OECD Economics Department Working Papers No. 411

Wealth Effects on Money Demand in EMU: Econometric Evidence

Laurence Boone,

Fanny Mikol,

Paul van den Noord

https://dx.doi.org/10.1787/437345756132

OECD

Unclassified **ECO/WKP(2004)34**

Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

09-Nov-2004

English - Or. English

ECONOMICS DEPARTMENT

ECO/WKP(2004)34
Unclassified

WEALTH EFFECTS ON MONEY DEMAND IN EMU: ECONOMETRIC EVIDENCE

ECONOMICS DEPARTMENT WORKING PAPER No. 411

by
Laurence Boone, Fanny Mikol and Paul van den Noord

JT00173482

English - Or. English

ABSTRACT/RÉSUMÉ

Wealth effects on money demand in EMU: econometric evidence

This paper investigates the determinants of money demand (M3) in the euro area. It specifically examines the potential impact of financial and housing wealth on money demand. It tests the hypothesis, whether wealth associated with increases in asset prices is used to finance liquidity holdings in a standard portfolio context. Regressing velocity on interest rates and a wealth variable (a composite of residential property and stocks) within an error-correction framework provides evidence of positive wealth effects from financial and housing assets on money demand in the long run, but no significant impact in the short run. Tests suggests that the long-run and dynamic money demand equations are stable and have not been disrupted by the adoption of the euro on 1 January 1999, while the impact of wealth on money demand may have increased.

JEL codes:E41, E52

Keywords: Money demand, inflation, wealth

* * * * * * *

Les effets de richesse sur la demande de monnaie dans l'union économique et monétaire : une analyse économétrique

Cet article étudie les facteurs qui déterminent la demande de monnaie (M3) dans la zone euro. Il examine de manière explicite quels sont les effets de richesse liés aux avoirs mobiliers et immobiliers sur la demande de monnaie. Il teste l'hypothèse selon laquelle, dans un contexte classique de choix de portefeuille, la richesse résultant d'une hausse des prix des actifs est employée pour financer la détention de liquidités. Un modèle à correction d'erreur est mis en oeuvre pour effectuer une régression économétrique de la vitesse de circulation de la monnaie sur les taux d'intérêt et sur une variable composite de richesse (qui agrège immeubles et actions), faisant apparaître des effets de richesse liés aux actifs mobiliers et immobiliers sur la demande de monnaie qui sont significatifs à long terme mais non à court terme. Différents tests suggèrent que les équations de demande de monnaie, tant dynamiques que de long terme, sont stables et n'ont pas été perturbées par l'adoption de l'euro le 1er janvier 1999 tandis que l'importance des effets de richesse sur la demande de monnaie semble s'être accrue.

Classification JEL: E41, E52

Mots clés : demande de monnaie , inflation, richesse

TABLE OF CONTENTS

WEALTH EFFECTS ON MONEY DEMAND IN EMU: ECONOMETRIC EVIDENCE

Laurence Boone, Fanny Mikol and Paul van den Noord[1]

Introduction

1. Since the advent of the single currency on 1st January 1999, the year-on-year growth rate of broad money (M3) in the euro area has persistently exceeded the "reference value" of 4½ per cent which the European Central Bank (ECB) uses as the benchmark for a prudent, non-inflationary expansion of the money stock (Figure 1).[2] Aside from a short spell between mid-2000 to mid-2001 when growth of M3 fell short of the reference value, M3 growth in excess of the reference value has hovered in a range of 2 to 4 percentage points per annum. This has raised concerns that the "monetary overhang" could at some point boost inflation (ECB, 2004). These concerns may be unfounded if the "excess" money growth can be shown to stem from an increase in liquidity preference. The latter may be linked to the secular increase in wealth associated with shareholding and homeownership, which in a context of financial market liberalisation should ease the liquidity constraints facing economic agents. This paper seeks to examine this link.

2. Many observers as well as the ECB explain the "monetary overhang" that built up since the advent of the euro by a combination of two essentially temporary factors: *i)* a flight into liquidity in response to heightened uncertainty in the wake of the stock market slump in 2000/01; and *ii)* the historically low level of market interest rates and hence low opportunity cost of holding liquidity. If this assessment is correct, growth in M3 should return to (and perhaps initially undershoot) the reference value once uncertainty surrounding the stock market has diminished and bond yields recover. This assessment is in line with the standard view that developments in M3 may contain information about opportunity cost variables for holding money beside the nominal short rate, including a range of yields on financial and real assets that may be considered as substitutes for money and other liquid assets.[3] However, there may also be longer-term forces at work. Gains in financial and non-financial wealth may act as a source of money demand over and above the short-term opportunity cost effects. More than three decades ago Friedman (1970) suggested that wealth may be a determinant of money demand in a portfolio framework. We posit that financial market liberalisation has raised the importance of such wealth gains and that these gains may have contributed to the increase in the ratio of M3 to GDP.

