorbed mainly through the surge in inflation. This contrasts with the post-Global Financial Crisis (GFC) period, during which subdued money growth helped correct imbalances without generating significant inflationary pressures.

**Figure 4:** M3 to real GDP – the relationship of development between growth of money supply M3 and growth of real GDP in the Euro Area from 2005

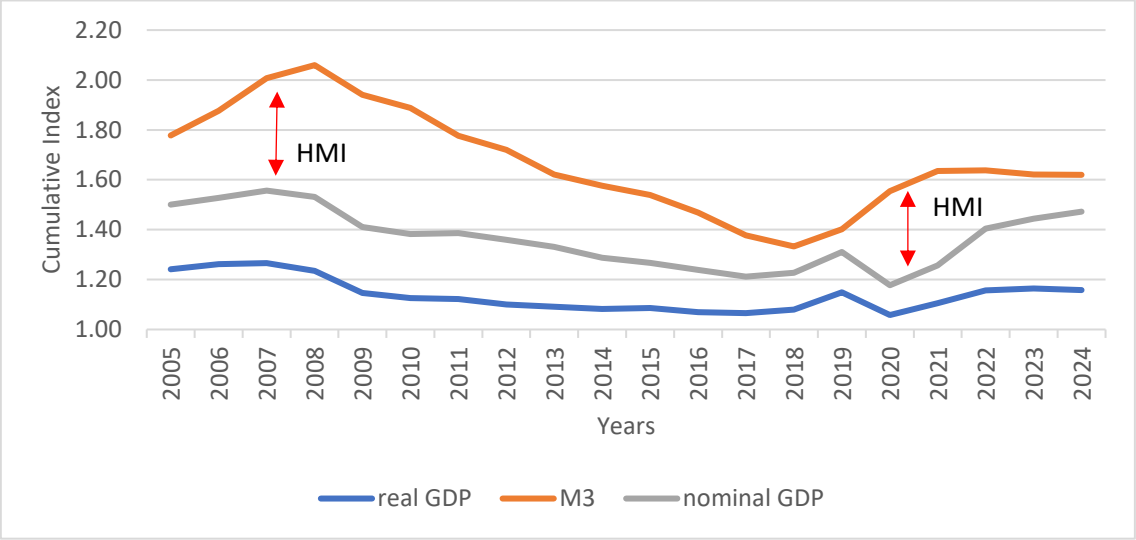



**Note**: Adapted from European Central Bank (2025a).

The framework also offers insight into earlier episodes. Figure 6 shows that the largest pre-COVID imbalance emerged during the run-up to the GFC. Between 1998 and 2007, M3 growth consistently exceeded 5% annually, reaching a peak of 11.5% in 2007. Inflation simultaneously reached 3.1 %, its highest level in that cycle. The ECB responded by raising the main refinancing rate to 4.25 %. After the crisis struck, real GDP stagnated for several years, household balance sheets were restructured (see Figure A2), and moderate monetary growth (averaging 1.4% between 2009 and 2013) helped reduce imbalances. Inflation remained subdued in the years following the Global Financial Crisis. In the GFC episode, contraction in output and credit demand, combined with swift ECB tightening, prevented

monetary imbalances from turning into high inflation. In the COVID-19 episode, however, the rebound in velocity and the liquidity injections translated more directly into prices.

