

SPEECH

Money and inflation

Thünen Lecture by Isabel Schnabel, Member of the Executive Board of the ECB, at the annual conference of the Verein für Socialpolitik

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In the two and a half years following the outbreak of the pandemic, the sum of currency in circulation and overnight bank deposits in the euro area, referred to as M1, increased by over 30%. Over the same period, inflation accelerated from 1.2% to 9.1%. It peaked at 10.6% in October 2022.

The concurrence of these developments sparked a renewed debate on the relationship between money growth and inflation. Some commentators saw the rise in inflation as proof of the validity of the quantity theory of money, arguing that nominal wages and prices could not keep on rising if money did not expand correspondingly.^[1] For others, the correlation was spurious and held little economic significance.^[2]

In my remarks today, I would like to discuss the role of money in explaining the recent surge in inflation in the euro area. I will start by reviewing the reasons why most central banks relegated the analysis of monetary developments to the background.

I will then ask whether the rise in money growth in the wake of the pandemic was a harbinger of the surge in inflation. In answering this question, I will explain what has caused broad money growth, including the role of the monetary and fiscal responses to the pandemic, and how the money that was created by these measures may have affected the way in which firms and households responded to supply chain disruptions and the sharp increase in energy prices.

In the final part of my lecture, I will show how the ECB's determined tightening of monetary policy had an imminent and significant effect on monetary dynamics, supporting disinflation. However, the current, unusual contraction in monetary aggregates is unlikely to foreshadow a deep recession but rather reflects a significant rebalancing of portfolios after a long period of low interest rates. Hence, there is not yet an all-clear for the inflation problem.

My overall conclusion is that money growth still matters, and that it matters most in unstable conditions when adverse cost-push shocks risk lifting inflation away from the central bank's target.

As such, the recent experience serves as a reminder that the quantity theory of money is not a vacuous concept of no practical importance for modern central banks. With the benefit of hindsight, we can see that the strong rise in broad money growth may have been an early and sufficiently robust sign that inflation would not simply fall all the way back to 2% on its own as supply shocks reversed, but that it would percolate through the economy and leave a more persistent footprint.

Inflation is not always and everywhere a monetary phenomenon

One of the central predictions of the quantity theory of money is that there is a long-run one-to-one relationship between money growth and inflation.^[3] It is perhaps the most celebrated and most controversial proposition in the economic science, going back at least to the mathematician Nicolaus Copernicus and the Polish King Sigismund in 1540.^[4]

Conceptually, the quantity theory of money hinges on the existence of a stable long-run demand for real money balances, which is positively related to real income and inversely related to the opportunity cost of holding money.^[5] If shifts in trend real income and low-frequency variations in nominal interest rates are comparatively limited, money growth and inflation will move one-for-one over sufficiently long periods of time.^[6]

Such a relation does not imply that changes in the money stock *cause* inflation. But empirically, both cross-sectional and time series evidence have for a long time provided strong support in favour of a stable long-run relationship between money and prices.

Across countries, the long-run averages of inflation and excess money growth, defined as the growth in broad money over and above the growth in real GDP, typically fall on or near the 45-degree line, consistent with the predictions of a one-to-one link.^[7] This evidence essentially holds for the entire post-Second World War period (Slide 2, left-hand side).^[8]

In countries where sufficiently long time series are available, low-frequency variation in money growth and inflation points to the same close relationship between the two series in the vast majority of cases (Slide 2, right-hand side).^[9]

These findings are not confined to a particular type of model; they are empirical facts.

However, these facts did not prove robust over time. Most importantly, they were found to break down, or to weaken substantially, in an environment of low and stable inflation (Slide 3, left-hand side).^[10]

Specifically, splitting samples over time revealed that the findings of a unit slope critically depended on the inclusion of high-inflation episodes, such as those during wartime periods in the 1910s and the 1940s, or in the aftermath of the oil price shocks in the 1970s (Slide 3, right-hand side).^[11] Outside these episodes, it seemed inflation was not always and everywhere a monetary phenomenon.

In some cases, the relationship between money growth and inflation could be recovered when controlling for shifts in trend real GDP growth and the impact of the secular decline in interest rates on the velocity of money.^[12]

Lower interest rates reduce the opportunity cost of holding money and raise the risk of capital losses from bond or stock holdings in case of rising interest rates. Hence, they tend to increase money holdings per unit of output, thereby lowering velocity (Slide 4, left-hand side).^[13] Over the past few decades, such changes in money velocity have driven a wedge between money growth and inflation.