---

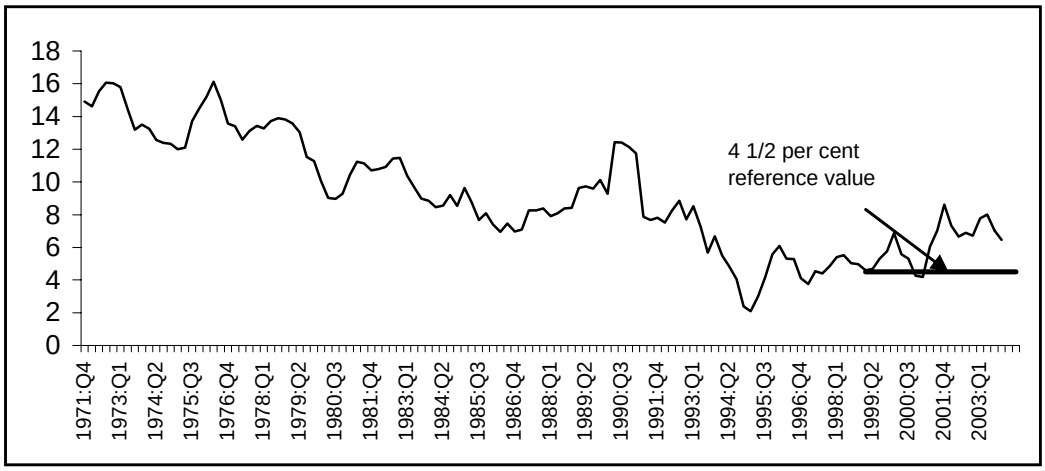
1. Laurence Boone is now at Barclays but previously in the Economics Department. Fanny Mikol is *élève administrateur* at ENSAE in Paris and Paul van den Noord is in the Economics Department. This paper draws on research done by Fanny Mikol during her stay as a summer trainee in the Economics Department. The authors are indebted to Marie-Christine Bonnefous for the research assistance and to colleagues in the Economics Department for their helpful comments, in particular Peter Hoeller, Vincent Koen, Paul O'Brien and Torsten Slok. They are also grateful to Julian van Landesberger and Livio Stracca of the ECB for their constructive comments. Obviously the authors assume full responsibility for remaining errors and omissions. Moreover, any opinions expressed in this paper are the authors' and should not be attributed to the Organisation or its member countries.

2. This reference value is based on the assumption that, with trend output growth estimated at 2 to 2½ per cent and trend velocity declining by around ½-1 per cent, in order to keep inflation at around 1½ per cent, the money stock should grow by 4¼ to 4¾ per cent per year. The coverage of M3 has been changed several times to remove distortions, for example due to non-euro area residents' holdings, and was modified also with the adoption of the euro by Greece in 2001. This paper always refers to the revised series.

3. For a review of theories that support this view see Nelson (2003).

Figure 1. Growth of M3 in the euro area

Per cent, compared to the same quarter in the previous year



3. In this paper we regress the ratio of M3 to GDP on short- and long-term interest rates and a composite of residential property and stock prices within an error-correction framework. We find evidence for a positive relationship between asset prices and liquidity ratios in the long run, but no significant relationship in the short run. This long-run positive effect suggests that the observed money overhang may indeed reflect wealth effects on money demand. Tests suggest that this relationship is stable and has not been disrupted by the introduction of the euro on 1 January 1999, except that wealth may play a greater role post-1998. Similarly, the dynamic relationship explaining the ratio of M3 to GDP, which includes wealth in the error-correction term, is stable and has not been disrupted by the introduction of the euro.

Theoretical underpinnings

4. The quantity theory of money assumes a stable relationship between the volume of activity or transactions (*Y*), the price level (*P*) and the money stock (*M*). This theory is based on the notion that the velocity of money circulation (*V*) is either constant or exogenous. If this assumption holds, the identity

(1) $MV = PY$

may be interpreted as a money demand equation of the following type:

(2) $M = PY/V$

5. The economics profession has since long rejected this equation as too simple because it does not take into consideration the possibility of endogenous variations in money velocity, associated with developments in the cost of credit or the opportunity cost of holding liquidity. This has led to specifications of the type:

(3) $M = M(\overset{+}{P}, \overset{+}{Y}, \overset{+}{irs}, \overset{-}{irl})$

6. In this equation money demand is assumed to rise if the short-term interest rate (*irs*) increases, because of a higher return on short-term deposits. Moreover, money demand is assumed to decrease if the long-term interest rate or bond yield (*irl*) rises, because the opportunity cost of holding liquidity as opposed to bonds increases. It is this specification, or variants thereof, that has been used frequently as a starting point for estimating money demand equations to explain developments of M3 in the euro area. Variants include Fagan and Henry (1998) and Coenen and Vega (2001) who suggest to enter the difference between *irs* and *irl* (*i.e.* the yield curve) in the equation, thus restricting the coefficients of *irs* and *irl* to be the same. In a more recent study, Brand and Cassola (2004) remove *irs* and only retain *irl*, whereas Avouyi-Dovi *et al*. (2003) and Bruggeman *et al.* (2003) emphasise the importance of *irs* as a measure of the "own rate of

money", *i.e.* the yield on near-money included in M3. Artis and Beyer (2004) remove *irs* and retain *irl* as well, but argue that *irl* should represent the German bond rate, this being the relevant benchmark rate in Europe. Inflation is sometimes introduced in the equation as a proxy of the capital loss of holding money and to capture the impact of inflation on real interest rates.[4]

7. In this paper we augment the standard money demand equation with an explanatory variable that captures the possible impact of wealth (*W*) on money demand. The basic idea is that a gain in wealth will exert an influence on the demand for money through two channels. One channel is the substitution effect (Friedman, 1988): a rise in asset prices makes these assets more attractive alternative investment vehicles in comparison with money. The other channel is the income effect: as wealth increases, part of the additional wealth may be stored in liquid instruments. Moreover, as the turnover of financial transactions increases with the higher level of asset prices, the demand for money for transaction purposes will rise. The substitution effect of wealth on money demand is negative and the income effect is positive, hence *a priori* the sign of the net impact of wealth on money demand is undetermined. This leads to the following specification:

$$(4) \quad M = M(\overset{+}{Y}, \overset{+}{P}, \overset{+}{irs}, \overset{-}{irl}, \overset{?}{W})$$

8. Fase and Winder (1998) have found empirical evidence for a positive sign on the wealth variable in this relationship for the European Union prior to the adoption of the euro in 1999, including net financial wealth derived from balance sheet data as an explanatory variable. By contrast, Bruggeman *et al.* (2003) reject a relationship between money demand and share prices for the euro area, including observations for the period after the adoption of the single currency. Moreover, they find that interest rates are not very well determined in the equation. There are recent studies which aim to estimate the impact of the volatility in share prices. The *Institut für Weltwirtschaft* (2003), for example, finds a positive correlation with M3, the rationale being that volatility and the associated increased uncertainty leads to a flight in low-risk liquid assets that are included in M3. To our knowledge, however, the relevance of a broader wealth variable that includes property prices along with share prices has not been tested to date.

