

Heterogeneity in money holdings across euro area countries: the role of housing

Ralph Setzer

(Deutsche Bundesbank and European Commission)

Paul van den Noord

(European Commission)

Guntram Wolff

(Deutsche Bundesbank and European Commission)



Discussion Paper
Series 1: Economic Studies
No 04/2010

Discussion Papers represent the authors' personal opinions and do not necessarily reflect the views of the Deutsche Bundesbank or its staff.

Editorial Board:

Klaus Düllmann
Frank Heid
Heinz Herrmann
Karl-Heinz Tödter

Deutsche Bundesbank, Wilhelm-Epstein-Straße 14, 60431 Frankfurt am Main,
Postfach 10 06 02, 60006 Frankfurt am Main

Tel +49 69 9566-0

Telex within Germany 41227, telex from abroad 414431

Please address all orders in writing to: Deutsche Bundesbank,
Press and Public Relations Division, at the above address or via fax +49 69 9566-3077

Internet <http://www.bundesbank.de>

Reproduction permitted only if source is stated.

ISBN 978-3-86558-600-1 (Printversion)

ISBN 978-3-86558-601-8 (Internetversion)

Abstract

In this paper we examine why monetary aggregates of euro area Member States have developed differently since the inception of the euro. We derive a money demand equation that incorporates housing wealth and collateral as well as substitution effects on real money holdings. Empirically, we show that cross-country differences in real balances are determined not only by income differences, a standard determinant of money demand, but also by house price developments. Higher house prices and higher user costs of housing are both associated with larger money holdings. Country-specific money holdings are also connected with structural features of the housing market.

JEL Classification: E41, E51, E52

Keywords: Money, housing, national contribution, euro area

Non technical summary

The monetary policy framework of the European Central Bank attaches high importance to understanding the determinants of money growth in the euro area. Since the onset of the financial crisis this has been motivated not only by concerns that excessive money growth can heighten inflation risks, but also because excess liquidity can contribute to instability of the financial system and the economy at large. To deepen this understanding this paper looks at the differences in money growth across euro area countries and attempts to explain these differences, with the emphasis on the role played by housing.

The paper starts with the observation that since the introduction of the euro money stocks indeed behaved very differently across euro area countries. For example, in Spain and Ireland the money stock grew on average per year by over 11% and 16%, respectively, as compared to 6½ % in Germany. Meanwhile differences in house prices across euro area countries were even more pronounced. For example, in Spain and Ireland house prices grew at two-digit rates whereas in Germany house prices declined. Countries with high house price inflation thus show strong money growth. The paper examines if these phenomena may be related, both theoretically and empirically.

The possible theoretical relationships between housing and money stocks are multiple. First, there may be a *wealth effect*, by which is meant that after a house price increase households feel richer and want to hold some of that extra wealth in the form of liquid assets. Second, there may be a *substitution effect*, by which is meant that in the face of an expected increase in house prices households see housing as an investment opportunity and are induced to cut their money holdings to fund a bigger or a second home. A further relationship between housing and money demand stems from the *collateral effect*: higher house prices make it easier for households to take out loans and maintain larger money holdings. Finally, there is a *transaction effect*: in a housing boom transactions soar and the associated demand for money will increase as well.

The econometric estimates suggest that higher house prices do raise money demand. In about half of the euro area countries in the sample, this effect explains at least one-third of the deviation in money growth from the euro area average. There is also evidence that the impact of future (expected) house price increases reduce the demand for money. Moreover, institutional differences regarding housing and mortgage markets between countries appear to be important determinants of cross-country differences in money demand. For example, the typical 'loan-to-value' ratio differs widely across countries and the higher these are, the stronger will be the demand for money. There is also a positive impact of home ownership on the demand for money.

A potentially interesting question is whether the creation of the single currency itself has been a factor in shaping the relationship between house prices and the money stock. Prior to monetary union cross-border financial flows were hampered by exchange rate risks and other (institutional) barriers. Since monetary union has been established, however, most of these barriers have been lifted and domestic housing booms could attract cross-border capital flows to a larger extent than before. This would be reflected

in higher money growth. The findings are largely consistent with this possibility: there is no significant effect of house prices on money demand prior to monetary union, but it is strongly significant afterwards. This suggests that it is important to expand the monitoring of money growth to include the differences in house price effects on money holdings across euro area countries. This is particularly important since aggregate developments may be masking diverging trends at the country level, which could eventually have systemic and financial stability risks for the euro area as a whole.

Nicht-technische Zusammenfassung

Die geldpolitische Strategie der Europäischen Zentralbank legt großen Wert auf das Verständnis der Determinanten des Geldmengenwachstums im Euro-Währungsgebiet. Seit dem Ausbruch der Finanzkrise wurde dies nicht nur damit begründet, dass überschüssiges Geldmengenwachstum Inflationsrisiken erhöht, sondern auch damit, dass Überschussliquidität zu Instabilitäten des Finanzsystems und der Volkswirtschaft als Ganzes führen kann. Um dieses Verständnis zu vertiefen, betrachtet die vorliegende Studie die Unterschiede im Geldmengenwachstum in den Ländern des Euroraums und versucht diese zu erklären, wobei der Schwerpunkt auf Entwicklungen im Immobiliensektor gelegt wird.

Ausgangspunkt der Studie ist die Beobachtung, dass die Geldmengenentwicklung in den einzelnen Ländern des Euroraums sehr unterschiedlich verläuft. So wuchsen zum Beispiel in Spanien und Irland die nationalen Beiträge zur Geldmenge M3 im Jahresdurchschnitt um mehr als 11% und 16%, verglichen mit lediglich 6½% in Deutschland. Die Unterschiede bei den Immobilienpreisen zwischen den einzelnen Ländern des Euroraums waren sogar noch ausgeprägter. Zum Beispiel wuchsen in Spanien und Irland die Immobilienpreise mit zweistelligen Zuwachsraten, während sie in Deutschland sanken. Darüber hinaus weisen Länder mit hohen Hauspreisanstiegen auch starkes Geldmengenwachstum auf. Das Papier untersucht sowohl theoretisch wie empirisch, inwieweit diese Phänomene zusammenhängen.

Die möglichen theoretischen Beziehungen zwischen Immobilien und Geldmengen sind vielfältig. Erstens erhöht ein Anstieg der Immobilienpreise das Vermögen der Wirtschaftssubjekte. Aufgrund dessen steigt die Nachfrage nach den einzelnen Bestandteilen des Anlageportfolios, zu denen auch liquide Mittel in Form von Geld gehören. Zweitens kann es zu einem Substitutionseffekt kommen, wenn gestiegene Renditeerwartungen im Immobiliensektor die Wirtschaftssubjekte veranlassen, zulasten ihrer Geldhaltung verstärkt in Immobilien zu investieren. Eine weitere Beziehung zwischen Immobilien und Geldnachfrage ergibt sich aus dem Kreditbesicherungseffekt: Eine Erhöhung der Immobilienpreise steigert die Kreditwürdigkeit eines Kreditnehmers und führt somit tendenziell zu einer besseren Kreditverfügbarkeit. Schließlich spielt der Transaktionseffekt eine Rolle. Steigende Immobilienpreise sind üblicherweise mit einer verstärkten Aktivität auf dem Immobilienmarkt verbunden. Die größeren Umsätze gehen mit einer größeren Nachfrage nach Zahlungsmitteln einher.

Die ökonometrischen Schätzungen zeigen, dass höhere Immobilienpreise mit einer erhöhten Geldnachfrage einhergehen. In etwa der Hälfte der Länder des Euroraums erklären die Entwicklungen auf dem Immobilienmarkt mindestens ein Drittel der Abweichung im Geldmengenwachstum vom Durchschnitt des Euroraums. Es zeigt sich zudem, dass zukünftige (erwartete) Hauspreisanstiege zu einer geringeren Geldhaltung führen. Darüber hinaus scheinen institutionelle Differenzen auf den Immobilien- und Hypothekenmärkten zur unterschiedlichen Entwicklung der Geldnachfrage in den Ländern des Euroraums beizutragen. So variiert zum Beispiel der typische Beleihungssatz stark zwischen den einzelnen Ländern des Euroraums. Je höher

dieser ist, desto stärker wird die Nachfrage nach Geld. Es zeigt sich zudem ein positiver Einfluss des Wohneigentums auf die Geldnachfrage.

Eine potenziell interessante Frage ist, ob die Entstehung der einheitlichen Währung selbst einen Einfluss auf die Beziehung zwischen den Immobilienpreisen und der Geldmenge hatte. Vor der Währungsunion wurden grenzüberschreitende Finanzströme von Wechselkursrisiken und anderen (institutionellen) Barrieren behindert. Mit der Währungsunion wurden die meisten dieser Hemmnisse beseitigt, mit der Folge, dass inländische Hauspreisbooms nun in einem größeren Umfang grenzüberschreitende Kapitalströme anziehen können. Dies sollte sich in einem höheren Geldmengenwachstum widerspiegeln. Unsere Ergebnisse stehen weitgehend im Einklang mit dieser Vorstellung: Während es keine signifikanten Auswirkungen der Häuserpreise auf die Geldnachfrage im Vorfeld der Währungsunion gibt, zeigen sich hochsignifikante Effekte seit 1999. Dies spricht dafür, die monetäre Analyse um Unterschiede in den Hauspreisen der Euro-Länder zu erweitern. Dies ist insbesondere deshalb von Relevanz, da Entwicklungen im Euro-Aggregat unterschiedliche Entwicklungen auf Länderebene verdecken können, die schließlich zu systemischen Risiken und finanzieller Instabilität im gesamten Euroraum führen könnten.

Contents

1	Introduction	1
2	Housing in the money demand equation	3
3	Empirical model and data	7
4	Empirical results	10
4.1	Main results	10
4.2	Robustness checks	15
4.3	Comparison with the pre-EMU period	18
5	Conclusions	19
6	References	21
7	Annex	24

Heterogeneity in money holdings across euro area countries: the role of housing¹

1 Introduction

From the outset the monetary policy framework of the ECB has stressed the importance of monetary variables. The special consideration of monetary variables is based on the generally accepted view that, in the long term, “inflation is a monetary phenomenon”, meaning that monetary growth in the medium to long term is associated with a rise in the general price level. Moreover, in the wake of the financial crisis, the role of money growth as a factor determining financial stability has been stressed more prominently again.² From a financial as well as price stability perspective, it is therefore important to understand the central determinants of monetary aggregates which is typically done in a money demand framework.

