Freie Universität Berlin

The (In)stability of Money Demand in the Euro Area: Lessons from a Cross-Country Analysis

Dieter Nautz
Ulrike Rondorf

School of Business & Economics
Discussion Paper

Economics

2010/17

978-3-941240-29-2

The (In)stability of Money Demand in the Euro Area: Lessons from a Cross-Country Analysis*

Dieter Nautz and Ulrike Rondorf†

18th August 2010

Abstract

The instability of standard money demand functions has undermined the role of monetary aggregates for monetary policy analysis in the euro area. This paper uses country-specific monetary aggregates to shed more light on the economics behind the instability of euro area money demand. Our results obtained from panel estimation indicate that the observed instability of standard money demand functions could be explained by omitted variables like e.g. technological progress that are important for money demand but constant across member countries.

JEL classification: E41, E51, E52

Keywords: Money demand, cross-country analysis, panel error correction model, euro area

*We thank Jörg Breitung, Christian Offermanns and two anonymous referees for helpful comments and suggestions. This research was supported by the Deutsche Forschungsgemeinschaft through the CRC 649 “Economic Risk”.

†Department of Economics, Free University Berlin, Boltzmannstraße 20, 14195 Berlin; Corresponding author: Dieter Nautz, E-mail: dieter.nautz@fu-berlin.de.

1 Introduction

While most economists would agree that standard money demand functions have become unstable in the euro area, the economics behind money demand instability are still under debate. On the one hand, the instability of empirical money demand functions are seen as ultimate proof of the decoupling of monetary aggregates from inflation and the real economy. From this perspective, money demand instability undermines the information content and usefulness of money growth data for the ECB's monetary policy. On the other hand, empirical money demand functions might have been unstable simply because the estimated models were misspecified due to the omission of important variables.

The empirical literature has proposed several plausible candidates as additional regressors in order to reestablish money demand stability. Examples include proxies for wealth (Boone and van den Noord 2008, Beyer 2009) and macroeconomic uncertainty (Greiber and Lemke 2005, de Bondt 2009), the prices of stocks (Dreger and Wolters 2009, 2010) and their volatility (Carstensen 2006). Empirical results, however, have been mixed and the causes and consequences of money demand (in)stability are still under-researched. This paper re-investigates money demand (in)stability by estimating a euro area money demand function from cross-country data.

The empirical money demand literature is almost exclusively based on aggregated data for the whole euro area. For most applications, this is the natural choice because cross regional money holdings may be important and the common monetary policy in the euro area should depend on euro area wide aggregates and not on country-specific developments. Yet, money demand functions obtained from a panel analysis of regional data may still contain useful information. For example, Driscoll (2004) estimates the regional money demands of U.S. states to assess the relevance of the bank lending channel.[1]

In the current paper, we estimate a panel money demand function of the euro area to shed more light on the causes of money demand instability. Since the panel estimation is based on national deviations from the euro area wide means, all variables that are constant across countries cancel out, including those who are probably responsible for the instability of the aggregate money demand, like technological progress, international stock market indices, consumer senti-

[1]Rondorf (2010) and Cappiello et al. (2010) adopt Driscoll's approach to explore the impact of bank loans on output growth in the euro area. A further panel estimation of euro area money demand is provided by Setzer and Wolff (2009).

ment etc. Put differently, evidence in favour of stable regional money demand functions indicate that the observed instability of the aggregate money demand might be explained by some missing macro variables. In this case, stable euro area money demand functions may be obtained by augmenting money demand by those omitted variables and research directed to find these variables is promising.

The cross-sectional approach to money demand has been introduced by Mulligan and Sala-i-Martin (1992) who estimated U.S. money demand using data from the federal states. They already emphasised that a cross-country analysis of money demand can overcome the stability problems of standard time series approaches, because omitted variables may drop out. Advancing on Mulligan and Sala-i-Martin (1992), we follow Driscoll's (2004) analysis of regional U.S. money demand by exploiting the panel structure of the data.

The following empirical analysis employs data from the founding members of the European Monetary Union (EMU) from 1999 to the second quarter of 2008. In contrast to traditional time series studies on money demand, the relatively short euro area period is not a problem for panel estimation. As a result, the analysis does not have to rely on synthetic euro area data. Our empirical results support the notion of structural stability of money demand in the euro area. In particular, we obtain reasonable estimates for the long-run (semi)elasticities of interest rates and income.

The paper is structured as follows: In Section 2 we briefly review the main findings of the literature on the European money demand. Section 3 discusses the features and problems of the cross-sectional approach to money demand estimation. Section 4 describes the data set and presents the empirical results. Finally, Section 5 offers some concluding remarks.

2 The (in)stability of European money demand

Since the start of the Economic and Monetary Union (EMU) in 1999, the European Central Bank has repeatedly emphasised the prominent role of monetary aggregates for its monetary policy analysis. Especially in the early years of the century, inspired by the monetary targeting strategy of the German Bundesbank, the ECB tried to explain the course of monetary policy by the development of money growth. However, compared with former evidence on German money demand (Lütkepohl et al. 1999), the empirical link between money growth and inflation appeared to be less close and predictable in the euro area. Referring to the published reference value for money growth, naive forecasts of the ECB's interest rate decisions would have typically been misleading in the short-term. In May 2003, the ECB responded to these communication problems by abandoning the reference to the value from its monthly bulletins and with a clarification of its monetary policy strategy, see ECB (2003). Since then, the ECB's monetary analysis puts more emphasis on the long-term relation between monetary aggregates and inflation.

