A Proposal for Extracting Policy Information from the ECB's Second Pillar

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Abstract

This paper presents a procedure the ECB could employ within the framework of its second-pillar analysis. My procedure involves extracting from estimated money demand equations for the euro area policy information suitable for cross checking the signals obtained from the ECB's first pillar. Specifically, my procedure yields reference lines describing the evolution of the aggregates M2 and M3 consistent with the ECB's inflation objective and potential growth in euro-area real GDP. However, the reference lines based on my procedure differ from the ECB's reference value for M3 in several respects. Above all, my reference lines do not imply a fixed growth rate for the respective aggregate. Rather, they move up or down in response to changes in the ECB's refinance rate, its key policy variable. Furthermore they are updated to shifts in the estimated parameters in the money demand equations. For these reasons, my procedure is immune to some of the objections to the ECB's much criticised second-pillar analysis.

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1 Introduction

The ECB employs a two-pillar approach to setting monetary policy. Under the first pillar, it monitors a wide range of data and relies on various econometric models in order to forecast real growth and inflation of the euro area. Under the second pillar, it considers specifically monetary developments, which, in its view, play a crucial role in determining the future course of inflation. According to the ECB, it uses the second-pillar analysis largely for "cross checking" the policy information drawn from the first.

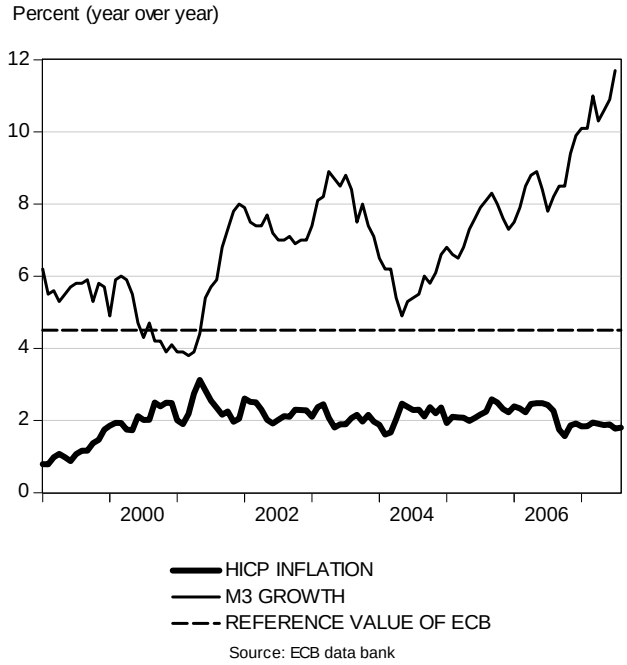
While the first pillar conforms to the approaches followed by other leading central banks, the ECB's emphasis on the second pillar is unusual. Numerous central banks, including the US Federal Reserve, no longer pay much attention to money. The relationship between inflation and money growth, they maintain, is not sufficiently stable to allow policy makers to forecast future price movements from monetary developments. Other central banks such as the Swiss National Bank still treat the monetary aggregates as important policy variables. Nevertheless, they do not follow the example of the ECB by placing money on a separate pillar.

New Keynesian models looming large in the current macroeconomic literature also tend to discount the usefulness of money. In these models, money does not play any role in the transmission of monetary policy disturbances to the real economy and the price level. Instead, the central bank is assumed to fix a credible inflation target, which serves as the nominal anchor for the real economy. The central bank influences real activity and the price level by setting a rate of interest consistent with its inflation target. It is of course possible to add to such new Keynesian models a money-demand equation. However, money demand is not essential for determining the nominal values of the variables, as both the level and rate of change in prices are tied down to the inflation target. Woodford (2007a,b) and Svensson (2007) are prominent macroeconomists supporting new Keynesian models without money. They fail to see a need for monitoring money, let alone for placing money on a separate pillar. They deny that the ECB is able to extract useful policy signals from money growth and favour abolishing its second pillar altogether. They take the ECB to task for using monetary indicators that – in their view – are unhelpful in gauging properly its policy course.[1]

The development of the euro-area money stock M3 since the introduction of the common currency tends to nourish doubts about the usefulness of the second pillar in setting monetary policy. The ECB has fixed a reference value of 4.5 percent for M3 growth. Provided real GDP is near its potential level, the reference value equals the rate of increase in M3 that the ECB considers to be consistent with its objective of keeping HICP inflation slightly below 2 percent. As indicated by Fig. 1, M3 growth since 2001 has exceeded continuously its reference value, in the past three years by an ever increasing margin. Despite the excessive growth in M3 during much of the period 2001-2007, inflation has hovered about 2 percent since 2002, contrary to what one would expect if the deviations from the reference value were to contain useful policy information.

[1] De Grauwe and Polan (2005) are other vocal critics of the ECB's second pillar.

Fig. 1: Euro-Area Inflation, Growth in the Money Stock M3 and Reference Value of ECB



Despite the difficulties of extracting policy signals from the aggregate M3, the ECB continues to emphasise the usefulness of its second pillar. It expends considerable efforts in explaining to the public the analysis underlying its second pillar. Nevertheless, I do not find the ECB's defence of its second pillar entirely convincing. Although the ECB's analysis leaves something to be desired, I do not wish to go as far as Woodford and Svensson and to reject money as a policy indicator. Rather, I sketch an alternative procedure the ECB could employ for extracting policy signals from the monetary aggregates. The procedure presented in this paper could usefully supplement the ECB's arsenal of analytical tools, as it is immune to some of the critical arguments raised against the ECB's second-pillar analysis.