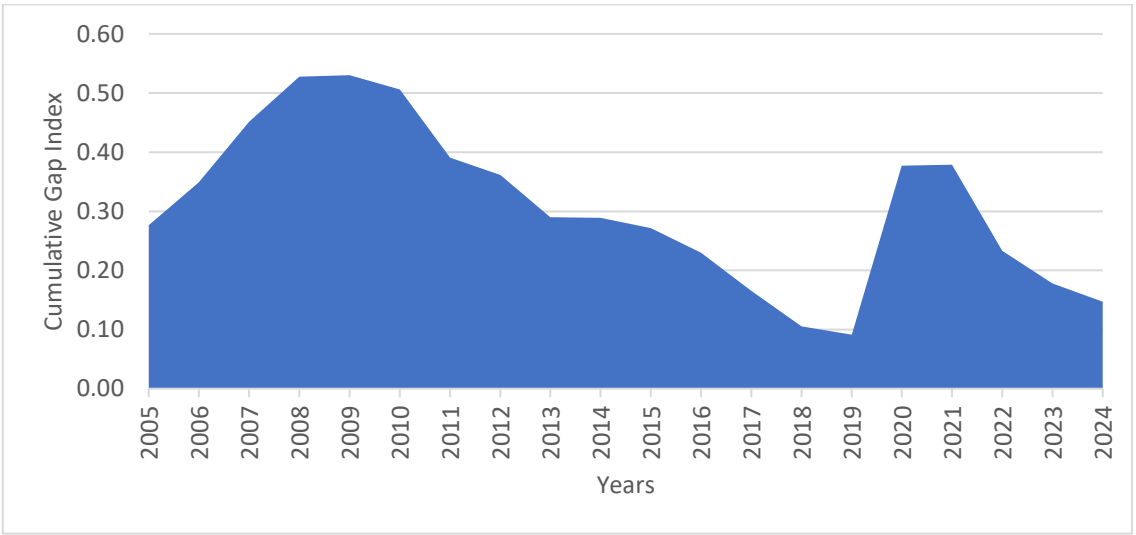
**Figure 5:** M3 to nominal GDP – the relationship of development between the growth of money supply M3 and the growth of real GDP adjusted by the development of HICP in the Euro Area




**Note**: Adapted from European Central Bank (2025a).

To test robustness, we replicate the construction of HMI with alternative horizons of five and fifteen years (Figure A5). The shorter window produces more responsive series, while the longer window highlights the cumulative effects of monetary expansion. Importantly, the qualitative timing and persistence of the HMI rise consistently across horizons, supporting the interpretation that excess liquidity contributed to sustained inflationary pressures.

**Figure 6:** Development of hidden monetary imbalances as the gap between the growth of M3 and real GDP adjusted by HICP in the Euro Area

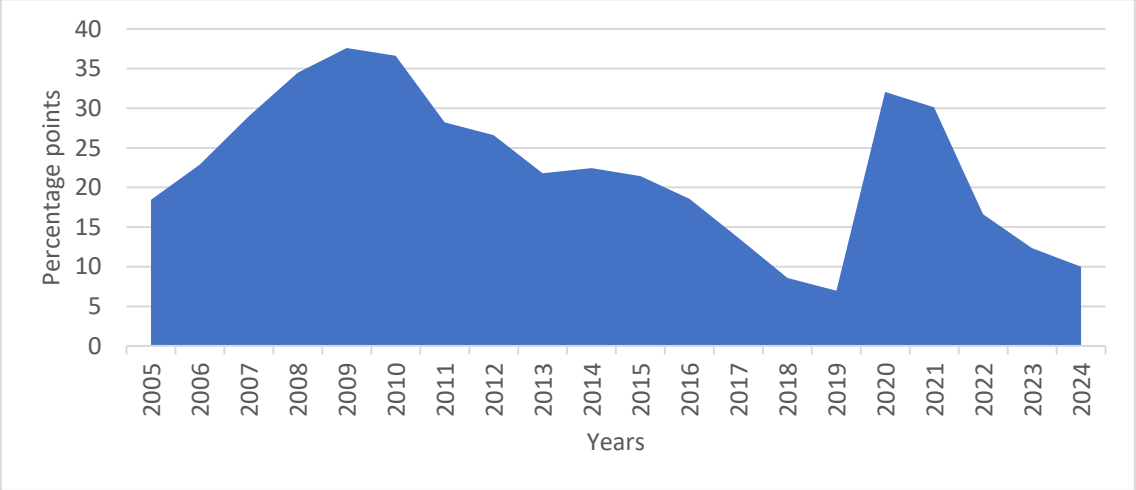



**Note**: Adapted from European Central Bank (2025a)

Although our analysis is descriptive, the robustness check demonstrates that the main finding does not depend on the exact choice of horizon. The alignment of results across specifications strengthens confidence in the observed pattern.

To further illustrate the risks implied by monetary expansion, we compute Potential Future Inflation ($P_f$), defined in the Methods as the cumulative price-level increase required to eliminate HMI. Figure 7 shows that by 2020, this indicator has already signaled potential inflationary pressures exceeding 30% over the coming years. While the measure is descriptive, the timing and magnitude underscore that monetary imbalances were sufficiently large to warrant concern about the persistence of inflation.