The money demand function provides the predominant theoretical concept for the empirical relationship between monetary aggregates, inflation, and the real economy. The (in)stability of euro area money demand functions has therefore always been an important theme in the recent debate on the role of money for monetary policy. Among others, Brand and Cassola (2004), Coenen and Vega (2001), Hayo (1999) and Funke (2001) confirmed the stability of euro area money demand. These early contributions employed standard specifications of money demand and performed cointegration analysis to identity the long run relationship between real money supply, income and an interest rate variable.

Following this first round of supportive evidence on money demand stability, several studies including Carstensen (2006) and Gerlach and Svensson (2003) fail to find a stable long-run money demand in the euro area. They conclude that money demand has become unstable implying that the informational content of monetary aggregates for monetary policy gets dubious. Carstensen (2006) provides a first attempt to explain the observed instability. He augments the standard money demand specification by stock prices and stock market volatility to capture the massive re-allocations of liquidity observed in 2001. He shows that the sharp increase in money growth rates after 2001 can partly be explained by falling stock prices and high stock market volatility.

In the same vein, the recent literature tries to reestablish the stability of euro area money demand by including additional regressors in the money demand equation. Boone and van den Noord (2008) include stock prices and also house prices in their empirical money demand model to capture wealth effects. Greiber and Lemke (2005) investigate whether macroeconomic uncertainty can explain the portfolio shifts that lead to high money growth in the past decade. By incorporating financial markets characteristics and economic sentiment indicators in a money demand equation, they are able to explain the movements of M3, at least until 2004. For a similar sample period, Dreger and Wolters (2010) suggest that the apparent instability of money demand can be explained by the strong movements in the stock markets. After 2004, however, economic sentiment indicators increased and financial markets recovered, but the growth rates of M3 even increased further.

Even 10 years after the introduction of the euro, the empirical literature on euro area money demand has to rely on synthetic euro area data where national data starting from the early eighties have been converted into a single synthetic currency. As a consequence, the resulting data and, thus, the money demand estimates, crucially depend on the choice of the exchange rate. In the literature, current exchange rates, fixed rates of a base period as well as the PPP exchange rates have been applied.[2] Moreover, the time series approach to euro area money demand implicitly assumes a common European monetary policy even for the pre-euro period. Following Arnold (1994) , the stability of euro-area wide money demand equations found for the pre-euro period might be spurious, because negatively correlated idiosyncratic shocks to money demand in individual countries. Since the adoption of a common monetary policy leads to a greater degree of synchronisation of shocks across countries, money demand in the euro area might be less stable than that estimated using area-wide data for the pre-euro period. In the view of these problems, it is a further advantage of a cross-country panel approach to euro area money demand that estimates can be based completely on data from the euro area.

3 Money demand from a cross-sectional perspective

The cross-sectional approach to money demand has been introduced by Mulligan and Sala-i-Martin (1992). They estimate the US money demand year by year using cross-sectional data from the individual states. Following Mulligan and Sala-i-Martin (1992), cross-sectional estimation of money demand avoids many problems of the standard time series approach. In particular, structural breaks over time or instability of money demand due to time-varying coefficients are more likely to occur in a time series analysis due to the longer time horizon needed.

More importantly, a cross-sectional money demand function can reveal information about the sources of money demand instability. From a purely time series perspective, the omission of relevant variables can lead to biased and presumably

[2] Beyer et al. (2001) discuss the alternative ways to construct synthetic euro area data.

unstable estimates of in fact stable money demand functions. By contrast, cross-sectional money demand estimations are unaltered by the omission of variables provided that those are constant across units. Since cross-section estimation is based on deviations from cross-sectional means those (probably omitted) variables simply drop out. Mulligan and Sala-i-Martin (1992) view the variable "technological process" as a typical example for a variable that affects US money demand but is constant across states.

While a pure cross-sectional analysis might be feasible for 50 US federal states, the number of euro area member countries is relatively small. Following Driscoll (2004), we therefore augment the cross-sectional perspective by the time dimension and shall estimate a euro area money demand using panel econometrics. Estimating a cross-sectional or panel money demand function does not only require the availability of regional data, see Section 4.1. For the US, the cross-sectional approach to money demand is feasible because federal states are (i) highly decentralised but (ii) still within a federal system having a common monetary policy.

Both assumptions also apply to the member countries of the euro area. In fact, the cross-sectional approach to money demand might work even better in the euro area than in the US. Firstly, in the euro area distortionary cross-border holdings are of minor importance. For Europeans, it is far less common to have an account in another Euro area country than it is for an US citizen to have an account in a different federal state.[3]

Secondly, in the US regional monetary aggregates are problematic because the states New York and Illinois (Chicago) are dominant financial centres that attract a lot of money from other states. By contrast, the role of financial centres, like Frankfurt, is comparably week in the euro area. In fact, the main European financial centre is London which is outside the euro area. Luxembourg is the only euro area country where the financial sector accounts for a very high fraction of the gross domestic product. As a result, the inclusion of Luxembourg could be a problem for the estimation of a cross-country euro area money demand. However, in the following empirical analysis, this country cannot be

[3]If a European household invests money abroad, it will mainly be for portfolio reasons. On average cross-border holdings from other EMU members account for only 8% of deposits of non-monetary financial institutions, see ECB bank balance sheet statistics. Note that 8% is a stock and not a flow value such that flows could still be important within one period. Unfortunately, however, the availability of flow data on cross-country business is very limited. Cross-border holdings usually tend to be higher in smaller countries. Thus, cross-border holdings are more important in the US partly because the cross-sectional units (the states) are relatively small.

considered anyway because national monetary aggregates are not available for Luxembourg.

