Money demand in Euroland

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Abstract

This paper explores the determinants of alternative monetary aggregates in Euroland. A sample consisting of quarterly data covering the 1980:1–1998:4 period is considered. We are interested whether a conventionally defined money demand equation is stable in some aggregates as opposed to others. Both long-run and short-run relationships are considered in this paper. Overall, the results indicate that broad (narrow) money demand in Euroland is a stable (unstable) function of Euroland-wide income and interest rates. © 2001 Elsevier Science Ltd.

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Keywords: Money demand; Monetary policy; European Central Bank

1. Introduction

Whether a monetary policy based on intermediate monetary targets is the best way to ensure a satisfactory economic performance is a question of great policy relevance and controversy. We would like to begin by briefly sketching the state of the policy debate, as it stands at the end of the 1990s. At present, national central banks follow diverse approaches in monetary policy. In recent years, inflation targets have come into fashion and have been increasingly adopted as the primary focus for the conduct of monetary policy in various countries including Australia, Canada, Finland, Israel, New Zealand, Spain, Sweden and the UK. Advocates of direct inflation targeting object that it is difficult to control intermediate targets; others doubt that a clear-cut link exists between intermediate and ultimate targets. In an inflation-targeting framework, the government or the central bank typically announces a target for future inflation. In most cases, inflation targets have been
specified as inflation bands with widths of up to two percentage points. Operationally, inflation targeting can be viewed as a two-step process whereby the central bank first produces an inflation forecast. The second step is taken in the event that future inflation is judged to move outside the target range. In this instance, necessary monetary policy measures are taken. Contrary to this new monetary policy strategy, the Bundesbank had adopted a two-step approach with intermediate monetary targets. This operational framework contains three basic principles. First, price stability is recognized as the main goal of monetary policy. Second, monetary policy is conducted within a framework of annual targets for broad money in pursuit of its ultimate objective price stability. Third, the intermediate monetary targets provide a transparent guide to the conduct of monetary policy and serve as a coordination device in the wage- and price-setting process.\(^1\)

While the Maastricht Treaty provides unambiguous guidance as to the ultimate objective of the ECB, namely price stability, it does not specify the monetary strategy to be adopted. As a new central bank, the ECB obviously needs to set some sort of nominal anchor to help build anti-inflationary credibility. Preparatory work undertaken by the European Monetary Institute (1997) initially reduced the number of possible options to just two strategies: monetary targeting and inflation targeting.\(^2\) The Bundesbank, in line with its own practice over the past 25 years, favoured a money supply target while other central banks argued for an inflation target. In October 1998 the EMI finally compromised and adopted not one but two policy guides: a monetary target — or more precisely a ‘reference value’ — and an inflation target of 2% or less. To monitor its performance against the inflation target, the ECB is using a basket of economic indicators, including an inflation forecast. However, the EMI also noted that certain technical preconditions have to be met for this prominent role of a publicly announced monetary target. Specifically, such targets or ranges would only be meaningful guides to monetary policy if the relationship between money and prices — as encapsulated in a money demand equation — is expected to remain sufficiently stable over time. In this regard, recent work of the ECB has pointed towards the stability of area-wide money demand only in a ‘core group’ of countries excluding Italy, Portugal and Spain.\(^3\) Against this background and the fact

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\(^1\) Despite its preference for an intermediate target, the Bundesbank has, however, always acknowledged that a wide range of indicators are used along with M3 to reach its policy decisions. “…The Bundesbank continues to adhere to its annual monetary targets which, however, must be seen and assessed even more than before in a medium-term perspective…Finally, it bases its assessments on a wide range of financial and real indicators” [Deutsche Bundesbank, 1995, p. 84]. Recent reviews of monetary targeting in Germany are available in Clarida et al. (1998) and Issing (1997).

\(^2\) The EMI has thus already ruled out exchange rate targeting as a nominal anchor for monetary policy in Euroland. In the past, the monetary authorities of the smaller EU-countries have pursued an exchange rate orientation.

that the ECB has taken over monetary policy for 11 Euro economies the paper re-
examines the stability of money demand in a large union.

The remainder of the paper is organized as follows. Section 2 outlines the model
to be estimated, briefly discusses some relevant econometric issues and discusses
the empirical results. Section 3 contains the structural stability analysis while Section
4 summarizes the results and concludes with some tentative policy implications.