Empirical analysis

9. First, a long-term relationship between the ratio of the money stock to GDP and the fundamentals is estimated. The econometric method rests on co-integration, following Stock and Watson (1993).[5] Second, a dynamic relationship in the form of an error correction model (ECM) is derived. For both the long and short-run relationships, a set of statistical tests are run to assess the stability of the relationship, particularly with respect to the introduction of the euro.

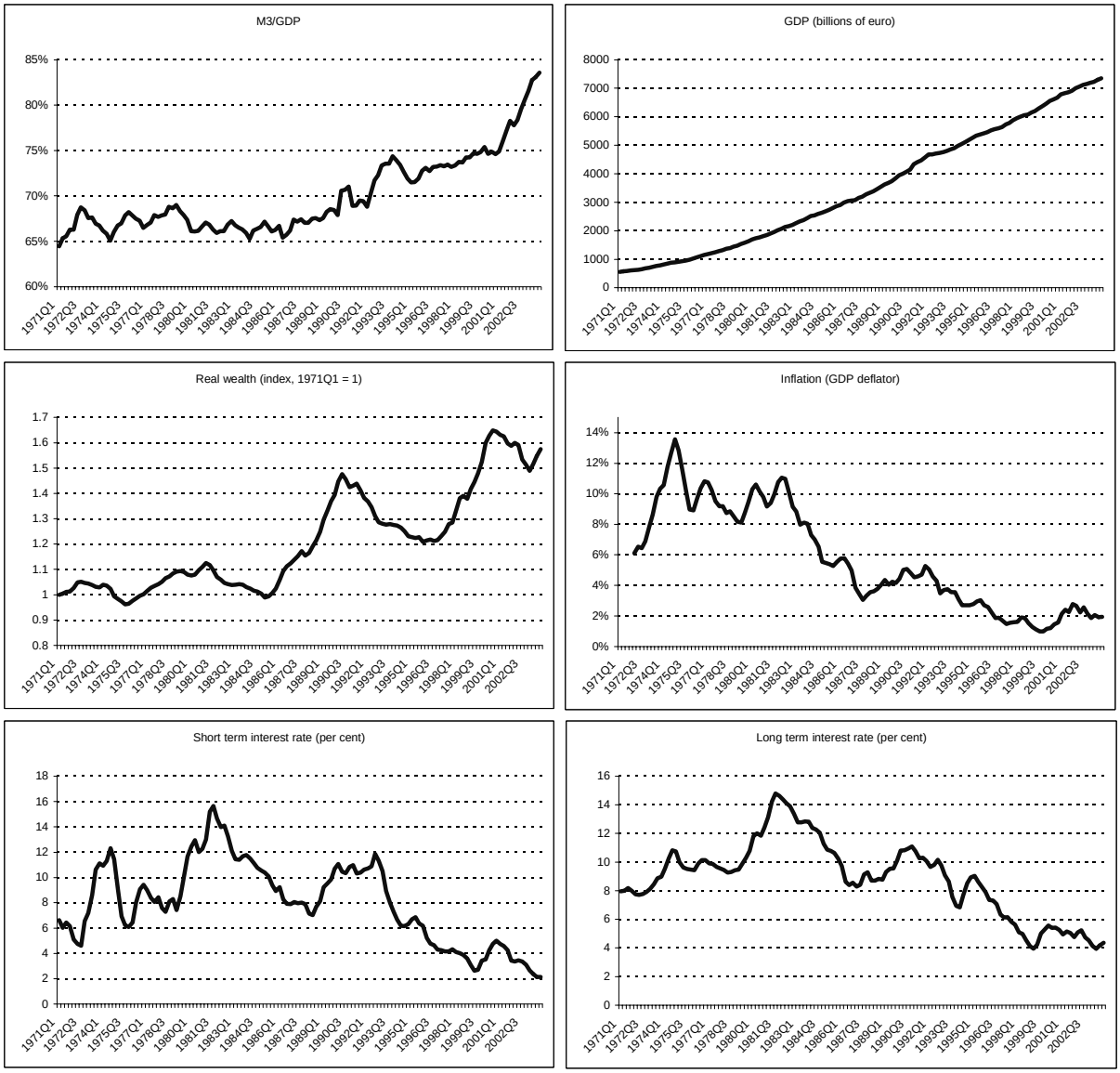
10. Data are quarterly, covering the period 1971 Q1 until 2003 Q4. The variables considered are broad money M3, real GDP, the GDP deflator, nominal short and long-run interest rates, and wealth (Figure 2). The wealth variable is provided by the Bank for International Settlement and is a geometric weighted average of equity prices and residential and commercial property prices. They are available for all the countries of the euro area, except Greece, Luxembourg and Portugal, on a quarterly basis, over the whole period in real and nominal terms.[6] All other data are extracted from the OECD *Economic Outlook No. 75* database.

4. It also allows for some degree of short-run price non-homogeneity, see Bruggeman *et al.* (2003).

5. Stock and Watson (1993) proposed to estimate the long-run relationship between macroeconomic variables in the form of co-integration, adding leads and lags of the change in the co-integrating variables, which make the usual statistical tests (such as the t-test for significance of the variables) valid. A first step consists of testing the integration order of the relevant variables, since co-integration can only take place between variables that are integrated of the same order. A second step consists of estimating the co-integrating vectors between those variables.

6. More details on the construction of the data can be found in Borio and Lowe (2002).

Figure 2. The data



The long-run relationship

11. Various interpretations of the theoretical relationship were tested to identify the best possible long-run equilibrium relationship.[7] Our preferred theoretical representation is one in which the elasticity on nominal output is fixed at unity, based on the premise that in the absence of changes in interest rates or asset prices money velocity should be stationary, in line with Artis and Beyer (2004). This specification can be written as:

$$(5) \quad m_t - p_t - y_t = \alpha_1.irs_t + \alpha_2.irl_t + \alpha_3.\pi_t + \alpha_4.w_t + k$$

where *m* stands for log of money demand, *p* for the log of the GDP deflator, *y* the log of real GDP, *irs* and *irl* respectively the short and long-term interest rates, π for inflation, *w* for wealth and k is a constant. This equation was estimated with and without wealth, with and without inflation, and with different inflation measures.[8] The semi-elasticities for interest rates and inflation are not always significant, depending on the definition of inflation and whether the wealth variable is included.