Finally, the use of cross-country data may ameliorate the critical issue of money supply endogeneity.[4] Endogeneity might be of particular importance for the euro area where monetary aggregates play a role for the communication and the conduct of monetary policy. Suppose, for example, that a money supply shock leads to an increase in the interest rate governed by the central bank. If higher interest rates imply lower income, then the resulting correlation between money supply shocks and income will bias the estimated money demand coefficients. Therefore, as long as euro area wide monetary policy does not react to country-specific shocks, cross-sectional estimation mitigates the endogeneity problem of aggregate money supply.

4 A panel estimation of euro area money demand

4.1 Data

4.1.1 Monetary aggregates

Our panel analysis of euro area money demand employs quarterly data from all founding members of the European monetary union (EMU) including Belgium, Germany, Ireland, Spain, France, Italy, Austria, Portugal, Finland and the Netherlands.[5] We use quarterly data from the start of EMU in 1999 until the second quarter of 2008 which gives us $10 \times 38 = 380$ observations.

In accordance with Mulligan and Sala-i-Martin's (1992) and Driscoll's (2004) analysis of US money demand, we use country-specific monetary aggregates supplied by the national central banks. In the euro area, these country-specific monetary aggregates can be interpreted as the national contribution to the euro zone-wide aggregate. Currency is excluded in these series as it cannot be unambiguously assigned to a specific country.[6] Following the empirical money demand literature, we focus on the demand for M3. Figure 1 displays M3 for the euro area as a whole and the sum of the national contributions over all euro area countries under consideration. Confirming the reliability of the country-specific monetary aggregates, the differences between the two series is small and mainly

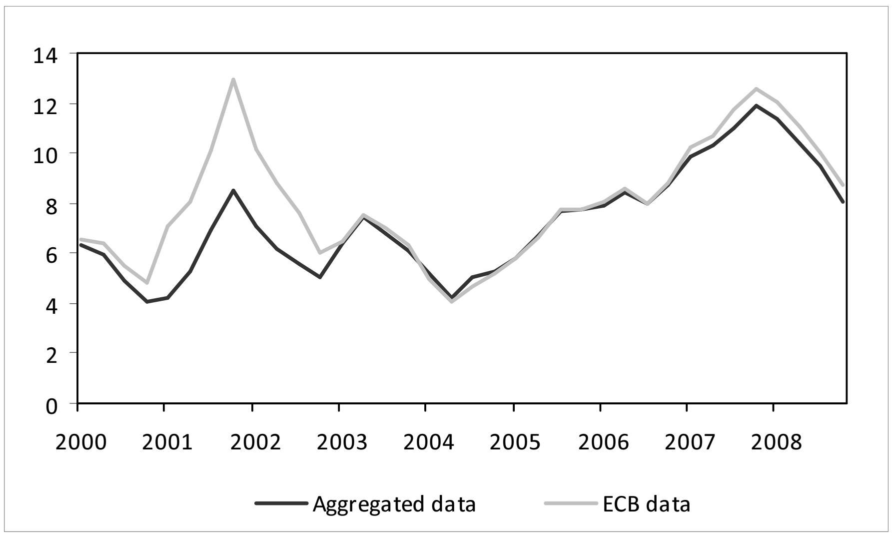
[4] The time-series literature addresses the endogeneity issue by estimating VARs and testing for weak exogeneity, see e.g. Hayo (1999).

[5] The only exception is Luxembourg which is not included because of data availability.

[6] Currency accounts on average for 6.7% of M3 over the whole sample horizon.

due to the entry of further countries to the euro area.[7] The average annual growth rate of M3 less currency amounts to 7.2% from 1999 to 2008.

Figure 1: M3 growth rates



Notes: The line labelled "ECB data" shows the growth rates of the monetary aggregate M3 minus currency for all current member countries as published by the ECB. "Aggregated data" denotes growth rates of M3 derived from the sum of the national M3 contributions of the ten countries under considerations.

While Mulligan and Sala-i-Martin (1992) assume that the price level is the same in all US states, we obtain real money supply referring to country-specific GDP deflators. Although our approach might have the drawback that money movements between two countries do actually change the area wide real monetary aggregates when using regional deflators, the assumption of identical price levels across euro area countries seems too restrictive.[8] The seasonally adjusted series of country-specific GDP and its deflator are obtained from Eurostat.

4.1.2 Interest rates

The cross-sectional approach to money demand is based on cross-sectional demeaned variables. Therefore, a variable can only be used in a panel estimation of euro area money demand if it differs across countries. This requirement has

[7] Greece joined the euro in 2001, Slovenia, Cyprus, Malta and Slovakia followed.

[8] In Mulligan and Sala-i-Martin (1992) the price indices cancel out when demeaning the data. Therefore they basically estimate a nominal demand function.

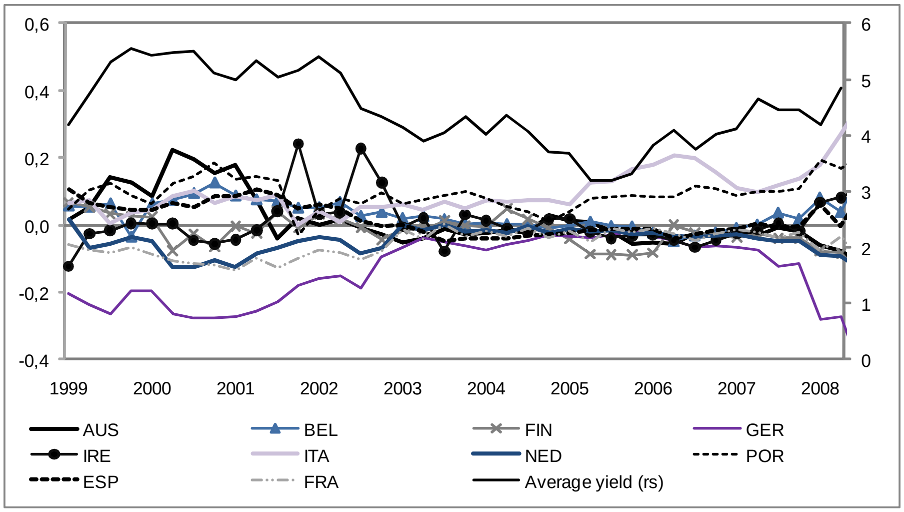
important implications for the choice of the interest rate variable in the money demand function. In particular, short-term money market rates are not feasible in our application because the degree of integration of euro area interbank money markets is extremely high. As a consequence the Euribor replaced the national interest rates as a reference rate after 1999 in the three month segment of the money market. In order to account for both, the opportunity costs for holding money and the own rate of money, we consider two different sets of country-specific interest rates.