My procedure draws on information derived from econometric estimates of money demand. It rests on the assumption that the ECB sets its key policy variable, the refinance rate, largely on the basis of its first-pillar analysis. Under the first pillar, the ECB is assumed to employ models and forecasting techniques that tend to disregard money. However, under the second pillar, the ECB monitors monetary variables with the aim of cross checking the information derived from the first. To this end, it estimates regularly long-run money demand equations. For my procedure to yield reliable policy signals, nominal money demand should be reasonably stable and determined by just a few key variables such as the price level, real GDP and interest rates. Provided the ECB is able to estimate simple and stable money demand equations, it constructs reference lines for the respective monetary aggregate. These reference lines are both similar to and different from the ECB's reference value of 4.5 percent displayed in Fig. 1. They are similar in the sense that they trace the evolution of the respective monetary aggregate consistent with the ECB's inflation objective and its assumption about potential real growth. However, they differ from the ECB's reference value in three respects:

- They define levels, rather than rates of change in the respective monetary aggregate.
- They shift up or down in response to revisions in the parameter values, as the ECB re-estimates its money demand equations.
- Most importantly, they shift up or down in response to changes in monetary policy, i.e., to adjustments in the ECB's refinance rate.

Thus, the reference lines not only incorporate information about the ECB's inflation objective and potential real growth. They also take account of changes in monetary policy and in the estimated parameters of the money demand equations.

In a next step, the ECB compares the actual development of the respective monetary aggregate with the reference lines. Substantial deviations from the reference lines imply that the ECB should review the policy conclusions drawn from its first pillar. I should note that the procedure presented here for cross checking the ECB's first-pillar analysis would yield meaningful results even if new Keynesian models were to provide a realistic description of the monetary transmission process in modern economies. Provided money demand is stable, it contains important policy information regardless of whether it serves merely as a residual or plays an active role in the transmission process. Forecasts based on models without money suppress a potentially important piece of information: They ignore the income elasticity of money demand, i.e., a parameter establishing a link between money and economic activity. Because of this link, money may contain information on future inflation. Economists, including Woodford and Svensson, agree that central banks should utilise all available information shedding light on future inflation. Thus, one should not ignore *a priori* monetary indicators in setting monetary policy.[2]

In the following, I explain my procedure for extracting policy information from money demand. Section 2 offers a critical discussion of the ECB's second-pillar analysis. This is followed by a brief review of existing research on euro-area money demand. In Sections 4 and 5, I apply my procedure to the aggregates M3 and M2 respectively. The paper ends with a summary and conclusions.

2 The ECB's Second Pillar: A Critical Review

In an address to the ECB Watchers Conference of 2007, Jürgen Stark (2007), Member of the ECB's Executive Board, emphasised that the ECB's monetary analysis embodies three main elements:

- The ECB does not focus exclusively on headline M3, but follows a broad-based approach exploiting a full set of monetary, financial and economic information. In particular, the ECB analyses the components and counterparts of M3 and other monetary and credit aggregates.
- The ECB employs a wide range of empirical models, comprising money demand equations, time series indicator models and structural general

[2] Woodford (2007b, p. 29) admits that "[t]here is no *a priori* reason to exclude monetary variables from the set of indicators" to be monitored by central banks.

equilibrium models. These models are used for explaining developments in money and credit, for identifying innovations in these variables and for exploring the broader outlook for inflation and real growth.

- The models are supplemented by informed judgment about prospective structural changes in the euro area's monetary and financial sector.

Relying on its monetary analysis, the ECB (2004, pp. 45-49; 2005, pp. 13-16; 2007, pp. 55-61) has repeatedly argued[3] that the surge in M3 growth during the period 2001-2003 did not jeopardise price stability, while a similar expansion since 2004 has threatened to fuel inflation. In the first period, the ECB attributed the acceleration of M3 growth to portfolio shifts into liquid monetary assets, due to public concerns about an uncertain economic and financial outlook. Such portfolio shifts were considered to have little impact on future inflation. Therefore, the ECB decided to cut interest rates despite the surge in money growth. In the second period, by contrast, the ECB found the surge in M3 growth to be correlated with a strong credit expansion driven by easy financing conditions and financial innovations designed to boost bank lending. The ECB came to the conclusion that such developments called for tightening of monetary policy. Otherwise, they would stimulate inflation in due course.

Although the 2001 spike in M3 growth indeed did not cause inflation to pick up significantly, the ECB's analysis raises a number of questions. Even if M3 is adjusted for portfolio shifts (henceforth called "adjusted M3"), that aggregate still exceeded the ECB's reference value by 1 to 1.5 percentage points during the period 2001 to 2003 (see Chart F in ECB, 2005, p. 16). Thus the inflation trend should have accelerated from 2 to 3 or 3.5 percent had adjusted M3 emitted correct monetary policy signals. Furthermore, only the future will tell whether the ECB's distinction between portfolio- and credit-based expansions in M3 growth will pass the test of time and will be helpful in improving inflation forecasts.

Another approach followed by the ECB consists in developing monetary indicators of inflation risks. In as much as such indicators tend to lead inflation, they may be used for assessing the risks to price stability arising from the ECB's current policy course. The ECB has explored the leading indicator role of a wide range of variables. It has not only forecasted inflation from a bivariate relationship with unadjusted and adjusted M3 (ECB, 2004, pp. 56-57), but has also examined other indicators such as M1 and M2, loans of financial institutions to the private sector and P* measures of excess liquidity based on adjusted and unadjusted M3 (ECB, 2006, pp. 22-25; 2007, p. 70). In general, the ECB feels that these indicators act as useful warning signals of future inflation.

