

The relationship between money and prices

The relationship between money and prices forms the basis of one of the two pillars of the Eurosystem's monetary policy strategy. Monetary aggregates serve as important indicators for estimating medium to long-term price developments and hence for assessing risks to price stability. Their particular role in shaping the Eurosystem's monetary policy strategy is due to the relatively close empirical relationship between money and prices. Even so, the significance of the money stock for the euro-area's monetary policy has increasingly become a subject of debate recently. This article highlights the role of money in price developments, particularly in the euro area, against the backdrop of recent theoretical and empirical findings from academic research. Generally, many empirical studies show that monetary trends contain valuable information on price developments in the euro area. In the long term, there is a close correlation between the two variables. In the short term, however, the relationship between money and prices is very complex.

Monetary developments an important indicator for monetary policymakers

The quality of the relationship between monetary and price developments has always been a contentious issue in the academic debate. While some regard the money stock

*Debate on the
money stock's
significance
for price
developments*

as the key variable in determining prices, others see the monetary aggregates playing, at most, a passive function, which is not suited to extracting information on future price movements. This debate has been revived again recently in the light of the portfolio shifts within the euro area. In the wake of the stock market slump which began in 2000 and the attendant marked uncertainty in the financial markets, monetary growth started to accelerate from mid-2001. Consequently, the M3 growth rate was consistently above the published ECB reference rate for the inflation-free growth of the money stock without the resulting monetary overhang thus far having brought about a rise in inflation.

Monetary analysis remains a major component of the Eurosystem's monetary policy strategy

However, it is with good reason that the analysis of monetary trends remains a principal component of the Eurosystem's monetary policy strategy. In its monetary policy strategy review in 2003, the ECB Governing Council confirmed the importance of monetary analysis for estimating risks to price stability. It emphasised the medium to long-term nature of the monetary-based inflation assessment and of comparison with the reference value, in particular.¹

Monetary policies geared to the money stock – past experience

Bundesbank's monetary targeting strategy

In the 1970s, the Bundesbank established a money supply target for the first time.² With a view to a medium-term price-stabilising policy, an intermediate goal was set for the growth rate of a monetary aggregate. This

was based on an estimate of the potential growth of the German economy, the trend change in the velocity of circulation of money and an "unavoidable" rise in prices, ie an inflation rate compatible with the price norm. Until the changeover to the single currency in the euro area in 1999, the money stock was at the heart of the Bundesbank's monetary policy strategy and hence made a crucial contribution to a long period of price stability in Germany. The Eurosystem continued the Bundesbank's "money stock tradition" by assigning a prominent role to monetary developments in the form of a separate pillar within its monetary policy strategy.

However, the concept of a central bank strategy based on the money stock was not equally successful everywhere. Although a number of central banks initially embarked on a similar course, they changed their monetary policy strategies again later. In the early 1970s, for example, the Federal Reserve began paying particular attention to monetary aggregates when assessing the monetary policy situation. At the same time, however, the operational target of managing the overnight rate in the interbank market (Federal Funds Rate), retained a prominent role in shaping the Fed's monetary policy. Monetary growth did not become the key target variable until the period between late 1979 and

Monetary targeting strategy not successful everywhere

¹ See ECB *Monthly Bulletin*, June 2003.

² This objective was published for the first time in late 1974. It referred to the central bank money stock, ie the notes and coins in circulation held by non-banks and the minimum reserve requirement at constant minimum reserve ratios (as at January 1974). From 1988, the money supply target was defined for the broad M3 aggregate.

1982.³ Subsequently, however, the money stock was superseded by other monetary policy target variables.