In contrast to interbank rates, the interest rate on the deposits of non-financial corporations have converged but constraints are still in place, see the financial integration report by the ECB (2008). From 2003 onwards, national deposit rates for deposits with a maturity up to one year are published monthly in the ECB-statistics, see Section "interest rates by monetary financial institutions". Before 2003, the series are obtained directly from the national central banks. Due to the maturity mismatch between the (up to) one year deposit rate and M3 which contains deposits up to only three month, the available deposit rates are not a perfect measure for the own rate of money. Driscoll (2004), for example, estimates a negative relationship between deposit rates and US money demand implying that deposit rates capture the opportunity cost of money rather than the own rate of interest.

According to the empirical money demand literature, a natural choice for a variable measuring the opportunity cost of money is the interest rate for long-term government bonds. Country-specific spreads between long-term interest rates are driven by the indebtedness and the economic situation in that country. In the current financial crisis, spreads have increased dramatically for some euro-area countries. In our sample, cross-country deviations from the average euro area bond rate were typically about eight basis points, compare Figure 2.

We tested the stationarity of our data using the panel unit root test introduced by Pesaran (2007) that allows for cross-sectional dependence. The results clearly indicate that the levels of all variables, including real money supply, income, and both interest rates under consideration, follow I(1)-processes, see Table 4 in the Appendix.

Figure 2: Spreads between long-term interest rates in the euro area



Notes: The figure shows the national deviations of the ten year government bond yields from the cross-country average (left hand side y-axis) and the cross-country average yield itself (right hand side y-axis).

4.2 The benchmark specification for euro area money demand

In accordance with Driscoll (2004), our empirical analysis is based on the following standard specification for the long-run money demand,

$$\tilde{m}_{it} - \tilde{p}_{it} = \beta_1 \tilde{y}_{it} + \beta_2 \tilde{r}_{it} \tag{1}$$

where real money demand depends on income and an interest rate variable. In the panel estimation, all variables are demeaned from their cross-sectional average, i.e. $\tilde{x}_{it} = x_{it} - (1/N) \sum_{i=1}^{N} x_{it}$ and are given in logs and per capita (except for the interest rates). In order to account for short-run dynamics of money demand, we follow e.g. Pesaran and Shin (1999) and estimate the long-run income and interest rate elasticities in an error correction framework,

$$\begin{aligned} \triangle(\tilde{m}_{it} - \tilde{p}_{it}) \quad = \quad & \delta(\tilde{m}_{it-1} - \tilde{p}_{it-1}) + \alpha_1 \tilde{y}_{it} + \alpha_2 \tilde{r}_{it} + \\ & \sum_{j=1}^{p-1} \lambda_j \triangle(\tilde{m}_{it-j} - \tilde{p}_{it-j}) + \sum_{j=0}^{q-1} (\theta_j \triangle \tilde{y}_{it-j} + \phi_j \triangle \tilde{r}_{it-j}) \\ & + d_i + \varepsilon_{it}, \end{aligned} \tag{2}$$

where d_i denotes a country-specific fixed effect and the long-run (semi)elasticities are obtained as $\beta_1 = -\alpha_1/\delta$ and $\beta_2 = -\alpha_2/\delta$, respectively. Similar to an estimation of an aggregate euro area money demand based on a purely time-series perspective, our benchmark specification assumes in a first step that the short-run dynamics are the same across countries. Applying standard information criteria, we choose the lag orders p and q equal to two.

Table 1 presents the estimation results for the benchmark specification of euro area money demand using three different interest rate variables for measuring the opportunity cost of money. In the three columns of the table we show the estimates obtained for long-term government bond yields ($r^{\,l}_{it}$), the interest rate for deposits up to one year ($r^{\,d}_{it}$), and their spread ($r^{\,l}_{it} - r^{\,d}_{it}$). The results suggests two main conclusions. First, for all interest rate measures under consideration the estimated long-run income elasticity of euro area money demand is highly significant and plausibly signed. In line with earlier contributions on euro area money demand based on a pure time series approach, the panel estimates of income elasticities are clearly above one, ranging from 1.41 to 1.55. Therefore, the cross-country analysis of money demand supports the evidence of a declining income velocity in the euro area.

Second, as expected, the results obtained for the long-run interest rate (semi)elasticity strongly depends on the interest rate measure applied. In line with the interpretation of an opportunity cost variable, one obtains a negatively signed estimate for the long-term interest rate and the interest rate spread. In contrast, the positive coefficient of the deposit rate indicates that this interest rate is more closely related to the concept of the own rate of money. However, the long-run interest rate effect is only significant in case of $\tilde{r}_{it} = r^{\,l}_{it}$. Moreover, panel cointegration tests show that the inclusion of the long-term interest rate is required to obtain a cointegrated long-run money demand function for the euro area. This shows that the long-term interest rate is the most appropriate interest measure in our application. In the following, we therefore investigate the robustness of the results focusing on money demand functions incorporating the long-term interest rate.