Nonetheless, even when controlling for such shifts, the evidence of a strong long-run link between inflation and money growth has become more limited and fragmented as inflation significantly and persistently declined from the mid-1980s onwards. The decline in inflation volatility during the Great

Moderation made it harder to identify robust econometric evidence of the effect of money growth on inflation (Slide 4, right-hand side).^[14]

An important implication is that changes in monetary policy regimes can significantly influence the relationship between money growth and inflation, especially if central banks move towards targeting inflation directly.^[15] This can be seen as an instance of “Goodhart’s law”, which states that “when a measure becomes a target, it ceases to be a good measure”.

The instability in the link between money growth and inflation gradually led to monetary aggregates playing less of a role as an intermediate target for central banks.^[16] This tendency was reinforced by the rise of a class of New Keynesian models that were able to explain fluctuations in key macroeconomic time series despite money demand playing no role.^[17]

The founders of the monetary union and the ECB still adopted a reference value – but no target – for broad money growth, building on the long-standing analytical framework of the Deutsche Bundesbank. Deviations from the reference value did not directly commit the ECB to adjust its policy. But it elevated money growth to an important variable in determining the policy response.^[18] Symbolically, monetary analysis was the first, not the second, pillar of the ECB’s monetary policy strategy of 1998.^[19]

In 2003, as part of the ECB’s evaluation of the monetary policy strategy, the annual review of the reference value was discontinued and the ranking of the pillars changed, starting with the economic analysis – focused on short to medium-term developments – before moving to the monetary analysis assessing medium to long-term inflation trends. Incidentally, this was in line with the growing consensus that the link between money growth and inflation had weakened since the 1980s.^[20]

Since the 2021 strategy review, the Governing Council has based its policy decisions on an integrated assessment of all relevant factors. While this assessment is still built on an economic analysis on the one hand and a monetary and financial analysis on the other, it recognises that a distinct monetary pillar is no longer essential for successfully conducting monetary policy.^[21]

Could money growth have helped predict current inflation?

The post-pandemic surge in inflation has put the quantity theory of money to a new test. It raises the question whether the increase in excess money growth in 2020 was an early and sufficiently strong warning sign that risks to medium-term price stability were rising rapidly.^[22]

These signs were not confined to the euro area. A simple visual inspection suggests that the size of the inflation shock was positively correlated with excess money growth across a sample of advanced and emerging economies (Slide 5).

That correlation was far away from the unitary relationship that the quantity theory of money would predict. Given the short horizon involved, this would also not have been expected. And yet, researchers of the Bank for International Settlements (BIS) found that taking excess money growth into account would have helped to materially reduce inflation forecast errors in recent years.^[23]

By itself, this evidence is intriguing. At least, it means that monetary aggregates remain important sources of information when assessing risks to price stability. It also suggests that the most famous monetarist proposition may not be dead after all.^[24] It may simply have been dormant over the period of low and stable inflation, much as its New Keynesian counterpart, the Phillips curve.^[25]

This view would correspond to the warning issued by Thomas Sargent and Paolo Surico in their seminal contribution in 2011: “if a monetary rule unleashes persistent and seemingly exogenous movements in money growth, ... the quantity theory will come back.”^[26]

At the same time, the mere fact that excess money growth helped predict inflation is not suggesting causality. The joint dynamics of inflation and money growth always depend on the nature of the shocks hitting the economy.

In other words, we need to understand what has caused the surge in money growth and inflation before drawing conclusions about whether monetary policy should have taken the signs from broad money growth more seriously.

This assessment seems especially relevant against the background of the vastly different experiences with quantitative easing (QE) over time in the euro area and beyond. While large-scale asset purchases after the global financial and euro area sovereign debt crises had only moderate effects on broad money growth and did not succeed in lifting inflation back to target, the expansion of central bank balance sheets in the wake of the pandemic coincided with strong growth in both variables.

This coincidence fuelled the narrative that QE was the cause of both inflation and broad money growth. And while that link might well exist, it is often prone to misconceptions. In reality, the relationship between asset purchases and money growth is much more subtle and complex.

Asset purchases and broad money growth

Asset purchases, together with targeted longer-term refinancing operations (TLTROs), were our primary instruments for responding to the outbreak of the pandemic in 2020, as our key policy rate was already in negative territory, and hence close to the effective lower bound.^[27]

Asset purchases were highly effective in addressing illiquidity in financial markets in an environment in which traditional intermediaries were either unwilling, or unable, to provide liquidity to the market. And they were instrumental in reversing the sharp tightening in borrowing costs that resulted from the uncertain effects of the pandemic on the balance sheets of firms, households and governments.

Asset purchases affect monetary aggregates in different ways. When central banks purchase securities, they create new central bank reserves to pay for these transactions. Reserves can only be held by commercial banks, which use them to settle payments among themselves.

