ARTICLES

MONEY DEMAND AND UNCERTAINTY

The period between 2000 and 2003 was characterised by heightened geopolitical, economic and financial uncertainty, triggered by a number of shocks to the global economy. This uncertainty has had a profound impact on many dimensions of the euro area's economic performance. In particular, it has influenced the portfolio decisions of firms and households, leading to considerably higher money holdings in the euro area than would have been anticipated on the basis of developments in the conventional determinants of money demand, such as income, prices and interest rates. Portfolio shifts – in particular between money, on the one hand, and holdings of securities, especially foreign securities, on the other hand – have played a key role in this regard. Indeed, in the context of increased globalisation, the spillover of global shocks between economies is likely to continue playing a significant role in domestic money demand developments.

1 INTRODUCTION

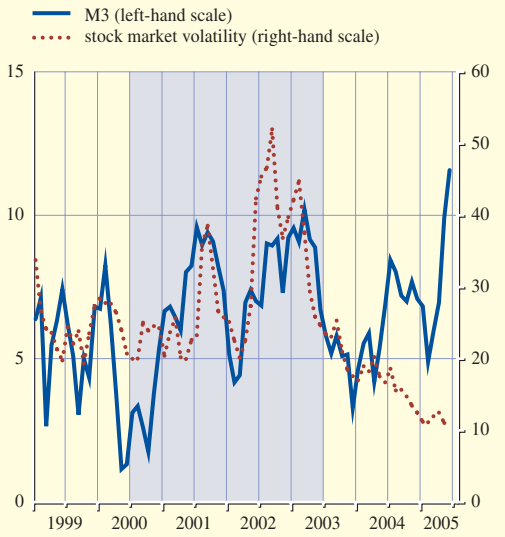
The period between 2000 and 2003 was characterised by heightened geopolitical, economic and, especially, financial uncertainty, triggered by a series of large and mainly unprecedented shocks to the world economy. The key events include the bust marking the end of the IT-driven boom, the terrorist attacks in the United States on 11 September 2001, a spate of accounting scandals on both sides of the Atlantic in the aftermath of the equity market correction, and the wars in Afghanistan in late 2001 and in Iraq in early 2003. All these events contributed in one way or another to a significant and protracted fall and heightened volatility in global stock prices from mid-2000 onwards.

These global shocks have had a profound impact on the behaviour of economic agents, on the dynamics of monetary aggregates, on developments in financial, commodity, goods and factor markets, and, thus, on the evolution of the euro area economy. The uncertainty arising from such shocks has important implications for the design and conduct of monetary policy.[1]

This article investigates in some detail how these shocks have influenced euro area money demand through their impact on economic and financial uncertainty. For example, the growth rate of euro area M3 – particularly in the second half of 2001 and between end-2002 and early 2003 – appears to have been related to greater than normal uncertainty about future stock price developments (at least as expressed in terms of the implied volatility of stock indices derived from option prices), as shown in the shaded area of Chart 1.

Chart 1 Short-term growth of M3 and implied stock market volatility

(annualised three-month growth rate in percentages; percentages per annum)



Sources: ECB and Bloomberg.
Note: The implied volatility series consists of the implied volatility on the near-contract generic future reported by Bloomberg. The equity index that the implied volatility refers to is the Dow Jones Euro Stoxx 50 index.

Moreover, the article recognises that the impact of such global shocks on euro area M3 has been further amplified by the increased globalisation of financial markets, resulting in international capital flows exerting a more

1 See the article entitled "Monetary policy-making under uncertainty" in the January 2001 issue of the ECB's Monthly Bulletin.

significant influence on developments in domestic money holdings.

2 MONEY AND UNCERTAINTY

Textbook presentations of monetary economics typically portray money as serving three main functions: a unit of account, a medium of exchange, and a store of value. Each of these functions alleviates, at least to some extent, problems arising from conditions of uncertainty.[2]

Since the demand for money arises, at least in part, from a need to insure against uncertainties, developments in the demand for money are influenced by the prevailing level and character of uncertainty in the economy. Monetary indicators thus have the potential to provide information about risks and uncertainty that may be hard to observe directly. A number of implications result from this.

First, monetary indicators may be a signal of (often unobserved) changes in a large set of asset prices. Asset prices are typically influenced by the nature and magnitude of uncertainty in the economy. For example, corporate bond prices will reflect the credit risk of the issuer and, therefore, uncertainties related to companies' future profits and cash flow. It may be impossible to observe such uncertainties directly. Since monetary indicators are also likely to be influenced by these uncertainties, they may constitute good proxy measures of corporate bond spreads.[3]

Second, in this setting, it is inevitable that – despite considerable efforts having been made in the economic literature – the modelling of money demand, especially at shorter-term horizons, will remain imperfect. In other words, some part of the evolution of the demand for money, reflecting the development of unobservable and, therefore, from the central bank's perspective, uncertain variables, will always remain difficult to explain or check in the context of formal econometric models.

Yet the inevitable imperfection of any single approach to modelling money demand does not disqualify such quantitative analysis. Rather it implies that various – not necessarily mutually exclusive – specifications of money demand can exist. Specifications range from simple money demand models to more complex dynamic stochastic general equilibrium (DSGE) models. Furthermore, the analysis of money demand needs to be complemented by other "off-model" information that is analysed on a judgemental basis. Such a judgemental approach fulfils an important role in the short to medium-term analysis of monetary developments. More specifically, by helping to explain the "unexplained" component of money dynamics, the judgemental analysis constitutes a framework for deepening the real time monitoring and assessment of monetary developments and, over time, improving the performance of the underlying models.[4] One example of the incorporation of such off-model information into the monetary analysis is the construction of an M3 series adjusted for the estimated impact of so-called portfolio shifts into and out of monetary assets which have taken place during the past few years as a consequence of heightened uncertainty (see Box 1). The ECB has published this adjusted series in its Monthly Bulletin on a regular basis since December 2004.

Against this background, the remainder of this article presents some elements of the conceptual framework used to undertake a quantitative assessment of the impact of specific types of uncertainty on money demand without, however, attempting to provide an exhaustive or fully integrated overview of the concept of uncertainty and its effect on monetary dynamics. Within this framework, the article presents a number of simple,

2 Goodhart, C.A.E. (1989, p. 29) stresses that "in a world of certainty, there is no need for the physical existence of markets or for money". See Goodhart, C.A.E. (1989), Money, Information and Uncertainty, second edition, MacMillan Ltd.