2. Data, specifications and estimation results

2.1. Data and measurement issues

The data for this study are quarterly beginning in 1980:1 (before differencing and
lags) and ending in 1998:4. Two issues stand out in estimating money demand func-
tions for Euroland.4 They are: the choice of monetary and income aggregates, and
the issue of aggregation. Two definitions of money were examined in this paper,
namely narrow money (M1) and broad money (M3).5 The income variable is defined
as real GDP (in 1995 prices). The income variable, as well as the money stocks, are
seasonally adjusted. The opportunity costs are represented by the 90-day money
market rate and the GDP deflator (Index 1995=100) is used to derive real money
balances. In constructing Euroland-wide aggregates the ECB has used
fixed weights based on 1995 GDP at PPP rates. Finally, the Euroland interest rates was created
through weighting the national rates by national GDP to Euroland GDP in 1995
prices, and adding them up.6

2.2. Specifications

The standard semi-logarithmic specification of the long-run money demand func-
tion can be written as follows:

\[ m_t = \alpha + \beta y_t + \delta r_t + \epsilon_t, \]  

\footnote{Strictly speaking, the use of the word ‘Euroland’ is incorrect, because the empirical analysis for
1980:1–1998:4 is a ‘pre-Euroland’ study.}

\footnote{All data were kindly provided by the ECB. More complete definitions for all the series have been
relegated to the data appendix.}

\footnote{Since the exchange rate is not constant in the sample, aggregation of national time-series into euro-
wide data is not straightforward. Two general classes of methods are available: current exchange rates
or fixed conversion rates. Current exchange rates permit an obvious interpretation from an economic
standpoint as they are the market yardstick. On the other hand, using market exchange rates ‘distorts’
the dynamics of the time series and introduces a large number of spurious shocks. Resorting to fixed PPP
exchange rates avoids this distortion but implies to proceed as if the exchange rate between the European
currencies did not vary. This is clearly at odds with historical experience but anticipates exactly that the
exchange rate is not a relevant variable inside Euroland any more. Given this appeal, fixed PPP exchange
rates have been used in the paper. See Beyer et al. (2000) for a discussion of existing methods of recon-
structing historical Euro-zone data.}
where \( m \) represents logged real money balances created by taking a monetary aggregate deflated by the GDP deflator; \( y \) is logged real income measured via real GDP; \( r \) is an opportunity cost measure proxied via the 90-day money market rate, and \( \varepsilon \) is a residual term. The coefficients \( \beta \) and \( \delta \) are expected to enter with positive and negative signs, respectively. If a long-run relationship exists between \( m \), \( y \) and \( r \) then the finding of cointegration is the statistical equivalent of the long-run concept in economics. In that case \((1, -\beta, 0)\) would constitute a cointegrating vector and \( \varepsilon_t \) in Eq. (1) would therefore be expected to be stationary.\(^7\) The existence of cointegration can be reinforced via the estimation of error-correction models (ECMs). Granger’s Representation Theorem (Engle and Granger, 1987) formalises the theoretical connection between cointegration and error-correction. To illustrate, the theorem implies that the appropriate short-run model which satisfies the cointegrating regression (1), can be written as:

\[
\Delta m_t = \alpha + \Delta m_{t-1} + \beta \Delta y_{t-1} + \delta \Delta r_{t-1} + \theta \varepsilon_{t-1} + e_t,
\]

where \( \Delta \) is the first-difference operator. For simplicity, (2) omits additional lags beyond the first, although these can of course be incorporated. In other words, cointegration between a set of variables implies that their short-run dynamics are influenced by feedback returning them to their long-run equilibrium. The converse is also true: if such feedback exists, then the variables must be cointegrated.

2.3. Econometric issues and estimation results

In order to test for cointegration, we have employed the fully-modified OLS (FM-OLS) procedure proposed by Phillips and Hansen (1990).\(^8\) The underlying principle of the single equation estimator is to filter the short-run variables semi-parametrically by estimating a model which includes both short-run and long-run variables. The idea of the non-parametric correction is to take account of the impact on the residual term of autocorrelation and possible endogeneity if the right-hand-side variables in the cointegration equation are not weakly exogenous. The estimator thus contrasts with the static Engle–Granger estimator where the cointegrating vector is estimated without taking into account the short-run dynamics. The underlying econometric model is given by

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\(^7\) This, of course, presumes that all three series are \( I(1) \). The Phillips–Perron tests indicating that all variables are indeed nonstationary are available upon request.