As far as the indicator role of M3 is concerned, the ECB (2006, p. 25) argues that M3 growth, adjusted for portfolio shifts, provides relatively unbiased forecasts of future inflation. In a critical assessment of the second pillar, the ECB researchers Fischer, Lenza, Pill and Reichlin (2006) explore various bivariate forecasting models used by the ECB in its monetary analysis. They find that unadjusted M3 over predicts trend inflation. Adjusted M3, by contrast, yields forecasts matching average actual inflation. However, the forecasts based on adjusted M3 are much more volatile than those derived from the unadjusted variant. Furthermore, forecasts resting on M3 manage to

[3] See also Stark (2007).

capture the inflation trend, whereas forecasts relying on the ECB's first pillar are able to trace the fluctuations around the average.

The recent academic literature (Gerlach, 2004; Neumann and Greiber, 2005; Von Hagen and Hofmann, 2007; Assenmacher and Gerlach, 2007) has emphasised the importance of low-frequency movements in M3 for future inflation, a view also endorsed by the ECB (2003, p. 87). Assenmacher and Gerlach favour a modified version of a standard Phillips curve, with inflation decomposed into high-frequency and low-frequency components. High-frequency movements in inflation are determined by the output gap and various cost-push factors, while the low-frequency movements depend on the low-frequency components of M3 growth, output growth and the rate of change in M3 velocity, with the latter assumed to be related to the first difference in long-term interest rates. Assenmacher and Gerlach conclude that their modified Phillips curve fits the data well, i.e., money is useful for forecasting low-frequency movements in inflation. However, they qualify their conclusions somewhat by pointing out that their results rest on data drawn to a large extent from the pre-euro period, a problem to be discussed below.

In a thorough study, Hofmann (2006) assesses the performance of various monetary indicator models in out-of-sample forecasts of inflation. He considers standard bivariate forecasting models, forecasts based on the common factors contained in a group of monetary indicators, forecast combinations and the modified version of the Phillips curve proposed by Assenmacher and Gerlach. He finds the bivariate models for M3 growth, adjusted for portfolio shifts, to provide better inflation forecasts than all the other models considered in his paper. However, he also qualifies his conclusions to some extent as his results suggest that the forecasting powers of M3 have deteriorated in recent years.

In a more recent paper, Berger and Österholm (2007) apply a mean-adjusted Bayesian VAR approach to forecasting euro-area inflation from M2 and M3 growth. They find that out-of-sample forecasts of inflation are improved considerably if money growth is included. This result not only holds for bivariate but also trivariate and fourvariate BVARs. Nevertheless, they warn against overemphasising the importance of money. Like Assenmacher/Gerlach and Hofmann, they conclude that the forecast performance of money is substantially lower for the most recent sample periods than for the distant past.

In its 2007 economic survey of the euro area, the OECD (2007, Annex 2.A2) too finds that the predictive ability of M3 has declined. The OECD splits the forecasting period into two halves: 1995 to 2000 and 2000 to 2005. Like Hofmann, the OECD considers a variety of monetary indicators: Growth in M1, M2, adjusted and unadjusted M3, and in private lending, a measure of the monetary overhang (difference between M3 and the value estimated from a long-run money demand equation), a P* indicator, various gap and capacity indicators, and several other indicators. The forecasts provided by these indicators are compared with those derived from a base-line model. For the first period, several monetary indicators indeed contain useful information on future inflation, with M2 able to improve short-horizon forecasts, while M1, M3 and the P* model perform better at longer horizons. Credit growth, by contrast, contains little predictive power. The gap, capacity and other real indicators work well at short horizons. However, the results are different for the second period. The performance of the monetary indicators worsens considerably, except for the P* model, while several real variables outperform the

monetary aggregates. Thus, while money was useful for long-horizon forecasts until 2000, it is uncertain whether its predictive power is still intact today.

Even if stable demand equations for the euro-area monetary aggregates were to exist, forecasting inflation from money growth would run up against a fundamental obstacle. Suppose that the ECB is successful in achieving its inflation objective and manages to keep inflation slightly below 2 percent over an extended period of time. It reacts correctly to any shock threatening to jeopardise its inflation objective by adjusting monetary policy. Suppose further that M3 grows at the reference value of 4.5 percent. Now the ECB faces a negative shock to aggregate demand, opening up the prospect of deflation. To offset the deflation threat, the ECB responds to the shock by lowering its refinance rate. The drop in the interest rate will stimulate growth in demand for M3, while the business cycle contraction will have the opposite effect. If money demand is strongly sensitive to changes in interest rates, M3 growth is likely to accelerate and surpass its reference value. However, the positive deviation from the reference value does not imply that the ECB is pursuing an inflationary monetary policy. On the contrary, it signals a correct response of policy makers to the deflationary shock. Only if the ECB were to overreact to the shock and to stimulate money growth excessively would the positive deviation from the reference value herald a surge in inflation. Therefore, it is important to distinguish between stabilising and destabilising movements in money growth. Stabilising movements occur so long as the ECB manages to keep inflation close to its objective. The ECB correctly alters its refinance rate in response to destabilising shocks. Money growth also fluctuates substantially about the ECB's reference value, while the variance of inflation is small. In these circumstances, the ECB would waste valuable research resources by trying to forecast changes in inflation from movements in past money growth. Since inflation would remain more or less constant at slightly less than 2 percent, while money growth would fluctuate considerably, the ECB could not possibly detect a statistically significant relationship between these two variables even it confined its analysis to low-frequency movements in money growth.[4]

For these reasons, the predictive power of money growth is likely to dissipate gradually provided the ECB continues to keep inflation near 2 percent as it has done quite successfully since 2002. In this case, forecasting inflation from money growth would become an exercise in futility even if money demand in the euro area were to remain stable. Considering the pitfalls of forecasting inflation from money growth, I propose an alternative procedure for extracting policy signals from the monetary aggregates. This procedure rests on estimates of money demand equations for the euro area. If money demand is sufficiently stable, my procedure may be employed for cross checking the policy information derived from the ECB's first pillar.