3 See Nelson, E. (2002), "The future of monetary aggregates in monetary policy analysis", CEPR Discussion Paper No 3897.

4 See the article entitled "Monetary analysis in real time" in the October 2004 issue of the ECB's Monthly Bulletin.

Box 1

THE IMPACT ON M3 OF PORTFOLIO SHIFTS ARISING FROM HEIGHTENED UNCERTAINTY

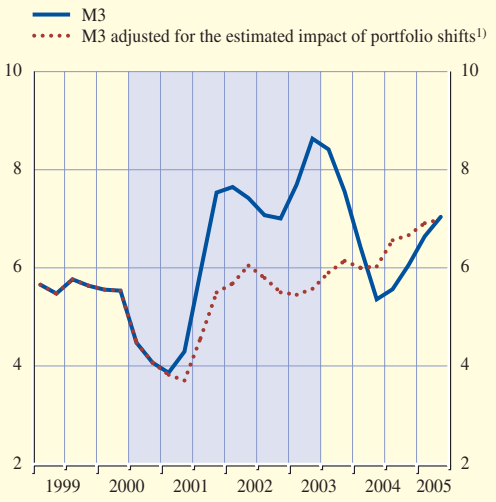
The period of heightened economic and financial uncertainty between 2000 and 2003 led to a strong preference by euro area residents for safe and liquid assets. As a consequence, extraordinary portfolio shifts into monetary assets took place. These shifts strongly influenced M3 growth in a way that could not be easily explained by the conventional determinants of money demand, such as prices, income and interest rates. Against this background, in order to assess the implications of monetary developments for future price stability, it was crucial to develop a view of how M3 should be corrected for the estimated impact of portfolio shifts.

A number of methods for estimating the magnitude of these portfolio shifts into and out of M3 have been discussed in previous issues of the Monthly Bulletin.[1] In particular, regression variables (dummies and trends) designed on the basis of a comprehensive analysis of the available data (e.g. on the components and counterparts of M3, from the monetary presentation of the balance of payments, and from the financial accounts) were introduced into a univariate time series model for the level of M3 in order to produce quantitative estimates of the required adjustments for portfolio shifts.

The results of this exercise led to the construction of an M3 series adjusted for the estimated impact of portfolio shifts (see Chart). Of course, the estimation methods underlying the derivation of this series embody, to some extent, elements of judgement. They therefore have to be interpreted with caution. Nonetheless, it is apparent from the Chart that the magnitude of the adjustments made has been significant.

M3 and M3 adjusted for the estimated impact of portfolio shifts

(annual growth rates in percentages; adjusted for seasonal and calendar effects)



Source: ECB.
1) Estimates of the magnitude of portfolio shifts into and out of M3 are constructed using the approach discussed in section 4 of the article entitled "Monetary analysis in real time" in the October 2004 issue of the ECB's Monthly Bulletin.

The difference between the official and adjusted M3 series peaked in late 2001 and early 2003 – the two periods most associated with heightened global uncertainty. These adjustments provide an initial quantification of the impact of uncertainty on money demand, and this is developed further in the remainder of the article.

1 For details, see the box entitled "Approaches to identifying and estimating portfolio shifts into and out of M3" in the January 2005 issue of the ECB's Monthly Bulletin, the article entitled "Monetary analysis in real time" in the October 2004 issue of the ECB's Monthly Bulletin and the box entitled "Estimating the size of portfolio shifts from equity to money" in the May 2003 issue of the ECB's Monthly Bulletin.

illustrative examples of how uncertainty has affected money demand as reflected in the recent euro area monetary data.

3 CONCEPTUAL FRAMEWORK

Quantifying the demand for money by the private sector is a key, albeit challenging, element of monetary analysis. Households and firms hold money for a variety of purposes. In the economic literature, three main motives for holding money have traditionally been distinguished: the need to hold money to finance regular expenditures (i.e. the *transactions demand* for money), the need to hold money to finance unexpected expenditures and to bridge the period between unsynchronised payment inflows and outflows (i.e. the *precautionary demand* for money), and the willingness to hold money as an asset or savings vehicle (i.e. the *speculative demand* for money).

As regards the speculative demand for money, traditional approaches focused solely on the portfolio choice between holding money and bonds, emphasising that money would be held so as to avoid capital losses on bonds if interest rates were expected to increase. However, more modern approaches regard money as a part of a broader portfolio choice, where wealth holdings are distributed across a range of assets (such as bonds or equities or even residential investment) according to their risk and return characteristics.

The different motives for holding money are reflected in conventional empirical specifications of money demand. Money demand equations explain money holdings on the basis of a small number of macroeconomic variables. The transactions demand for money is captured by the inclusion of measures of expenditure (often proxied by national income or GDP). Generally, these expenditure measures are also viewed as capturing the precautionary demand for money, since the money holdings required to manage uncertain cash flow developments are likely also to be related to the volume of ongoing transactions. Finally, the speculative demand for money is captured by the inclusion of opportunity cost variables – typically interest rates – which reflect the relative financial returns on money and alternative financial assets. However, conventional money demand specifications do not embody an explicit measure of risk or uncertainty in the economy and thus do not directly address the issues raised in the remainder of this article.

Obviously, making a precise quantification of the impact of uncertainty on money demand would require reliable operational measures of uncertainty and a clear sense of how uncertainty affects the different motives for holding money. However, by its very nature, uncertainty is not directly observable and can take many shapes and forms over time. Consequently, its measurement and the quantification of its impact is an issue of ongoing economic debate. Indeed, various types of uncertainty exist. In the economic literature, a distinction is drawn between risk – a form of uncertainty where probabilities can be assigned to various possible outcomes – and Knightian uncertainty, where the assignment of such probabilities is deemed impossible.[5] Moreover, uncertainty surrounds all economic variables; in the context of money demand, uncertainties about future inflation, future interest rates and future returns on risky financial assets are particularly important. Furthermore, the way uncertainty may influence the demand for money depends on the range of financial instruments available to money holders and on the impact of the uncertainty on the economic counterparts (banks, foreign investors) with whom the money holders transact.

In this context, it is important to bear in mind that shifts of financial assets within the money-holding sector cancel each other out and, thus, have no overall impact on aggregate money

5 See Knight, F. H. (1921), Risk, Uncertainty, and Profit, Boston, MA: Hart, Schaffner & Marx, Houghton Mifflin Company.

demand. For instance, the sale of equity from one household to another would simply shift bank deposits used for the corresponding payment from the bank account of one household to that of the other, with no overall impact on M3. Consequently, portfolio shifts in response to heightened uncertainty which have an effect on the behaviour of M3 must reflect transactions between the money-holding sector (largely euro area firms and households) and the non-money-holding sector (in essence non-residents and euro area MFIs). Against this background, when analysing the impact of uncertainty on money demand, it is particularly important to assess the differential impact of shocks on the money-holding sector and the non-money-holding sector, since it is largely the flows between these sectors that will determine and reflect the evolution of money demand.

Taking account of all these considerations, it is likely that the relationship between various kinds of uncertainties and money demand will be complex, varying over time and across situations. Indeed, one would expect that the response of money demand to uncertainty will depend on the nature of the uncertainty.

At the conceptual level, the *transactions* motive reflects the necessity of holding cash so as to bridge the gap between regular income receipts and regular payments. The key point is that cash inflows and cash outflows are not perfectly synchronised even if they are known with complete certainty. This creates a demand for money to bridge the gap between receipt of income and payment of bills. To the extent that this motive can be separated from the precautionary motive, the impact of a rise in economic uncertainty on the transactions demand for money should be negligible.