*Impact of
financial
innovation
on money
holdings ...*

The main reason why the Federal Reserve's monetary targeting failed was a lack of stability in the empirical relationship between monetary aggregates and prices in the US.⁴ This is most likely to have been due, above all, to the deregulation of the financial markets and the associated emergence of financial innovations which often represented near-money substitutes. Purely portfolio-related shifts of monetary sub-aggregates into these alternatives to money holdings were thus able to cause changes in the money stock without showing any perceptible impact on the demand for goods or the prices of goods. This meant that the function of monetary aggregates as an indicator of US price movements was impaired.⁵ Over and above that, money creation in the US banking sector was influenced in part by special statutory factors.⁶ However, the fact that deregulated financial markets do not necessarily weaken the relationship between the money stock and prices can be seen in the case of Germany, where there was no sudden emergence of financial innovations to take the place of money holdings on a large scale.⁷

... varies

*Central banks
successful with
monetary
targeting in
the past*

Notwithstanding the problems of implementing monetary targeting strategies in some countries, those central banks which have placed great importance on the information content of monetary aggregates when making their monetary policy decisions, do nonetheless appear to have been very

successful in stabilising the domestic purchasing power of their currencies. For example, Bernanke and Mishkin (1992) note that "central banks most 'hawkish' on inflation ... have been the most consistent in maintaining a money targeting strategy".⁸ This has also been confirmed by Fatas, Mihov and Rose (2004), who have established empirically that countries whose central banks pursue a monetary target, on average, have lower inflation rates.⁹

³ For this period, the Federal Reserve established a corridor for the growth of nonborrowed reserves, ie the share of central bank money which is generated via open market transactions. In contrast to the situation in the present euro area, in the United States, outright open market transactions are banks' major source of refinancing for covering their central bank money requirements. Accordingly, nonborrowed reserves represent the largest share of the monetary base in the US.

⁴ See B M Friedman and K N Kuttner (1992), Money, Income and Prices after the 1980s, *NBER Working Paper*, No 2852.

⁵ These developments not only led to instability in the relationship between money and prices in the US, but also to instability in the usual money demand functions. See A Calza, and J Sousa (2003), Why has Broad Money Demand been more Stable in the Euro Area than in other Economies? A Literature Review, *ECB Working Paper*, No 261.

⁶ For example, for several financial institutions there were no incentives to attract deposits as statutory regulations restricted their ability to extend credit. See Calza and Sousa (2003) *loc cit*.

⁷ Money market funds in Germany are a case in point. These were not permitted until 1994. Purchases of units in money market funds remained negligible, however, and thus hardly affected the properties of the money stock M3. Today, these units are a component of the monetary aggregate M3 in the euro area. See J Reischle, (2001), The Role of the Analysis of the Consolidated Balance Sheet of the Banking Sector in the Context of the Bundesbank's Monetary Targeting Strategy Prior to Stage Three, in *Monetary Analysis: Tools and Applications*, H Klöckers and C Willeke (eds), European Central Bank, Frankfurt.

⁸ See B Bernanke, und F Mishkin, (1992), Central Bank Behaviour and the Strategy of Monetary Policy: Observations from Six Industrialized Countries, *NBER Working Paper*, No 4082, p 38.

⁹ See A Fatas, I Mihov and A K Rose, (2004), Quantitative Goals for Monetary Policy, *NBER Working Paper*, No 10846.

The long-term relationship between money and prices – the quantity theory

Quantity equation and quantity theory

In economic theory there are various mechanisms which can explain the existence of a relationship between money and prices. These depend on the time-horizon and the interaction of the economic variables under consideration. Quantity theory is typically used as a starting point for analysing the long-term relationship between the money stock and prices. This theory may be illustrated using the equation of exchange

$$M \cdot V = P \cdot Y,$$

where M denotes money in circulation, multiplied by the velocity of circulation, V , the product of the price level, P and real GDP, Y .

In applying this method for monetary policy purposes, say, when calculating the Euro-system's reference rate for inflation-free growth of M3, the equation of exchange is reformulated in terms of growth rates

$$\Delta m + \Delta v = \Delta p + \Delta y,$$

where Δm denotes the growth of the money stock, plus the change in the velocity of circulation, Δv , the inflation rate, Δp , plus real economic growth, Δy . Assuming a constant change in the velocity of circulation, an increase in the money stock leads to a corresponding increase in the inflation rate, provided there is no change in real output.