**Figure 7:** Potential future inflation in case hidden monetary imbalances on the market will pass to prices




**Note**: Adapted from European Central Bank (2025a)

Three key observations emerge. First, broad money (M3) has consistently grown faster than real economic activity in the Euro Area, especially during crisis episodes. Second, the unprecedented expansion of liquidity during 2020-2021 coincided with the significant build-up of hidden monetary imbalances. Third, the subsequent inflation acceleration occurred alongside the rebound in money velocity, consistent with the view that excess liquidity amplified price pressures.

## Discussion

Interpreting the results through the Quantity Theory of Money (QTM) suggests that persistent gaps between broad money growth and real activity created hidden monetary imbalances (HMI) that became relevant once velocity normalized after pandemic restrictions. In 2021, the ECB primarily attributed rising prices to temporary and supply-driven factors.

While such factors clearly mattered, the monetary configuration documented in the Results provides an additional lens for understanding why elevated inflation lasted longer than initially expected.

This reading relates to work that assigns informational value to monetary aggregates for medium-term inflation forecasting. Friedman's arguments about systematic money-growth rules (Friedman, 1956; 1969) and the targets-and-indicators perspective by Bruner and Meltzer (1969) provide a theoretical rationale for monitoring broad money alongside standard forecasts. Recent ECB commentary points in the same direction. Schnabel (2023) argues that rapid broad-money growth can serve as an early warning for price-stability risks, consistent with our HMI diagnostics, in line with evidence on demand-side contributions to recent inflation (Di Giovanni et al., 2022; Erdogan et al., 2020; Buelens & Zdarek, 2022). Our HMI diagnostics indicate that broad-money conditions were consistent with upward pressure on prices.

Balance sheet constraints and excess liquidity also shaped the policy environment. The ECB's accommodative stance aimed to stabilize financial markets and support recovery (see Figure A4 for excess liquidity). At the same time, the ECB faced constraints, most notably expansion of loans to households and non-financial corporates, which limited its ability to raise rates and complicated the policy environment (see Figures A2 and A3). These conditions created a policy environment that helps explain the ECB's cautious approach.

The analysis remains descriptive and does not identify causal effects. Fiscal transfers, commodity and energy prices, and wage dynamics offer alternative mechanisms for explaining the post-pandemic inflation surge. HMI should therefore be viewed as diagnostics that summarize the joint evolution of money, prices, output, and velocity, not as forecasts.

Taken together, the findings suggest the value of complementing inflation-targeting practices with a systematic monetary cross-check. Routine monitoring of broad money, along with summary indicators such as HMI, could help flag periods when liquidity creation outpaces real absorption capacity, and the risk of persistence is elevated.

## Conclusion

In this study, we asked whether the post-pandemic inflation surge that began in 2021 could have been anticipated as persistent based on monetary developments. We hypothesized that excess broad-money growth over the preceding decade contributed to inflation risks that were not fully reflected in assessments.

Using the QTM lens, we document a sustained divergence between M3 and real GDP growth since 2015, with an average annual growth rate of approximately 5% for M3 compared to 1.5% for real GDP. The gap widened sharply in 2020, when M3 expanded by 12.2% while real GDP contracted by 6.0%. This imbalance accumulated into hidden monetary imbalances (HMI), which reached their highest level in 2021. Translating HMI into Potential Future Inflation (Pf) indicates that, by 2020, excess liquidity already implied an upward price-level adjustment of more than 30%. Pf indicator should not be read as a forecast but as a diagnostic. It represents the cumulative inflation required to absorb monetary imbalances if output and velocity remain unchanged entirely. Inflation subsequently accelerated, with the HICP rising above 5% in early 2022 and peaking at 10.6% in October 2022, before remaining above target until late 2024. Robustness checks with 5- and 15-year windows yield consistent qualitative results in terms of timing and persistence. While causality cannot be inferred, the alignment of these dynamics suggests that monetary expansion likely amplified inflation persistence in response to supply-side shocks. The results complement evidence that monetary aggregates retain medium-term informational content for inflation. The study is observational and does not isolate fiscal influences, external price shocks, or wage dynamics. These caveats bound the interpretation.