The current paper investigates the demand for money in the euro area with a special focus on the heterogeneity of monetary and housing market dynamics across euro area countries. From a policy point of view, this topic is of great importance as real and nominal divergence across euro area countries has been persistent and substantial. An investigation into the link between housing and money could help to understand determinants of that heterogeneity. In particular, housing markets could play a key role in explaining divergences in money across euro area countries. To the extent that these developments reflect intra-area disequilibria, a thorough review of the structural features of the housing market would be conducive to increasing intra-euro area cohesion and macro-financial stability.

We start from the observation that monetary aggregates have behaved very differently across euro area Member States since the introduction of the euro. The heterogeneity in monetary dynamics among euro area countries is reflected in pronounced differences in the average annual growth of the national contributions to M3 since 1999³ For example, national contributions' annual rate of growth was 6.6

¹ European Commission, Economic and Financial Affairs, email: ralph.setzer@ec.europa.eu; paul.vandennoord@ec.europa.eu; guntram.wolff@ec.europa.eu. We thank Andreas Beyer, Gabor Koltay, Heinz Herrmann and seminar participants at the Bundesbank and at the ECB workshop on “Housing market and the Macroeconomy”, Frankfurt am Main, 26-27 November 2009 for valuable comments. The opinions expressed in this paper do not necessarily represent the views of the European Commission or DG ECFIN and are in the sole responsibility of the authors.

² For example, some studies find that house price bubbles could be driven by excessive money or credit growth (Alessi and Detken 2009, Gerdesmeier, Reimers and Roffia 2009, Agnello and Schuknecht 2009, Eickmeier and Hofmann 2009).

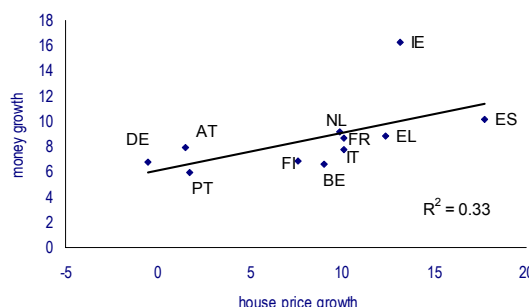
³ National contributions to euro area M3 do not include currency in circulation. Note also that a country's national contributions to euro area monetary aggregates are defined as liabilities of domestic monetary financial institutions (MFI) to the whole euro area non-MFI sector. As such, e.g. German households' and enterprises' short-term deposits held with branches and subsidiaries of German MFIs in Luxembourg are part of Luxembourg's contribution to euro area M3. However, the amount of deposits from and loans to euro area residents outside the domestic country is very low. As such, it can be assumed that national contributions to M3 are driven by macroeconomic developments in the individual euro area countries.

percent in Germany compared to 10.6 percent in Spain (average from 1999 to 2008).⁴ Ireland recorded by far the strongest money growth with an average growth rate of more than 16 percent annually. To our knowledge, no recent contribution has studied the determinants of this heterogeneity within a money demand framework.

Graph 1: Growth of national contributions to M3 (1)	Graph 2: House price growth (1)
<p>(1) average annual nominal growth from 1999 to 2008 in %. <i>Source:</i> ECB.</p>	<p>(1) average annual nominal growth from 1999 to 2008 in %. <i>Source:</i> ECB and OECD.</p>

At the same time, house price developments have been even more diverse across euro area countries. Several countries experienced strong increases in house prices, which in the cases of Ireland and Spain reached double-digit average annual growth rates (Graph 2).⁵ The central hypothesis of this paper is therefore, that differences in real house price developments have been among the central factors driving the heterogeneity in monetary dynamics. This hypothesis finds some graphical evidence in Figure 3. Countries with high growth rates for house prices, such as Spain, Ireland or Greece, also show high growth rates for national contributions to M3.⁶

Graph 3: House prices and money in the euro area (1)



(1) average annual growth from 1999 to 2008 in %
Source: ECB and OECD.

Earlier studies of money demand identified stable relationships between real balances, real income and interest rates in the euro area (see e.g. Calza, Gerdesmeier and Levy 2001). As a result of the strong monetary dynamics after 2001, traditional money demand specifications for the euro area that model the real M3 stock as function of real GDP and an interest rate variable (for example, the difference between the three-

⁴ Moreover, M3 dynamics have been varying substantially over time, as can be seen in Figures A1 and A2 of the appendix.

⁵ Figures A3 and A4 in the appendix show the heterogenous profiles of the time series.

⁶ Omitting Ireland from the graph still leaves a positive and significant relation between housing and money.

month money market rate and the return on M3 assets), leave a major part of monetary growth since 2001 unexplained. Several explanations for the monetary overhang have been given. For a time, the heightened economic and geopolitical uncertainties in the wake of the terrorist attacks of 11 September 2001 and the dramatic decline in stock prices between 2000 and 2003 were speaking for a demand-side-driven acceleration of monetary growth in the euro area. At that time, the response of households and enterprises included extensive portfolio shifts in favour of secure and liquid bank deposits which are part of M3 (Greiber and Lemke 2005, Carstensen 2006).

After around mid-2004, however, such special effects have no longer been boosting monetary growth. Instead, the monetary expansion was driven by a marked increase in lending. At the same time, the macroeconomic development in the euro area in the 2004 to 2007 period was characterised by a very sharp increase in the price of assets, in particular house prices. The more recent literature on aggregate money demand in the euro area accounts for these developments and explains the sharp credit-driven money growth in the post-2004 period by incorporating developments in asset markets. A number of studies extends conventional money demand functions by including housing or financial wealth variables (Boone and van den Noord 2008, Greiber and Setzer 2007, de Santis et al. 2008, de Bondt 2009, Beyer 2009). One important conclusion that can be drawn from these studies is that monetary developments at times cannot be fully explained by real income or interest rates and that asset market developments need to be included.

The remainder of the paper is structured as follows. The next section derives a money demand equation from a theoretical model incorporating wealth/collateral as well as substitution effects. In section 3, we develop our empirical specification that is particularly suited to uncover the heterogeneity of monetary dynamics across euro area countries. Our empirical results, presented in section 4, show that differences in money holdings across euro area countries can be explained by key features of the housing market as well as differences in real-economy developments. Finally, we draw some policy conclusion (section 5).

2 Housing in the money demand equation

Empirical approaches to money demand that incorporate housing have often been subject to the criticism that they were not underpinned by a structural model. Authors therefore questioned the stability of the ad-hoc empirical relation on the basis of a missing theoretical foundation. In this section, we try to remedy this by deriving a money demand model that is augmented by housing market developments.

Standard specifications for money demand equations usually comprise a rather narrow range of explanatory variables. Money demand varies with the volume of activity or transactions and the price level in line with the quantity theory of money. In addition, money demand is assumed to decrease if the interest rate rises, because the opportunity cost of holding liquidity as opposed to bonds increases. We propose to augment the standard money demand relationship with explanatory variables that capture the possible impact of house prices on money demand.

In a seminal paper, Friedman (1988) classified the possible relationships between asset prices and money demand into wealth, substitution, and transaction effect:

- The *wealth effect* stems from the fact that money is a store of value and as such serves as an alternative to holding other assets such as housing or financial wealth. An increase in house prices leading to differences between existing and desired portfolio composition, can then be associated with a rise in the portfolio demand for real balances in order to adjust the portfolio composition to the desired equilibrium.
- In contrast to the wealth effect, a *substitution effect* postulates that changes in the relative attractiveness of different assets alter the individual's portfolio structure. Specifically, an (expected) rise in house prices, *ceteris paribus*, renders this type of investment more attractive than holding money balances and causes a portfolio shift into housing and away from money.
- The *transaction effect* captures that housing sales and purchases mirrored in price and volume movements imply a rise in the need for money due to a simple transaction motive. This effect is possibly amplified by a rise in the number of transactions on the housing market during housing boom episodes (Stein 1995).

The wealth and substitution effects are both *portfolio effects*, but carry opposite signs and therefore are partly offsetting each other. The sign of the total portfolio effect of house prices on money demand is thus ambiguous and can only be determined empirically.

A further important aspect of the relation between housing and money stems from the *collateral effect* of household's assets. Higher house prices increase the collateral values of homes and improve home owners' access to loans, fostering credit and money growth. Due to asymmetric information distribution on credit markets, agents' ability to borrow depends on the value of their collateral (Iacoviello 2004, 2005). Since housing wealth is an important balance sheet variable, it determines the borrowing constraints faced by agents. Higher collaterals reduce the influence of asymmetric information and improve lending conditions. Thus there is a direct link between housing and loan developments. Moreover, in the spirit of Kiyotaki and Moore (1997) housing property may act as a catalyst which amplifies the effects of monetary policy.

In order to illustrate how the portfolio (wealth and substitution) and collateral effects could enter the money demand equation we set up a model that combines the two. It takes the standard model for money and consumption as a starting point, and extends it with housing as an argument in the utility function. Housing is considered to be both a consumer durable that delivers utility in the form of housing services, and a (real) asset that serves as a store of wealth akin to bonds and cash balances. Following Iacoviello (2004) and others we split the household sector in 'lenders' and 'borrowers'. The lenders are assumed to finance their homes with own savings and to hold bonds, whereas the borrowers are assumed to take up mortgage loans to finance their homes – hence they face a collateral constraint.

The optimisation decision faced by the *lenders* is:

$$(1) \quad \max_{C_t^l, \frac{M_t^l}{P_t}, H_t^l} E_0 \left[\sum_{t=0}^{\infty} \beta^t U \left(C_t^l, \frac{M_t^l}{P_t}, H_t^l \right) \right]$$

subject to the flow of funds constraint:

$$(2) \quad C_t^l + \frac{B_t^l}{P_t} + \frac{M_t^l}{P_t} + \frac{Q_t}{P_t} (H_t^l - H_{t-1}^l) = Y_t^l + R_{t-1} \frac{B_{t-1}^l}{P_{t-1}} + \frac{P_{t-1}}{P_t} \frac{M_{t-1}^l}{P_{t-1}}$$

where $Y_t, C_t^l, B_t^l, P_t, M_t^l, Q_t, H_t^l, R_t$ denote, respectively, real income, real consumption, bonds, the price level of consumption, money balances, the house price level, the volume of housing services and the real gross rate of return. The superscript l denotes that the variable refers to the lenders, E_t is the expectations operator and β^t is the rate of time preference. Households derive utility from the stock of housing whereas expenditure on housing must equal the change in the stock times its current price. The latter is the cash flow associated with residential investment. The real gross rate of return is defined by the Fisher parity equation:

$$(3) \quad 1 + i_t = R_t \frac{E_t P_{t+1}}{P_t}$$

where i_t denotes the nominal interest rate.