My procedure bears some similarities to an approach proposed by Reynard (2007). Relying on data for the US, the euro area and Switzerland, he argues that money is a reliable predictor of future price movements if it is adjusted for changes in velocity and potential output. His adjusted measures of money are derived from estimated money demand equations. Therefore, his approach is also immune to the criticism raised above. However, in contrast to my procedure, Reynard's approach does not take account of the ECB's actual policy stance. He relates money demand to the low-frequency filtered components of interest rates, rather than their actual levels.

[4] Svensson (2007) makes a similar point.

3 Euro-Area Money Demand: A Brief Review

The ECB has long emphasised that euro-area money demand is sufficiently stable to serve as a useful policy device. It has investigated extensively money demand, employing both aggregated and disaggregated approaches.[5] Researchers outside the ECB have also produced a variety of studies on euro-area money demand.[6] According to these studies, money demand was reasonably stable until the introduction of the euro. However, if the sample period is extended beyond 1999, researchers have had less success in uncovering stable money demand equations, at least so long as simple specifications, relating real demand for M3 to real GDP and interest rates, are tested. Some researchers have been able to restore stability by introducing additional explanatory variables of money demand such as measures of uncertainty capturing the portfolio shifts between 2001 and 2003, proxies for wealth such as house and stock prices, or the inflation rate as a proxy for the opportunity cost of holding money. The ECB (2007, pp. 64-68) admits that simple models explaining the dynamics of M3 are unsatisfactory because this aggregate "also includes assets that are held for saving and portfolio reasons and therefore are influenced by a richer set of variables" (p. 64). The ECB mentions as additional factors influencing M3 new financial instruments such as structured products limiting downside risk, borrowing to finance M&A activity, the rapid growth in the M3 deposits of non-monetary financial intermediaries, strong capital inflows to the euro area boosting M3 growth, and the influence of wealth on money demand.

In general, existing studies suggest that stability obtains only for complex specifications of M3 demand. The need for complex specifications poses a dilemma if my procedure is applied to M3 demand. My procedure involves forecasts of money demand consistent with the ECB's inflation objective, real potential growth and the ECB's current policy stance. It is easy to derive such forecasts from simple equations relating real demand for M3 to real GDP and interest rates. However, if real demand for M3 is influenced by a host of additional variables, the forecasting exercise becomes tricky because the future evolution of these additional variables must also be taken into account. Some of these additional variables are highly elusive and difficult to predict. Therefore, it is an empirical question of whether simple or complex specifications of money demand yield the most reliable policy signals. I do not explore this question in this paper, but I admit that it would have to be investigated thoroughly if my procedure were to be applied in practice. For the time being, I limit myself to simple specifications of M3 demand even though the resulting parameter estimates may suffer from instabilities complicating the signal extraction problem.

4 An Alternative Procedure for Extracting Policy Signals from Money Growth – The Case of M3

In extracting policy information from M3 demand, I assume that the ECB proceeds as follows: It estimates at the beginning of each year simple long-run money demand

[5] See Coenen and Vega (2001), Bruggemann, Donati and Warne (2003), and Calza and Sousa (2003) for studies on euro-area demand for M3. Recently, the ECB has presented research on sectoral models of money demand (Von Landesberger, 2007).

[6] See OECD (2007, pp. 66-67) and Dreger and Wolters (2006), and the literature cited there.

equations, relating the level of M3, deflated by the HICP consumer price index, to the level of real GDP and to various interest rate variables. All the variables, except interest rates, are seasonally adjusted and expressed in logs. The ECB is assumed to compute these equations from rolling samples covering the past forty quarters. A sample period of forty quarters appears to be reasonable. It is long enough to yield meaningful results. Likewise, it is not overly long and precludes using information from the distant past that may be irrelevant for current policy decisions. Sensitivity analysis suggests that the results do not alter much if the rolling sample period is shortened by one or two years.

The estimated parameter values of the money demand equations are shown in Table 1. For reasons of data availability, the first sample period ending in 2000Q4 only covers 38 quarters. The estimates are based on cointegration analysis. One of the estimated cointegration equations may be treated as a long-run money demand function, as displayed in Table 1. However, the estimates obtained for M3 are not entirely satisfactory. The Johansen test suggests that in 3 out of the 8 sample periods covered by Table 1 no statistically significant cointegration equation exists.

In as much as we may trust the estimated equations, they point – with one exception – to a statistically significant relationship between real money demand and real GDP, but the corresponding elasticity, drifting up from 1.3 in the first sample period to over 2 in 1994Q1 – 2003Q4 and down again to 1.4 in the last sample period, is not very stable. As to interest rates, I employ the differential between the three-month euribor interest rate and the ten-year government bond yield as an independent variable. I include the interest rate differential because in other studies it was found to exert a statistically significant impact on euro-area demand for M3. Note that the sign of the semi-elasticity with regard to the interest differential turns from positive to negative as we advance in time. However, it has become statistically significant in the most recent past even though its stability still leaves something to be desired.[7] I also consider in the first two equations the bond yield – taken by itself – but it fails to explain much of the movements in M3 demand. Inclusion of the bond yield in the equations for the subsequent sample periods tends to generate absurd estimates for the income elasticity of money demand. Similar problems arise if the 3-month euribor rate is substituted for the bond yield. Therefore, I generally confine myself to the differential as the sole interest rate variable included in the money demand equations.