Although the Quantity Theory of Money is not a precise forecasting tool, it remains a valuable framework for understanding long-term price dynamics. Policy implications follow in two respects: first, incorporating structured monetary cross-check, tracking broad money, and summary indicators such as HMI, alongside standard forecasts; and second, specifying ranges of HMI that warrant heightened vigilance. Finally, future research should test the predictive content of HMI using econometric models. Comparative studies with other advanced economies would further clarify whether the patterns documented here also apply outside the Euro Area and provide insights into how monetary aggregates might be reintegrated into contemporary policy frameworks.

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## Appendix

**Table A1.** Calculation of the development of the velocity of money

| period | velocity of money | y/y change | period | velocity of money | y/y change |
|---|---|---|---|---|---|
| **2015** | 1.000 | | 2020 | 0.792 | *-16.5%* |
| **2016** | 0.980 | *-2.0%* | 2021 | 0.827 | *4.4%* |
| **2017** | 0.974 | *-0.6%* | 2022 | 0.901 | *8.9%* |
| **2018** | 0.966 | *-0.8%* | 2023 | 0.932 | *3.4%* |
| **2019** | 0.948 | *-1.9%* | 2024 | 0.929 | *-0.3%* |

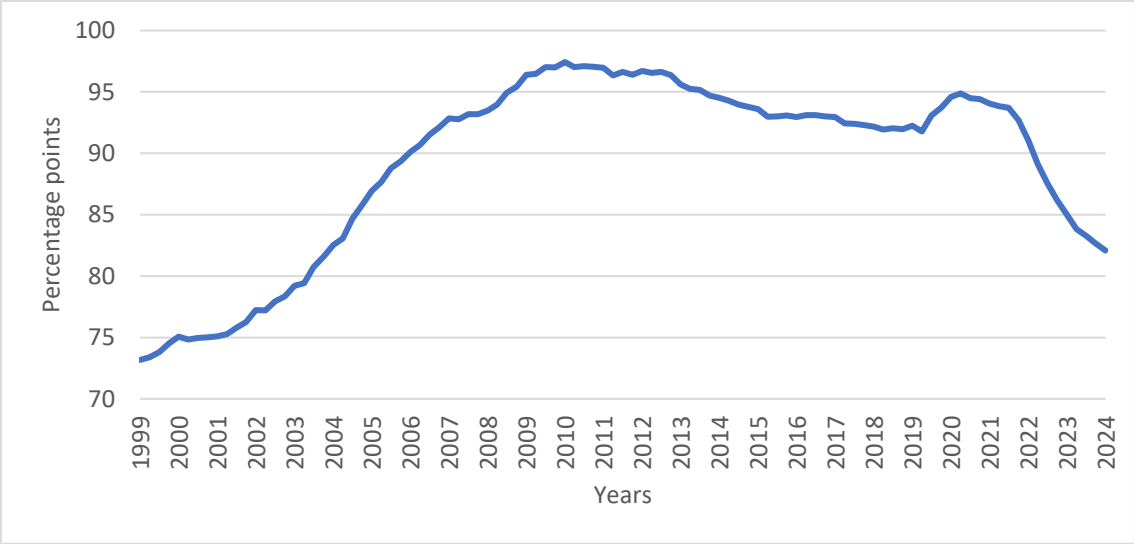
**Note**: Authors' calculations based on Central Bank (2025a).

We calculated an index for the velocity of money for the period from 2015 to 2024 (Equation 4). We initiated this index at a value of 1 on December 31, 2014.