By contrast, an increased level of economic uncertainty can be expected to lead to an increase in the level of *precautionary* cash holdings, as money holders prepare for the possibility of higher unexpected expenditures or a potentially lower level of income resulting from the higher uncertainty. Some empirical studies have tried to proxy the precautionary motive by introducing the unemployment rate.[6] This variable is intended to capture the tendency for money to be hoarded when labour market prospects are weak, income flows are surrounded by increased uncertainty and workers may hold more liquid savings in the form of money as a reserve to cover their expenses should they be laid off.

The accumulation of liquidity as a response to rising uncertainty is, at the microeconomic level, captured more explicitly by the so-called "buffer stock" theory of money demand. In essence, this theory suggests that economic agents react to unexpected changes in their cash flows by increasing money holdings, which can then act as a buffer to smooth out the irregular and the certain pattern of receipts and payments. Because money holders usually require some time and additional information to be reassured that their income and payment flows have normalised in the aftermath of the shock, their reversion to normal patterns of behaviour is, generally, gradual. Furthermore, as the adjustment of portfolios typically implies transaction costs, agents can be expected to delay this adjustment until confidence has increased substantially. By implication, money demand will tend to jump in response to shocks while the reversion towards more normal levels will take place more slowly.

As already mentioned, the *speculative* demand for money, or more broadly the portfolio approach to money demand, is mostly concerned with the choice between holding money and holding alternative assets. This choice is governed by an assessment of the consequences for the liquidity, return and risk characteristics of the portfolio as a whole. As a consequence, for a given pattern of expected returns on a set of assets, increased uncertainty surrounding the return on one asset is likely to

6 See, for instance, Fase, M.M.G. (1998), On money and credit in Europe: The selected essays of Martin M.G. Fase, Edward Elgar, Cheltenham, UK/Northampton, MA, USA.

trigger substitution of wealth holdings from that asset into alternatives. To the extent that money is one of this set of alternative instruments, changes in the uncertainty surrounding asset returns will affect money demand. Such considerations are likely to be particularly important for broader measures of money – such as euro area M3 – which include instruments such as short-term savings deposits, money market fund shares/units and short-term MFI debt securities that are typically used as savings vehicles rather than to conduct transactions.

Using relatively plausible assumptions, the economic literature has demonstrated that an increase in uncertainty affects the portfolio distribution between risky and safe assets, and thus also the demand for money within the overall portfolio (i.e. a "flight to safety" or an increase in the preference for liquidity).[7] At the same time, informational frictions and (switching) cost considerations have to be taken into account. For instance, information asymmetries among various market participants make it difficult to assess whether the risk/return profile of an asset adequately reflects changes in fundamentals or whether the changes are of a more transitory nature.

The empirical modelling of the speculative demand for money requires the inclusion of a broader set of returns and risk measures in money demand equations. As the array of available financial instruments has broadened over time, portfolios are allocated across a very wide variety of assets (such as bonds, equities or even residential investment). As a consequence, a number of studies have attempted to introduce not only short-term and long-term interest rates, but also stock price-earnings ratios or some measure of changes in the stock market price index (i.e. variables intended to reflect the expected return on equity).[8] Other studies have addressed the issue of changes in risk aversion by referring to conditional correlations between returns on long-term bonds and stock market indices.[9] In the context of the increasing globalisation of financial markets, information about the return and risk of foreign assets also needs to be taken into account when investigating the speculative or portfolio demand for money. Therefore, other specifications contain foreign interest rates or exchange rates as additional determinants of money demand behaviour. However, due to the sometimes quite considerable degree of co-movement of various rates of return in the financial markets, it is not always easy to identify their individual effects on money demand.

These considerations have led to the development of more elaborated money demand functions, which attempt to reflect the complex interdependencies underlying the portfolio behaviour of the private sector. Among the possible modelling approaches, DSGE models have achieved some prominence. While they entertain the possibility of capturing more complex portfolio choice considerations, they also suffer from a number of caveats, such as data and estimation problems (see Box 2).

7 More particularly, risk-averse behaviour has to be assumed. See, for instance, Tobin, J. (1958), "Liquidity preference as behaviour towards risk", Review of Economic Studies, Vol. 25, pp. 65-86 and Friedman, M. (1959), "The demand for money: Some theoretical and empirical results", Journal of Political Economy, Vol. 67, pp. 327-351. It is worth noting, however, that there is, in general, no automatic link between the flight to safety and developments in monetary assets, as the flight to safety might as well be simply a substitution between equity and bonds.

8 For a more detailed overview of the ECB's monetary analysis, see Issing, O. (2001), "The importance of monetary analysis", in: ECB (ed.), Monetary Analysis – Tools and Applications, p. 6.

9 See, for instance, the box entitled "Risk aversion and developments in monetary aggregates" in the December 2004 issue of the ECB's Monthly Bulletin.

Box 2

THE USE OF DYNAMIC STOCHASTIC GENERAL EQUILIBRIUM MODELS TO UNDERSTAND THE RESPONSE OF MONEY TO ECONOMIC SHOCKS

As described in the main text, the better remunerated and longer-maturity assets included within a broad monetary aggregate such as euro area M3 are typically held by households as a savings vehicle. Developments in these holdings are, naturally, understood in the context of household portfolio decisions, through which household wealth is allocated across a variety of competing assets according to their risk/return profile. Against this background, one may ask whether the analysis of monetary developments requires a richer modelling structure than a standard money demand equation, where the determinants of such complex portfolio decisions are only taken into account in a simplified, summary form.

Dynamic stochastic general equilibrium (DSGE) models represent one potentially richer modelling framework within which to consider such issues. These models have become increasingly popular in the economic literature and are now starting to be used for monetary policy analysis. Their defining features are twofold. First, they are derived from micro-foundations. This means that the economic behaviour captured in the model can be traced back to the solutions to constrained optimisation problems intended to represent, albeit in a stylised manner, the way in which households and firms determine their consumption, production and investment choices over time in the face of inevitable uncertainties surrounding the future. Second, DSGE models exhaustively capture all the interactions between households, firms and other agents that participate in the economic system defined by the model. This means that all feedback effects of one economic decision on other decisions within the model framework – which would be ignored if each decision were treated in isolation – are fully captured. This latter feature is particularly important whenever portfolio decisions are being considered. For example, if the household sector were to switch from equities into money, some other sector would, by necessity, have to be prepared to switch in the opposite direction such that all assets are ultimately held in the final overall equilibrium.

DSGE models have a number of important advantages over alternative modelling strategies. First, in principle the outcome of the model can be explained in terms of economic behaviour, at least insofar as it is captured by the definition of the constrained optimisation problems facing firms and households. This facilitates the use of the model to explain why the data has developed in a certain way, which is an attractive feature of a model used in a policy context. Second, DSGE models permit the identification of the underlying economic shocks – those events determined outside the model which are deemed not to be governed by the choices of firms and households – that influence consumption, production and investment decisions. In principle, in a rich enough model this latter feature would allow the recent behaviour of euro area M3 to be decomposed into developments associated with a variety of underlying shocks. More specifically, in a model that allowed a shock to the overall uncertainty faced by money holders and/or to their level of risk aversion to be identified, an assessment could be made of the proportion of the strong growth of M3 between 2000 and 2003 that was caused by the channels relating money demand and uncertainty discussed in the main text, at least insofar as they are appropriately taken into account by the model.