The borrowers are assumed to have the same utility schedule as the lenders, the only asymmetry being that the former are assumed to be myopic i.e. the discount factor is equal to unity for the present and zero for the future. Accordingly, the optimisation problem faced by the *borrowers* reads:

$$(4) \quad \max_{C_t^b, \frac{M_t^b}{P_t}, H_t^b} U \left(C_t^b, \frac{M_t^b}{P_t}, H_t^b \right)$$

The borrowers are subject to a flow of funds constraint and a collateral constraint:

$$(5) \quad C_t^b - \frac{B_t^b}{P_t} + \frac{M_t^b}{P_t} + \frac{Q_t}{P_t} (H_t^b - H_{t-1}^b) = Y_t^b - R_{t-1} \frac{B_{t-1}^b}{P_{t-1}} + \frac{P_{t-1}}{P_t} \frac{M_{t-1}^b}{P_{t-1}}$$

$$(6) \quad R_t \frac{B_t^b}{P_t} \leq \frac{E_t Q_{t+1}}{E_t P_{t+1}} H_t^b$$

where the superscript b denotes the borrowers. It is important to note that the variable B_t^b now stands for borrowing, not lending, and hence its sign turns negative in the flow of funds constraint. The collateral constraint is saying that the lenders demand a gross return on the loan that is covered at least by the expected value of the home. Iacoviello (2004) proves that this constraint will always be binding, and we will simply assume this to be the case here. The collateral constraint is essential because the discounted disutility of future sacrifices of consumption to service the mortgage debt is zero in this set-up; without the collateral constraint the amount of borrowing would be indefinite.

From the first order conditions of these problems, and assuming log-linear utility, an aggregate money demand equation can be derived which reads (see the mathematical annex):

$$(7) \quad \log \frac{M_t}{P_t} = \delta \log \frac{b_t}{d} + \log C_t + \log \frac{Q_t}{P_t} + \lambda \log \frac{H_t^b}{C_t^b} \left[1 - \frac{B_t^b}{Q_t H_t^b} \right] + (1 - \lambda) \left[\log \frac{H_t^l}{C_t^l} (i_t - \rho_t) - \log i_t \right]$$

where

$$(8) \quad \rho_t = \frac{E_t Q_{t+1} - Q_t}{Q_t}$$

denotes the expected rate of house price inflation, λ is the weight of credit-constrained households (borrowers) in aggregate money demand, b_t stands for shifts in preferences for holding money and d is the weight of housing in the (log-linear) utility function.

Equation (7) says that aggregate money demand is a function of the autonomous trend in money preference (b), aggregate (non-housing) consumption, C , the real house price, Q/P , the net real housing wealth of credit-constrained home-owners (scaled to consumption), the real user cost per unit of housing capital (given by the nominal interest rate less the expected house price increase, again scaled to consumption and with a positive sign because an increase in the user cost of housing leads to a substitution away from housing towards cash balances) and the interest rate (with the usual negative sign). It is important to note that the neat linear homogeneity of the equation disappears for more complex utility functions than the log-linear function, but the basic relationship would still hold. On the other hand, it needs to be stressed also that equation (7) is by no means intended as an all-encompassing theory but rather as an illustration as to how relatively straightforward behavioural assumptions can give rise to house prices being a determinant of money demand.

3 Empirical model and data

The aim of the paper is to analyse the determinants of the observed heterogeneity of money holdings across euro-area countries with a particular view to the role of different developments of the housing market. Our money demand equation is specified in a panel model that includes housing variables alongside the standard determinants of money and is suited to uncover differences across countries. As such, the empirical specification is intended to empirically illustrate the importance of housing market developments for money demand in a general way without strictly following our theoretical money demand equation.

A special feature of the model is that all variables are measured in deviations to the euro area average.⁷ As has been shown by Setzer and Wolff (2009), a central advantage of estimating the money demand function in difference to the euro area average is that it allows taking out drivers of money demand that are common to all countries. Such a procedure avoids the problem of formulating precise proxies for unexplained shifts in aggregate money balances. Greiber and Lemke (2005) show, e.g., that changes in financial and economic uncertainty, which are highly correlated across euro area countries, lead to temporary portfolio shifts and this may distort the link between money and prices. By taking out these global shocks, the approach permits to focus on the heterogeneity of money demand across euro area countries. In other words, the approach does not aim to explain aggregate euro area money holdings but rather focuses on uncovering the differences in money holdings across countries. Nevertheless, as the estimated elasticities reflect the same underlying parameters as in the aggregate money demand estimation (see Setzer and Wolff 2009), our approach is also able to provide evidence on the money-housing nexus at the aggregate level.

Econometrically, this approach is similar to a panel estimation which includes time fixed effects. The difference to fixed time effects estimations is that time fixed effects cater for the unweighted annual average of all variables while our approach takes out the weighted average developments of the variables.⁸ In other words, real money holdings are measured relative to the real money holdings of the euro area and all other variables are also measured relative to the euro area values. Moreover, the model includes country fixed effects to allow for constant country-specific preferences for money holdings.⁹ Specifically, we estimate the following relation:

$$(9) \quad \tilde{m}_{it} - \tilde{p}_{it} = f(\tilde{y}_{it}, \tilde{i}_{it}, (\tilde{q}_{it} - \tilde{p}_{it}))$$

where variables are measured in deviations from the euro area average as symbolized by the tilde. The variables m , p , y and i denote nominal national contributions to M3, the GDP deflator, real GDP, and the short-term interest rate variable (three months money market rate). The variable q corresponds to the nominal residential property price index. All variables except the interest rates are seasonally adjusted and they are

⁷ Greece and Luxembourg were excluded from the analysis due to missing data.

⁸ For example, we use the house price index for the euro area as a whole and not an unweighted average of the house prices of all euro area countries.

⁹ We do not include a deterministic trend on the assumption that exogenous shifts in money preferences are uniform across the euro area, i.e. $b_{it} - b_t = 0$.

computed in log differences to the euro area average (in case of GDP, M3 and GDP-weighted house prices) or relative to the euro area value in case of the interest rate..

The coefficients on the variables are assumed to be homogenous across countries. It is clear, however, that in a macroeconomic panel, there is usually some variation in the reaction coefficients across countries. As has been shown by Pesaran and Smith (1995), in a static case, if the coefficients differ randomly, a pooled estimation gives unbiased estimates of coefficient means. The estimated coefficients should thus be interpreted as the average cross-country reactions to the underlying variables. However, in the robustness section, we will also show that the estimated coefficients do not hinge on a small subset of countries and are fairly robust when omitting a number of countries.

Money balances were deflated with the GDP deflator. For the monetary aggregates we use quarterly data for national contributions to M3.¹⁰ The sample ranges from 1999Q1 to 2008Q4 in the baseline specification. Quarterly data for GDP and the GDP deflator are from Eurostat. Housing developments in the euro area are approximated by residential property price indices from the ECB. For some countries, data were only available on lower frequency (semi-annual or annual). Missing values were generated by linear interpolation.

Regarding the interest rate variable, it is very difficult to come up with a good measure of the opportunity cost of holding money that is specific to the individual euro area country. The more short term the interest rate, the more integrated the financial market becomes, and individual interest rates do not differ from the euro area aggregate. At the longer end of the maturity spectrum, significant differences can be found across euro area countries. However, these differences partly reflect different risk assessments of e.g. government bonds (see for example Hallerberg and Wolff 2008). In this sense, they are ill-suited to capture opportunity costs of holding money as higher risk assessment (fuelled e.g. by economic and financial uncertainty) may lead to higher money holdings due to precautionary portfolio shifts (Greiber and Lemke 2005). Moreover, domestic money holders can invest money in other euro area money or bond markets at little cost. Since 1999, with the removal of exchange rate risk, the opportunity costs of holding money are therefore rather similar across euro area countries. For sake of completeness, we nevertheless include a three-month interest rate, for which small variations are observable. In addition, we use alternative opportunity cost measures such as the spread between the ten year government bond yield and the three month interest rate (see also Coenen and Vega 2001) as well as the HICP inflation rate (see also Dreger and Wolter 2009). As will be shown below, our central results remain unaffected by the use of these alternative opportunity cost measures.¹¹

¹⁰ The national contributions are computed from the "Aggregated balance sheet of euro area monetary and financial institutions, excluding the eurosystem" published by the ECB by adding and subtracting the following items: 2.2-2.2.1-2.2.2-2.2.3.2.3-2.2.3.3.2+2.3+2.4-2.4.3. Obviously, this definition excludes money in circulation. However, the latter is of relatively lower importance for the monetary dynamics in a country as it accounts for less than 8% of the aggregate M3 in the euro area.

¹¹ For most countries the three-month Treasury bill is employed, except for the Netherlands, Portugal, Finland and Spain for which we use the deposit rate. Data for money and interest rates are obtained from official ECB statistics.

To assess the time series properties of the data, we examine the degree of integration of the variables. The null hypothesis of the Hadri (2000) stationarity test can be clearly rejected in all cases implying that not all time series in our panel are stationary. Findings from the IPS test suggest that the null hypothesis that all time series contain a unit root cannot be rejected (Table 1). The results are not sensitive to the number of lags.

Table 1: Panel unit root and stationarity tests

		M3	GDP	Interest rate	House price	H ₀
Hadri	Z(tau)	8.748	15.004	14.517	12.67	Stationarity
	p-value	0.00	0.00	0.00	0.00	
IPS	t-bar	-1.385	-1.058	2.575	-1.877	Unit root
	p-value	0.63	0.9336	1.00	0.082	

Note: Hadri test: Null hypothesis is that all time-series in the panel are stationary processes. Controlling for serial dependence in the errors and heteroskedastic disturbances across units (lag truncation=2). IPS is the Im-Pesaran-Shin test with the null hypothesis that all time series in the panel are realizations of a unit root process.

We therefore test for panel co-integration. Table 2 provides the statistics of the Phillips Peron group tests and the ADF test. The test indicates that the null hypothesis of no cointegration can be rejected. Hence, we base our main estimations on a panel co-integration framework. However, it should also be taken into consideration that panel co-integration and unit root tests have notoriously low power. Moreover, from an economic point of view, it is debatable to what extent the variables, which are measured in deviation from the euro area average, can exhibit a unit root. While this can locally be the case, it appears unlikely that the deviation would also exhibit a unit root in the long run.