Let us close this section by looking at the short-run dynamics, also displayed in Table 1. An increase in interest rates first leads to a rise in monetary aggregates. The initial positive response can be explained by portfolio shifts. The short-term assets that belong to M3 will attract more buyers and monetary

Table 1: The benchmark specification of euro area money demand using alternative interest rates

Interest rate:		r^{l}_{it}	$r^{l}_{it} - r^{d}_{it}$	r^{d}_{it}
Long-run money demand:	$\tilde{y}_{it}$	1.44*** (2.64)	1.41** (2.06)	1.55** (2.38)
	$\tilde{r}_{it}$	-0.58** (-2.11)	-0.18 (-1.01)	0.03 (0.16)
Error correction term:		-0.09*** (-4.21)	-0.07*** (-3.73)	-0.07*** (-3.65)
Short-run dynamics:	$\Delta\tilde{y}_{it}$	0.56*** (3.51)	0.50*** (2.84)	0.47*** (2.61)
	$\Delta\tilde{y}_{it-1}$	0.58*** (3.66)	0.49*** (2.78)	0.45** (2.51)
	$\Delta\tilde{r}_{it}$	0.16*** (4.71)	0.09*** (4.97)	-0.05*** (-2.67)
	$\Delta\tilde{r}_{it-1}$	0.06** (2.08)	-0.01 (-0.31)	0.02 (1.22)
	$\Delta\left(\tilde{m}_{it-1} - \tilde{p}_{it-1}\right)$	-0.01 (-0.18)	0.05 (0.40)	0.04 (0.79)
R^2		0.17	0.16	0.13
Prob. of cointegration test		0.00	0.16	0.25

Notes: The estimation is based on Equation (2). r^l and r^d denote the long-term and the deposit interest rate. Sample: 1999Q1 - 2008Q2; *,**,*** indicate significance at the 10%, 5%, 1% level, respectively; t-statistic in parentheses. The p-value of the cointegration test refers to the null of "no cointegration" against the alternative that the majority of cross-sectional units are cointegrated, see Westerlund (2005).

aggregates increase.[9]

4.3 Sensitivity Analysis

4.3.1 Heterogeneous short-run dynamics: Pooled mean group estimation

Following e.g. Driscoll (2004) and Mulligan and Sala-i-Martin (1992), the benchmark specification presented in Table 1 assumed that money demand coefficients are homogeneous across euro area countries. This restriction may be particular severe for the short-run dynamics of a money demand function. In order to check the robustness of our results, we therefore re-estimate the euro area money demand function applying the pooled mean group estimation (PMGE) introduced by Pesaran, Shin and Smith (1999). In this model the short-run dynamics are allowed to differ between countries but the long-run relationships are restricted to be homogeneous. Advancing on our benchmark specification, the pooled mean group estimation is based on a ARDL-model with heterogeneous short-run dynamics:

$$\begin{aligned}\triangle\left(\tilde{m}_{it}-\tilde{p}_{it}\right) = {} & \delta_i\left(\tilde{m}_{it-1}-\tilde{p}_{it-1}\right)+\alpha_1\tilde{y}_{it}+\alpha_2\tilde{r}_{\,it}+ \\ & \sum_{j=1}^{p-1}\lambda_{ij}\triangle\left(\tilde{m}_{it-j}-\tilde{p}_{it-j}\right)+\sum_{j=0}^{q-1}\left(\theta_{ij}\triangle\tilde{y}_{it-j}+\phi_{ij}\triangle\tilde{r}_{\,it-j}\right) \\ & +d_i+\varepsilon_{it}.\end{aligned} \tag{3}$$

We find that the standard Hausman test rejects the null hypothesis of homogeneous short run dynamics at the 5% but not at the 1% significance level. Therefore, it is not obvious that assuming heterogeneous short-run dynamics is actually helpful and that PMGE should be the preferred estimation technique. However, according to the results shown in Table 2, the main results obtained for the euro area money demand are not affected by the assumptions about short-run dynamics. The PMGE estimates for both, the long-run income and the interest rate (semi)elasticity are highly significant, plausibly signed and similar to those obtained for the benchmark specification. In fact, neither the somewhat higher point estimate of the income elasticity nor the slightly lower interest elasicity are significantly affected by the estimation procedure.

[9] Blaes (2009) analyses the dynamics after changes in the monetary policy in more detail.

Table 2: Euro area money demand with heterogeneous short-run dynamics

Dependent variable: $\tilde{m}_{it} - \tilde{p}_{it}$			
Long-run money demand:			
	Coeff.	Std. Err.	t-Stat.
$\tilde{y}_{it}$	1.53***	0.10	15.99
$\tilde{r}^{l}_{it}$	-0.40***	0.07	-5.76
Error correction term:	-0.15*	0.08	-1.88
	Test stat.	Prob.-value	
Hausman Test	7.1770	0.0276	
Cointegration test	5.9976	0.0000	

Notes: Results obtained from pooled mean group estimation (PMGE) based on Equation (3). The country-specific lag order is chosen using the Akaike criterium with maximum lag order eight. The interest rate measure is the long-term interest rate. The panel cointegration test rejects the null of "no cointegration" at the 1% level, compare Westerlund (2005). See Table 1 for further explanation.