$$V = \frac{P \times y}{M} \quad (4)$$

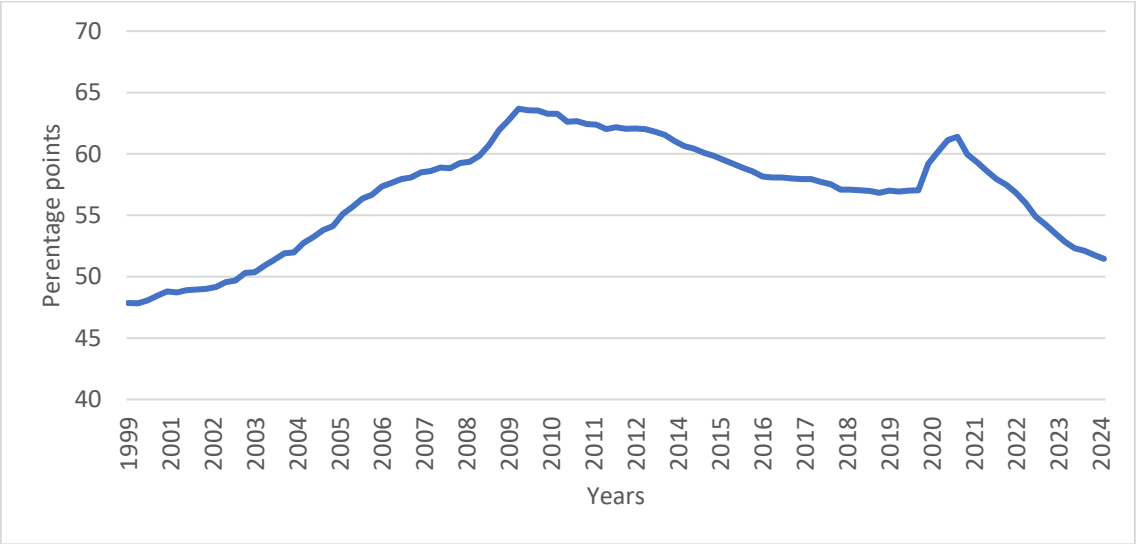
Where: V represents the velocity of money, P denotes the price index, y refers to the index of real output, and M stands for the money supply.

**Figure A1:** Debt of households in % to income - loans granted to households as a ratio of disposable income for the Euro Area