Table 2: Results of panel cointegration tests

		Rho statistic	p-value
$\tilde{m} - \tilde{p}, \tilde{y}, \tilde{i}, \tilde{q} - \tilde{p}$	Group PP	-2.463	0.007
	Group ADF	-2.457	0.007

Note: Pedroni (1999) group tests for null of no cointegration among a multivariate vector (group rho statistic). Tests are performed with the automatic lag selection criterion by Akaike Schwarz.

Hence, in order to be sure that our results are not an artefact of the wrong econometric procedure applied, we proceed with two different methodologies. In line with the time series evidence, however, we rely on a panel co-integration framework as the specification tests indicate that this is appropriate. As robustness check, we show the

results of a simple fixed effects approach, which would be appropriate if the variables were stationary and not co-integrated. For the co-integration approach, we perform the estimation by dynamic ordinary least squares with one lead and one lag (DOLS(-1,1)). Dynamic OLS was originally developed by Stock and Watson (1993); Kao and Chiang (2000) analyze its properties in a panel context.¹² Our money demand equation takes then the following form:

$$\begin{aligned}
(10) \quad \ln(\tilde{M}_{it} / \tilde{P}_{it}) &= \beta_1 \ln(\tilde{Y}_{it} / \tilde{P}_{it}) + \beta_2 \tilde{i}_{it} + \beta_3 \ln(\tilde{Q}_{it} / \tilde{P}_{it}) + e_{it} \\
&+ \rho_{11} \Delta(\ln(\tilde{Y}_{i,t+1} / \tilde{P}_{i,t+1})) + \rho_{12} \Delta(\ln(\tilde{Y}_{i,t-1} / \tilde{P}_{i,t-1})) + \rho_{21} \Delta(\tilde{i}_{i,t+1}) + \rho_{22} \Delta(\tilde{i}_{i,t-1}) \\
&+ \rho_{31} \Delta(\ln(\tilde{Q}_{i,t+1} / \tilde{P}_{i,t+1})) + \rho_{32} \Delta(\ln(\tilde{Q}_{i,t-1} / \tilde{P}_{i,t-1})) \quad \square
\end{aligned}$$

where the tilde again symbolizes deviations from the euro area average, and $e_{it} = u_i + \varepsilon_{it}$ with u_i being the country fixed effects and ε_{it} is an error term with the usual properties. The inclusion of leads and lags of the first difference of the regressors improves the efficiency in estimating the co-integration vector, which is given by $(-1, \beta_1, \beta_2, \beta_3)$. It is important to note that Kao and Chiang (2000) show that ε is by definition auto-correlated. When estimating equation (10), appropriate correction for the autocorrelation needs to be performed. We employ the correction of Newey and West (1994). Moreover, our standard errors are robust with respect to arbitrary heteroskedasticity. Finally, the estimation results presented constrain the short- as well as long-run dynamics to be the same across the countries. However, as a robustness check, we also allowed for different short-run dynamics for the countries. The main results were unaffected when estimating the less restrictive model.

4 Empirical results

4.1 Main results

Table 3 presents the estimation of the corresponding dynamic OLS estimations. Column A displays the coefficients of a benchmark specification that includes only real income and short-term interest rates and thus the traditional explanatory variables of a money demand equation. The magnitude of the income elasticity is in line with previous research (compare, e.g., Calza, Gerdesmeier and Levy 2001, Carstensen 2006, De Santis et al. 2008, Setzer and Wolff 2009). The interest rate elasticity is positive and not significant. The non-significance is consistent with our theoretical model (*viz.* equation (7)), which predicts ambiguous effects of interest rates on money. Moreover, as described above, one should be cautious with respect to the interpretation of the interest rate semi-elasticity as there has been a high co-movement in interest rates across euro area countries after 1999. This results in a low cross-country variation of the time series in our sample period.

¹² See also Kao et al. (1999) and Pesaran and Smith (1995).

Column B displays the augmented money demand model, with real house prices included. The coefficient of the house price variable is highly significant indicating that higher house prices lead to larger holdings of real balances. This suggests that the wealth and collateral effects are important determinants of money holdings. This view is further supported by the fact that the income elasticity falls when house prices are included in the estimation. This confirms the notion that the income elasticity in traditional money demand specifications (i.e. those that exclude wealth variables) also captures some of the wealth and collateral effects.

Table 3: Results of money demand estimation, dynamic OLS specification, sample 1999q1-2008q4

	A	B	C	D	E	F	G	H	I
Real GDP	1.57*** (11.21)	1.43*** (10.16)	1.38*** (10.48)	1.63*** (11.66)	1.48*** (10.48)	1.43*** (10.78)	1.56*** (12.58)	1.42*** (11.52)	1.38*** (11.53)
Short-term interest	1.08 (0.26)	0.75 (0.20)	1.92 (0.46)						
Inflation rate				6.19* (1.85)	5.87* (1.91)	5.87* (1.88)			
Interest rate spread							-0.46 (0.30)	0.13 (0.08)	0.11 (0.07)
Real house price						0.09*** (2.87)	0.09*** (2.73)	0.09*** (3.09)	0.09*** (2.83)
Δ real house price (+1)						-0.58* (-1.73)	-0.58* (-1.73)	-0.62* (-1.87)	
N	380	380	370	380	380	370	380	380	370
R ²	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.998	0.998

Note: All variables are measured in difference in the euro area average. t-values are below the coefficient estimates in brackets. ***, **, * indicates significance at a 1, 5, 10 percent level, respectively.

The absolute value of the house price coefficient is relatively small, but non-negligible. A one percentage point increase in real house prices (compared to the euro area average) leads, *ceteris paribus*, to a rise above-euro area average rise in real money holdings of 0.09 percentage point. However, this value has to be interpreted against the background of the heterogeneous house price developments in the individual euro area countries which considerably exceed differences in monetary dynamics. As such, even a relatively small house price elasticity may provide a sizeable explanatory factor in explaining monetary heterogeneity.

Assuming constancy of the remaining variables, Table 4 displays –in a somewhat simplified way- the share of the deviation in money growth that is explained by house price developments for each euro area country (last column). In half of the countries in our sample, national house price developments explain at least a third of the deviation in money growth from the euro area average. For France, Austria and Spain in particular, the wealth and collateral effects of housing seem to have been important as there has been a close money-housing nexus. By contrast, house prices do not provide any explanation for below-average money growth in Belgium, Finland and Italy, suggesting that other factors (including the above described substitution effects between money and housing) are more important drivers of the monetary dynamics in these countries (Table 4).

Table 4: Deviation from EA money growth explained by house price elasticity

Country	M3 growth		House price growth		Deviation from EA money growth explained by house price elasticity (assuming elasticity of 0.09 and constancy of other variables)
	average annual % change 1999-2008	deviation of EA average (percentage points)	average annual % change 1999-2008	deviation of EA average (percentage points)	
EA	8.4		6.2		
AT	7.9	-0.5	1.5	-4.6	81%
BE	6.6	-1.8	9.0	2.9	-14%
DE	6.8	-1.6	-0.5	-6.7	37%
ES	10.1	1.7	17.7	11.6	60%
FI	6.9	-1.5	7.6	1.5	-9%
FR	8.6	0.2	10.1	4.0	144%
IE	16.3	7.9	13.1	7.0	8%
IT	7.7	-0.7	10.1	4.0	-53%
NL	9.2	0.8	9.9	3.7	45%
PT	5.9	-2.5	1.7	-4.4	16%

Note: The deviation of EA money growth which is explained by house price developments is calculated under ceteris paribus assumption by multiplying the country-specific average annual deviation of house price growth from the euro area average with the estimated house price elasticity of 0.09 (see Table 3) and dividing it by the country-specific average annual deviation of the country-specific M3 growth. M3 growth does not include currency in circulation.

Column C in Table 3 further extends the model to include future changes in real house prices. This variable intends to capture expectations about future house price increases (assuming rational expectations) and thus serves as a variable to assess the importance of substitution effects. The variable is negative (as predicted by the theoretical model) and significant at the 10 percent level, suggesting that substitution effects between money and housing have played an important role, despite the different degrees of liquidity of both assets (see also Boone and van den Noord 2008 for a similar result).

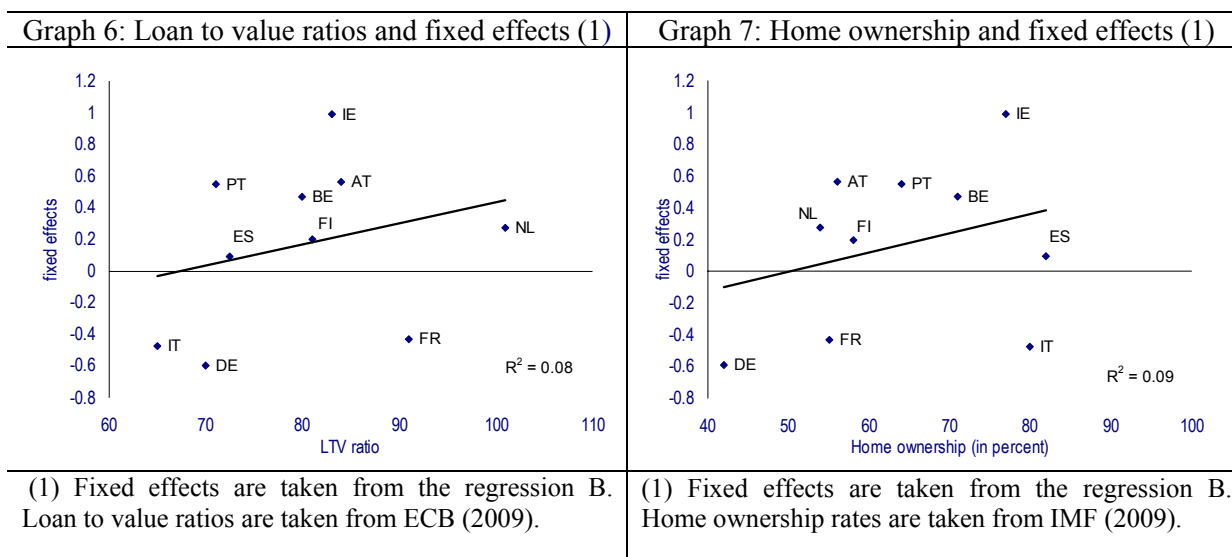
The remaining columns corroborate these results using alternative opportunity costs measures. Specifications D to F replace short-term rates by inflation as inflation may be a measure of the return on holding goods (see also Dreger and Wolters 2010). Models G to I use the difference between the long-term and the short-term interest rates as opportunity cost measure. The long-term rate is defined as the yield on the 10 year government bond. The positive effects stemming from the wealth and collateral channel remain to be reflected in a highly significant positive house price elasticity, while the negative substitution effect remains to be significant as well, although to a somewhat lesser extent. The results regarding opportunity cost measures are somewhat less robust, documenting the difficulty of capturing differences in opportunity cost of money holdings across euro area countries.