4.3.2 The role of wealth

Let us now investigate whether our results are also robust with respect to the inclusion of additional variables. According to the literature, wealth is the most critical factor that may have additional effects on long-run money demand. In particular, as Mankiw (1992) already emphasised, income elasticities higher than one could be explained by the omission of wealth in the estimated money demand function. Since both income and wealth increase the total volume of liquid assets that a household can possibly hold, wealth might be a relevant figure in portfolio decisions. Note, however, that it is not indisputable that the effect of wealth on the demand for money is positive, see Boone and van den Noord (2008). A rise in wealth can also cause a decline in money demand due to a substitution effect that is opposed by the positive income effect of wealth. If, for instance, equity prices go up, the households will probably move money into stock markets as the cost of the availability of liquid assets increase. This effect could be observed in the current financial crisis. Conditional on the slump in all asset prices at the trough of the downturn, the attractiveness of money compared to other investment rose.

In accordance with the recent literature, we re-estimate the benchmark specification for euro area money demand by including two different wealth measures,

Table 3: Wealth effects and the demand for money in the euro area

	Coefficient	Model specification		
		house prices	equity prices	equity prices (with break)
Long-run money demand:	$\tilde{y}_{it}$	1.51** (2.53)	1.51*** (2.82)	1.71*** (2.83)
	$\tilde{r}^1_{it}$	-0.42* (-1.72)	-0.71** (-2.35)	-0.89** (-2.49)
	$\tilde{w}_{it}$	0.09 (0.82)	-0.17 (-1.21)	-0.22* (-1.94)
	$\tilde{w}_{it} \times d_{2003}$			0.25 (1.13)
Error-correction term:		-0.11*** (-4.33)	-0.09*** (-4.29)	-0.08*** (-4.08)
Short-run dynamics:	$\Delta\tilde{y}_{it}$	0.65*** (3.06)	0.52*** (2.91)	0.50*** (2.75)
	$\Delta\tilde{y}_{it-1}$	0.61*** (2.76)	0.62*** (3.49)	0.62*** (3.44)
	$\Delta\tilde{r}^1_{it}$	0.19*** (4.74)	0.18*** (5.09)	0.19*** (5.33)
	$\Delta\tilde{r}^1_{it-1}$	0.08** (2.03)	0.07** (1.99)	0.08** (2.36)
	$\Delta(\tilde{m}_{it-1} - \tilde{p}_{it-1})$	0.04 (0.44)	0.05 (0.91)	0.03 (0.46)
	$\Delta\tilde{w}_{it}$	0.04 (0.37)	-0.02 (-0.59)	-0.02 (-0.87)
	$\Delta\tilde{w}_{it-1}$	-0.04 (-0.42)	0.05** (2.02)	0.05** (1.99)
R^2		0.18	0.18	0.18
Prob. of cointegration test:		0.02	0.03	0.00

Notes: Results obtained from the benchmark specification for money demand augmented by wealth. The time dummy d_{2003} is equal to one from 2003Q1 onwards and zero otherwise to capture a potential time break in the effect of equity prices, compare Figure 4. See Table 1 for further explanation.

house and equity prices. From a cross-country perspective, the role of wealth can only be assessed if it varies across countries. For house prices country-specific differences are very pronounced. For example, while Spain and the Ireland have experienced a massive housing boom, house prices in Germany and Austria more or less stagnated, see Figure 3. In the following, we use the house price indexes published by the ECB and the German Bundesbank as proxies for the house prices in the 10 countries.[10] The second proxy of wealth refers to equity prices. Specifically, we employ the leading national stock price index of the euro area countries under consideration, as indicated by Bloomberg. In fact, there have been notable cross-country variations in stock prices in the euro area during the first years of the monetary union, particularly before 2003, see Figure 4. Following the suggestion of a referee, we controlled for a potential break in the impact of equity price variations in 2003 and allowed for a time-varying effect of equity prices on long-run money demand.

The results obtained for the wealth-augmented money demand functions are shown in Table 3. Apparently, none of our conclusions based on the benchmark specification of euro area money demand is distorted by wealth effects. In spite of the notable cross-country variations in both proxies for wealth, neither equity nor house prices affect the cross-sectional long-run money demand in a significant way, at least not from 2003 onwards.[11] The only significant coefficient refers to the lagged first difference of the cross-country deviation in stock prices. Overall, wealth does not seem to be a major determinant of the movements in the cross-country deviations of euro area money demand.

5 Concluding remarks

The (in)stability of the euro area money demand function plays a central role for the importance of money for the monetary policy of the European Central Bank. The current paper investigated the determinants of euro area money demand from a cross-country perspective. To that aim, we employed country-specific data including the national contributions to the euro-area wide monetary ag-

[10] Note that these indexes are only available from 2000 onwards. Not all of these indexes are constructed in the same way but this is the best we can do because there is no EU-harmonised index, yet.

[11] We also checked the robustness of our results with respect to country-specific effects of house prices. Allowing different effects for countries with weak and strong growth in house prices shows, however, that house prices are insignificant for both groups of countries. For brevity, results are not presented but are available on request.

gregates collected from the national central banks. In contrast to the partly mixed results of the empirical literature using aggregated time series data, panel cointegration tests provided evidence in favour of a stable long-run money demand function. In particular, irrespective from the interest rate measure, the estimation procedure, and the inclusion of wealth in the empirical money demand model, the estimated long-run income elasticity of money demand is clearly above one. This strongly confirms earlier evidence on the declining income velocity of money demand in the euro area.

The distinguishing feature of a cross-country perspective on money demand is that aggregated shocks like technological innovations or turmoils of financial markets that hit all countries equally cannot distort estimation results because the estimation is based exclusively on deviations from cross-country averages. A stable cross-country money demand for the euro area thus indicates that the instability of standard euro area money demand functions could be explained by omitted macro variables. This finding has two important consequences. First, recent research directed to find these omitted macro variables is promising, compare de Bondt (2009). And, second, our results support the renewed interest in the development of monetary aggregates stirred by the recent financial crisis.