Next, I assume that the ECB, from these estimated money demand equations, derives reference lines describing the evolution of the nominal values of M3, likely to be consistent with its objective of keeping inflation slightly below 2 percent. Moreover, I take account of the fact that the ECB is prepared to accommodate the increase in the demand for M3 arising from potential real growth in the euro-area economy.

To determine such a reference line, the ECB, say, at the beginning of 2007 estimates the money demand equation displayed in Table 1 for the sample period 1997Q1 - 2006Q4. It then constructs a reference line for nominal M3, covering the five-quarter

[7] Economic theory suggests that the relationship between real demand for M3 and the interest rate differential may be positive or negative. In the case of a positive sign, an increase in the differential causes funds to move from non-monetary assets into deposits that are part of M3 and yield a market-related return. In the case of a negative sign, funds move from deposits without a market-related return to monetary and non-monetary assets with a market-related return.

period from 2007Q1 to 2008Q1. To this end, the ECB derives a corresponding reference line for real M3. It inserts in the equation for real M3 demand an expansion path for potential real GDP, which is assumed to match the long-run trend in the actual values. Thus, potential real GDP equals the estimated values derived from the following regression equation:

$$\log rgdp = \underset{(4185.7)}{14.11} + \underset{(58.4)}{0.0052}\, trend\,,\ R^2 = 0.98\,,\ \text{sample period: 1991Q1 – 2007Q2.}$$

Since the data for the actual level of real GDP are known only for the period up to 2007Q2 (as of the time of estimation), the values of the potential level for 2007Q3 onwards are extrapolated from the estimated trend. The ECB is also assumed to take account of the policy-induced portion of the interest rate variables and to set that portion equal to the values estimated from the following regression equations:

$$indiff = \underset{(-9.37)}{-2.743} + \underset{(5.10)}{0.485}\, ref\,, R^2 = 0.45\,,$$

$$by = \underset{(9.78)}{2.906} + \underset{(5.40)}{0.521} ref\,, R^2 = 0.48\,,\ \text{sample period: 1999Q1-2007Q2,}$$

where *indiff*, *by* and *ref* denote the interest rate differential, the bond yield and the ECB's refinance rate respectively.[8] The ECB in turn plugs into the real money demand equation the policy-induced portion of the interest rate variables. It derives the reference lines on the assumption that it will leave the refinance rate unchanged in the period 2007Q1 – 2008Q1. Thus the reference line indicates how real M3 should evolve if the ECB were to keep its policy rate of interest unchanged. Of course, the ECB will update its reference line in the course of the period 2007Q1 – 2008Q1, as it adjusts its refinance rate. The reference lines displayed in Fig. 2 constitute such updated versions, incorporating the refinance rates actually set by the ECB up to 2007Q2. Lastly, the ECB determines analogous reference lines for nominal M3 by multiplying the quarterly reference values for real M3 with its objectives for the HICP index. These quarterly objectives are assumed to lie on an expansion path for the HICP index consistent with its aim of keeping inflation slightly below 2 percent per year. For simplicity, the expansion path for the HICP index is derived on the assumption that the ECB is willing to tolerate an increase in consumer prices of exactly 0.5 percent per quarter from 2007Q4 to 2008Q1.

As indicated earlier, the location and shape of the reference lines depend not only on the ECB's inflation objective and its assumption about potential growth, but also on its policy rate of interest and the estimated parameters of the money demand equations. In this paper, the ECB is assumed (what I am sure it is doing in practice) to set its refinance rate at levels that – in its view – will help achieving or safeguarding its inflation objective in the longer run. Thus, the procedure presented here does not yield any information on the appropriate levels of the ECB's refinance rate. Instead, the ECB must rely on its first pillar in order to determine the levels of its refinance rate that are in sympathy with its inflation objective. Since my proposed procedure exploits information drawn from the first pillar, it cannot serve as a stand-

[8] I calculated quarterly values of the refinance rate as follows: For example, in 2007Q2 the ECB changed its refinance rate once on 13 June from 3.75 to 4 percent, that is, on the 74th day of the second quarter. Therefore, the average is given by (3.75*73+4*18)/91=3.80.

alone approach to setting monetary policy. However, it can be employed to cross check the results of the ECB's first-pillar analysis.

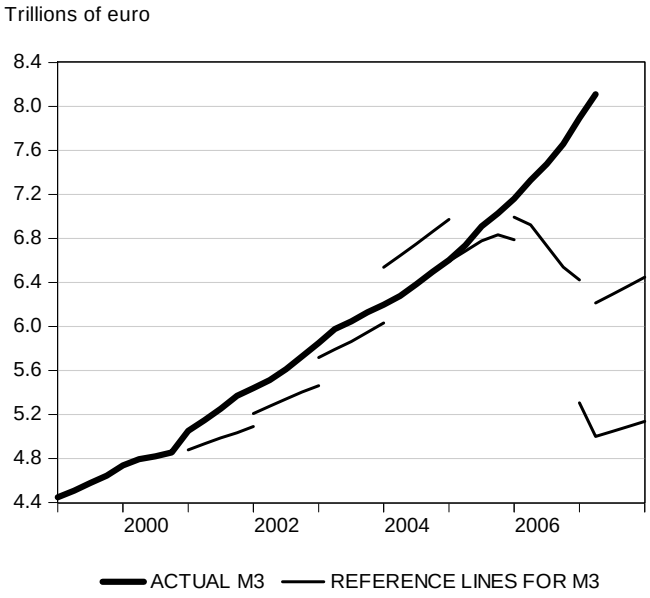
Table 1: Values of Elasticity and Semi-Elasticity of Real Demand for M3