\(^8\) See Phillips and Loretan (1991) and Lim and Martin (1995) for informative reviews. For ample details of the computational algorithms compare Phillips and Hansen (1990). One of the key advantages of this approach over alternative estimators, such as Johansen (1988) and Stock and Watson (1988), is that it facilitates a complete analysis of the inclusion of deterministic trends in the cointegration set. An additional benefit of the above framework is that it facilitates a test of cointegration, where cointegration is taken to be the null hypothesis. In the statistics literature this would be the natural way to test for cointegration. An investigation of the behaviour of the test statistics in finite samples is available in Gregory and Nason (1991) and Pesaran and Shin (1995). An alternative procedure which is similar in spirit is Engle and Yoo’s (1991) three-step estimator.
\[ y_t = \beta_0 + \beta_1 x_t + \epsilon_t \quad t=1, 2, \ldots, n, \]

where \( y_t \) is an \( I(1) \) variable, and \( x_t \) is a \( k \times 1 \) vector of regressors. It is also assumed that \( x_t \) has the following first-difference stationary process

\[ \Delta x_t = \mu + u_t \quad t=2, 3, \ldots, n, \]

where \( \mu \) is a \( k \times 1 \) vector of drift parameters, and \( u_t \) is a \( k \times 1 \) vector of \( I(0) \), or stationary variables. The OLS estimators of \( \beta = (\beta_0 \beta_1') \) are consistent even when \( x_t \) and \( \epsilon_t \) are contemporaneously correlated.\(^9\) But in general the asymptotic distribution of the OLS estimator involves the unit-root distribution and is non-standard. Carrying out inferences on \( \beta \) using the usual \( t \)-tests in the OLS regression of (3) will be invalid. To overcome these problems appropriate corrections for the possible correlations between \( u_t \) and \( \epsilon_t \) and their lagged values is required. The Phillips–Hansen (1990) FM-OLS estimator takes account of these correlations in a semi-parametric manner. As a result, the procedure gives unbiased estimates of the long-run relationships as well as \( t \)-statistics which are asymptotically normal. Based upon these cointegrating relationships, we have then estimated ECMs.\(^10\) The estimates resulting from a standard general-to-specific approach are summarized in Tables 1 and 2.

In Table 1 all variables except the scale variable in the equation for narrow money are significant and enter with the expected sign. The long-run elasticity of real broad money with respect to \( y_t \) is larger than one which can be interpreted as proxying omitted wealth effects in Eq. (1).\(^{11}\) Turning to the elasticities for the interest rate, these are quite small but statistically significant. This suggests that higher Euroland-wide interest rates reduce the demand for broad and narrow money. The ECMs are

<table>
<thead>
<tr>
<th>Table 1</th>
<th>FM-OLS estimates(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Narrow money ((m1_t))</td>
</tr>
<tr>
<td>Constant</td>
<td>-6.68 (5.7)</td>
</tr>
<tr>
<td>( r_t )</td>
<td>-0.016 (3.2)</td>
</tr>
<tr>
<td>( y_t )</td>
<td>0.86 (5.7)</td>
</tr>
<tr>
<td>DUM86</td>
<td>-0.08 (1.1)</td>
</tr>
</tbody>
</table>

\(^a\) Notes: asymptotic \( t \)-values are given in parentheses. The FM-OLS estimates have been calculated using Bartlett weights with truncation lag \( k=8 \). The level estimates include a dummy for 1986 to account for special developments in German data around the period in which debt securities were subjected to reserve requirements [see Coenen and Vega (1999) for further details]. DUM86 equals 0.5 in the first, third and fourth quarter of 1986, 1.0 in the second quarter of 1986, and 0.0 elsewhere.

\(^9\) See Stock (1987), for example. Phillips (1991) has demonstrated that FM-OLS estimation has the same asymptotic efficiency as the Johansen (1988) procedure where all variables are assumed to be endogenous from the outset.

\(^10\) We have employed a two-step ECM procedure in the spirit of Engle and Granger (1987) because the CUSUM test, the CUSUM of squares test and Hansen’s (1992b) test for parameter stability calculated below require stationary regressors.