Our theoretical model in chapter 2 suggests that institutional aspects of housing markets are also important. Recent studies have found important heterogeneity in the transmission of monetary policy on house prices depending on the structural and institutional features of the mortgage market (Maclennan et al 1998, Calza et al. 2007, Muellbauer and Murphy 2008). However, one problem with accounting for institutional differences is the nature of the available data. Institutional characteristics change little over time, if available in the form of time series all, so that time series analysis with such data is precluded.

We therefore relate unexplained country-specific preferences for holding money to institutional features of the housing market. The country-specific preference for holding money is captured by the country-specific fixed effects. Specifically, we therefore relate our country-specific fixed effects to the loan to value ratios (LTV) to first time buyers and to the home ownership rate. A high LTV ratio is akin to a lower collateral constraint. As less equity is required for a house purchase, a higher share of the property can be financed by loan. The creation of a new loan is likely to go along with the creation of new deposits, suggesting that the effects of house prices on money are likely to be marked in economies with high LTV ratios.

Graph 6 indeed provides some evidence for this hypothesis as we find a positive relation between the LTV and the fixed effect. Hence, *ceteris paribus*, a country where the LTV ratio is high tends to have larger real balances as households can relatively easily obtain financing to purchase property. France and the Netherlands could be seen as outliers in the Figure. In the Netherlands this could be related to tax incentives which push up the LTV to extremely high levels nominally for tax purposes, but in reality there are offsetting endowments by households in the form of life insurance and other (tax exempt) saving vehicles (see van den Noord (2005) . In France, the LTV ratio for all homeowners is on average comparatively low. The LTV on new home purchases shown in the figure is therefore not representative for the entire economy. Abstracting

just from France increases the R^2 to 25%. Abstracting from both countries would raise the slope of the relationship substantially.



As regards home ownership, we also find a positive relationship as higher home ownership is associated with a higher fixed effect (Graph 7). Hence, all other things equal, money holdings are higher in countries with high home ownership ratios. This may be explained by the transaction motive of money demand which is likely to be stronger if home ownership is higher, but it is also consistent with theoretical considerations according to which the wealth effect of housing should increase with a higher share of home ownership. Italy is a clear outsider in this case, possibly related to cultural forces as dwellings are often a parental gift and thus housing transactions are not necessarily associated with the raising of housing loans (ECB 2009). Removing Italy from the table increases the R^2 to 36%.

4.2 Robustness checks

As a first robustness check, we estimate our money demand specification with standard fixed effects. The estimation of that model yields very similar results, with the coefficients of our main variable of interest hardly change (see Table 5). There is now even stronger evidence for the existence of substitution effects between money and housing.

In view of the heterogeneity of euro area countries, our results could be sensitive to changes in the cross-section or time dimension of our sample. Table 6 presents robustness tests with regard to the exclusion of individual countries. In columns A-C, we exclude the largest EMU country, Germany, as it might unduly influence the estimates because of its size. Moreover, in further sub-sample tests we exclude the three countries with the highest real money growth between 1999 and 2008, namely Ireland, Spain and France (columns D to F) as well as the two countries with the lowest monetary growth rates since the introduction of the euro, namely Portugal and Belgium (columns G to I).

Table 5: Results of money demand estimation, fixed effects specification, sample 1999q1-2008q4

	A	B	C
Real GDP	1.56*** (21.49)	1.44*** (18.22)	1.42*** (17.84)
Short-term interest	0.55 (0.21)	0.21 (0.08)	0.61 (0.21)
Real house price		0.09*** (3.67)	0.09*** (3.29)
Δ real house price (+1)			-0.40*** (-2.47)
N	390	390	380
R ² (within)	0.56	0.58	0.59

*Note: All variables are measured in difference to the euro area average. t-values are below the coefficient estimates in brackets. ***, **, * indicates significance at a 1, 5, 10 percent level, respectively. Estimation method is fixed effects.*

This robustness check reveals a considerable degree of sub-sample stability. The income elasticity does hardly change compared to our baseline scenario and consistently falls when house prices developments are taken into account. Also the wealth effects remain significant. It is, however, less significant in the group excluding the low money growth group, especially when the user cost of housing is included. Here, the evidence for substitution effects is very strong. Overall, the robustness check therefore supports our hypothesis of the importance of housing market developments. Economic growth and house prices explain a significant part of the cross-country heterogeneity of real balances. These findings are not driven by a small subset of countries but rather reflect a rather constant pattern of determinants of cross-country differences in money holdings. In other words, cross-country differences in money holdings can be explained by a number of observable variables and the empirical relations appear to be rather stable across the countries.

Table 6: Results sensitivity analysis, fixed effects estimation, sample 1999q1-2008q4

	A	B	C	D	E	F	G	H	I
Real GDP	1.57*** (20.56)	1.43*** (16.57)	1.41*** (16.27)	1.23*** (7.2)	1.14*** (7.14)	1.19*** (7.23)	1.46*** (22.76)	1.40*** (20.01)	1.37*** (19.76)
Short-term interest	-3.19 (-0.97)	-0.57 (-0.17)	0.28 (0.08)	1.91 (0.61)	-1.36 (-0.46)	-1.12 (-0.33)	1.16 (0.47)	0.90 (0.37)	1.68 (0.62)
Real house price	0.11*** (3.32)	0.11*** (3.12)	0.11*** (3.12)	0.17*** (6.3)	0.17*** (6.3)	0.17*** (6)	0.17*** (6)	0.05** (2.04)	0.03 (1.36)
Δ real house price (+1)			-0.34** (-1.97)			-0.14 (-0.75)			-0.68*** (-3.80)
N	351	351	342	273	273	266	312	312	304
R ²	0.56	0.58	0.58	0.18	0.29	0.30	0.65	0.66	0.67
Removed	DE	DE	De	IE, ES, FR	IE, ES, FR	IE, ES, FR	PT, BE	PT, BE	PT, BE

Note: All variables are measured in difference in difference to the euro area average. t-values are below the coefficient estimates in brackets. ***, **, * indicates significance at a 1, 5, 10 percent level, respectively.

4.3 Comparison with the pre-EMU period

A potentially interesting issue is whether the creation of the single currency itself has been a factor in shaping the relationship between house prices and money demand. Our hypothesis is that when countries still maintained their own currencies, current account constraints were more binding and therefore housing needed to be financed largely domestically, whereas after the creation of the single currency cross-border capital flows were unhampered by exchange rate risk. As a result, before monetary union money growth would reflect predominantly national monetary policy setting whereas in monetary union cross-country differences in money growth could also reflect capital flows associated with different investment opportunities in real estate and its financing.

Against this backdrop, we apply our specification to the pre-EMU period (Table 7). The estimation results for the period 1990q1 to 1998q4 document a clear robustness regarding the income elasticity. Thus, we find no evidence for a structural change regarding the link between income and money holdings after 1999. However, in the earlier sample, we find an insignificant house price elasticity. House price developments have only become an important parameter of money holdings with the introduction of the common currency. This finding is corroborated in an estimation covering the entire sample, which is documented in the last column of Table 7. There we clearly find that only after 1999, house price developments have become a significant determinant of money as suggested by the highly significant interaction parameter between house prices and the dummy variable "EMU" which is denoted one for the period after 1999q1 and zero otherwise.

This finding is consistent with our above hypothesis but also with previous studies analyzing the link between interest rates, consumer prices and housing wealth in the euro area (Weber, Gerke, Worms 2009), who find similar effects for the entire EMU period. Importantly, our result does not result from lower variation in house prices in the pre-EMU period. In fact, the heterogeneity in house prices across euro area countries has been high also in the pre-EMU period. However, one additional possible explanation for the fact that housing emerges as a relevant variable determining money only with EMU is related to the process of financial liberalisation and innovation. This process has generally eased the access of credit to borrowers. For instance, innovations in credit markets have facilitated the access to standardised credit for lower-income borrowers and reduced financial constraints for homebuyers. Moreover, as a result of the property price boom and a rise in homeownership rates, households were increasingly able to withdraw equity in the post-1999 period (ECB 2009). This boosts consumption spending and aggregate demand, and might support the link between house prices and money after 1999.

Table 7: Results sensitivity analysis, dynamic OLS, pre-EMU sample (1990q1-1998q4/2008q4)

	A	B	C	D	E	F	G
Real GDP	1.36*** (18.88)	1.39*** (17.04)	1.37*** (17.73)	1.41*** (17.11)	1.36*** (18.88)	1.39*** (17.11)	1.40*** (19.24)
Short-term interest	0.61* (1.87)	0.56* (1.76)					2.5*** (5.04)
Inflation rate			-1.82*** (-3.52)	-1.74*** (-3.36)			
Interest rate spread					-0.53 (-1.64)	-0.49 (-1.53)	-0.49 (-1.53)
Real house price	-0.01 (-0.47)	-0.02 (-0.72)	0.00 (0.03)	-0.01 (-0.29)	-0.01 (-0.27)	-0.02 (-0.59)	-0.04 (-1.27)
Real house prices*EMU							0.14*** (2.67)
Δ real house price (+1)		-0.21 (-0.98)		-0.22 (-1.08)		-0.22 (-1.06)	
N	360	360	360	360	360	360	740
Sample	1990q1-1998q4	1990q1-1998q4	1990q1-1998q4	1990q1-1998q4	1990q1-1998q4	1990q1-1998q4	1990q1-2008q4
R ²	0.999	0.999	0.999	0.999	0.999	0.999	0.995

Note: All variables are measured in difference to the euro area average. *t*-values are below the coefficient estimates in brackets. ***, **, * indicates significance at a 1, 5, 10 percent level, respectively.