Sample periods	Log M3 with Respect to			
	Log Real GDP	Interest Rate Difference*	10-Year Bond Yield	Constant
1991Q4 – 2000Q4**	1.26 (6.92)	0.0035 (0.79)	0.0014 (0.29)	-2.63
1992Q1 – 2001Q4	1.47 (14.06)	0.0083 (2.60)	0.0023 (0.65)	-5.63
1993Q1 – 2002Q4**	1.77 (13.62)	0.0098 (0.96)		-9.80
1994Q1 – 2003Q4	2.15 (7.26)	-0.1089 (-3.96)		-15.40
1995Q1 – 2004Q4**	1.71 (6.02)	-0.1749 (-5.06)		-9.29
1996Q1 – 2005Q4	1.71 (4.84)	-0.2343 (-5.49)		-9.35
1997Q1 – 2006Q4	0.76 (0.72)	-0.5632 (-4.74)		3.80
1997Q2 – 2007Q1	1.42 (2.52)	-0.2935 (-4.87)		-5.14

Numbers in parentheses are t values. Data on M3 are deflated by the HICP index. Data sources: Real GDP from 1995Q1 onwards: ECB, for earlier data Eurostat (data adjusted to make them comparable with those of the ECB), M3 and interest rates: ECB.
* Difference between 3-month euribor rate and 10-year bond yield.
** Cointegration equations not statistically significant.

The reference lines emerging from my procedure are displayed in Fig. 2. They cover the period 2001Q1 to 2008Q1 and extend from the first quarter of each year to the same quarter of the following year. Furthermore, I compare the reference lines with the actual development of M3. Major deviations in M3 growth from its reference lines imply that the signals extracted from money growth are at variance with those obtained from the ECB's first pillar, as the actual development of M3 is inconsistent with the inflation objective and the assumption of potential growth. In the case of major deviations, the ECB would have to assess the situation in order find out which of the two pillars – if at all – is likely to emit the correct policy signals.

Fig. 2: Actual Levels of M3 and Reference Lines



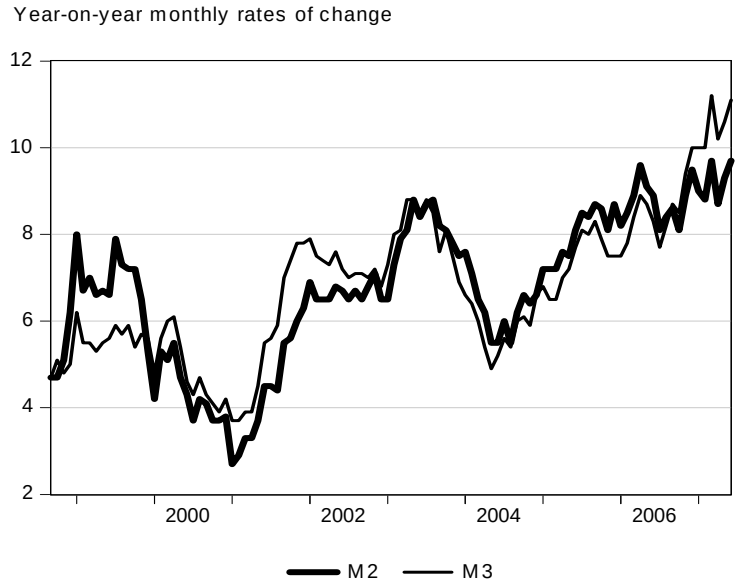
A comparison of the actual evolution of M3 with the reference lines does not point to major deviations up to the beginning of 2006. If the estimated money demand equations can be trusted at all, my analysis at best suggests that the ECB's policy course may have been a bit too easy in 2001-2003 and a bit too restrictive in 2004. Thus, in downplaying the inflationary effects of portfolio-based money growth, the ECB may not have paid sufficient attention to the surge in M3 growth in 2001 and overreacted, at least initially, to the renewed acceleration in 2004. However, I do not wish to read too much into the information extracted from M3 demand. As may be seen from Fig. 2, the reference lines derived for 2006 and 2007 move about erratically. According to Table 1, both the income elasticity of M3 demand and semi-elasticity with respect to the interest rate differential are highly sensitive to even a slight advance of one quarter in the sample period 1997Q1 – 2006Q4. Considering the instabilities in the parameter estimates for the most recent sample periods, I doubt that Fig. 2 yields useful policy conclusions for 2006 and 2007. Currently, trying to extract reliable policy signals from M3 growth appears to be fruitless. In my view, the ECB should not pay much attention to the aggregate M3, at least not at the present moment.

5 An Application to M2

Considering the difficulties arising from M3, I also apply my procedure to an alternative aggregate, i.e., the money stock M2.[9] Fig. 3 shows that there was a fairly close positive correlation between the growth in the aggregates M2 and M3. Nevertheless there were significant deviations at times even though the two aggregates generally moved in tandem. Therefore, demand for M2 may be more stable than demand for M3.

[9] Reynard (2007) considers euro-area M2 to be a better policy indicator than M3.