These reserves are part of the monetary base, or M0.^[28] Because of QE, the monetary base increased in a mechanical way one-for-one after 2015, when the ECB launched its asset purchase programme (APP), and again during the pandemic, when we created the pandemic emergency purchase programme (PEPP) and conducted further purchases under the APP (Slide 6).

The TLTROs further added to the large increase in base money. In these lending operations, banks could pledge collateral against central bank reserves and obtained funding at highly beneficial rates if they fulfilled certain lending criteria.

By contrast, the impact of these measures on broad money growth, M3, is much less mechanical.^[29] TLTROs, for example, 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.

For asset purchases, the effects on M3 are more convoluted. Specifically, 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. Other cases, especially transactions with non-residents and banks, which are often the main counterparties, will leave M3 unchanged at the time of settlement.^[30]

Over time, however, QE, much like the TLTROs, can have important *indirect* effects on broad money growth.^[31]

Above all, QE compresses the yields on long-term debt securities, stimulating loan demand and supply as well as economic activity. Lower interest rates also make money holdings relatively more attractive by reducing the opportunity cost of holding money. These effects tend to raise M3.

On the other hand, if euro area residents use the proceeds from the sale of a bond to repay loans, to acquire foreign assets or to purchase financial instruments not included in M3, such as other long-term bonds, from non-money-holding institutions, the initial positive effect on broad money is reversed.^[32]

In net terms, the impact of QE on M3 fundamentally depends on the strength of these indirect effects, which may vary over time. This can be seen when considering the money multiplier, which is the ratio of broad money to base money (Slide 7).

The multiplier was broadly constant until the outbreak of the global financial crisis in 2008. This was mainly because the injection of central bank reserves was demand-driven – that is, banks' recourse to our operations depended on currency in circulation and banks' reserve requirements, which are a function of banks' short-term liabilities.^[33] For that reason, M0 and M3 were expanding at a broadly similar pace.

But after the start of the APP, the multiplier fell measurably and persistently. It declined further when we launched the PEPP. 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.^[34]

The banking system as a whole cannot escape the addition of new reserves, as purchases are always settled through banks, regardless of who the ultimate seller is. Importantly, banks do not draw on excess reserves to create new loans, as is sometimes suggested, with base money "multiplying" into broad money.

So, if there is no demand for credit, or if banks do not want to lend, because of risk considerations or capital requirements, asset purchases will not, on their own, affect broad money growth beyond their

more limited direct mechanical impact.

The effects of asset purchases are state-dependent

It is now easy to see why the effect of QE on broad money growth, economic activity and inflation is highly state-dependent.

Between 2015 and 2018, when we first conducted large-scale asset purchases, the decline in long-term interest rates succeeded in lifting loan creation from depressed levels.

But broad money growth remained moderate overall, and inflation remained subdued, as loan demand and supply were held back by a combination of lacklustre growth and the need for balance sheet repair from the global financial and sovereign debt crises (Slide 8). In particular, governments were consolidating public finances and banks were in the process of building up capital buffers, as non-performing loans remained elevated (Slide 9).^[35]

As a result, for the period before the pandemic, most empirical studies find that asset purchases had no, or a very limited, effect on the lending behaviour of banks across major economies.^[36] This explains the marked and persistent decline in the money multiplier in that period.

During the pandemic, however, the picture changed dramatically. Fiscal deficits soared as governments responded to the crisis with large transfers to households and firms. The primary deficit was 5.5% in 2020 and nearly 4% in 2021, reflecting an unprecedented fiscal stimulus.

Borrowing by firms rose sharply, too, often benefiting from government guarantees (Slide 10). Loan demand by firms went well beyond the drawdown of credit lines in 2020. Annual credit growth to firms peaked at nearly 9% in late 2022, after interest rates had already started rising. And lending by households for house purchases reached growth rates not seen since the global financial crisis.

So, in sharp contrast to the experience before the pandemic, the money multiplier fell only briefly (slide 7). 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 (Slide 6).

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.

But the demand for money went well beyond the initial “dash for cash”. Although uncertainty remained exceptionally high for a long time, the economy responded strongly to historically accommodative financing conditions, boosting credit creation. This reflected the solid balance sheets with which banks, households and firms had entered the crisis, as well as Europe’s common policy response, mainly through Next Generation EU, which mitigated fiscal borrowing constraints at national level.

Was money the grease that kept the wheels of inflation going?

What then – if any – was the role broad money growth played in facilitating the rise in inflation?