5 Conclusions

Monetary analysis remains an essential ingredient of the economic analysis on which monetary policy decisions in the euro area are based, so it is important to establish a stable relationship between real-economy developments and money aggregates. We find it striking that both money demand and real-economy developments have been rather diverse across the member countries of the euro area – a challenging situation for economic policy making.

Against this background, this study presents a theoretical and empirical analysis of the determinants of money holdings across euro area countries. Specifically, we

derive a money demand specification that includes apart from the usual determinants of money demand (real income, interest rates and inflation) developments in the housing sector. The empirical specification is based on an innovative model featuring housing wealth, collateral and substitution effects. Housing wealth and collateral effects imply a positive relationship between money demand and house prices, while the substitution effect implies a negative relationship between the expected increase in house prices and money demand.

The empirical specification allows us to analyze the determinants of the strong differences in monetary dynamics of euro area Member States. It resorts to an idea originally proposed by Setzer and Wolff (2009), in which all variables are measured in deviation from the euro area average. In this way, we can control for unobserved common shocks to money demand that affect all countries. Differences in the monetary dynamics across euro area Member States are related to differences in the economic fundamentals determining money demand.

Our empirical findings provide support for our model. By estimating euro area money demand in national deviations from the area average, we show that cross-country differences in monetary dynamics can be explained to a large extent by asymmetries in house price developments on top of different income developments. We find robust evidence that housing wealth as captured by house prices has been a significant determinant of money holdings since 1999. Moreover, in line with our theoretical model, we show that lower user costs of housing lead to a substitution away from money holdings. Sensitivity analyses suggest that these results are stable and do not depend on the money-housing nexus in some individual euro area countries only.

Interestingly, our results provide less evidence for a role of housing prior to the adoption of the single currency in 1999. In that period there may have been a closer relationship between local income and house price developments, with the role of cross border capital flows more limited. Since the launch of the single currency, fairly large cross-country differences in price fluctuations of assets occurred despite a single monetary policy reflecting the impact of large capital flows. A simple analysis of the money-price relationship which does not take explicit account of such a development in asset markets then misses an important determinant of cross-country monetary and credit dynamics.

Our findings point to a potentially promising new line of research which at some point may have implications for the interpretation of the monetary policy framework in the euro area. No explicit consideration of cross-country differences in house prices is needed in a monetary context as long as these broadly move in concert with income, as was the case before 1999. However, after 1999 high money growth in several euro area countries has been a reflection of excessive house price developments. These developments were less apparent at the aggregate level, and yet could eventually have systemic and financial stability risks for the euro area as a whole.

References

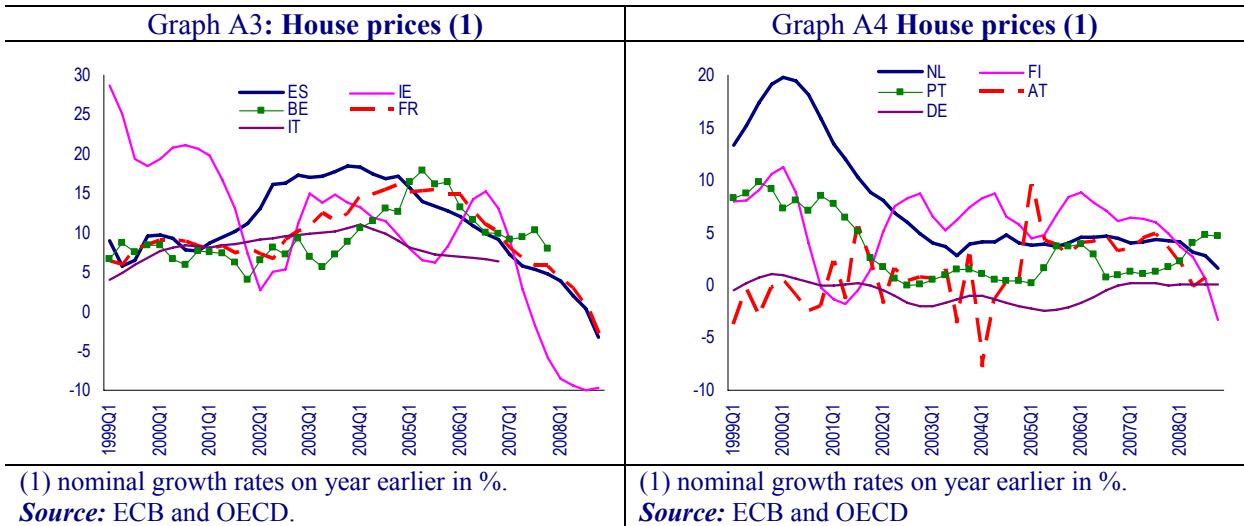
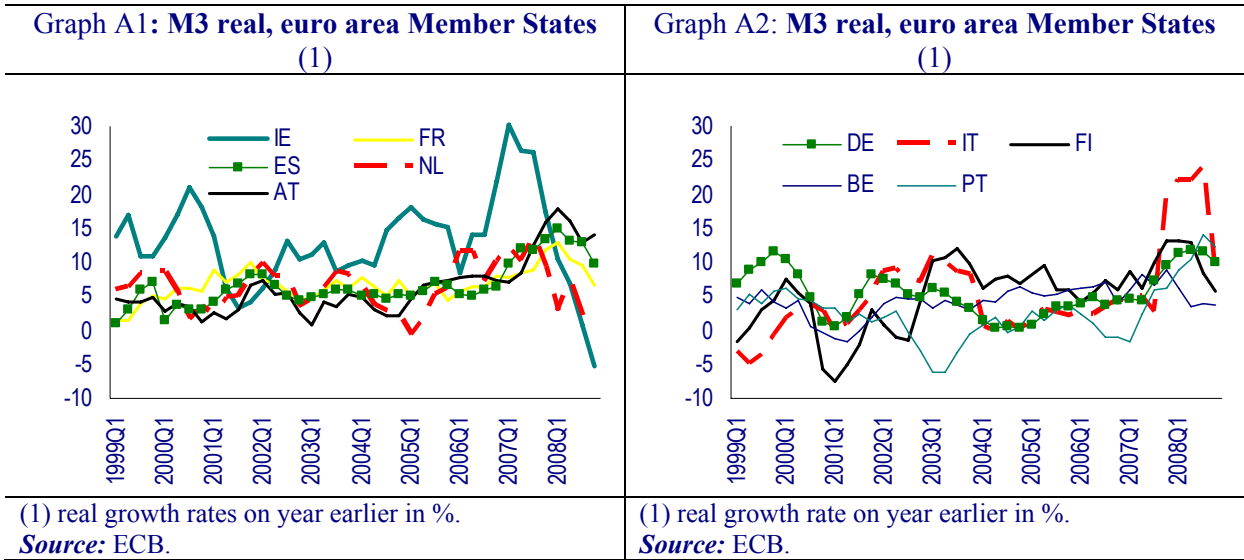
- Agnello, Luca and Ludger Schuknecht (2009). Booms and busts in housing markets: identification, determinants and implications. ECB working paper No. 1111, European Central Bank.
- Alessi, Lucia and Carsten Detken (2009). Real-time early warning indicators of costly asset price boom/bust cycles: a role for global liquidity. Paper presented at the workshop "Tools for detecting asset price imbalances, the role of money and credit and the impact on consumer price inflation", Frankfurt, December 15.
- Beyer, Andreas (2009). A Stable Model for Euro Area Money Demand: Revisiting the Role of Wealth. ECB working paper No. 1111, European Central Bank.
- Boone, Laurence and Paul van den Noord (2008). Wealth Effects on Money Demand in the Euro Area. *Empirical Economics*, No. 38(3): 525-536.
- Calza, Alessandro, Dieter Gerdesmeier and Joaquim Levy (2001). Euro Area Money Demand: Measuring the Opportunity Costs Appropriately. IMF Working Paper No. 11/179, International Monetary Fund.
- Calza, Alessandro, Tommaso Monacelli and Livio Stracca (2007). Mortgage Markets, Collateral Constraints, and Monetary Policy: Do Institutional Factors Matter? CFS Working Paper No. 10/2007.
- Carstensen, Kai (2006). Stock Market Downswing and the Stability of European Monetary Union Money Demand. *Journal of Business and Economic Statistics*, Vol. 25(4), pp. 395-402.
- Coenen, Günther and Juan-Luis Vega (2001). The demand for M3 in the euro area," *Journal of Applied Econometrics*, 16, 727–748.
- De Bondt, Gabe (2009), Euro area money demand: empirical evidence on the role of equity and labour markets. ECB Working Paper No. 1086, European Central Bank.
- Del Negro, Marco and Christopher Otrok (2007). 99 Luftballons: Monetary Policy and The House Price Boom across US States. *Journal of Monetary Economics*, No. 54(7), 1962-85.
- De Santis, Roberto A., Carlo A. Favero and Barbara Roffia (2008). Euro area money demand and international portfolio allocation. ECB Working Paper 926, European Central Bank.
- Dreger, Christian and Jürgen Wolters (2010). Investigating M3 Money Demand in the Euro Area – New Evidence Based on Standard Models. *Journal of International Money and Finance*, forthcoming.
- ECB (2009). Housing finance in the euro area, ECB Occasional Paper No. 101, European Central Bank.
- Eickmeier, Sandra and Boris Hofmann (2009), Monetary Policy, Housing Booms and Financial (Im)Balances, mimeo.
- Friedman, Milton (1988). Money and the Stock Market. *Journal of Political Economy*, No. 96(2), pp. 221-245.