\(^11\) We have not included wealth effects due to the lack of reliable wealth data for the Euro area.
Table 2
Estimates of ECMs for broad and narrow money$^a$

<table>
<thead>
<tr>
<th></th>
<th>$\Delta m_1$</th>
<th>$\Delta m_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.002 (1.7)</td>
<td>0.004 (4.9)</td>
</tr>
<tr>
<td>$\Delta m_{t-1}$</td>
<td>0.54 (5.8)</td>
<td>0.46 (5.2)</td>
</tr>
<tr>
<td>$\Delta y_{t-1}$</td>
<td>0.006 (0.4)</td>
<td>0.15 (1.7)</td>
</tr>
<tr>
<td>$\Delta r_{t-1}$</td>
<td>$-0.003$ (1.9)</td>
<td>$-0.002$ (2.2)</td>
</tr>
<tr>
<td>$\epsilon_{t-1}$</td>
<td>$-0.05$ (2.0)</td>
<td>$-0.12$ (4.4)</td>
</tr>
<tr>
<td><strong>Diagnostics:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.53</td>
<td>0.48</td>
</tr>
<tr>
<td>LM(1)</td>
<td>0.72</td>
<td>0.54</td>
</tr>
<tr>
<td>LM(4)</td>
<td>7.10</td>
<td>2.60</td>
</tr>
<tr>
<td>JB</td>
<td>2.50</td>
<td>0.78</td>
</tr>
<tr>
<td>RESET</td>
<td>0.17</td>
<td>0.61</td>
</tr>
<tr>
<td>HET</td>
<td>0.03</td>
<td>0.25</td>
</tr>
<tr>
<td>CHOW</td>
<td>35.11</td>
<td>2.83</td>
</tr>
</tbody>
</table>

$^a$ Notes: asymptotic $t$-values are given in parentheses. 74 observations used for estimation from 1980:3–1998:4. The ECMs have been estimated without DUM86. LM($n$), Lagrange multiplier test for residual correlation from lag 1 to $n$ distributed $\chi^2(n)$; JB, Jarque and Bera’s $\chi^2(2)$ test for normality based on the estimated skewness and kurtosis of the residuals compared to their counterparts for the normal distribution; RESET(2), Ramsey’s test for specification error distributed $\chi^2(2)$; HET(1), Lagrange multiplier test for heteroscedasticity based on the regression of squared residuals on squared fitted values distributed $\chi^2(1)$. CHOW is Chow’s test of the stability of regression coefficients over the period 1999:1–1999:4 distributed $\chi^2(4)$.

given in Table 2. All variables are lagged one period as this proved to be adequate from a statistical standpoint. Of particular interest is the sign and statistical significance of the coefficient on the lagged residuals from the cointegrating regression. The $t_{ECM}$-statistics indicate cointegration for broad money while narrow money fails the sufficient test for cointegration required to establish a long-run relationship between the variables of interest. In other words, the narrow money demand function as represented in Eq. (1), is not an equilibrium relationship. The signs for the short-run impact of income and interest rates are generally in line with theoretical predictions, namely that an acceleration in income (interest rates) increases (reduces) the demand for money. From a statistical point of view both models appear well-specified, with tests showing no signs of residual autocorrelation, heteroscedasticity, non-normality and functional form mispecification. Finally, we have used data from 1999:1 to 1999:4 to test for the forecast accuracy of both equations. The CHOW test is based upon dynamic forecasts over the period 1999:1–1999:4. The estimated parameters appear constant for broad money, while the hypothesis of constancy is rejected for narrow money. This supports the view that the area-wide broad money demand equation outperforms the area-wide narrow money demand equation.
3. Structural stability for broad money demand

Because structural stability is crucial for prediction and policy conclusions, we have next employed various structural stability tests. In order to test for long-run structural stability of the broad money demand function we have first employed Hansen’s (1992a) semi-parametric SupF-test which is based upon the FM-OLS procedure. The test explicitly considers the possibility of structural change in a cointegrated system. The null hypothesis is that the FM-OLS estimator $\beta$ is constant. Possible parameter instability may be captured by specifying $\beta$ as time-dependent under the alternative hypothesis, that is, $\beta = \beta_t$. The SupF procedure tests for an unknown structural break or regime shift at time $t$ in $\beta$, that is, for

$$
\beta_i = \begin{cases} 
\beta_1 & \text{for } i \leq t, \\
\beta_2 & \text{for } i > t
\end{cases}
$$

where the null hypothesis, $H_0$, is $\beta_1 = \beta_2$ and the alternative hypothesis, $H_1$, is $\beta_1 \neq \beta_2$. The timing of the break is assumed unknown $[t/n] \in \mathbb{I}$, where $\mathbb{I}$ is some subset of $(0, 1)$, and $[.]$ denotes ‘integer part’. The maximum of the sequence of $F$-statistics indicates the most likely date of a structural break. Following Hansen (1992a), the statistic is calculated over the $[0.15; 0.85]$ interval of the sample period.\(^{12}\)