According to some commentators, the price surge over the past two years is the sole result of adverse supply-side shocks, first caused by pandemic-related disruptions to global value chains and later by the strong rise in energy prices in the wake of Russia's invasion of Ukraine.

On this account, money growth played only a minor, ancillary role, as the surge in inflation was purely exogenous. The broadening of inflation to most goods and services was seen as simply reflecting the pass-through of the increase in input costs to final consumer prices, which would have happened with or without money growth.

This interpretation of recent events, however, naturally raises the question of why the pass-through of supply-side shocks to final consumer prices was so strong. After all, prices are always the sum of costs and profit margins. In the past, margins had often been a key shock absorber. In a downturn, unit labour costs typically increase as output falls faster than employment. Because reduced demand limits the scope for price increases, unit profits normally decline (Slide 11).

However, in recent years, unit profits have increased strongly despite the sharp rise in firms' input costs. Such outcomes are atypical for purely exogenous cost-push shocks. Instead, they suggest that inflation was the outcome of the endogenous interaction between demand and supply, with consumers both willing and able to absorb significant price increases.

So, a different way to interpret the events of the past years is to suggest that demand was exceptionally resilient in the face of two of the largest economic shocks since the end of the Second World War, fuelling the rise in inflation. Money growth may play a different role in this scenario.

To see this, it is intriguing to look at the evolution of households' real disposable income.

After the sovereign debt crisis, it took more than four years for real disposable income to recover to its pre-crisis level, weighing heavily and persistently on aggregate demand (Slide 12, left-hand side). At the height of the pandemic, it took only three months. And today, real disposable income is higher than a year ago.

These developments are, to a large extent, the result of significant money creation fuelled by the fiscal response to the crisis. Public transfers compensated households for the loss in income during pandemic lockdowns, and later for the loss in purchasing power from the energy shock (Slide 12, right-hand side). And by stabilising aggregate demand, these transfers paved the way for the rise in nominal wages and employment growth that is increasingly driving the growth in income today.

The money that was created was used in different ways by households. Part of it was used to finance the sharp increase in nominal consumption expenditures that allowed households to maintain their real consumption at a level close to that seen before the pandemic (Slide 13).

As such, money growth may have been the grease that kept the wheels of inflation going. It is likely to have been a sign that demand would be more resilient than in a typical downturn, with households less sensitive to price increases, thereby facilitating the pass-through of cost-push shocks to final consumer prices.

Moreover, lockdowns meant that a significant share of the money that was created was saved, boosting household balance sheets. By the end of 2022, households accumulated excess savings of around €860 billion, or about 10.6% of annual disposable income (Slide 14, left-hand side).

Part of these savings were held in liquid assets. In 2020 alone, household overnight bank deposits increased by €570 billion (Slide 14, right-hand side). Over time, however, most of the excess savings have been invested in stocks and bonds or were used to pay back outstanding loans.^[37] As a result, households accumulated more wealth, also reflecting significant valuation gains as asset prices, especially house prices, increased measurably during the pandemic (Slide 15, left-hand side).

So, on aggregate, households essentially emerged from three years of crisis unscathed. Even households at the bottom of the wealth distribution managed to significantly deleverage between 2017 and 2021, as shown by our most recent household finance and consumption survey (Slide 15, right-hand side).

The resilience of households' income and balance sheets, in turn, is likely to have contributed to the significant credit demand by firms, which further fuelled broad money growth and sustained aggregate demand.

This money-based interpretation of inflation is consistent with three stylised facts.

First, a model-based decomposition of inflation into supply and demand factors suggests that demand played a significant role in generating underlying price pressures.^[38]

Second, if inflation were money-driven, one would expect price changes to largely reflect common factors rather than sector-specific shocks.^[39] This is precisely what we have seen in recent years. Today, the share of price changes across goods and services that can be explained by a common factor is about twice as high as before the pandemic (Slide 16).

Third, money velocity recovered gradually after the pandemic. This is a sign that spending was not held back by higher prices, contributing to firms being able to pass through rising input costs.

In this light, the findings by the BIS that money growth helped predict inflation, even over short horizons typically unrelated to the quantity theory of money, may seem less of a surprise. Money growth is likely to have been an underappreciated harbinger of risks to medium-term price stability.

Money is currently not a reliable measure of economic activity

The unprecedented rise in inflation necessitated a sharp tightening of monetary policy, which has been critical in paving the way for a timely return to price stability.

Since July last year, we have raised our key policy rate, the deposit facility rate, by 4.50 percentage points – the steepest tightening cycle in the history of the euro area (Slide 17, left-hand side). We are also reducing our balance sheet, as banks are paying back the TLTROs and as we no longer reinvest the proceeds from maturing government bonds under the APP (Slide 17, right-hand side).