12. In the following, we use the "best specification" identified to analyse the long-run relationship between money demand, prices, interest rates and wealth (Table 1).[9] In this representation, wealth is expressed in real terms and inflation is removed because it is not significant.[10] We check whether the wealth variable indeed adds explanatory power to the long-term monetary equilibrium, without adversely affecting the statistical properties of this equation. Table 1 reports the results for both estimates, with and without wealth.[11] The equation which includes wealth performs significantly better. The residuals from the equation without wealth do not pass the ADF tests, and therefore the hypothesis of co-integration between the ratio of broad money to GDP and interest rates is rejected. In practice, this means that residuals from this equation are trended and that we cannot proceed with standard statistical tools to analyse this relationship. By contrast, when including wealth, the ADF tests strongly reject the hypothesis of a unit root in the residuals. Thus we cannot reject the hypothesis of co-integration between the ratio of broad money

7. The standard Dickey-Fuller procedure confirmed that all the relevant variables are integrated of order 1 so that a co-integration vector may be estimated.

8. Various measures of inflation were considered: the GDP deflator, the private consumption deflator, as quarterly year-on-year growth rates or quarter-on-quarter growth rates. M3, GDP, the GDP deflator and wealth are in logs. When inflation is introduced in the equation, both interest rates and the wealth variables are in nominal terms to avoid introducing a colinearity between the explanatory variables that would damage the statistical analysis.

9. "Best specification" in this context refers to the statistical properties of the relationship in equation (5). We also experimented with a version of the equation in which the coefficients on real output and the price level were freely estimated. Without the wealth variable this yielded a point estimate of the coefficient on real output equal to 1.3, which is significantly greater than 1 based on a Wald test. The estimated coefficient on prices in this specification was exactly 1, so the combined coefficient on nominal output is normally between 1 and 1.3. Introducing the wealth variable in this specification yielded an insignificant coefficient on wealth albeit with a positive sign. The coefficient on real output remained practically unchanged at 1.3 while the coefficient on the price level fell to 0.8. So with the wealth variable included the combined coefficient on nominal output would normally be close to 1. This seems to support our assumption that money velocity ought to be stationary in the absence of changes in real asset prices or interest rates.

10. That inflation does not have any influence over M3 in the long run should not surprise for a sample where inflation has been declining throughout the sample to reach a relatively low level (Gerlach, 2003).

11. Obviously wealth is an endogenous variable and there is unavoidably multicollinearity with the interest rate variables. However, the specification allows to distinguish the pure interest rate and wealth channels, which is the purpose of this study.

to GDP, real wealth, and the short and long interest rates.[12] In addition, the explanatory power is significantly higher when wealth is introduced in the relationship. The Bera-Jarque normality test shows that the distribution of the residuals is normal.

Table 1. Long term money demand equation

Dependant variable: **(M/PY)**	**Co-integration coefficients** **(Standard Errors)**	
	Without wealth	With wealth
Constant	20.03 (0.02)	19.9 (0.01)
Short term interest rate	0.0089 (0.015)	-0.0069 (0.002)
Long term interest rate	0.031 (0.004)	-0.0044 (0.003)
Wealth		0.268 (0.018)
R2 adjusted	0.65	0.90
ADF unit root test in the residual (probability of rejecting the unit root hypothesis)	P=0.40	P=0.87

13. Nearly all explanatory variables have the expected sign. A rise in the long term rate triggers a substitution effect in the sense that agents augment their holdings in less liquid assets outside M3 relative to their income. Perhaps surprisingly, this is also the case for a rise in the short-term rates. One explanation may be linked to expectations: a rise in short-term rates may be expected to induce a fall in long-run rates as monetary policy tightening will ease inflationary pressure. This will prompt substitution away from liquid assets into bonds.[13] Overall, interest rates entail strong substitution effects. By contrast, the variable measuring wealth has a positive sign, suggesting the income effect from wealth outweighs a substitution effect.

12. The Johansen procedure was also used to test for a co-integrating relationship among these variables and concludes in favour of the existence of at most two co-integrating vectors between this set of variables, at the 5 per cent significance level. The coefficients estimated with Johansen vary from those estimated with Stock and Watson, which is a usual result over a short sample period.

13. The negative sign on short-term interest rates may also suggest that it is a rather incomplete proxy for the own rate of return on M3.

The short-run relationship

14. The second step of the procedure consists in estimating the short term dynamic relationship between the change in money velocity and the change in interest rates, the inflation rate and asset prices. The co-integrating vector estimated above, lagged once, is introduced as an explanatory variable, acting as an error correction term. In this equation, the dependant variable is real money. The dynamic of GDP is freely estimated because short run variations in income might yield a different allocation between liquid and illiquid saving vehicles. The short-run equation is estimated as:

$$\Delta\left(\frac{m}{p}\right)_t = \alpha[\left(\frac{m}{p.y}\right) - \alpha_3 irs - \alpha_4 irl - \alpha_6 w - k]_{t-1}$$
$$+ \sum_{i=1}^{4} \beta_{0i} \Delta\left(\frac{m}{p}\right)_{t-i} + \sum_{i=1}^{4} \beta_{1i} \Delta w_{t-i} + \sum_{i=1}^{4} \beta_{2i} \Delta irs_{t-i} + \sum_{i=1}^{4} \beta_{3i} \Delta irl_{t-i} + \sum_{i=1}^{4} \beta_{4i} \Delta y_{t-i} + \sum_{i=1}^{4} \beta_{5i} \Delta \pi_{t-i} \quad (6)$$

where Δ stands for the first difference operator, and 4 lags are initially introduced, since the variables are quarterly. Insignificant variables are removed in a sequential fashion.