This simple analysis provides a rather good guideline for describing the longer-term

empirical relationship between monetary growth and inflation. In the short term, however, it is quite possible for trends to emerge, which cannot be explained by the quantity theory. First, money holdings might be affected as a result of temporary portfolio shifts by economic agents. Second, the neutrality hypothesis of money may be breached in the short term. This means that a change in the money stock can have a short-term influence on real economic growth.¹⁰ In this case, movements in the money stock are accompanied by a change in Y and do not correspond solely to a change in P . Moreover, quantity theory is of use to monetary policymakers only if the trend velocity of circulation can be forecast with adequate precision. In practice, this means that either it follows a time trend or fluctuates as a function of known economic variables, such as the opportunity costs of holding money.

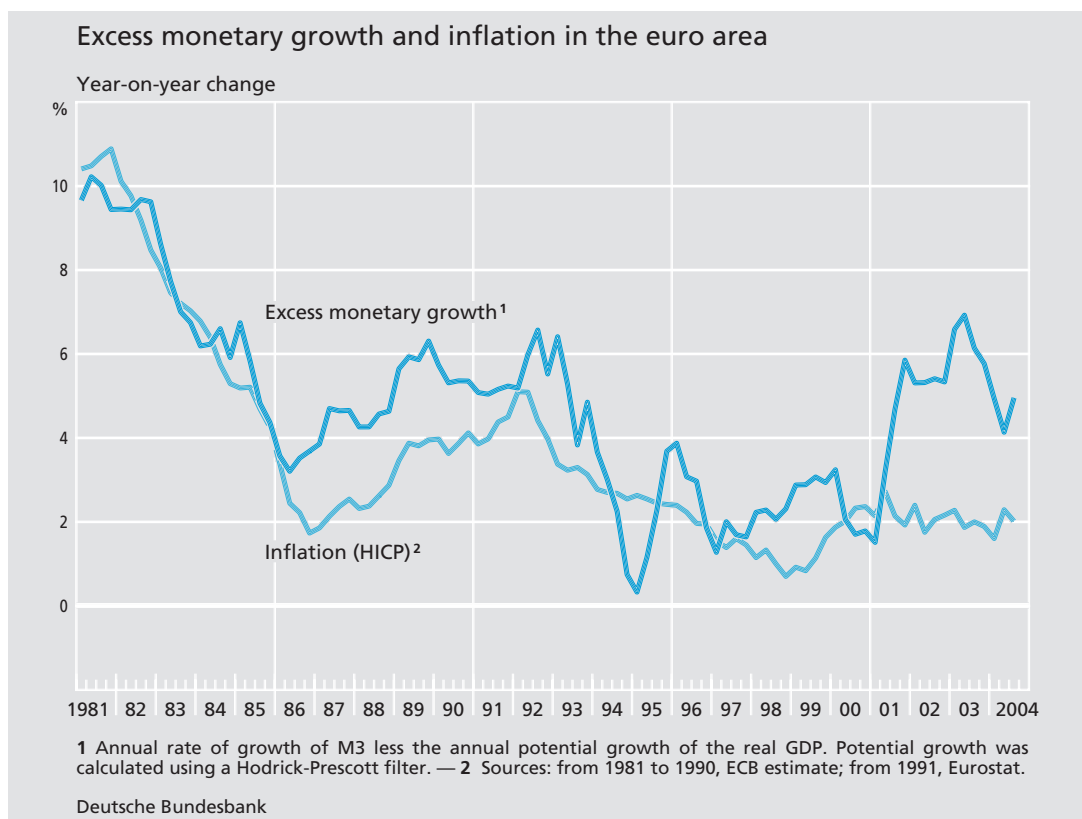
The chart on page 17 illustrates the quantity theory relationship for the euro area. It depicts the "excess monetary growth", ie the annual growth rate of M3 adjusted for potential GDP growth and the annual inflation rate measured by the Harmonised Index of Consumer Prices.¹¹ Excess monetary growth $\Delta m - \Delta \bar{y}$ corresponds to the increase in the money stock which goes beyond the level of growth necessary to finance potential

Quantity theory as a form of longer-term guidance for monetary policymakers

Long-term relationship between monetary growth and inflation in the euro area ...