References

Arnold, I., 1994. The myth of a stable European money demand. Open Economies Review 5, 249–259.

Beyer, A., 2009. A stable model for euro area money demand revisiting the role of wealth. ECB Working Paper No. 1111.

Beyer, A., Doornik, J., Hendry, D., 2001. Constructing historical euro-zone data. The Economic Journal 3, 102–121.

Blaes, B., 2009. Money and monetary policy transmission in the euro area: Evidence from FAVAR- and VAR approaches. Deutsche Bundesbank Discussion Paper, Series 1: Economic Studies (18).

Boone, L., van den Noord, P., 2008. Wealth effects on money demand in the euro area. Empirical Economics 34, 525–536.

Brand, C., Cassola, N., 2004. A money demand system for euro area M3. Applied Economics 36 (8), 817–838.

Cappiello, L., Kadareja, A., Sorensen, C., Protopapa, M., 2010. Do bank loans and credit standards have an effect on output? a panel approach for the euro area. ECB Working Paper No. 1150.

Carstensen, K., 2006. Stock market downswing and the stability of European Monetary Union money demand. Journal of Business and Economic Statistics 24 (4), 395–402.

Coenen, G., Vega, J.-L., 2001. The demand for M3 in the euro area. Journal of Applied Econometrics 16, 727–748.

de Bondt, G., 2009. Euro area money demand - empirical evidence on the role of equity and labour markets. ECB Working Paper No. 1086.

Dreger, C., Wolters, J., 2009. Money velocity and asset prices in the euro area. Empirica 36 (1), 51–63.

Dreger, C., Wolters, J., 2010. Investigating M3 money demand in the euro area. Journal of International Money and Finance 29 (1), 111–122.

Driscoll, J., 2004. Does bank lending affect output? Evidence from the U.S. states. Journal of Monetary Economics 51, 451–471.

ECB, June 2003. The outcome of the ECB's evaluation of its monetary policy strategy. Monthly Bulletin, 79–92.

ECB, April 2008. Financial integration in Europe, chapter 1.

Funke, M., 2001. Money demand in Euroland. Journal of International Money and Finance 20, 701–713.

Gerlach, S., Svensson, L., 2003. Money and inflation in the euro area: A case for monetary indicators? Journal of Monetary Economics 50 (8), 1649–1672.

Greiber, C., Lemke, W., 2005. Money demand and macroeconomic uncertainty. Deutsche Bundesbank Discussion Paper 26 (5).

Hayo, B., 1999. Estimating a European demand for money. Scottish Journal of Political Economy 46 (3), 221–244.

Lütkepohl, H., Teräsvirta, T., Wolters, J., 1998. Modeling the demand for M3 in the unified Germany. The Review of Economics and Statistics. 80 (3), 399–409.

Mankiw, G., 1992. Comment on: Mulligan, C. B. and Sala-i-Martin, X. (1992), U.S. money demand: Surprising cross-sectional estimates. Brookings Papers on Economic Activity 2, 285–327.

Mulligan, C., Sala-i Martin, X., 1992. U.S. money demand: Surprising cross-sectional estimates. Brookings Papers on Economic Activity 2, 285–327.

Pesaran, M., 2007. A simple panel unit root test in the presence of cross-sectional dependence. Journal of Applied Econometrics 22, 265–312.

Pesaran, M., Shin, Y., 1999. An autoregressive distributed lag modelling approach to cointegration analysis. In: Strom, S. (Ed.). Econometrics and Economic Theory in the 20th Century: The Ragnar Frisch Centennial Symposium.

Pesaran, M., Shin, Y., Smith, R., 1999. Pooled mean group estimation of dynamic heterogenous panels. Journal of the American Statistical Association 94 (446), 621–634.

Rondorf, U., 2010. Are bank loans important for output growth: A panel analysis of the euro area, Working paper, Freie Universität Berlin.

Setzer, R., Wolff, G., 2009. Money demand in the euro area: New insights from disaggregated data. EU Commission, Economic Papers (373).

Westerlund, J., 2005. New simple test for panel cointegration. Econometric Reviews 24 (3), 297–316.

Appendix

Table 4: Unit root tests by Pesaran (2007)

Null hypothesis: series contains an unit root		
Variable	Test-Statistic	Prob. value
$Real\ M3$	-2.111	0.165
GDP	-1.276	0.920
r^l	-1.131	0.965
r^d	-2.296	0.065
$\Delta\,(Real\ M3)$	-5.486	0.010
$\Delta\,(GDP)$	-5.575	0.010
Δr^l	-4.463	0.010
Δr^d	-5.905	0.010

Notes: This panel unit root test assumes individual unit root processes and allows for cross-sectional dependence; it is conducted using the original data (not cross-sectional demeaned); the selection of the maximum lags is done automatically based on Akaike, Schwarz criteria.