Fig. 3: Growth in the Euro-Area Aggregates M2 and M3



In line with the analysis for M3, the ECB, say, at the beginning of 2007 estimates a demand equation for real M2, covering the sample period 1998Q2 to 2006Q4. The starting date of the sample period is determined by the availability of data. Real M2 is defined in the same manner as real M3. The log of real demand for M2 is related to the log of real GDP and the interest rate differential. As in the case of M3, the estimates presented in Table 2 are based on cointegration analysis. The Johansen cointegration test suggests that the three variables considered in the analysis are cointegrated in all the sample periods. There exists at least one cointegrating equation, which I interpret as a long-run money demand function.

The estimates in Table 2 raise a number of problems requiring discussion. First, the results are sensitive to the choice of the interest rate variable in the money demand equation. If the interest differential is replaced by the euribor rate, the Johansen procedure does not point to any cointegration among the variables. Therefore, I reject this specification. By contrast, if the interest rate differential is replaced by the bond yield, cointegration exists, but the coefficient for real GDP becomes unstable and tends to assume implausibly low values in the sample periods ending with 2003Q4 and 2004Q4. Fig. 4 shows why econometric studies are likely to underestimate the influence of real GDP on M2 demand in the early part of the period under consideration if the bond yield is employed as an interest rate variable. Fig. 4 relates the velocity of M2 (nominal GDP divided by nominal M2) to the euribor rate and the bond yield. Velocity clearly tended to decrease from 1997 to 2007. The downward trend in velocity could be explained by two factors: (1) The income elasticity of money demand exceeds unity, i.e., real money demand rises proportionally more than real GDP or (2) the downward trend in velocity reflects the decline in the bond yield over much of the sample period, i.e., real money demand rose relative to real GDP because of falling bond yields. Although the decrease in interest rates no doubt tended to boost money demand, it is implausible to attribute the downward trend in velocity to movements in the bond yield alone. The bond yield ceased to decline in 2005 and rose again substantially thereafter. Yet, velocity continued to proceed on its downward course. If velocity had responded mainly to

movements in the bond yield, it should have rebounded after 2005. For this reason, I suspect that equations including the bond yield provide misleading estimates of the income elasticity of money demand. A better bet is to use the interest rate differential. As Table 2 clearly indicates, this specification yields estimates of the income elasticity exceeding unity, which in turn accounts mainly for the downward trend in velocity.

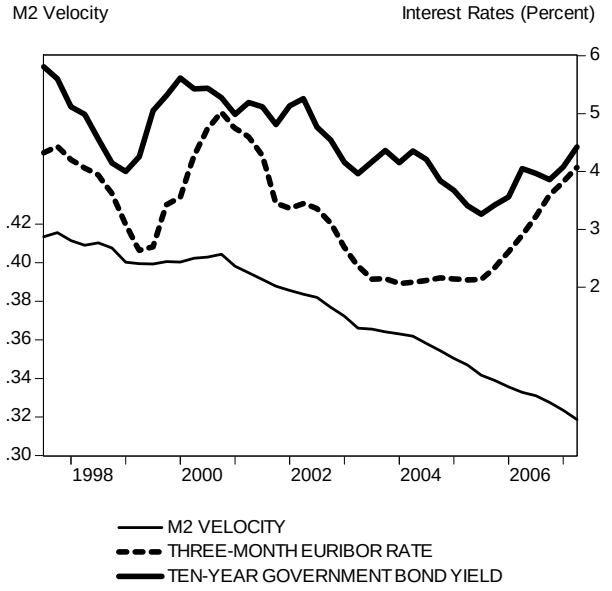
Table 2: Values of Elasticity and Semi-Elasticity of Real Demand for M2

Sample Periods	Log M2 with Respect to		
	Log real GDP (income elasticity)	Interest Rate Difference	Constant
1998Q2 – 2003Q4	1.50 (21.8)	-0.048 (-9.5)	-6.29
1998Q2 – 2004Q4	1.52 (10.4)	-0.074 (-7.4)	-6.53
1999Q2 – 2004Q4	2.30 (11.9)	-0.046 (-6.1)	-17.73
1998Q2 – 2005Q4	1.88 (11.4)	-0.063 (-5.0)	-11.69
2000Q2 – 2005Q4	2.50 (14.2)	-0.047 (-8.0)	-20.52
1998Q2 – 2006Q4	1.94 (19.5)	-0.036 (-3.9)	-12.56
2001Q2 – 2006Q4	2.43 (19.0)	-0.047 (-9.0)	-19.58
Data source: ECB.			

Second, the estimates provided in Table 2 suggest that the income elasticity of M2 demand increased gradually over the period 1998-2006. It rose from about 1.5 in 1998Q2 - 2003Q4 to almost 2 in 1998Q2 - 2006Q4 provided the sample periods always start with 1998Q2. The gradual increase in the income elasticity suggests that its estimates may be sensitive to the choice of sample period. To explore this problem, I assume that the ECB estimates its money demand equations also from sample periods of fixed length. At the end of each year, it estimates money demand equations from data based on the past 22 quarters. The estimated coefficients based on sample periods of fixed length are shown in the table too, which reveals a jump in the estimated income elasticity from about 1.5 to 2.3-2.4 from the first sample period to the subsequent periods with a fixed length of 22 quarters. To deal with the uncertainties arising from the size of the income elasticity, I assume that the ECB – at the beginning of each year – derives two versions of the money demand equation: one estimated from data based on a sample period with a fixed length of 22 quarters

and the other one from data based on a sample period of varying length but always starting with 1998Q2.