¹⁰ For a discussion on the neutrality of money, see J Bullard, (1999), Testing Long-Run Monetary Neutrality Propositions: Lessons from the Recent Research, Federal Reserve Bank of St. Louis Review, November/December 1999, Vol 81, No 6, pp 57-77.

¹¹ No account has been taken here of the trend change in the velocity of circulation. As this remained constant throughout the observation period, it would represent only a shift in the level of excess monetary growth.



growth.¹² Generally, it is evident that these two variables move in parallel with the inflation rate. However, it also shows that short-term deviations from the long-term relationship may occur. This is especially true of the last three years which were characterised by the influence of portfolio effects. These comprised a shift away from riskier securities to safer forms of investment, including short-term bank deposits, which belong to the monetary aggregate M3.

Beyond this purely graphic form of analysis, numerous studies provide additional empirical evidence for the fundamental validity of the quantity-theory relationship.¹³ Furthermore, it can be demonstrated that taking account of monetary aggregates and indicators improves inflation forecasting for the euro area, espe-

cially for a forecast horizon of roughly two years or more, ie for the medium and long term.¹⁴ Monetary developments therefore do indeed provide information content for monetary policymakers with respect to the longer-term price outlook in the euro area.

¹² The Hodrick-Prescott filter was used to calculate potential GDP growth. See R J Hodrick and E C Prescott, (1997), Post-war U.S. business cycles: An empirical investigation, *Journal of Money, Credit, and Banking*, Vol 29, No 1, pp 1-16.

¹³ See G T McCandless Jr and W E Weber (1995), Some Monetary Facts, Federal Reserve Bank of Minneapolis *Quarterly Review*, Vol 19, No 3, pp 2-11 and Mervyn King, (2002), No Money, No Inflation – The Role of Money in the Economy, Bank of England, *Quarterly Bulletin*, Summer 1995, pp 162-177. Moreover, for the euro area, many studies show that money demand is generally a stable function. This, too, implies a close correlation between money and prices. See A Bruggeman, P Donati and A Warne (2003), Is the Demand for Euro Area M3 Stable?, *ECB Working Paper*, No 255.

¹⁴ See S Nicoletti Altinari, (2001), Does Money Lead Inflation in the Euro Area?, *ECB Working Paper*, No 63.

... confirmed
by empirical
studies

The shorter-term relationship between money and prices – a framework for analysis

*Price discovery
in the
short term ...*

One problem with the quantity theory with respect to assessing current monetary developments is that it says little on how a short-term change in the money stock correlates to changes in prices or other variables and how the long-term equilibrium relationship is achieved. Furthermore, in the short term, other non-monetary factors such as wage costs and the cost of capital or fiscal demand effects also influence price trends. The interaction between the money stock and prices is therefore more complex and less direct in the short term than in the long term. To differentiate between monetary-related price movements and non-monetary processes that are relevant to inflation, more comprehensive approaches are required which can take account of the various channels determining prices.

*... as part of
a stylised
basic model*

For this, a stylised basic model serves as a starting point, which essentially comprises three economic relationships.¹⁵ The first describes the development in the real quantity of goods. This mostly depends on past or expected output and an interest rate. However, in the event of a short-term non-neutrality of money, real cash holdings can also have an impact. The second equation describes the inflation trend, which is determined by the expected or past rate of inflation, costs and demand factors as well as by monetary variables. The third relationship describes economic agents' money holdings as a function of their income and the opportunity costs of holding cash.

In this context, the monetary trend can directly determine prices through the inflation equation. Given non-neutrality, monetary aggregates can have an indirect impact on prices through the demand for goods. Nevertheless, money can also play a role in price developments merely as an information variable without there being any relationship in a causal sense. This is possible if monetary variables reflect developments in other economic variables, which themselves can be observed only imperfectly or with a time lag, but which, at the same time, are relevant to price discovery.