- Greiber, Claus and Wolfgang Lemke (2005). Money Demand and Macroeconomic Uncertainty. Deutsche Bundesbank Discussion paper, No. 26/05.
- Greiber, Claus and Ralph Setzer (2007). Money and Housing: Evidence for the euro area and the US. Deutsche Bundesbank Discussion paper, No. 12/07.
- Giuliodori, Massimo (2005). The Role of House Prices in the Monetary Transmission Mechanism Across European Countries. *Scottish Journal of Political Economy*, No. 52(4), pp. 519-543.
- Goodhart, Charles and Boris Hofmann (2007). *House Prices and the Macroeconomy: Implications for Banking and Price Stability*. Oxford University Press.
- Hadri, Kaddour (2000). Testing for Stationarity in Heterogeneous Panel Data. *Econometrics Journal*, No. 3(2), 148-161.
- Hallerberg, Mark and Guntram B. Wolff (2008). Fiscal institutions, fiscal policy and sovereign risk premia in EMU. *Public Choice*, No. 136(3-4), 379-396.
- Iacoviello, Matteo. (2004). Consumption, house prices, and collateral constraints: a structural econometric analysis. *Journal of Housing Economics*, Vol. 13(4), pp. 304-320.
- Iacoviello, Matteo (2005). House Prices, Borrowing Constraints, and Monetary Policy in the Business Cycle. *American Economic Review*, No. 95(3), 739-64.
- IMF (2009), House price developments in Europe: A comparison, IMF Working Paper No. 2111, International Monetary Fund.
- Kao, Chihwa, and Min-Hsien Chiang (2000): On the Estimation and Inference of a Cointegrated Regression in Panel Data, in: Baltagi B. (ed.), *Nonstationary panels, panel cointegration, and dynamic panels*, *Advances in Econometrics*, Amsterdam: JAI Press, No. 15, 179-222.
- Kao, Chihwa, Min-Hsien Chiang, and Bangtian Chen (1999). International R&D Spillovers: An Application of Estimation and Inference in Panel Cointegration. *Oxford Bulletin of Economics and Statistics*, No. 61(4), 693-711.
- Kiyotaki, Nobuhiro and John Moore (1997). Credit Cycles. *Journal of Political Economy*, No. 105(2), pp. 211-248
- Maclennan, Duncan, John Muellbauer and Mark Stephens (1998). Asymmetries in housing and financial market institutions and EMU. CEPR discussion paper No 2062.
- Muellbauer, John and Anthony Murphy (2008). Housing markets and the economy: the assessment. *Oxford Review of Economic Policy*, 24(1), pp.1-33.
- Pesaran, M. Hashem and Ron Smith (1995). Estimating Long-Run Relationships from Dynamic Heterogeneous Panels. *Journal of Econometrics*, No. 68(1), 79-113.
- Setzer, Ralph and Guntram B. Wolff (2009). Money demand in the euro area: new insights from disaggregated data. DG ECFIN, *Economic Papers* 373.
- Stein, Jeremy C. (1995). Price and Trading Volume in the Housing Market: A Model with Down-Payment Effects. *Quarterly Journal of Economics*, No. 110, pp. 379-406.

- Stock, James and Mark W. Watson (1993). A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica*, No. 61(4), 783-820.
- Van den Noord, Paul (2005). Tax Incentives and House Price Volatility in the Euro Area. *Economie Internationale*, No. 101, 29-45.
- Weber, Axel A., Rafael Gerke, and Andreas Worms (2009). Has the monetary transmission process in the euro area changed? Evidence based on VAR estimates. BIS working paper 276.

Annex A

Graphs A1 to A4 display real money and nominal house price growth in the euro area from 1999 to 2008. They show that there is substantial variation of the variables not only across countries but also within each individual country in time.



Annex B

In this Annex we derive the first order conditions for the theoretical model proposed in equations (1) to (8) in the main text and subsequently derive an aggregate money demand equation from these conditions.

Deriving the first order conditions for the lenders

To derive the first order conditions from the problem described in equations (1) to (3) for the lenders we need to compute the Bellman equations for the problem. The

household inherits from the past $\frac{B_{t-1}^l}{P_{t-1}}$, $\frac{M_{t-1}^l}{P_{t-1}}$ and H_{t-1}^l , i.e., bonds, money and the home. We define the state variable ω_{t-1} as:

$$(A1) \quad \omega_{t-1} = \frac{Q_t}{P_t} H_{t-1}^l + R_{t-1} \frac{B_{t-1}^l}{P_{t-1}} + \frac{P_{t-1}}{P_t} \frac{M_{t-1}^l}{P_{t-1}}$$

This implies that the budget constraint can be rewritten as:

$$(A2) \quad \frac{B_t^l}{P_t} + \frac{M_t^l}{P_t} + \frac{Q_t}{P_t} H_t^l = \omega_{t-1} + Y_t^l - C_t^l$$

The transition equation for the new state variable is:

$$(A3) \quad \begin{aligned} \omega_t &= \frac{E_t Q_{t+1}}{E_t P_{t+1}} H_t^l + R_t \frac{B_t^l}{P_t} + \frac{P_t}{E_t P_{t+1}} \frac{M_t^l}{P_t} = \\ &= \frac{E_t Q_{t+1}}{E_t P_{t+1}} H_t^l + \frac{P_t}{E_t P_{t+1}} \frac{M_t^l}{P_t} + R_t \left[-\frac{M_t^l}{P_t} - \frac{Q_t}{P_t} H_t^l + \omega_{t-1} + Y_t^l - C_t^l \right] \end{aligned}$$

After some re-arranging this yields:

(A4)

$$\omega_t = R_t \left[\omega_{t-1} + Y_t^l - C_t^l \right] - \left[R_t \frac{Q_t}{P_t} - \frac{E_t Q_{t+1}}{E_t P_{t+1}} \right] H_t^l - \left[R_t - \frac{P_t}{E_t P_{t+1}} \right] \frac{M_t^l}{P_t}$$

The Bellman equation for the problem then reads:

$$(A5) \quad V_t(\omega_{t-1}) = \max_{C_t^l, \frac{M_t^l}{P_t}, H_t^l} E_0 \left[U \left(C_t^l, \frac{M_t^l}{P_t}, H_t^l \right) + \beta V_{t+1}(\omega_t) \right]$$

The first order conditions with respect to consumption, real money and housing read:

$$(A6) \quad \frac{\partial U}{\partial C^l} + \beta V'(\omega_t) \frac{\partial \omega}{\partial C^l} = 0 \Rightarrow \frac{\partial U}{\partial C^l} = \beta R_t V'(\omega_t)$$

(A7)

$$\frac{\partial U}{\partial (M^l/P)} + \beta V'(\omega_t) \frac{\partial \omega}{\partial (M^l/P)} = 0 \Rightarrow \frac{\partial U}{\partial (M^l/P)} = \beta \left[R_t - \frac{P_t}{E_t P_{t+1}} \right] V'(\omega_t)$$

$$(A8) \quad \frac{\partial U}{\partial H^l} + \beta V'(\omega_t) \frac{\partial \omega}{\partial H^l} = 0 \Rightarrow \frac{\partial U}{\partial H^l} = \beta \left[R_t \frac{Q_t}{P_t} - \frac{E_t Q_{t+1}}{E_t P_{t+1}} \right] V'(\omega_t)$$

Putting the results for real money and consumption together yields:

$$(A9) \quad \frac{\frac{\partial U}{\partial (M^l/P)}}{\frac{\partial U}{\partial C^l}} = \frac{R_t - \frac{P_t}{E_t P_{t+1}}}{R_t} \Rightarrow \frac{\frac{\partial U}{\partial (M^l/P)}}{\frac{\partial U}{\partial C^l}} = \frac{i_t}{1+i_t}$$

This is the standard result that would also be obtained by including only money and consumption in the utility function, and therefore it is not very interesting for our purposes. However, putting the results for real money and housing together does yield an interesting relationship:

$$(A10) \quad \frac{\frac{\partial U}{\partial (M^l/P)}}{\frac{\partial U}{\partial H^l}} = \frac{R_t - \frac{P_t}{E_t P_{t+1}}}{R_t \frac{Q_t}{P_t} - \frac{E_t Q_{t+1}}{E_t P_{t+1}}} \Rightarrow \frac{\frac{\partial U}{\partial (M^l/P)}}{\frac{\partial U}{\partial H^l}} = \frac{i_t}{\frac{Q_t}{P_t} \left[1 + i_t - \frac{E_t Q_{t+1}}{Q_t} \right]}$$

This equation says that the marginal utility of money relative to that of housing will increase if the real price increases and if the expected increase in the house price (the expected capital gain) falls. In fact, the term in the denominator represents the user cost of housing capital. Hence, if the user cost of housing capital increases, the marginal

utility of money decreases relative to that of housing, i.e. the amount of real cash balances held by the household will increase relative to the amount of housing services.

Deriving the first order conditions for the borrowers

Substituting the collateral constraint (6) in the flow of funds constraint (5) and rearranging yields:

(A11)

$$C_t^b + \frac{Q_t}{P_t} (H_t^b - H_{t-1}^b) + R_{t-1} \frac{B_{t-1}^b}{P_{t-1}} + \frac{M_t^b}{P_t} - Y_t^b - \frac{E_t Q_{t+1} H_t^b}{R_t P_t} - \frac{P_{t-1}}{P_t} \frac{M_{t-1}^b}{P_{t-1}} = 0$$

If ϕ_t is the Lagrange multiplier, the first order conditions read:

$$(A12) \quad \frac{\partial U}{\partial C^b} = \frac{\partial U}{\partial (M^b/P)} = \phi_t$$

$$(A13) \quad \frac{\partial U}{\partial H^b} = \phi_t \frac{Q_t}{P_t} \left[1 - \frac{E_t Q_{t+1}}{R_t Q_t} \frac{P_t}{E_t P_{t+1}} \right]$$

This implies that:

$$(A14) \quad \frac{\frac{\partial U}{\partial (M^b/P)}}{\frac{\partial U}{\partial H^b}} = \frac{1}{\frac{Q_t}{P_t} \left[1 - \frac{E_t Q_{t+1}}{R_t Q_t} \frac{P_t}{E_t P_{t+1}} \right]}$$

Or, after substituting the collateral constraint (5) in this result:

$$(A15) \quad \frac{\frac{\partial U}{\partial (M^b/P)}}{\frac{\partial U}{\partial H^b}} = \frac{1}{\frac{Q_t}{P_t} \left[1 - \frac{B_t^b}{Q_t H_t^b} \right]}$$

This equation effectively says that the relative utility of money (compared to housing) will decrease if the net wealth position of households increases. The net wealth, in turn, is a positive function of the real house price.

Deriving the aggregate money demand equation

In order to derive money demand equations for the two groups of households (which together determine aggregate money demand), we need to specify the utility function. For the sake of convenience we assume a log-linear utility function, noting that more complex utility functions would not lead to a fundamentally different relationship in terms of its signs. So, the utility function reads:

$$(A16) \quad U\left(C_t^j, \frac{M_t^j}{P_t}, H_t^j\right) = \log C_t^j + b_t^\delta \log \frac{M_t^j}{P_t} + d \log H_t^j, j = l, b$$

where b_t stands for shifts in preferences for holding money. Aggregate money demand M is determined as:

$$(A17) \quad \log M_t = (1 - \lambda) \log M_t^l + \lambda \log M_t^b$$

where λ denotes the weight of money demand of credit-constrained households (borrowers) in total money demand.