Table 2. Long-term and dynamic relationships

	Long term equation		Dynamic equation		
	All sample, with wealth	Change after 1999	All sample	Change after 1999	
	I	II	III	IV	V
constant	19.87**	n	19.87**	n	n
Irs	-0.007**	-0.038**	-0.007**	n	n
Irl	-0.004*	N	-0.004*	n	n
wealth	0.27**	0.41**	0.27**	n	n
Ecm			-0.036**	n	n
dm(-1)			0.36**	n	n
dm(-2)			0.20**	n	n
dirs(-1)			-0.002*	n	n
dirl(-1)			-0.002*	n	n
dinflation(-1)			-0.35**	-0.85**	-1.06**
dinflation(-2)			0.19*	n	n
Dgdp(-2)			0.30**	n	n
R2 adj.	0.90	0.91	0.38	0.36	0.38
SE	0.022	0.021	0.005	0.005	0.005
SSR	0.059	0.050	0.003	0.003	0.003
ADF	-2.7				

Note: Column I is the long-run relationship estimated over the whole sample. Column II is the same co-integrating vector as column I, but allowing for a change in the coefficients after the introduction of the euro. When such a change takes place, the value by which the coefficient is affected is reported in the cell, otherwise a "n" denotes no change. Column III, IV and V summarize information on the error-correction representation. Column III is the full sample estimate of the dynamic relationship. Column IV allows a change in the dynamic coefficients only, through a dummy variable. Column V allows a change in all coefficients, using the same technique. ** and * denote significance at the 5 and 10% level.

15. The estimated equation is satisfactory (Table 2, column III). The explanatory power is significant, and the standard statistical tests are passed without difficulties. The error correction term is significant at the 1 per cent level, pointing to the existence of an equilibrium relationship between money demand, the level of interest rates and wealth. The magnitude of the coefficient is in line with those previously estimated in the literature (Calza *et al*. 2001, Coenen and Vega 2001, or Brand and Cassola 2004), suggesting that the speed of adjustment is quite slow, with a half-life slightly greater than two years.[14] Other significant variables in the short run are the changes in interest rates, changes in GDP and changes in inflation. Changes in wealth are not significant even at the 10 per cent level. Short run fluctuations in both interest rates are negatively correlated with the variations of money demand, possibly reflecting that M3 embodies short term and somewhat longer term deposits. The growth rate of inflation has a negative effect on M3, in line with the expected flight from liquidity that takes place when inflation is rising.

Has the adoption of the euro had an effect on the stability of the relationship?

16. The importance of the evolution of M3 for the assessment of inflation risks over the medium and long term – which plays a prominent role in the ECB's policy framework – is strongly dependent on the stability of the money demand relationship. Structural changes may affect the stability of an econometric relationship, and the adoption of the euro may qualify as such. It is difficult to test for a break in an econometric relationship as it might take some time between the dates at which the change occurs and the full impact on the relevant relationship. Regarding the adoption of the euro, another difficulty stems from the fact that this changeover is very recent.

17. The strategy followed in this paper is to use several tests, on both the long-term and the dynamic relationship.[15] The adoption of the euro on 1 January 1999 may represent a regime change and we search for a break in the money demand equation at this date. There are three types of testing procedure: *i)* the forecasting and break point Chow tests, *ii)* testing for a change in the coefficient by introducing a dummy variable taking the value zero before the introduction of the euro and one afterwards, *iii)* comparing the performance of the equation estimated for a shorter sample (which stops at the end of 1998) with the full sample. These three procedures and the results are presented below.

The statistical tests do not detect a structural change following the introduction of the euro

18. The Chow breakpoint and forecast tests are used to identify a structural break in the relationship. The idea of the breakpoint Chow test is to fit the equation separately for each sub sample and to see whether there are significant differences in the estimated equations. A significant difference indicates a structural change in the relationship. One major drawback of the breakpoint test is that each sub sample requires at least as many observations as the number of estimated parameters. When this is not the case, such as for our dynamic equation, one may use the Chow forecast test. The Chow forecast test estimates two models, one using the full set of data, and the other using a long sub period. A large difference between the two models casts doubt on the stability of the estimated relation over the sample period. As shown in Table 3, the null hypothesis of a change in the two sub-relationships compared to the main one is rejected:

14. The half-life is given by the formula $\ln(1/2)/\ln(1-\alpha)$.

15. More details on tests for regime changes may be found in Boone and Girouard (2002).

Table 3. Chow tests for structural breaks

	Breakpoint (1999 Q1) (Probability of a structural break)	Forecasts (1999Q1-2003Q4) (Probability of a structural break)
Long term relationship	0.009	0.08
Dynamic relationship	n.r	0.11

Note: n.r stands for non relevant, as there are too many parameters to estimate.

Allowing a structural shift in the coefficient

19. The second procedure introduces a dummy variable which changes the estimated coefficients after the potential break date, i.e. it takes the value 0 between 1971:1 and 1998:4 and 1 between 1999:1 and 2003:4. This is akin to the Chow test, but it will also give an estimate of the magnitude of the change, if there has been a change with the inception of the euro. The estimated co-integrating vector is thus the following:

$$\log(M_3/p.y) = (\alpha_3 + \alpha_3'.\delta_{t>1999:I}).\log w + (\alpha_4 + \alpha_4'.\delta_{t>1999:I}).irs + (\alpha_5 + \alpha_5'.\delta_{t>1999:I}).irl + cte + cte'.\delta_{t>1999:I} \quad (7)$$

We include a dummy variable in both the long-term equilibrium and the dynamic relationship.[16] The results are shown in Table 2 above and indeed suggests that there has been some change with the inception of the euro. For the long-run relationship, this procedure suggests that the impacts of the short-term interest rate and wealth on money demand have increased with the adoption of the euro. For the dynamic relationship, all dummies are insignificant except for the one on the change in the inflation rate. This could well reflect the move towards a lower inflation regime that has completed with the creation of the euro. Although it is difficult to draw firm conclusions from this test, it does suggest that the influence of the wealth variable has become more important since 1999.