The plot of the SupF statistics is displayed in Fig. 1. The test statistics never cross the critical value lines, indicating long-run parameter stability. One reason for this result may be that in closely integrated economies firms and individuals tend to switch between currencies in response to interest rate differentials, an option that is not available in Euroland.\(^{13}\)

In order to test for short-run structural stability we have next calculated the

\[\text{Fig. 1. SupF test for parameter constancy of the broad money demand function.}\]

\(^{12}\) The trimming region over which the test statistic is calculated should not include the end-points 0 and 1 since for these values the test statistic will diverge to infinity almost surely. The fix suggested by Hansen (1992a) is to select $[0.15, 0.85]$.

\(^{13}\) A discussion of why it is possible that aggregate estimates perform better than single-country ones is available in Pesaran et al. (1989).
CUSUM and CUSUM of squares test statistics for the ECMs which are based upon recursive OLS estimates. Both tests do not require an a priori selection of a breakpoint.\(^{14}\) The recursively calculated test statistics for the ECM are given in Figs. 2 and 3.\(^{15}\)

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14 Another common test for structural stability is the CHOW test which is designed to test the null hypothesis of structural stability against the alternative of a one-time shift at some known observation, that is, the test requires to select the timing of the structural change a priori.

15 We have calculated the structural stability tests without the 1986 step dummy because resort to dummy variables to 'repair' a demand for money function smacks of stability restored with the benefit of hindsight rather than as something useful from a policy perspective.
Both test statistics indicate that the parsimonious equation was stable in the estimation period. A question which remains, however, is the power of these tests. Krämer et al. (1988) have shown that the CUSUM test is essentially a test to detect instability in the intercept alone, while Ploberger and Krämer (1990) have shown that the CUSUM of squares test can be viewed as a test for detecting instability of the variance of the residuals. In addition, we have therefore employed Hansen’s (1992b) Lagrange multiplier type tests to check for possible short-run parameter instability. The LM-type test statistics test the null hypothesis of parameter and variance constancy in static and dynamic regression equations, that is, no special treatment of lagged dependent variables is required. They are based upon an average of the squared cumulative sums of first-order conditions. Under the null hypotheses of parameter stability, the first-order conditions are mean zero, and their cumulative sums will wander around zero. Under the alternative hypothesis of parameter instability the cumulative sums will develop a nonzero mean in parts of the sample and therefore the test statistics will tend to be large. The alternative includes simple structural breaks of unknown timing as well as random walk parameters. An advantage of these tests is that they only require the ECMs be estimated once over the full sample period, that is, no sample-split points need to be chosen. They are, however, not designed for determining the timing of a structural break if one has occurred.

The results in Table 3 again indicate that the dynamic equation is structurally stable. When discussing policy implications, special attention should be paid to expectation formation under bounded rationality since central banks cannot be expected to know the underlying coefficients of the money demand equation a priori. In order to model the expectations formation process we have therefore also employed Pesaran’s (1987) augmented adaptive learning model which can be written as

$$E_t y_t^* - E_{t-1} y_t^* = \mu_t (y_t - E_{t-1} y_t^*) + (\Delta y_t)' \hat{\beta}_{t-1} + u_t, \quad (6)$$

<table>
<thead>
<tr>
<th>Parameter instability in the ECM for broad money$^a$</th>
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</thead>
<tbody>
<tr>
<td><strong>Individual parameter stability tests</strong></td>
</tr>
<tr>
<td>Constant</td>
</tr>
<tr>
<td>$\Delta m_{t-1}$</td>
</tr>
<tr>
<td>$\Delta y_{t-1}$</td>
</tr>
<tr>
<td>$\Delta r_{t-1}$</td>
</tr>
<tr>
<td>$\varepsilon_{t-1}$</td>
</tr>
<tr>
<td>Variance</td>
</tr>
<tr>
<td><strong>Joint statistic</strong></td>
</tr>
</tbody>
</table>