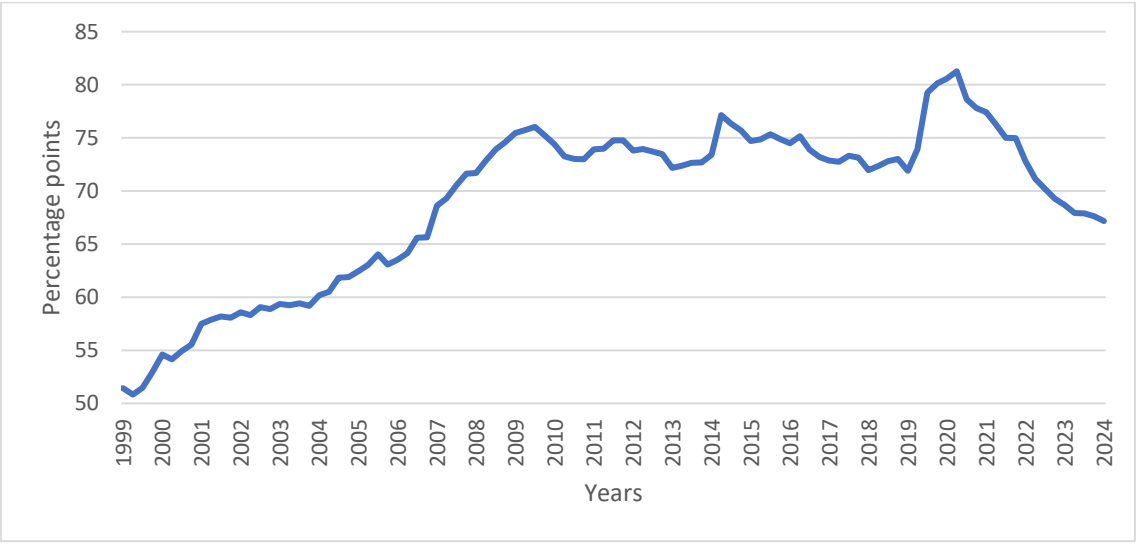

**Note**: Adapted from European Central Bank (2025b).

**Figure A2:** Debt of households in % to GDP - loans granted to households as a ratio of GDP for the Euro Area



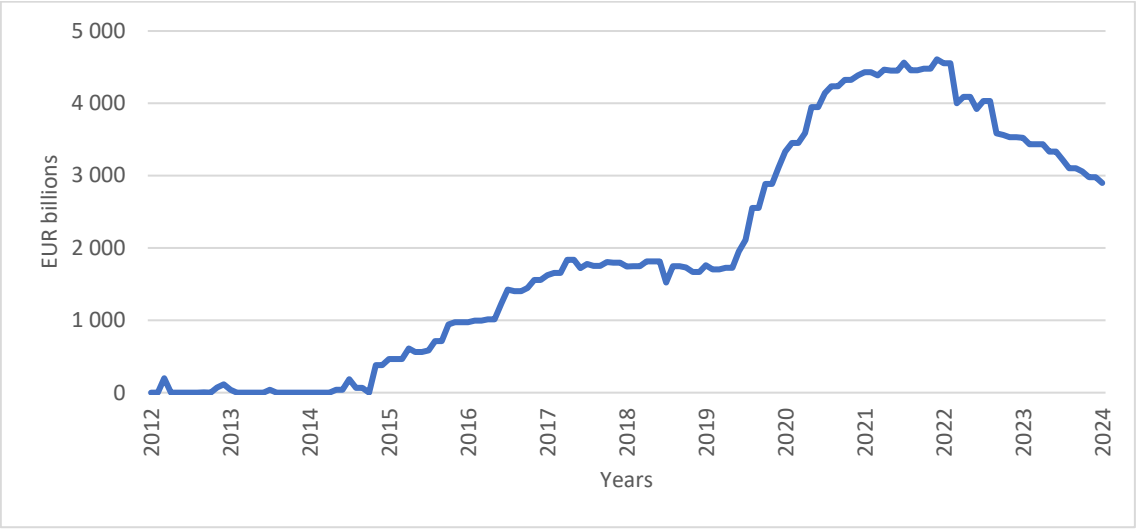

**Note**: Adapted from European Central Bank (2025b).

**Figure A3:** Debt of non-financial corporations in % to GDP - debt securities and loans of non-financial corporations as a ratio of GDP for the Euro Area




**Note**: Adapted from European Central Bank (2025b).

**Figure A4:** Excess liquidity in the Euro Area



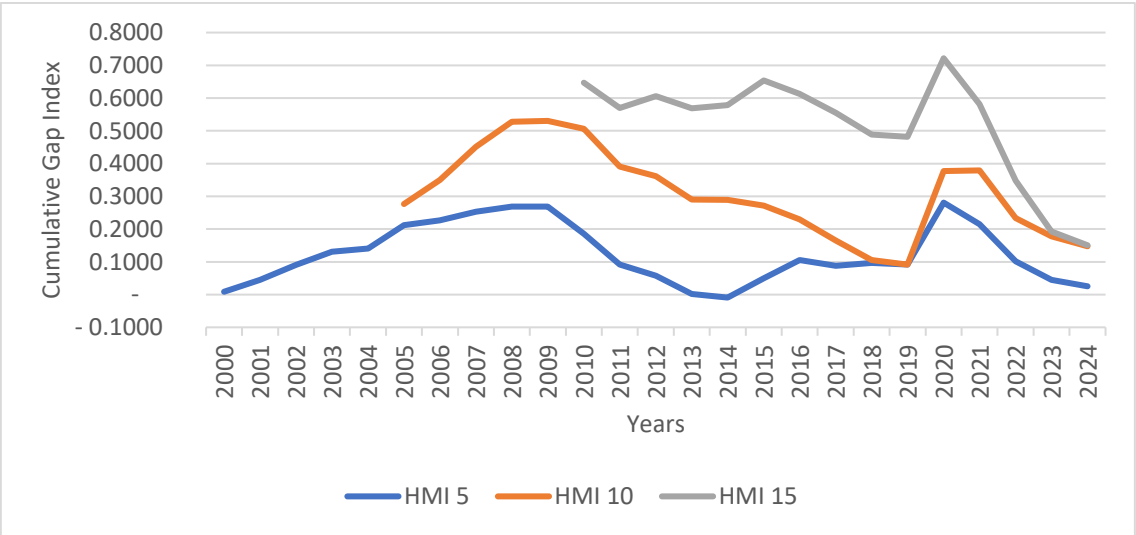

**Note**: Adapted from European Central Bank (2025b).

We calculate the excess liquidity (EL) in the Euro Area for the period from 2013 to 2024 (Equation 5).

$$EL = (CA - RR) + (DEPO - LEND) \quad (5)$$

Where: CA represents the Euro Area credit institutions' current account holdings, RR denotes the total required reserve requirements of credit institutions in the Euro Area, DEPO refers to the Eurosystem's deposit facility, and LEND refers to the Eurosystem's marginal lending facility.

**Figure A5:** Hidden Monetary Imbalances (HMI) under alternative lag assumptions (5-, 10-, and 15-year horizons)




**Note**: Adapted from European Central Bank (2025a).