20. In a third procedure, coefficients are estimated over the reduced sample, ending in 1998:4, and compared to the full sample estimate, for both the long run and the dynamic relationships. As shown in Table 4, there are no significant changes in the coefficients, and the residuals are unaltered. Compared with the results from the dummy procedure, this suggests that the regime change might be too recent to affect the whole sample estimates.

16. For the short-run relationship a significant coefficient for a dummy should be interpreted as the inception of the euro having an impact on the response of the growth rate of money to changes in the explanatory variables.

Table 4. Estimation over a sample ending in 1998Q4 compared to full sample estimates

1. Long-run equation

	Full sample coefficients (standard errors)	Shorter sample coefficients (standard errors)
Short- term interest rates	-0.007 (0.002)	-0.006 (0.002)
Long-term interest rates	-0.004 (0.003)	-0.005 (0.003)
Wealth	0.27 (0.02)	0.27 (0.02)
R2 adjusted	0.90	0.82
Standard error of regression	0.022	0.021
Sum of squared residuals	0.06	0.046

2. Dynamic equation

	Full sample coefficients (standard errors)	Shorter sample coefficients (standard errors)
Error-correction	-0.036 (0.02)	-0.046 (0.02)
ΔM3, 1 lag	0.36 (0.08)	0.30 (0.08)
ΔM3, 2 lags	0.20 (0.07)	0.17 (0.07)
ΔGDPV, 2 lags	0.30 (0.09)	0.32 (0.08)
ΔInflation, 1 lag	-0.35 (0.14)	-0.31 (0.14)
ΔInflation, 2 lags	0.19 (0.12)	0.12 (0.12)
ΔIRS, 1 lag	-0.002 (0.001)	-0.002 (0.001)
ΔIRL, 1 lag	-0.002 (0.001)	-0.003 (0.002)
R2 adjusted	0.38	0.50
Standard error of regression	0.005	0.005
Sum of squared residuals	0.003	0.003

21. Overall, the tests confirm the stability of the long-term and dynamic relationship since the introduction of the euro, although some variables, most notably wealth, appear to exert a stronger influence on money growth. The results for the long and short-run relationships are summarised in Table 5. Regarding the stability of the long-run equilibrium between money, inflation, wealth and interest rates, the tests reject the null hypothesis of a rupture in the co-integrating relationship. However, using the dummy procedure, the estimated parameters associated with the co-integrating variables are not always stable. More precisely, both short-term interest rates and the wealth variables do appear to have more influence on the evolution of M3 following the inception of the euro. Reducing the estimation sample so that it ends before the introduction of the euro does not alter the estimated coefficients; if anything, the explanatory power is slightly higher for this shorter sample period, which could reflect the change in the coefficient that has been detected, post 1998, for short-term interest rates and wealth. The results of the three procedures are similar for the error-correction model.

Table 5. Summary results of the stability tests

Testing procedures	Long-term equation	Dynamic equation
1. Chow tests		
Forecast test (break from 1999 Q1)	Stable	Stable
Break point test (break between 1998 Q4 and 1999 Q1)	Stable	Not relevant
2. Dummy after the introduction of the euro	Stable relationship but increased influence of wealth and short- term interest rates	Stable
3. Short versus full sample	Stable	Stable

Did wealth push up M3 growth?

22. What matters for the policy maker is to what extent wealth fluctuations may explain the overshooting of the ECB's M3 target. In this section, we first assess the contribution of wealth to changes in M3 over the recent past. Then we use the equilibrium relationship to project long-term changes in M3 with and without wealth, as if we were running these forecasts just before the euro changeover. This gives a measure of the forecasting errors that can be made when asset prices are not taken into account to project M3 growth.

23. Breaking down the M3 evolution into the different explanatory components provides information on the relative contribution of each variable. The long-term relationship is written as:

$$(8)\quad \frac{m_3}{p.y} = \alpha_6.w + \alpha_4.irs + \alpha_5.irl + ecm$$

The contribution of each explanatory variable X over a given period to the change in the liquidity ratio M_3/P.Y, (Ctr(X)), is given by:

$$(9)\quad Ctr(X) = \left(\frac{M_3}{P \cdot Y}\right)_{t-1} \alpha_i \Delta X$$

where Δ represents the change of the relevant variable over a pre-determined period and X stands for the log of wealth or the interest rates. Table 6 below presents the contribution of each of the explanatory variables to the long-run evolution of real money demand over the past eight years.