$^a$ Notes: the asymptotic distribution of the tests is nonstandard, depending upon the number of coefficients being tested for stability. The stability tests have been performed excluding the 1990:2 step dummy. The 5% critical value for the individual parameter stability tests (joint statistic) is 0.47 (1.68) [see Hansen, 1992b, p. 524].
where $E_{t}y_{t+1}$ denotes the expectations of $y_{t+1}$ formed at time $t$. Pesaran (1987, pp. 255–257) shows that the adaptive coefficients based on the information available at time $t$ can be estimated as

$$
\mu_t = x_t' \left( \sum_{j=1}^{t} x_j x_j' \right)^{-1} x_t, \quad t = k+1, k+2, \ldots, n.
$$

In other words, Eq. (7) determines how the adaptive coefficients $\mu_t$ need to be updated every period. For well-specified models where the learning process converges $\mu_t$ should tend to zero as $t \to \infty$. The recursively estimated adaptive coefficients for the broad money demand equation estimated above are shown in Fig. 4. Although $\mu_t$ varies considerably, it is indeed converging towards zero. This supports the empirical validity of the model.

4. Conclusions

The transition to Euroland is no doubt a difficult period. The structural discontinuity and uncertainty in the markets and the institutional changes associated with the advent of EMU creates problems for monetary policy. Recognizing this, the ECB has adopted two policy guides: a monetary target and an inflation target. This hybrid approach must merely be regarded as a compromise which is acceptable to all sides.16 What we have offered in the paper is an estimate for money demand using Euroland-wide aggregates. The crucial result is the short-run and long-run stability of broad money demand. This is in contrast to recent estimates by the EMI indicating structural stability of money demand only in a ‘core’ group of countries (EU7) while the

![Fig. 4. Values of the adaptive coefficient $\mu_t$.](image-url)

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16 In the hybrid approach a formal intermediate target range for broad money would be announced, but the target would be interpreted as an obligation for the ECB to publicly explain if it wishes to disregard a deviation in the growth rate of broad money from the targeted path. Whether the announced growth rate of broad money would in this case still deserve to be called an intermediate target or would have to be called just an indicator, is a matter of semantics. A similar hybrid strategy has recently been recommended by the Deutsche Bundesbank (1998).
results for EU14 are much less satisfactory.\textsuperscript{17} Although it should be born in mind that these results are subject to data and an ex-ante analysis of a regime change is notoriously difficult, it seems to be wrong to abandon the stock of broad money as a key guide-post, especially since a transfer of the reputation built up by the Bundesbank to the ECB should tend to strengthen market confidence in the 11 countries.\textsuperscript{18}

To reduce initial uncertainty and to deal with potential disruptions associated with the transition to stage three, however, a broader multi-year target range could be adopted for some time. Some elements of direct inflation targeting can then be used to supplement up this ‘basic’ strategy; the monitoring of other economic and financial indicators will then reveal how monetary policy feeds through to inflation.

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Appendix A. Data series used in the study

The historical data set for Euroland-11 was kindly provided by the European Central Bank. The various series are defined as follows:

\begin{itemize}
  \item M3 \quad \text{Index of M3 (December 1998=100).}
  \item M1 \quad \text{Index of M1 (December 1998=100)}
  \item Y \quad \text{Real GDP (1995) prices.}
  \item p \quad \text{GDP deflator (1995=100).}
  \item r \quad \text{90-day money market rate.}
\end{itemize}

All data are seasonally adjusted. The area-wide data were calculated from different national sources and then aggregated using fixed weights based on 1995 GDP at PPP rates.

\textsuperscript{17} See Fagan and Henry (1998). Their ‘core’ group comprises Austria, Belgium, Denmark, France, Germany, Ireland and the Netherlands, that is, the southern countries Italy, Portugal and Spain and Finland are excluded. The different results may be the result of a different methodology and sample period.

\textsuperscript{18} Arnold (1994, 1997) has recently argued that the stability of European money demand is ‘too-good-to-be-true’ and will fall victim to the Lucas critique. He argues on the basis of a comparison between regional money demands in the US and national money demands in Europe. The residual cross-correlations between regions in the US appear to be much higher than those between European nations. This confirms the intuition that inside a monetary union monetary developments to a large extent run in parallel. For EMU, this implies that the cross-correlations will increase in stage three. As a result, European money demand will be destabilized.
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