Combining equations (A10) and (A16) yields the following money demand equation for the *lenders*:

$$(A18) \quad \frac{M_t^l}{P_t} = \frac{b_t^\delta}{d} C_t^l \frac{Q_t}{P_t} \frac{H_t^l}{C_t^l} \frac{(i_t - \rho_t)}{i_t}$$

where $\rho_t = \frac{E_t Q_{t+1} - Q_t}{Q_t}$ denotes the expected rate of house price inflation.

Combining equations (A15) and (A16) yields for the *borrowers*:

$$(A19) \quad \frac{M_t^b}{P_t} = \frac{b_t^\delta}{d} C_t^b \frac{Q_t}{P_t} \frac{H_t^b}{C_t^b} \left[1 - \frac{B_t^b}{Q_t H_t^b} \right]$$

Converting equations (A18) and (A19) in logs, combining them with the aggregation identity (A17) and assuming that λ can be used to approximate the weight of credit constrained households in aggregate consumption then yields the aggregate money demand equation (7) in the main text.

Annex C

Table A1: Results sensitivity analysis, dynamic OLS estimation, sample 1999q1-2008q4

	A	B	C	D	E	F	G	H	I
Real GDP	1.58*** (11.12)	1.41*** (10.16)	1.37*** (10.05)	1.27*** (3.39)	1.17*** (3.42)	1.19*** (3.39)	1.42*** (9.66)	1.35*** (9.28)	1.31*** (9.84)
Short-term interest	-2.84 (-0.52)	0.68 (0.12)	2.67 (0.44)	2.50 (0.41)	-0.93 (0.16)	0.12 (0.02)	2.35 (0.66)	1.98 (0.63)	3.17 (0.88)
Real house price		0.11*** (2.30)	0.11*** (2.23)		0.18*** (4.99)	0.18*** (4.82)		0.03 (1.31)	0.02 (0.90)
Δ real house price (+1)			-0.50 (-1.43)			-0.04 (-0.12)			-0.82*** (-2.20)
N	342	342	342	380	380	370	380	380	370
R ²	0.997	0.997	0.998	0.998	0.998	0.998	0.998	0.998	0.998
Removed	DE	DE	DE	IE, ES, FR	IE, ES, FR	IE, ES, FR	PT, BE	PT, BE	PT, BE

Note: All variables are measured in difference in difference to the euro area average. t-values are below the coefficient estimates in brackets. ***, **, * indicates significance at a 1, 5, 10 percent level, respectively.

The following Discussion Papers have been published since 2009:

Series 1: Economic Studies

01	2009	Spillover effects of minimum wages in a two-sector search model	Christoph Moser Nikolai Stähler
02	2009	Who is afraid of political risk? Multinational firms and their choice of capital structure	Iris Kesternich Monika Schnitzer
03	2009	Pooling versus model selection for nowcasting with many predictors: an application to German GDP	Vladimir Kuzin Massimiliano Marcellino Christian Schumacher
04	2009	Fiscal sustainability and policy implications for the euro area	Balassone, Cunha, Langenus Manzke, Pavot, Prammer Tommasino
05	2009	Testing for structural breaks in dynamic factor models	Jörg Breitung Sandra Eickmeier
06	2009	Price convergence in the EMU? Evidence from micro data	Christoph Fischer
07	2009	MIDAS versus mixed-frequency VAR: nowcasting GDP in the euro area	V. Kuzin, M. Marcellino C. Schumacher
08	2009	Time-dependent pricing and New Keynesian Phillips curve	Fang Yao
09	2009	Knowledge sourcing: legitimacy deficits for MNC subsidiaries?	Tobias Schmidt Wolfgang Sofka
10	2009	Factor forecasting using international targeted predictors: the case of German GDP	Christian Schumacher

11	2009	Forecasting national activity using lots of international predictors: an application to New Zealand	Sandra Eickmeier Tim Ng
12	2009	Opting out of the great inflation: German monetary policy after the breakdown of Bretton Woods	Andreas Beyer, Vitor Gaspar Christina Gerberding Otmar Issing
13	2009	Financial intermediation and the role of price discrimination in a two-tier market	Stefan Reitz Markus A. Schmidt, Mark P. Taylor
14	2009	Changes in import pricing behaviour: the case of Germany	Kerstin Stahn
15	2009	Firm-specific productivity risk over the business cycle: facts and aggregate implications	Ruediger Bachmann Christian Bayer
16	2009	The effects of knowledge management on innovative success – an empirical analysis of German firms	Uwe Cantner Kristin Joel Tobias Schmidt
17	2009	The cross-section of firms over the business cycle: new facts and a DSGE exploration	Ruediger Bachmann Christian Bayer
18	2009	Money and monetary policy transmission in the euro area: evidence from FAVAR- and VAR approaches	Barno Blaes
19	2009	Does lowering dividend tax rates increase dividends repatriated? Evidence of intra-firm cross-border dividend repatriation policies by German multinational enterprises	Christian Bellak Markus Leibrecht Michael Wild
20	2009	Export-supporting FDI	Sebastian Krautheim

21	2009	Transmission of nominal exchange rate changes to export prices and trade flows and implications for exchange rate policy	Mathias Hoffmann Oliver Holtemöller
22	2009	Do we really know that flexible exchange rates facilitate current account adjustment? Some new empirical evidence for CEE countries	Sabine Herrmann
23	2009	More or less aggressive? Robust monetary policy in a New Keynesian model with financial distress	Rafael Gerke Felix Hammermann Vivien Lewis
24	2009	The debt brake: business cycle and welfare consequences of Germany's new fiscal policy rule	Eric Mayer Nikolai Stähler
25	2009	Price discovery on traded inflation expectations: Does the financial crisis matter?	Alexander Schulz Jelena Stapf
26	2009	Supply-side effects of strong energy price hikes in German industry and transportation	Thomas A. Knetsch Alexander Molzahn
27	2009	Coin migration within the euro area	Franz Seitz, Dietrich Stoyan Karl-Heinz Tödter
28	2009	Efficient estimation of forecast uncertainty based on recent forecast errors	Malte Knüppel
29	2009	Financial constraints and the margins of FDI	C. M. Buch, I. Kesternich A. Lipponer, M. Schnitzer
30	2009	Unemployment insurance and the business cycle: Prolong benefit entitlements in bad times?	Stéphane Moyen Nikolai Stähler
31	2009	A solution to the problem of too many instruments in dynamic panel data GMM	Jens Mehrhoff

32	2009	Are oil price forecasters finally right? Regressive expectations toward more fundamental values of the oil price	Stefan Reitz Jan C. Rülke Georg Stadtmann
33	2009	Bank capital regulation, the lending channel and business cycles	Longmei Zhang
34	2009	Deciding to peg the exchange rate in developing countries: the role of private-sector debt	Philipp Harms Mathias Hoffmann
35	2009	Analyse der Übertragung US-amerikanischer Schocks auf Deutschland auf Basis eines FAVAR	Sandra Eickmeier
36	2009	Choosing and using payment instruments: evidence from German microdata	Ulf von Kalckreuth Tobias Schmidt, Helmut Stix
01	2010	Optimal monetary policy in a small open economy with financial frictions	Rossana Merola
02	2010	Price, wage and employment response to shocks: evidence from the WDN survey	Bertola, Dabusinkas Hoerberichts, Izquierdo, Kwapil Montornès, Radowski
03	2010	Exports versus FDI revisited: Does finance matter?	C. M. Buch, I. Kesternich A. Lipponer, M. Schnitzer
04	2010	Heterogeneity in money holdings across euro area countries: the role of housing	Ralph Setzer Paul van den Noord Guntram Wolff

Series 2: Banking and Financial Studies

01	2009	Dominating estimators for the global minimum variance portfolio	Gabriel Frahm Christoph Memmel
02	2009	Stress testing German banks in a downturn in the automobile industry	Klaus Düllmann Martin Erdelmeier
03	2009	The effects of privatization and consolidation on bank productivity: comparative evidence from Italy and Germany	E. Fiorentino A. De Vincenzo, F. Heid A. Karmann, M. Koetter
04	2009	Shocks at large banks and banking sector distress: the Banking Granular Residual	Sven Blank, Claudia M. Buch Katja Neugebauer
05	2009	Why do savings banks transform sight deposits into illiquid assets less intensively than the regulation allows?	Dorothee Holl Andrea Schertler
06	2009	Does banks' size distort market prices? Evidence for too-big-to-fail in the CDS market	Manja Völz Michael Wedow
07	2009	Time dynamic and hierarchical dependence modelling of an aggregated portfolio of trading books – a multivariate nonparametric approach	Sandra Gaisser Christoph Memmel Rafael Schmidt Carsten Wehn
08	2009	Financial markets' appetite for risk – and the challenge of assessing its evolution by risk appetite indicators	Birgit Uhlenbrock
09	2009	Income diversification in the German banking industry	Ramona Busch Thomas Kick
10	2009	The dark and the bright side of liquidity risks: evidence from open-end real estate funds in Germany	Falko Fecht Michael Wedow

11	2009	Determinants for using visible reserves in German banks – an empirical study	Bornemann, Homölle Hubensack, Kick, Pfingsten
12	2009	Margins of international banking: Is there a productivity pecking order in banking, too?	Claudia M. Buch Cathérine Tahmee Koch Michael Koetter
13	2009	Systematic risk of CDOs and CDO arbitrage	Alfred Hamerle, Thilo Liebig Hans-Jochen Schropp
14	2009	The dependency of the banks' assets and liabilities: evidence from Germany	Christoph Memmel Andrea Schertler
15	2009	What macroeconomic shocks affect the German banking system? Analysis in an integrated micro-macro model	Sven Blank Jonas Dovern

Visiting researcher at the Deutsche Bundesbank

The Deutsche Bundesbank in Frankfurt is looking for a visiting researcher. Among others under certain conditions visiting researchers have access to a wide range of data in the Bundesbank. They include micro data on firms and banks not available in the public. Visitors should prepare a research project during their stay at the Bundesbank. Candidates must hold a PhD and be engaged in the field of either macroeconomics and monetary economics, financial markets or international economics. Proposed research projects should be from these fields. The visiting term will be from 3 to 6 months. Salary is commensurate with experience.

Applicants are requested to send a CV, copies of recent papers, letters of reference and a proposal for a research project to:

Deutsche Bundesbank
Personalabteilung
Wilhelm-Epstein-Str. 14

60431 Frankfurt
GERMANY