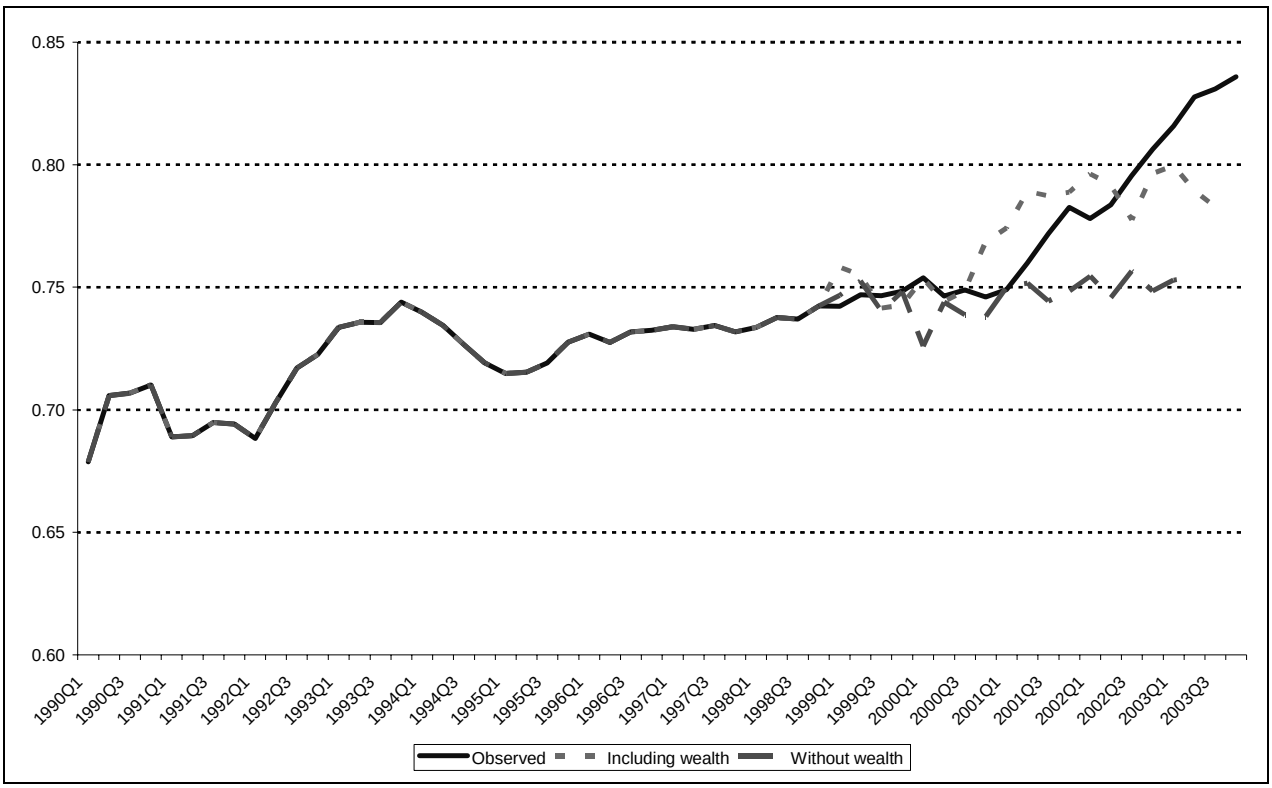
Table 6. Contributions to the accumulated change in the money demand to GDP ratio

	Change in M/PY	*Due to changes in :*			
		W	***Irs***	***Irl***	***Residuals***
1995-2003 (I)	0.12	0.056	0.026	0.017	0.02
1999-2001 (II)	0.04	0.024	-0.002	-0.003	0.02

24. These calculations show the important role played by the evolution of housing and financial wealth in accounting for the movements in the long-run money velocity. The two samples are chosen so as to cover the whole period (I), and the period when asset prices were rising fast (II). Overall, these contributions suggest that wealth has contributed in an important way to the rapid rise in M3, and the contribution of wealth is particularly important over the period (II) when asset prices were rising faster.

25. To check to what degree the inclusion of the wealth variable in the long-run equation may affect our assessment of the presence of a "money overhang " we have simulated the ratio of money to GDP using the long-run relationship with and without the wealth variables, from the 1st quarter 1999 onwards based on the equations presented in Table 1. The results are shown in Figure 3 below. They suggest that the estimated money overhang – defined as the accumulated difference between the actual and the simulated liquidity ratio using the long-term equation – indeed depends on the inclusion or non-inclusion of a wealth variable. According to the specification without the wealth variable a money overhang has been steadily building since 2001. However, including the wealth variable in the equation suggests that until 2001 a negative money overhang had been building up (*i.e.* money was growing slower than predicted by the long-term equation) which was subsequently absorbed. Obviously the margins of uncertainty surrounding this result are considerable, but it does cast some doubt on the view that there is a large money overhang out there which, once unleashed, may prove inflationary. .

Figure 3: Forecasting the ratio of money to GDP using the long-run equilibrium relationship



Note: Simulations start in 1999, hence numbers prior to 1999 are observed data

Concluding remarks

26. This paper presented an empirical analysis of the demand for money in the euro area over a period including the introduction of the euro in 1999 and next the introduction of the cash euro in 2002. The analysis sought to explain the rapid growth of money since the inception of the euro by the increase of wealth. The empirical evidence presented here suggests that a large part of the overshooting may indeed be due to financial and housing wealth developments. It also confirms, in line with the literature, that euro area money demand is stable and has not been disrupted by the inception of the euro. The influence of financial and housing wealth also looks robust over time and may even have increased after the changeover to the euro.

27. All considered, the systematic overshooting of the M3 target in the euro area may be less of a puzzle if it can be demonstrated that in a low inflation environment with a credible monetary policy framework, money is a relatively safe asset of which agents are prepared to hold more if their overall wealth position improves. Obviously the euro area and the single monetary policy are relatively young, and further monitoring will add valuable information as to the validity of this conclusion.

BIBLIOGRAPHY

Artis, M. and A. Beyer (2004), "Issues in Money Demand", *Journal of Common Market Studies*, Vol. 42.

Avouyi-Dovi, S. *et al.* (2003), "Estimation d'une fonction de demande de monnaie pour la zone euro : une synthèse des resultats", *Bulletin de la Banque de France*, No 111.

Boone, L. and Girouard, N. (2002) "The Stock Market, the Housing Market and Consumer Behaviour", *OECD Economic Studies*, No.35, 2002/2.

Borio, C. and P. Lowe (2002), "Asset Prices, Financial and Monetary Stability: Exploring the Nexus", *BIS Working Paper*, No.114, http://www.bis.org/publ/work114.htm.

Brand, C. and Cassola, N. (2004), "A Money Demand System for Euro Area M3", *Applied Economics*, Vol. 36.

Bruggeman, A., Donati, P. and Warne, A. (2003), "Is the Demand for Euro Area M3 Stable?", *ECB Working Paper*, No. 255.

Calza, A., Gerdesmeier, D. and Levy, J. (2001), "Euro Area Money Demand : Measuring the Opportunity Costs Appropriately, *International Monetary Fund Working Paper*, No. 01/179.

Coenen, G. and Vega, J-L. (2001), "The Demand for M3 in the Euro Area ", *Journal of Applied Econometrics*, Vol. 16, No. 6.

European Central Bank (ECB) (2004), "Monetary Analysis in Real Time", *Monthly Bulletin*, October 2004, Frankfurt.