All these measures are having a material effect on money dynamics, supporting disinflation.^[40] Since we started raising interest rates, broad money growth M3 has slowed down sharply and has turned negative on an annual basis in July (Slide 18, left-hand side). Lending to firms and households has essentially stalled.

Developments in narrower monetary aggregates are even more striking. The stock of M1 is contracting at a fast pace (Slide 18, left-hand side). In July, it was more than 9% below its level a year

ago. This is unprecedented: on an annual basis, M1 had not once declined since records began in the 1970s.

These developments have sparked concerns that monetary policy may now be at risk of overtightening. In the past, real CPI-deflated M1 growth has been a reliable leading indicator for all recessions in the euro area (Slide 18, right-hand side).^[41]

While activity in the euro area economy is clearly moderating, there are two reasons why monetary developments may currently not be a reliable measure of economic activity.

The first is that developments in real M1 growth have typically been more informative about future *turning points* in real GDP growth than about the *depth* of the downturn. Sharp declines in real M1 growth were often accompanied by relatively moderate declines in the annual growth rate of real GDP.

The second reason is that the volume of M1 critically depends on the opportunity cost of holding highly liquid, mostly overnight, deposits.

Before the pandemic, these opportunity costs were historically low, as asset purchases and other unconventional monetary policy measures compressed the spread between long-term and short-term interest rates.

As a result, the remuneration received by households and firms for holding overnight and time deposits was essentially identical, boosting M1 (Slide 19, left-hand side). Historically, M1 accounted for around 40% of M3. By the end of 2021, that share rose to 73%.

The sharp rise in interest rates has fundamentally changed this dynamic. Households and firms are actively and rapidly rebalancing their portfolios towards time deposits and other instruments with higher rates of remuneration, contributing to the sharp fall in M1 (Slide 19, right-hand side).^[42]

Portfolio rebalancing has also resulted in “money destruction”, in the sense that depositors are using bank deposits to purchase instruments outside the scope of M3 from non-money-holding institutions. For example, over the past year households have almost doubled their holdings of government bonds, and they have built significant additional exposures to government debt through investment funds.

Given the still elevated share of M1 in M3, considerable further declines in M1 can be expected. For example, if the share were to fall back to its pre-global financial crisis level, M1 outflows could amount to around €2 trillion.^[43] Similarly, current negative M3 growth is consistent with households and firms bringing their portfolios closer into line with historical regularities.

Such rebalancing of portfolios will not in itself affect consumption and savings decisions. Higher interest rates may induce households to save more. But these effects would come on top of the reallocation of the existing stock of savings.

Therefore, in the absence of other mechanisms at work, the current magnitude of the decline in real M1 growth says relatively little about the extent of the slowdown in economic activity in the euro area and the future evolution of inflation.^[44]

Conclusion

Let me conclude.

In this speech, I asked the question whether money growth still matters for central banks.

The events of the past three years have shown that it does matter in particular economic circumstances.^[45]

What are then the main takeaways for central banks? I see two areas of reflection.

One is that the extent to which the economy responds to an increase in the monetary base on the back of asset purchases fundamentally depends on the broader state of the economy, as reflected in its balance sheet capacity. On its own, QE is not inflationary. It only becomes inflationary if and when banks, households, firms and governments are both able and willing to respond to low interest rates, thereby boosting money growth, economic activity and, ultimately, inflation.

When looking at the experience before and after the pandemic, this distinction is perhaps what divides the “monetarists” – those claiming that inflation is always and everywhere a monetary phenomenon – from those advocating the fiscal theory of the price level – the idea that there are instances where the price level is determined by government debt.^[46]

The second takeaway is that excessive money growth can entrench adverse cost-push shocks. As such, it may have predictive power for risks to price stability that central banks need to monitor carefully. This is especially important for the future in which supply-side shocks, related to the green transition or structural changes in global value chains, threaten to drive inflation away from central banks’ targets more often than in the past.^[47] Strong money growth may make such shocks more persistent.

All in all, while a distinct monetary pillar is no longer essential to conduct monetary policy, money deserves a firm place in central bankers’ analysis.

Thank you.

Annexes

25 September 2023

[Slides](#)



1.

See, for example, Issing, O. (2021), “[The Return of Inflation?](#)”, *Project Syndicate*, 16 July.

2.

See, for example, Papadia, F. and Cadamuro, L. (2021), “[Does money growth tell us anything about inflation?](#)”, *Working Papers*, No 11, Bruegel, 4 November.

3.