Of course, these advantages are not costless. The DSGE approach also has its drawbacks. First, the rich theoretical structure of the models imposes a large number of restrictions on the data,

which may not all be empirically valid. This suggests that caution is required when relying on DSGE models for making quantitative assessments in a policy context. Second, the interpretation of shocks that these models suggest is strongly dependent on their structure and the assumptions made a priori on the nature of the shocks. Third, for reasons of tractability, DSGE models have thus far remained relatively simple. The complexity of the microeconomic structure underlying DSGE models makes it more difficult than in alternative frameworks to develop more extensive models, for example with a detailed sectoral breakdown. For this reason, most existing DSGE models in the economic literature still neglect the role of money and financial flows in the transmission mechanism of monetary policy. The absence of money from the model naturally precludes the analysis of M3 developments proposed in the preceding paragraph.

One exception in this respect is the DSGE model of Christiano, Motto and Rostagno (2003).[1] This model incorporates a relatively well-developed monetary and financial sector into a fairly standard DSGE model of the real economy. In this model, money serves mainly two roles. First, money facilitates transactions in the model, which generates a demand for cash balances. Second, households make portfolio decisions that involve allocating wealth across instruments of different maturities (inside and outside M3). In this context, adverse shocks to financial markets – such as those that might follow an increase in the uncertainty surrounding future investment returns – can induce portfolio shifts by households from risky assets into safer and more liquid monetary assets. In other words, the model attempts to capture in a stylised manner the intuition underlying the relationship between money demand and uncertainty outlined in the main text.

To sum up, at the current stage DSGE models with monetary and financial mechanisms constitute a promising and potentially powerful tool to support monetary analysis. However, their practical use in addressing policy-relevant questions remains in its infancy. Moreover, given the shortcomings identified above, DSGE models are, for the foreseeable future, likely to remain a complement to other tools of monetary analysis – such as the more conventional money demand equations described in Box 3 of this article – rather than a replacement for them. Nonetheless, the development of DSGE models embodying monetary and financial mechanisms should continue. This agenda is being pursued further by economists at the ECB.

1 For details, see Christiano, L., Motto, R. and Rostagno, M. (2003), "The Great Depression and the Friedman-Schwartz hypothesis," Journal of Money, Credit and Banking, Vol. 35, No 6, pp. 1119-1197. The DSGE model is used to analyse the financial dynamics surrounding the Great Depression in the United States in the 1930s. For a number of other examples of DSGE models that assign a role for money, see Andrés, J., López-Salido, J. D. and Nelson, E. (2004), "Money and the Natural Rate of Interest: Structural Estimates for the UK, the US and the Euro Area", CEPR Discussion Paper No 4337.

Drawing together the preceding discussion, the complexity of the relationships between portfolio allocation behaviour, asset price developments, asset price uncertainty and money holdings can be illustrated using the response of money holdings to developments in the stock market. While, in general, many further indirect channels linking interest rates, liquidity and asset prices exist, here the focus is placed on the direct links between stock prices and money holdings, of which five distinct channels can be identified.[10] The overall impact of stock price developments, price uncertainty and risk aversion depends on the empirical weight of these channels in specific situations.[11]

10 Of course, another reason could be that both variables react in the same direction to monetary policy or cyclical shocks in the economy. This could be described as an indirect channel.

11 For a detailed description of these channels, see, for instance, Friedman, M. (1988), "Money and the stock market", The Journal of Political Economy, Vol. 96, No 2, pp. 221-245, but also Baks, K. and Kramer, C. (1999), "Global liquidity and asset prices: measurements, implications and spillovers", IMF Working Paper No 99/168, Washington.

First, an increase in stock prices leads to higher nominal wealth, which – for a given share of money in the overall wealth portfolio – implies higher money holdings relative to income. Second, rising stock prices reflect an increase in the expected return from risky assets relative to safe assets. Assuming unchanged risk aversion, the overall portfolio of assets excluding equity might therefore be rebalanced towards highly liquid and safe assets in order to keep the risk/return profile unchanged (for example by substituting monetary assets for bond holdings). Third, rising stock prices may imply an increased need for balances to undertake financial transactions, increasing the desired level of money holdings. Fourth, an increase in stock prices may have balance sheet effects, raising the value of collateral available to borrowers and thus leading to more rapid credit expansion and, ultimately, faster broad money growth.

While the four channels described above suggest a positive relationship between developments in stock prices and money holdings, the substitution effect – i.e. the desire to switch wealth holdings from monetary assets towards equity at times of rising real stock prices, and in the opposite direction at times of decreasing stock prices or high stock price uncertainty – points to a negative relation between developments in stock prices and money holdings. The size and direction of the overall impact of asset price developments and asset price uncertainty on money demand depends on the relative magnitude of the first four channels versus the fifth and, thus, remains an empirical question.

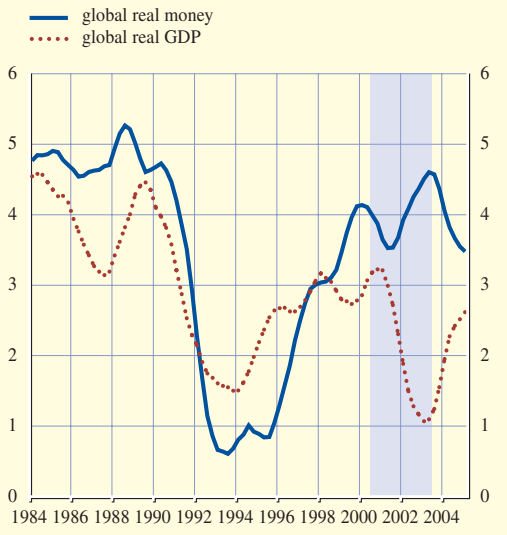
4 SOME INDICATORS OF THE IMPACT OF UNCERTAINTY ON MONEY DEMAND

This section presents evidence corroborating the view that the increase in money demand observed in the euro area between 2000 and 2003 was largely due to the response of money holders to the uncertainty associated with several global shocks.

Over the medium to longer term, the transaction demand for money should dominate the overall demand for money. Such dominance would lead to a link between developments in output and real money holdings. This relationship is apparent at the global level, where global money growth and global output growth have, in general, moved together (see Chart 2). However, between 2000 and 2003, a period characterised by heightened uncertainty triggered by global economic shocks, the usual relationship was reversed, as the relationship between global output growth and global broad money growth became negative (see the shaded area in Chart 2). Given the global nature of the shocks observed between 2000 and 2003, one would expect their impact on money demand to have been worldwide. Chart 2 suggests this was indeed the case.