Figure 3: High diversity of house price indexes

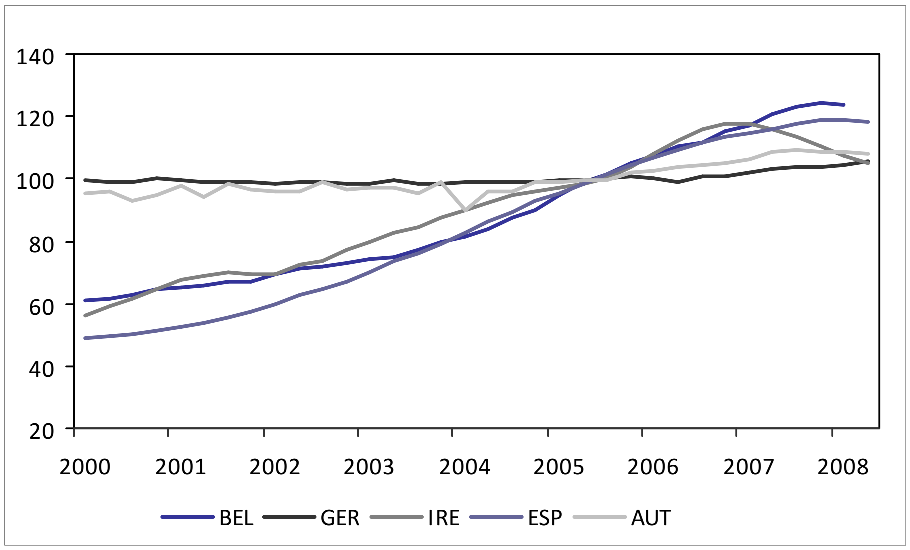
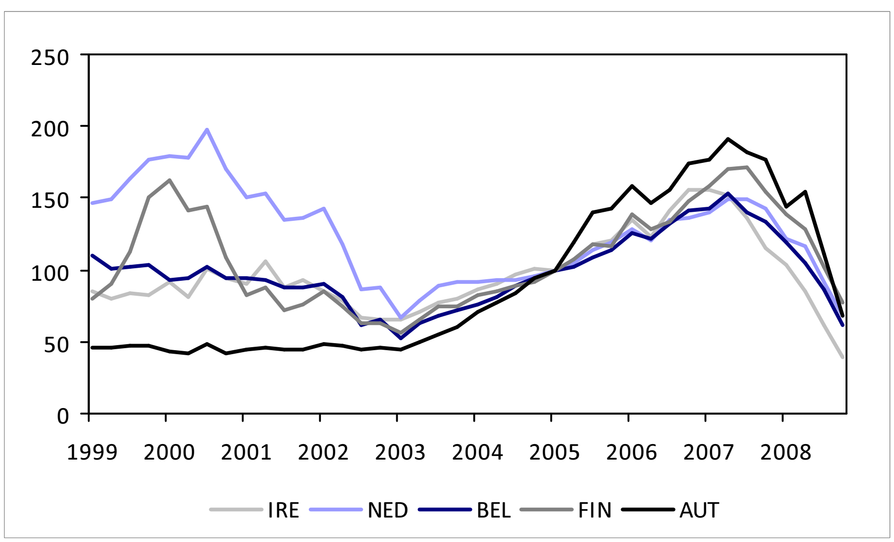


Figure 4: Equity leading indexes



Diskussionsbeiträge
des Fachbereichs Wirtschaftswissenschaft
der Freien Universität Berlin

2010

2010/1 BÖNKE, Timm / Sebastian EICHFELDER
Horizontal equity in the German tax-benefit system
Economics

2010/2 BECKER, Sascha / Dieter NAUTZ
Inflation, Price Dispersion and Market Integration through the Lens of a Monetary Search Model
Economics

2010/3 CORNEO, Giacomo / Matthias KEESE / Carsten SCHRÖDER
The Effect of Saving Subsidies on Household Saving
Economics

2010/4 BÖNKE, Timm / Carsten SCHRÖDER / Clive WERDT
Compiling a Harmonized Database from Germany's 1978 to 2003 Sample Surveys of Income and Expenditure
Economics

2010/5 CORNEO, Giacomo
Nationalism, Cognitive Ability, and Interpersonal Relations
Economics

2010/6 TERVALA, Juha / Philipp ENGLER
Beggar-Thyself or Beggar-Thy-Neighbour? The Welfare Effects of Monetary Policy
Economics

2010/7 ABBASSI, Puriya / Dieter NAUTZ
Monetary Transmission Right from the Start: The (Dis)Connection Between the Money Market and the ECB's Main Refinancing Rates
Economics

2010/8 GEYER, Johannes / Viktor STEINER
Public pensions, changing employment patterns, and the impact of pension reforms across birth cohorts
Economics

2010/9 STEINER, Viktor
Konsolidierung der Staatsfinanzen
Economics

2010/10 SELL, Sandra / Kerstin LOPATTA / Jochen HUNDSDOERFER
Der Einfluss der Besteuerung auf die Rechtsformwahl
FACTS

2010/11 MÜLLER, Kai-Uwe / Viktor STEINER
Labor Market and Income Effects of a Legal Minimum Wage in Germany
Economics

2010/12 HUNDSDOERFER, Jochen / Christian SIELAFF / Kay BLAUFUS / Dirk KIESEWETTER / Joachim WEIMANN
The Name Game for Contributions – Influence of Labeling and Earmarking on the Perceived Tax Burden
FACTS

2010/13 MUCHLINSKI, Elke
Wie zweckmäßig ist das Vorbild der Physik für ökonomische Begriffe und Metaphern
Economics

2010/14 MUCHLINSKI, Elke
Metaphern, Begriffe und Bedeutungen – das Beispiel internationale monetäre Institutionen
Economics

2010/15 Dittrich, Marcus und Andreas Knabe
Wage and Employment Effects of Non-binding Minimum Wages
Economics

2010/16 MEIER, Matthias und Ingo Weller
Wissensmanagement und unternehmensinterner Wissenstransfer
Management

2010/17 NAUTZ, Dieter und Ulrike Rondorf
The (In)stability of Money Demand in the Euro Area: Lessons from a Cross-Country Analysis
Economics