Fagan, G. and J. Henry (1998), "Long Run Money Demand in the EU: Evidence from Area-Wide Aggregates", *Empirical Economics*, Vol.23.

Fase, M. and Winder, C. (1998), "Wealth and the Demand for Money in the European Union", *Empirical Economics*, Vol. 23.

Friedman, M. (1970), "A Framework for Monetary Analysis", *Journal of Political Economy*, Vol. 78, No. 2.

Friedman, M. (1988), "Money and the Stock Market", *Journal of Political Economy*, Vol. 96, No. 2.

Institut für Weltwirtschaft (2003), "Exkurs: Zur Stabilität der Geldnachfrage im Euroraum", *Thesen zum Kieler Konjunkturgespräch*, No. 68, September.

Nelson, E. (2003), "The Future of Monetary Aggregates in Monetary Policy Analysis", *Journal of Monetary Economics*, Vol. 50.

OECD (2003), *Economic Outlook*, No. 73, OECD, Paris, 2003.

Stock, J. and M.W.Watson, (1993), "A Simple Estimator of Cointegrating Vectors in Higher Order Integrated Systems", *Econometrica*, Vol. 61.

WORKING PAPERS

The full series of Economics Department Working Papers can be consulted at www.oecd.org/eco/Working_Papers/

410. *Banking Reform in Russia: Problems and Prospects*
(November 2004) William Tompson

409. *Public expenditure management in France*
(October 2004) Andrew Burns and Alessandro Goglio

408. *Russian Industrial Restructuring: Trends in Productivity, Competitiveness and Comparative Advantage*
(October 2004) Rudiger Ahrend

407. *Improving the Capacity to Innovate in Germany*
(October 2004) Andrés Fuentes, Eckhard Wurzel and Margaret Morgan

406. *Tax Treatment of Private Pension Savings in OECD Countries and the Net Tax Cost per Unit of Contribution to Tax-Favoured Schemes*
(October 2004) Kwang-Yeol Yoo and Alain de Serres

405. *The Reform of the Health Care System in Portugal*
(October 2004) Stéphanie Guichard

404. *Accounting for Russia's Post-Crisis Growth*
(October 2004) Rudiger Ahrend

403. *Restructuring Russia's Electricity Sector: Towards Effective Competition or Faux Liberalisation?*
(October 2004) William Tompson

402. *Russia's Gas Sector: The Endless Wait for Reform?*
(September 2004) Rudiger Ahrend and William Tompson

401. *One Money, One Cycle? Making Monetary Union a Smoother Ride*
(September 2004) Peter Hoeller, Claude Giorno and Christine de la Maisonneuve

400. *Modelling Cyclical Divergence in the Euro Area: The Housing Channel*
(September 2004) Paul van den Noord

399. *Product Market Competition and Economic Performance in Korea*
(August 2004) Yongchun Baek, Randall Jones and Michael Wise

398. *Product Market Competition and Economic Performance in the United States*
(July 2004) Hannes Suppanz, Michael Wise and Michael Kiley

397. *Saving Behaviour and the Effectiveness of Fiscal Policy*
(July 2004) Luiz de Mello, Per Mathis Kongsrud and Robert Price

396. *The impact of exchange rate regimes on real exchange rates in South America, 1990-2002*
(June 2004) Anne–Laure Baldi and Nanno Mulder

395. *How Market Imperfections and Trade Barriers Shape Specialisation: South America vs. OECD*
(June 2004) Joaquim Oliveira Martins and Tristan Price

394. *Housing Markets, Wealth and the Business Cycle*
(June 2004**)** Pietro Catte, Nathalie Girouard, Robert Price and Christophe André

393. *Long-Term Budgetary Implications of Tax-Favoured Retirement Saving Plans*
(June 2004) Pablo Antolin, Alain de Serres and Christine de la Maisonneuve

392. *Enhancing Income Convergence in Central Europe after EU Accession*
(June 2004) Patrick Lenain and Lukasz Rawdanowicz

391. *Asset Price Cycles, "One-Off" Factors and Structural Budget Balances*
(June 2004) Nathalie Girouard and Robert Price

390. *Channels for Narrowing the US Current Account Deficit and Implications for Other Economies*
(May 2004) Anne-Marie Brook, Franck Sédillot and Patrice Ollivaud

389. *Product Market Competition and Economic Performance in Norway*
(May 2004) Jens Høj and Michael Wise.

388. *Product Market Competition and Economic Performance in Sweden*
(May 2004) Deborah Roseveare, Martin Jørgensen and Lennart Goranson

387. *Product Market Competition and Economic Performance in Japan*
(May 2004) Jens Høj and Michael Wise

386. *Migration and Integration of Immigrants in Denmark*
(May 2004) Deborah Roseveare and Martin Jørgensen

385. *Factors Driving Risk Premia*
(April 2004) Torsten Sløk and Mike Kennedy

384. *Rationalising Public Expenditure in the Slovak Republic*
(March 2004) Rauf Gönenç and Peter Walkenhorst

383. *Product Market Competition and Economic Performance in Switzerland*
(March 2004) Claude Giorno, Miguel Jimenez and Philippe Gugler

383. *Concurrence sur les Marchés de Produits et Performance Économique en Suisse*
(Mars 2004) Claude Giorno, Miguel Jimenez and Philippe Gugler

382. *Differences in Resilience between the Euro-Area and US Economies*
(March 2004) Aaron Drew, Mike Kennedy and Torsten Sløk

381. *Product Market Competition and Economic Performance in Hungary*
(March 2004) Carl Gjersem, Philip Hemmings and Andreas Reindl

380. *Enhancing the Effectiveness of Public Spending: Experience in OECD Countries*
(February 2004) Isabelle Joumard, Per Mathis Kongsrud, Young-Sook Nam and Robert Price

379. *Is there a Change in the Trade-Off between Output and Inflation at Low or Stable Inflation Rates? Some Evidence in the Case of Japan*
(February 2004) Annabelle Mourougane and Hideyuki Ibaragi

378. *Policies bearing on product market competition and growth in Europe*
(January 2004) Carl Gjersem