Chart 2 Global real money growth and global real GDP growth

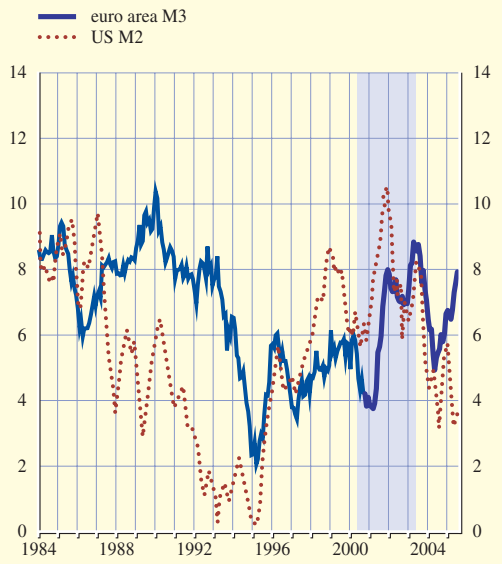
(two-year moving average of annual percentage changes; quarterly data)



Sources: ECB, BIS, EUROSTAT, OECD.
Note: Global real GDP growth is the weighted average of real GDP growth rates in the euro area, the United States, the United Kingdom, Japan and Canada constructed using GDP weights. Global real money is nominal global money, which is calculated as the sum of euro-denominated broad money aggregates of the countries used to construct global real GDP growth converted into euro using purchasing power parity exchange rates, deflated by the euro area GDP deflator.

Chart 3 Growth in broad monetary aggregates in the euro area and the United States

(annual growth rates in percentages)



Sources: BIS and ECB.

This evidence supports the argument that, at the global level, precautionary and speculative motives significantly influenced the overall demand for money during that period. The fact that common global shocks might have influenced the demand for money in several regions can be further illustrated by the close co-movement of the broad monetary aggregates in the euro area and the United States during the aforementioned period (see Chart 3). Nonetheless, it should be kept in mind that region-specific factors (for instance, asymmetric shocks) also contribute to monetary developments; the evidence presented in the charts is, therefore, inevitably rather simple.

Turning more specifically to the euro area, the wish to hedge against global uncertainties and their consequences led to increased precautionary money holdings over and above the level suggested by conventional money demand models. In support of this view, one can demonstrate that measures which contain information on uncertainty (for example, consumer confidence indicators or changes in the unemployment rate, both of which may reflect uncertainties concerning future income) are related to the residuals of conventional money demand equations (i.e. that component of observed monetary holdings that is not explained by the money demand model). Uncertainty thus appears to help explain why observed money holdings deviated from the level that would have been anticipated on the basis of the conventional determinants of money demand.

One measure of deviations of money holdings from long-run equilibrium money demand is the monetary overhang, which is defined as the difference between the actual level of real M3 and the "equilibrium" or "desired" level of real M3 given by the long-run relation from a money demand model.[12] Chart 4 demonstrates the negative relationship between consumer confidence and the monetary overhang derived from the Calza, Gerdesmeier and Levy (2001) money demand model,[13] which is particularly apparent in the period between mid-2000 and mid-2003 (the shaded area in the chart). The chart thus supports the view that economic uncertainty plays a considerable role in money demand. The chart also shows that the effect on money seems to be especially pronounced when uncertainty has been increasing strongly and for a protracted period.

A similar picture can be gained when comparing changes in the unemployment rate with smoothed residuals from an M1 demand model (see Chart 5).[14] The choice of M1 is particularly appropriate for this purpose, as it best reflects the transaction demand for money and thus, prima facie, should be a measure that is relatively resistant to the impact of uncertainty. The positive link between M1

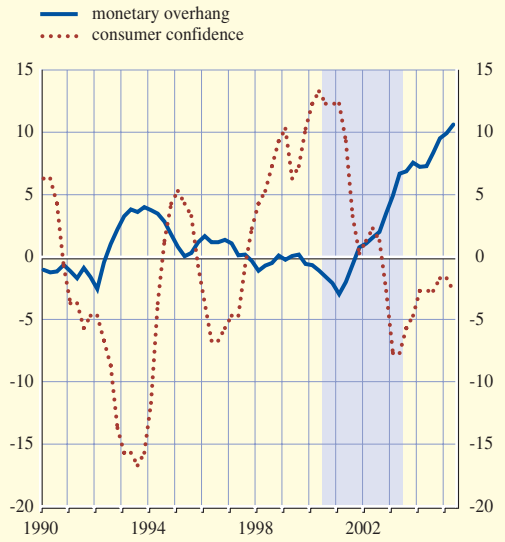
12 See Masuch, K., Pill, H. and Willeke, C. (2001), "Framework and tools for monetary analysis" in: ECB (ed.), Monetary Analysis – Tools and Applications, pp. 117-144.

13 For a detailed description of the methodology used, see Calza, A., Gerdesmeier, D. and Levy, J. (2001), "Euro area money demand: Measuring the opportunity costs appropriately", IMF Working Paper No 01/179.

14 See Stracca, L. (2001), "The functional form of the demand for euro area M1", ECB Working Paper No 51.

Chart 4 Monetary overhang and consumer confidence

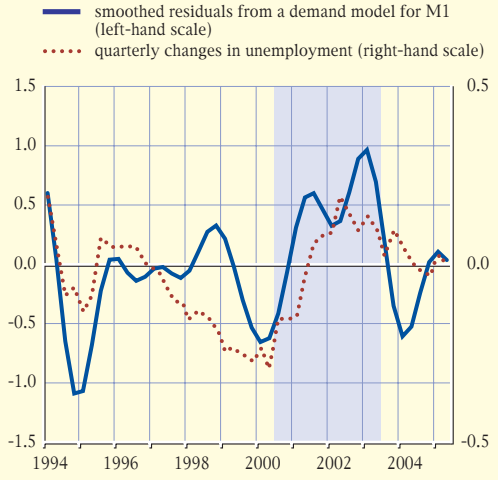
(deviations from long-run equilibrium in percentages; mean-corrected percentage balances)



Sources: Eurostat and ECB calculations.
Note: The monetary overhang is constructed using the approach discussed in Box 3 of the article entitled "Monetary analysis in real time" in the October 2004 issue of the ECB's Monthly Bulletin. The model used to derive the monetary overhang is Calza, A., Gerdesmeier, D. and Levy, J. (2001), "Euro area money demand: measuring the opportunity costs appropriately", IMF Working Paper No 01/179.

Chart 5 Smoothed residuals from a demand model for M1 and changes in unemployment

(in percentage points)



Sources: Eurostat and ECB calculations.
Note: For the money demand model, see Stracca, L. (2001), "The functional form of the demand for euro area M1", ECB Working Paper No 51. The chosen smoother is a band-pass filter that exludes all cycles with a higher frequency than 1.5 years, as described in Christiano, L. J. and Fitzgerald, T. J. (2003), "The Band Pass Filter", International Economic Review, 44 (2), pp. 435-465. The model used to derive the monetary overhang is Calza, A., Gerdesmeier, D. and Levy, J. (2001), "Euro area money demand: measuring the opportunity costs appropriately", IMF Working Paper No 01/179.

residuals and the unemployment rate suggests that in periods of high uncertainty, as for example between mid-2000 and mid-2003, precautionary money demand also affects a more transactions-oriented measure of money. Indeed, significant upward shocks observed in the M1 demand model coincide with economic uncertainty, as captured by large positive changes in the unemployment rate.