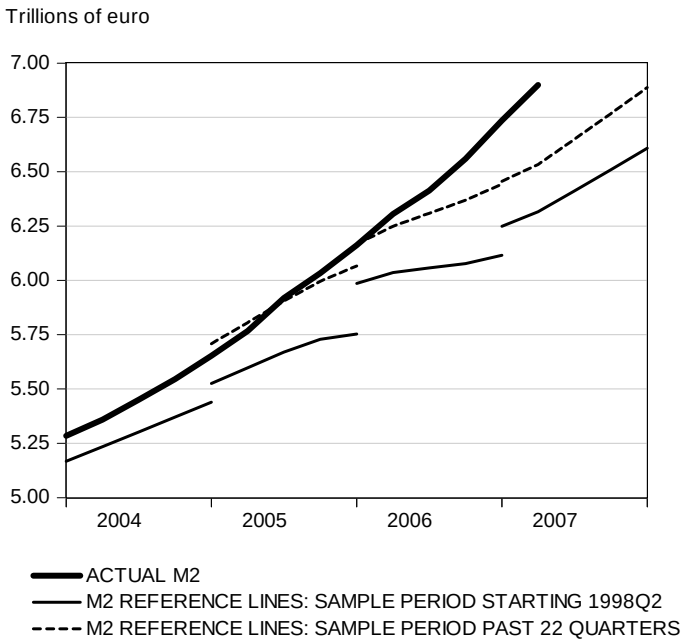
Fig. 4: Velocity of M2 and Interest Rates



In a next step, the ECB constructs a pair of reference lines for nominal M2 for the five-quarter period from 2007Q1 to 2008Q1. It derives this reference line in the same manner as those for M3. The reference lines emerging from my procedure are displayed in Fig. 5. They are not only derived for the period 2007Q1-2008Q1, but also for the three preceding five-quarter periods. The reference lines for the period 2004Q1 to 2007Q2 are based on the refinance rates actually set by the ECB. As already indicated, the reference line for 2007 is based on the assumption that the ECB will keep its refinance rate at the current level of 4 percent until the beginning of 2008.

The reference lines may be compared with the actual development of M2 for the period up to 2007Q2. As indicated by Fig. 5, the actual development of M2 more or less conformed to the reference lines until the beginning of 2006. However, since then, the actual levels have moved substantially above the reference values. The uncertainties about the size of the income elasticity do not appear to matter much as this conclusion holds regardless of the sample period chosen for estimating the money demand equations. Thus, my analysis suggests that the ECB's current monetary stance is still too expansionary, a view probably shared by key officials at the Frankfurt institution. If the ECB has abstained from raising its refinance rate since 13 June, 2007, this reflects, in all likelihood, concerns about the current turmoil in financial markets and the attendant risks of a global recession, calling for a great deal of caution in tightening further monetary policy.

Fig. 5: Actual Levels of M2 and Reference Lines



6 Summary and Conclusions

This paper presents a procedure the ECB could employ within the framework of its second-pillar analysis. My procedure involves extracting from estimated money demand equations for the euro area policy information suitable for cross checking the signals obtained from the ECB's first pillar. Specifically, my procedure yields reference lines describing the evolution of the aggregates M2 and M3 consistent with the ECB's inflation objective and potential growth in euro-area real GDP. However, the reference lines based on my procedure differ from the ECB's reference value for M3 in several respects. Above all, my reference lines do not imply a fixed growth rate for the respective aggregate. Rather, they move up or down in response to changes in the ECB's refinance rate, its key policy variable. Furthermore they are updated to shifts in the estimated parameters in the money demand equations. For these reasons, my procedure is immune to some of the objections to the ECB's fixed reference value. Since 2001 actual M3 growth has exceeded – most recently by an ever increasing margin – the ECB's fixed reference value (Fig. 1). Despite persistent M3 growth in excess of the ECB's reference value, it does not necessarily follow that the ECB has pursued an overly expansionary policy course. To interpret correctly the growth patterns revealed by Fig. 1, we must distinguish between stabilising and destabilising fluctuations in money growth. If M3 growth moves above its reference value because the ECB has rightly lowered its refinance rate in response to an incipient deflationary shock, this does not herald an impending acceleration of inflation. My procedure takes account of this problem by allowing for the reference lines to move up or down in response to changes in the ECB's refinance rate. My procedure rests on the assumption that the ECB, under its first-pillar, uses all available information to set its refinance rate at levels consistent with its inflation objective. In these circumstances, the reference lines derived from my procedure are

also likely to be consistent with the ECB's inflation objective. Therefore, by comparing actual growth of the respective aggregate with the reference lines, the ECB may cross check the policy signals derived from its first pillar. Of course, my procedure yields sensible results only if demand for the respective aggregate is reasonably stable.

Such cross-checking exercises suggest that the ECB since its inception has pursued monetary policies largely consistent with its inflation objective. According to the reference lines derived for M3, the ECB could have pursued a slightly more restrictive course over the period 2001-2003 and a slightly more expansionary course in 2004. However, the results for M3 should be treated with caution. Demand for that aggregate – at least for the simple specifications chosen in this paper – is not very stable, notably not for the most recent sample periods. Therefore, the ECB, in my view, should not pay too much attention to M3. By contrast, the results for M2 are more encouraging than for those M3. The development of M2 was largely in sympathy with the reference lines derived in my paper, except for the period since the beginning of 2006, when M2 growth started to move above its reference lines. This implies that European monetary policy at present is still too expansionary, a view probably shared by key ECB officials. Nevertheless, the ECB is reluctant to tighten further monetary policy in the face of the current turmoil in financial markets and the risks of a global recession.

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