Lucas, Jr., R.E. (1996), "Nobel Lecture: Monetary Neutrality", *The Journal of Political Economy*, Vol. 104(4), pp. 661-682.

4.

Volckart, O. (1997), "Early Beginnings of the Quantity Theory of Money and Their Context in Polish and Prussian Monetary Policies, c. 1520-1550", *The Economic History Review*, New Series, Vol. 50, No 3, pp. 430-449. After the Second World War, the contributions by Friedman (1956), Friedman and Schwartz (1963) and Lucas (1980) led to a proliferation of studies on the quantity theory of money. See Friedman, M. (1956), "The Quantity Theory of Money: A Restatement", in Friedman, M. (ed.), *Studies in the Quantity Theory of Money*, University of Chicago Press, Chicago, pp. 3-21; Friedman, M. and Schwartz, A.J. (1963), *A monetary history of the United States, 1867-1960*, Princeton University Press, Princeton; and Lucas Jr., R.E. (1980), "Two Illustrations of the Quantity Theory of Money", *The American Economic Review*, Vol. 70, No 5, pp. 1005-1014.

5.

The quantity theory of money can be developed from a simple accounting identity, or an "equation of exchange": over any period, the nominal expenditure on goods and services, $P*Y$, must equal the money used to settle these transactions, $M*V$. "P" is a price index, "Y" is a measure of real economic activity, "M" is the total stock of money and "V" is the velocity with which money circulates. For an exposition of the equation of exchange, see Fisher, I. (1912), "'The Equation of Exchange' for 1911, and Forecast", *The American Economic Review*, Vol. 2, No 2, pp. 302-319.

6.

At low frequencies, exogenous velocity shocks are largely irrelevant. Instead, they are near-uniformly driven by variations in interest rates, which is a direct implication of the stability of money demand.

7.

Vogel, R.C. (1974), "The Dynamics of Inflation in Latin America, 1950-1969", *The American Economic Review*, Vol. 64, No 1, pp. 102-114; Lothian, J.R. (1985), "Equilibrium Relationships between Money and Other Economic Variables", *The American Economic Review*, Vol. 75, No 4, pp. 828-835; McCandless Jr., G.T. and Weber, W.E. (1995), "[Some Monetary Facts](#)", *Quarterly Review*, Vol. 19, No 3, Federal Reserve Bank of Minneapolis, pp. 2-11; Dwyer Jr., G.P. and Hafer, R.W. (1999), "[Are Money Growth and Inflation Still Related?](#)", *Economic Review*, Vol. 84, No 2, Federal Reserve Bank of Atlanta, pp. 32-43. Excess money growth is often taken instead of money growth in recent empirical studies. See, for example, Gertler, P. and Hofmann, B. (2018), "Monetary facts revisited", *Journal of International Money and Finance*, Vol. 86, pp. 154-170.

8.

There is a debate about whether the relationship is stronger under fiat monetary regimes than under commodity standards. See, for example, Rolnick, A.J. and Weber, W.E. (1997), "Money, Inflation, and

Output under Fiat and Commodity Standards”, *Journal of Political Economy*, Vol. 105, No 6, pp. 1308-1321; and Benati, L. (2021), “Long-Run Evidence on the Quantity Theory of Money”, *Discussion Papers*, No 21-10, University of Bern.

9.

Lucas Jr., R.E. (1980), op. cit.; Benati, L. (2009), “[Long run evidence on money growth and inflation](#)”, *Working Paper Series*, No 1027, ECB, March; Assenmacher-Wesche, K. and Gerlach, S. (2007), “Money at Low Frequencies”, *Journal of the European Economic Association*, Vol. 5, No 2-3, pp. 534-542; Assenmacher-Wesche, K. and Gerlach, S. (2008), “Interpreting euro area inflation at high and low frequencies”, *European Economic Review*, Vol. 52, No 6, pp 964-986.

10.

Fратиани, M., Gallegati, M. and Giri, F. (2021), “International Historical Evidence on Money Growth and Inflation: The Role of High Inflation Episodes”, *The B.E. Journal of Macroeconomics*, Vol. 21, No 2, pp. 541-564; De Grauwe, P. and Polan, M. (2005), “Is Inflation Always and Everywhere a Monetary Phenomenon?”, *The Scandinavian Journal of Economics*, Vol. 107, No 2, pp. 239-259; Gertler, P. and Hofmann, B. (2018), op. cit.; and Jung, A. (2023), “The quantity theory of money and its role in central banking, 1870-2020”, forthcoming in: Farvaque, E. and Stanek, P. (Eds.), *Still conservative after all these years? Central banks frameworks and policies since Rogoff (1985)*.

11.