Shifting to the evidence most closely related to the speculative demand for money, a significant element in the detailed assessment of the relationship between uncertainty and monetary developments is the analysis of the counterparts and components of M3. Such analysis often provides further details that help to explain aggregate M3 growth and facilitate the detection of the underlying driving factors. Specifically, in times of increased global uncertainty, the analysis of the net external asset position of MFIs and the strength of demand for the money market fund shares/units component of M3 is of particular interest. In such periods, one may expect portfolio flows into monetary assets to constitute a significant source of increased money demand, by contrast with money creation via credit expansion which would be the main source of monetary growth in more normal circumstances.

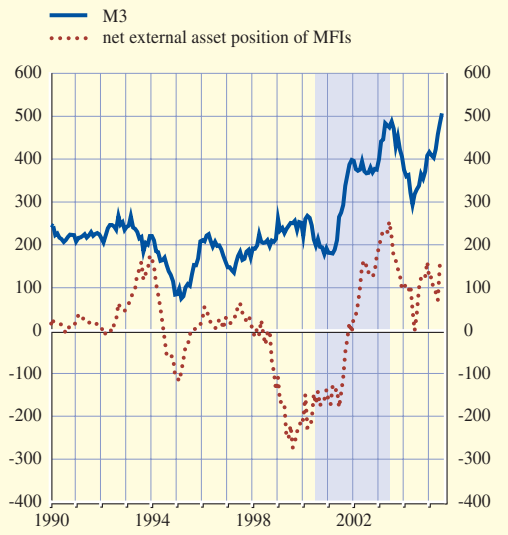
As a reaction to rising global uncertainty, one may expect an increase in the "home bias" of investment decisions. In that respect, changes in the net external asset position of euro area MFIs – which represent the net capital flow of the euro area money-holding sectors with non-residents channelled via euro area MFIs – should be particularly strong. As investors search for safer and more liquid assets at times of heightened uncertainty, they may repatriate funds previously invested abroad by selling the underlying holdings of foreign securities to non-residents. To the extent that non-residents

purchase these securities using deposits at euro area MFIs, MFI external liabilities will fall and thus MFI net external assets will rise, fuelling M3 growth. This is the counterpart to the accumulation of deposits by euro area residents as they receive payment for the sale of foreign securities.

Chart 6 demonstrates the link between changes in the net external asset position of euro area MFIs and M3 between mid-2000 and mid-2003 and confirms the existence of substantial portfolio shifts into money, driven to a significant extent by a portfolio inflow of capital from abroad. However, it should be recognised that, at least to some extent, these flows were linked to the previous strong outflows of funds from the euro area money-holding sector which were driven by the strong wave of international mergers and acquisition activities associated with the "New Economy" boom in the United States at the turn of the century. Nonetheless, overall, portfolio considerations – especially the repatriation of capital previously invested abroad – have had a considerable effect on monetary developments in past periods of high global uncertainty.

Chart 6 M3 and net external assets of MFIs

(annual flows; EUR billions)



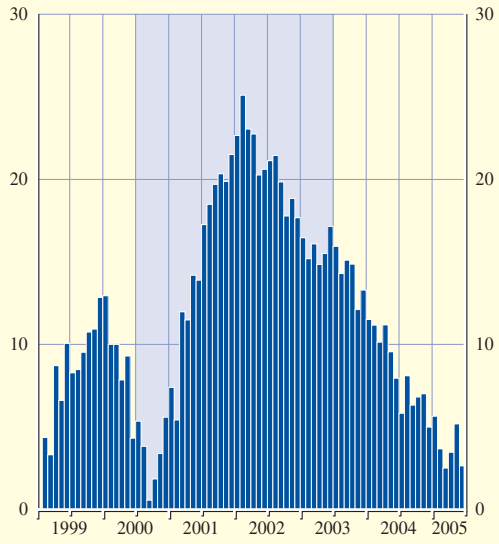
Source: ECB.
Note: Before September 1997, flows in the net external asset position of MFIs were derived as differences in outstanding amounts.

A similar form of analysis can be applied to the components of M3. There are two reasons why the analysis of money market fund shares/units may reflect the speculative demand for money. First, at times of high uncertainty investors may park money in money market fund shares/units, in part because the attractiveness of these funds at such times is likely to be high due to their limited asset class structure that is largely restricted to highly liquid short-term debt instruments. Second, a large proportion of households' holdings of shares in their wealth portfolio is held via equity funds. Relatively limited switching costs between equity funds and money market funds, remuneration close to market interest rates and the high liquidity of money market funds allow the move out of equity funds into money market funds at times of uncertainty and permit a relatively fast reversion into equity funds at times of increasing confidence. Overall, it is, therefore, not surprising that, during the period of heightened uncertainty driven by the global shocks between 2000 and 2003, the contribution of the growth in money market fund shares/units to overall M3 growth was sizeable (see Chart 7). It then decreased during the subsequent periods, when global and financial market uncertainty normalised to a large extent.

One way of deriving empirical measures of the uncertainties that affect the portfolio decisions of the euro area money-holding sector is to construct volatility measures, i.e. measures associated with variations in second-order moments of prices (i.e. the variances and co-variances). One such measure is the implied volatility of stock price indices derived from options prices on the index. A high value of such measures would indicate a reduced ability to predict future asset price developments, possibly leading to actions by investors to reduce their exposure to these risks and, thus, a switch into lower-yielding but capital-certain

Chart 7 Contribution of money market fund shares/units to annual M3 growth

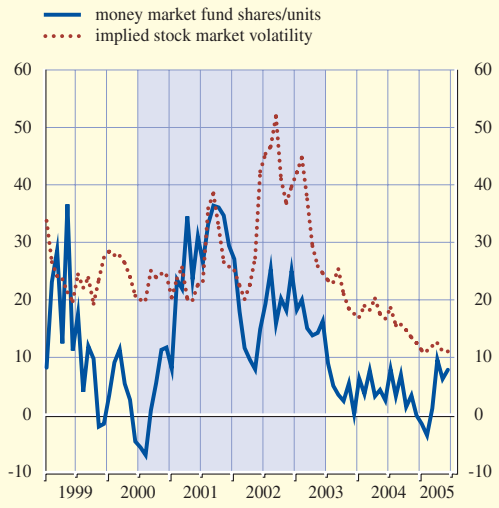
(in percentages)



Source: ECB.