Benati, L. (2009), op. cit.

12.

Teles, P., Uhlig, H. and Valle e Azevedo, J. (2016), “Is quantity theory still alive?”, *The Economic Journal*, Vol. 126, No 591, pp. 442-464; Kugler, P. and Reynard, S. (2022), “Money and inflation in Switzerland”, *Swiss Journal of Economics and Statistics*, Vol. 158, No 1. At the same time, other studies found instability in the relationship between money demand and interest rates due to financial innovations. See, for example, Berentsen, A., Huber, S. and Marchesiani, A. (2015), “Financial Innovations, Money Demand, and the Welfare Cost of Inflation”, *Journal of Money, Credit and Banking*, Vol. 47, pp. 223-261.

13.

Lucas Jr., R.E. (2000), “Inflation and welfare”, *Econometrica*, Vol. 68, No 2, pp. 247-274.

14.

In an environment of subdued price pressures, velocity shocks play a much more important role, in relative terms, thereby blurring the signal from money growth. See, for example, Estrella, A. and Mishkin, F.S. (1997), “Is there a role for monetary aggregates in the conduct of monetary policy?”, *Journal of Monetary Economics*, Vol. 40, No 2, pp. 279-304.

15.

Sargent, T.J. and Surico, P. (2011), "Two Illustrations of the Quantity Theory of Money: Breakdowns and Revivals", *American Economic Review*, Vol. 101, No 1, pp. 109-128. Large and persistent structural shocks, such as the disinflationary impact of globalisation during the 1990s and 2000s, are likely to have further weakened the relation between money growth and inflation.

16.

The Deutsche Bundesbank was probably the best-known case of a central bank announcing annual money growth targets as of the 1970s. There is still an empirical debate about whether or not the Bundesbank really responded to deviations of monetary aggregates from these targets. See Gerberding, C., Worms, A. and Seitz, F. (2004), "[How the Bundesbank really conducted monetary policy: An analysis based on real-time data](#)", *Discussion Paper Series 1: Studies of the Economic Research Centre*, No 25, Deutsche Bundesbank.

17.

See, for example, Smets, F. and Wouters, R. (2007), "Shocks and Frictions in US Business Cycles: A Bayesian DSGE Approach", *American Economic Review*, Vol. 97, No 3, pp. 586-606.

18.

Masuch, K., Nicoletti-Altieri, S., Pill, H. and Rostagno, M. (2003), "The role of money in monetary policy making", in Issing, O. (ed.), *Background Studies for the ECB's Evaluation of its Monetary Policy Strategy*, ECB, Frankfurt am Main, November, pp. 187-228.

19.

See Issing, O. (2000), "Communication challenges for the ECB", opening statement at the CFS research conference "The ECB and its watchers II", Frankfurt am Main, 26 June.

20.

Empirical studies also find that money growth lost its significance as a driver of the policy response. See, for example, Cour-Thimann, P. and Jung, A. (2021), "Interest-rate setting and communication at the ECB in its first twenty years", *European Journal of Political Economy*, Vol. 70.

21.

ECB (2021), "[The ECB's monetary policy strategy statement](#)". See Svensson, L.E.O. (2000), "The First Year of the Eurosystem: Inflation Targeting or Not?", *American Economic Review Papers & Proceedings*, Vol. 90, No 2, May, pp. 95-99, for an early statement regarding the redundancy of the monetary pillar.

22.

Bordo, M.D. and Filardo, A. (2007), "Money Still Makes the World Go Round: The Zonal View", *Journal of the European Economic Association*, Vol. 5, No 2-3, pp. 509-523.

23.

Borio, C., Hofmann, B. and Zakrajšek, E. (2023), "[Does money growth help explain the recent inflation surge?](#)", *BIS Bulletin*, No 76, Bank for International Settlements.

24.

Benati, L. (2021), op. cit.

25.

Ratner, D. and Sim, J. (2022), "[Who Killed the Phillips Curve? A Murder Mystery](#)", *Finance and Economics Discussion Series*, No 028, Board of Governors of the Federal Reserve System; Schnabel, I. (2023), "[Disinflation and the Phillips curve](#)", speech at a conference organised by the European Central Bank and the Federal Reserve Bank of Cleveland's Center for Inflation Research on "Inflation: Drivers and Dynamics 2023", Frankfurt am Main, 31 August.

26.

Sargent, T.J. and Surico, P. (2011), op. cit. Similar conclusions are drawn in Gao, H., Kulish, M. and Nicolini, J.P. (2020), "[Two Illustrations of the Quantity Theory of Money Reloaded](#)", *Working Papers*, No 774, Federal Reserve Bank of Minneapolis.