Chart 8 Short-term growth of money market fund shares/units and implied stock market volatility

(annualised three-month growth rate in percentages; percentages per annum)



Sources: Bloomberg and ECB.
Note: The implied volatility series consists of the implied volatility on the near-contract generic future reported by Bloomberg. The equity index that the implied volatility refers to is the Dow Jones Euro Stoxx 50 index.

and more liquid monetary assets. As shown in Chart 8, it appears that rises in the implied volatility of the Dow Jones Euro Stoxx 50 index – especially in late 2001 and late 2002 – led to increased inflows into money market mutual fund shares/units, as investors sought a safe haven from the prevailing financial uncertainty.

However, money demand does not seem to react immediately when implied volatility measures decline. Such asymmetric behaviour is in line with theory. As implied by the buffer stock theory of money demand, in the presence of adjustment costs it may not be optimal for economic agents to bring their monetary holdings back to the desired levels immediately after a shock. The reactions to shocks can therefore be assumed to be asymmetric, i.e. an immediate reaction to increased uncertainty, but a relatively slow process of correction. Risk measures designed to capture the impact of uncertainty on money demand should therefore take into account the impact of a time-varying risk aversion on the part of investors that is likely to increase after the profound losses incurred during the period between mid-2000 and mid-2003 (for a study of the impact of equity return and risk measures, see Box 3).

One possible measure of risk aversion that takes these empirical regularities into account is the conditional correlation between stock and long-term government bond returns.[15] This should constitute a reasonable proxy for risk aversion because government bond markets are less sensitive than equity markets to shifts in investors' attitudes towards risk. In periods of heightened risk aversion, the prices of the two asset classes should move in opposite directions, i.e. they should display a negative correlation or investors should leave the equity market and buy bonds. In normal periods, by contrast, standard asset allocation would

15 For details, see the box entitled "Risk aversion and developments in monetary aggregates" in the December 2004 issue of the ECB's Monthly Bulletin.

suggest a positive correlation between stock and bond returns as low interest rates support equity prices.

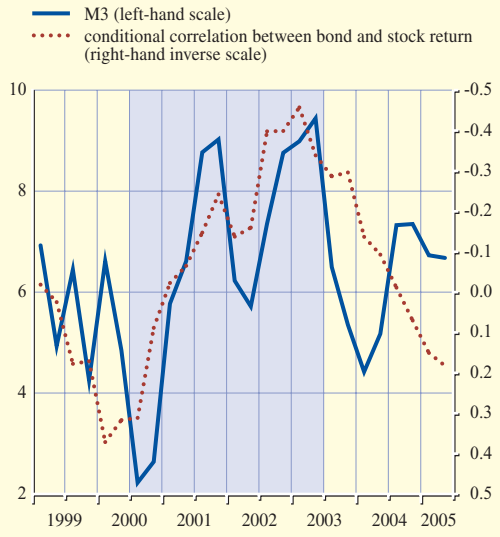
Chart 9 demonstrates the negative correlation between flows in M3 and the index of risk aversion for the period under review. In order to check for the robustness of these results, alternative indicators of risk appetite have been constructed, which show similar results. One of these alternative indicators is shown in Chart 10, which illustrates the "earnings yield premium" in the euro area – the difference between the earnings yields for equity and the real long-term interest rate. Such an indicator reflects investors' perception of a risk premium. This indicator has remained at relatively high levels even after the recovery in stock market indices and the reduction in equity price volatility since mid-2003. This measure therefore seems particularly appropriate for capturing the asymmetric reactions to shocks, i.e. a rapid reaction to higher uncertainty associated with a flight to safety, but a relatively slow reversal due to increased risk aversion. Indeed, as shown in Chart 10, this indicator seems relatively closely related to the real money gap of M3.[16]

When analysing the inertia in the risk aversion of money holders, one should not neglect the international dimension. In fact, the relatively positive expectations for euro exchange rates in recent years are likely to have dissuaded euro area money holders from investing more strongly in foreign assets. At the same time, a

16 For a more thorough analysis of the earnings yield premium index, see the ECB Financial Stability Review June 2005, pp. 66-68.

Chart 9 M3 growth and a measure of risk aversion

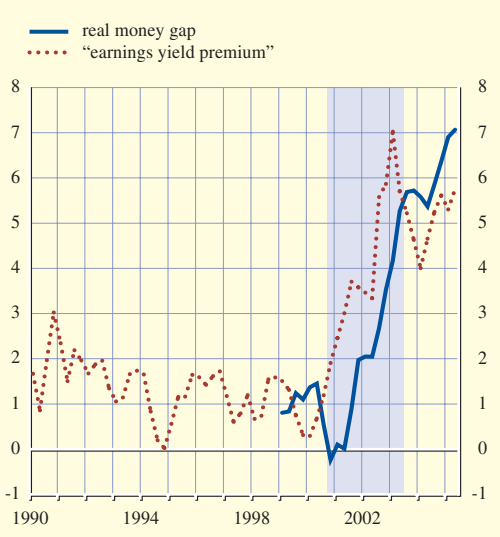
(annualised quarter-on-quarter growth rate in percentages; conditional correlation)



Sources: Global Financial Database, ECB and ECB calculations.
Note: The conditional correlation between bond and stock market returns has been estimated using a multivariate GARCH model. See Engle, R. F. and Kroner, K. K. (1995), "Multivariate Simultaneous Generalized ARCH", Econometric Theory, Volume 11, Issue 1, pp. 122-150.

Chart 10 Estimate of the real money gap[1] of M3 and the "earnings yield premium"

(as a percentage of the stock of real M3; adjusted for seasonal and calendar effects; December 1998 = 0; percentage points)



Sources: Thomson Financial Datastream and ECB calculations.
Note: The "earnings yield premium" is the difference between the earnings yield for equity and the real long-term interest rate (nominal long-term interest rate minus actual HICP inflation).
1) The measure of the real money gap is defined as the difference between the actual level of M3 deflated by the HICP and the deflated level of M3 that would have resulted from constant nominal M3 growth at its reference value of 4½% and HICP inflation in line with the ECB's definition of price stability, taking December 1998 as the base period.

possibly lower risk aversion on the part of international investors and the exchange rate expectations mentioned above may partly explain the capital inflows into the euro area in recent quarters, as recorded in the net external asset position of euro area MFIs.

Box 3

AN ILLUSTRATION OF HOW TO CAPTURE THE POSSIBLE IMPACT OF STOCK MARKETS ON MONEY DEMAND

As discussed in Section 3 of the main text, the sign of the relationship between stock market developments and money holdings is ambiguous on purely conceptual grounds and thus remains essentially an empirical question.

This box uses a simplified extension of a traditional money demand model[1] to demonstrate how variables capturing the return and the risk on alternative assets can affect money demand. More specifically, following the work of Carstensen (2004),[2] a smoothed version of the return on equity (combined with the ten-year government bond yield to give a broad measure of the returns available on non-monetary assets) and a smoothed version of a stock market volatility measure have been introduced into the long-run money demand equation.[3] The smoothing of the additional explanatory variables is meant to capture time-varying risk aversion, which appears characteristic of recent behaviour. Shocks to the stock market in preceding periods are likely to influence portfolio choices in current periods. Moreover, the short-term dynamics of the traditional money demand model have been extended by the introduction of a further risk measure related to the stock market, namely the first difference of the earnings-yield premium (as presented in section 4 of the main text).[4]

It should be noted that a number of interesting phenomena, such as potential asymmetric effects of stock market booms and busts on money demand, the possible inclusion of variables capturing the relative interest of foreign investors in euro area equity as compared with euro area investors, and the likely non-linear effects of the price-earnings ratio of equities on money demand, have been ignored in this specification and probably will have to be taken into account in future work.