27.

See, for example, Schnabel, I. (2020), "[Monetary policy in changing conditions](#)", speech at the second EBI Policy Conference on "Europe and the Covid-19 Crisis – Looking back and looking forward", Frankfurt, 4 November.

28.

The monetary base also includes currency in circulation. A distinction can be made between reserves that are held to cover the minimum reserve requirement and credit institutions' holdings of reserves over and above the level of required central bank reserves (excess central bank reserves).

29.

M3 consists of 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.

30.

Transactions within the euro area money-issuing sector are consolidated and do not affect broad money.

31.

ECB (2015), "[The transmission of the ECB's recent non-standard monetary policy measures](#)", *Economic Bulletin*, Issue 7.

32.

Purchases of financial instruments not included in M3 unequivocally reduce broad money only if such purchases are conducted, on net, by the money-holding sector as a whole.

33.

See, for example, ECB (2017), “Base money, broad money and the APP”, Economic Bulletin, Issue 6 / 2017. The use of non-standard measures after the global financial crisis, such as fixed rate full allotment in refinancing operations and long-term refinancing operations, implied that the multiplier had already fallen before the start of the APP.

34.

For an overview of the operational framework, see Schnabel, I. (2023), “[Back to normal? Balance sheet size and interest rate control](#)”, speech by Isabel Schnabel at an event organised by Columbia University and SGH Macro Advisors, New York, 27 March.

35.

For the importance of the capital channel, see Bordo, M.D. and Duca, J.V. (2023), “[Money Matters: Broad Divisia Money and the Recovery of Nominal GDP from the COVID-19 Recession](#)”, *Working Papers*, No 31304, National Bureau of Economic Research; and Giansante, S., Fatouh, M. and Ongena, S. (2022), “The asset reallocation channel of quantitative easing. The case of the UK”, *Journal of Corporate Finance*, Vol. 77, No 102294.

36. ↑

37.

Battistini et al. (2023), “The consumption impulse from pandemic savings – does the composition matter?”, published as part of the ECB Economic Bulletin, Issue 4/2023.

38.

Eickmeier, S. and Hofmann, B. (2022), “[What drives inflation? Disentangling demand and supply factors](#)”, *Working Papers*, No 1047, Bank for International Settlements; Gonçalves, E. and Koester, G. (2022), “[The role of demand and supply in underlying inflation – decomposing HICPX inflation into components](#)”, *Economic Bulletin*, Issue 7, ECB; Deutsche Bundesbank (2023), “[From the monetary pillar to the monetary and financial analysis](#)”, *Monthly Report*, January.

39.

Borio, C., Disyatat, P., Xia, D. and Zakrajšek, E. (2021), “[Monetary policy, relative prices and inflation control: flexibility born out of success](#)”, *BIS Quarterly Review*, Bank for International Settlements, September, pp. 15-29.

40.

The end of reinvestment under the APP portfolio mechanically reduces the amount of money in the economy as the Eurosystem receives the repayments of the principal maturing amounts. Repayments

of TLTROs have likely contributed to the slowdown in M3 growth to the extent that the repayments have induced banks to issue long-term bonds that are not included in M3. If these bonds are purchased by euro area residents, such transactions weigh on money growth.

41.

Musso, A. (2019), "[The predictive power of real M1 for real economic activity in the euro area](#)", *Economic Bulletin*, Issue 3, ECB.

42.

This is reinforced by the weak pass-through of policy rate changes to overnight deposit rates.

43.

For simplicity, this estimate assumes that M3 growth is zero. Positive M3 growth would result in a lower required amount of M1 to M3 shifting to reach the pre-global financial crisis ratio.

44.

Portfolio rebalancing could affect economic conditions through the bank lending channel. For example, it may affect bank funding costs, as banks have to pay higher interest for instruments outside the scope of M1. Also, banks that will lose deposits may not always be able to obtain funding in the market at reasonable prices. Unless replaced by central bank funding, this could lead banks with deposit shortfalls to restrain credit supply.

45.

Nearly 20 years ago, at the 2004 annual meeting of the Verein for Socialpolitik, Jürgen von Hagen gave a similar answer to this question. See von Hagen, J. (2004), "Hat die Geldmenge ausgedient?", *Perspektiven der Wirtschaftspolitik*, Vol. 5, No 4, pp. 423-453.

46.

See, for example, Cochrane, J. (2023), "The Fiscal Theory of the Price Level", Princeton University Press.

47.

Schnabel, I. (2022), "[Monetary policy and the Great Volatility](#)", speech at the Jackson Hole Economic Policy Symposium organised by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, 27 August.

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