Despite its admittedly simple structure, the estimated long-run relationship between real money balances, output, opportunity costs and equity risk measures is relatively stable up to the end of

1 For a detailed description of the methodology used, see Calza A., Gerdesmeier, D. and Levy, J. (2001), "Euro area money demand: Measuring the opportunity costs appropriately", IMF Working Paper No 01/179. A number of changes relative to the original model have been introduced: changes in the inflation rate were added to the short-run dynamics in order to relax the condition of short-run homogeneity, and the log of opportunity costs was taken in order to better capture possible non-linear effects in the interest rate elasticity. Furthermore, the model parameters were frozen from the estimation period ending in the second quarter of 2001, to take account of signs of instability that occurred in relation to the extraordinary portfolio shifts into money between 2001 and mid-2003.

2 See Carstensen, K. (2004), "Stock market downswing and the stability of EMU money", Kiel Institute of World Economics. Another approach leading to similar results is presented in Greiber, C. and Lemke, W. (2005) "Money demand and macroeconomic uncertainty", Deutsche Bundesbank Discussion Paper Series 1: Economic Studies No 26/2005.

3 The annualised three-year log differences of the quarterly Dow Jones Euro Stoxx index have been used as an equity return variable. A two-year average of conditional variances from a GARCH(1,1) model derived from the yields of the daily Dow Jones Euro Stoxx index has been used as a stock market volatility measure.

4 In addition, the lagged changes in the yield spread between the ten-year government bond yield and the three-month money market rate and the lagged changes of oil prices have been removed from the short-run equation.

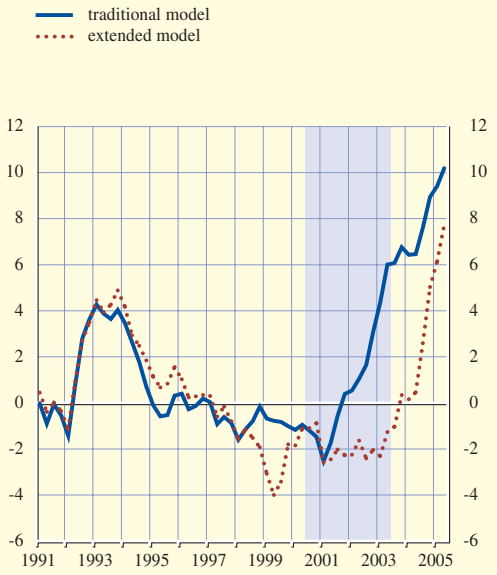
the sample period (the second quarter of 2005) and provides an appropriate framework to derive some stylised facts on the impact of stock market developments on money demand.

Chart A illustrates these stylised facts by comparing model-based measures of the monetary overhang stemming from the traditional money demand model with those of the model extended with stock market variables. In this respect, the two measures of the monetary overhang display significant differences during the period from 2001 to mid-2004. Whereas the traditional model indicates a positive and steadily increasing overhang in the period from 2001 to mid-2005, the overhang of the extended model including stock market effects remains negative over the whole period of heightened uncertainty between 2001 and 2003, as the higher money holdings resulting from a flight to safety are explained in terms of the high risk in equity holdings. Yet from the second half of 2004, the overhang measure of the extended model becomes positive and then increases strongly.

This simplified measure of excess liquidity corrected for the impact of heightened uncertainty in financial markets thus leads to similar conclusions to those derived from money gap measures constructed from the M3 series corrected for the estimated impact of portfolio shifts, as regularly presented in the Monthly Bulletin (see Chart B).

Chart A Monetary overhang from the traditional and extended money demand models

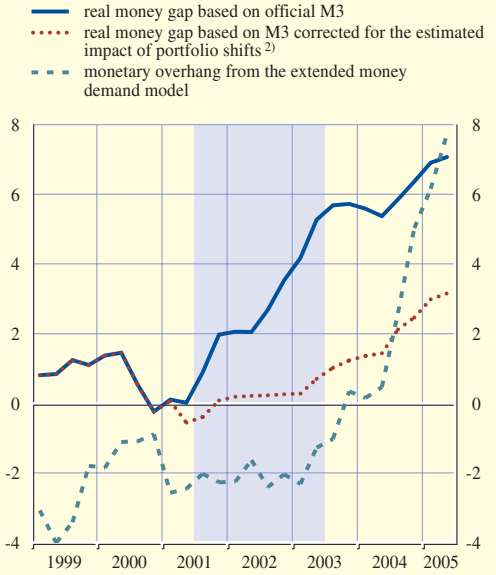
(percentage deviations from equilibrium)



Sources: ECB and ECB calculations.

Chart B Estimates of the real money gap[1] and the monetary overhang

(as a percentage of the stock of real M3; adjusted for seasonal and calendar effects; December 1998 = 0; percentage deviations from equilibrium)



Sources: ECB and ECB calculations.
1) The measure of the real money gap is defined as the difference between the actual level of M3 deflated by the HICP and the deflated level of M3 that would have resulted from constant nominal M3 growth at its reference value of 4½% and HICP inflation in line with the ECB's definition of price stability, taking December 1998 as the base period.
2) Estimates of the magnitude of portfolio shifts into M3 are constructed using the approach discussed in section 4 of the article entitled "Monetary analysis in real time" in the October 2004 issue of the ECB's Monthly Bulletin.

5 CONCLUSION

Understanding the impact of macroeconomic uncertainty on money demand is crucial when assessing risks to future price stability stemming from monetary developments.

In the environment faced over the past few years, it has been a challenging task to recover the information in monetary developments which is relevant for monetary policy decisions. In this respect, monetary analysis plays an important role in the ECB's monetary policy framework as it is used to check from a medium to longer-term perspective the assessment of short to medium-term risks to price stability obtained from economic analysis. It thereby helps to ensure that the Governing Council, in forming its overall judgement of the risks to price stability, does not overlook important information concerning future price trends.

A sequence of large shocks increased global uncertainty, especially during the period from 2000 to 2003. This appears to have triggered considerable flows into safe haven investments, especially monetary assets. Money demand therefore increased significantly. Due to the increasing globalisation of financial markets, shocks that increase global uncertainty are likely to have a considerably stronger effect on euro area monetary holdings than in previous decades. Efforts to incorporate these effects into econometric money demand models are ongoing.

This article has outlined the main elements of the conceptual framework within which the impact of uncertainty on M3 dynamics has been analysed. It has also illustrated some of the indicators and tools used by the ECB to foster a deeper understanding of the potential implications of monetary developments for future price stability.