*Differing
transmission
relationships
between
money and
prices*

Impact of money on prices in the short term

The P-star approach is a model where monetary aggregates directly influence inflation. In the long term, this model determines the equilibrium price level by means of a quantity theory relationship and, thus, ultimately the money stock. In the short term, the difference between the equilibrium and current price levels – known as the price gap – determines the adjustment pressure for the inflation rate. Consequently, in contrast to other inflation equations, such as Philips curves, a direct correlation is established between the current excess money stock and the inflation rate.¹⁶ Empirical studies for the euro area suggest

P-star model

¹⁵ See, for example, C Walsh, (2003), *Monetary Theory and Policy*, second edition, MIT Press, Cambridge.

¹⁶ The Bundesbank has also used the P-star model in the past to describe inflation in Germany in quantitative terms. See Deutsche Bundesbank, *The correlation between monetary growth and price movements in the Federal Republic of Germany, Monthly Report*, January 1992, pp 20-28.

that the P-star model helps to explain inflation trends.¹⁷ However, the short-term impact of the price gap on the current inflation rate tends to be marginal in some cases. Moreover, adjustment to the long-term quantity theory equilibrium is often obscured by other factors that drive inflation.

Real balance effect

Another transmission mechanism is the real balance effect. This is formed on the basis that a change in economic agents' real balances is perceived as a corresponding change in wealth. An increase, for example, then induces a positive demand impulse which may ultimately lead to an increase in prices, which then reduces the real money stock until equilibrium has been reestablished.

Little empirical evidence of real balance effects in the USA, euro area and United Kingdom ...

Ireland (2004) investigates the real balance effect using a general equilibrium model for the USA.¹⁸ In this model, the direct influence of real balances is not limited to the demand for goods; it is also entered as a direct determinant into the inflation equation. Empirically, however, the study finds no evidence for the relevance of real balance effects in the USA. Hence, money plays no direct role in the short-term determination of inflation and income. In the long term, however, the quantity theory also holds for this model insofar as the equilibrium inflation level is determined by the rate of monetary growth. The money stock therefore acts as an anchor for the inflation rate. Andres, Lopez-Salido and Nelson (2004) confirm the outcome that real balance effects are of no relevance for the USA and obtain the same result for the euro area and the United Kingdom as well.¹⁹

In contrast to these studies, Kremer, Lombardo and Werner (2003) – using a similar method – find significant real balance effects for Germany in the period between 1970 and 1998.²⁰ This suggests that they are relevant for at least part of the euro area. They might therefore exist for the euro area as a whole, at least in a weakened form.

... in contrast to Germany

Monetary aggregates as information variables for prices

Some new studies accentuate the role of monetary aggregates as information variables. This role is based on an indicator function of money for other economic variables that are relevant to inflation. Although money does not play an active or causal role in price developments in these studies, the close correlation between the money stock and price-determining factors can be used for monetary

Money as an indicator variable

¹⁷ See C Trecroci and J L Vega, (2002), The Information Content of M3 for Future Inflation, *Review of World Economics*, Issue 138, Vol 1, pp 22-53, H Reimers, (2002), Analysing Divisia Aggregates for the Euro Area, Economic Research Centre of the Deutsche Bundesbank, *Discussion Paper*, No 13/02, and S Gerlach and LEO Svensson, (2003), Money and Inflation in the Euro Area: A Case for Monetary Indicators?, *Journal of Monetary Economics*, Vol 50, issue 8, pp 1649-1672.

¹⁸ See P N Ireland (2004) Money's Role in the Monetary Business Cycle, *Journal of Money, Credit, and Banking*, Vol 36, No 6, pp 969-984. Such general equilibrium models have the advantage that they provide a consistent microtheoretical basis for the real balance effects. They also permit an integrated analysis of the interactions of the relevant economic processes and are not based solely on analyses of sub-aspects such as the isolated analysis of the demand for products, or inflation.

¹⁹ See J Andres, J D Lopez-Salido and E Nelson (2004), Money and the Natural Rate of Interest: Structural Estimates for the UK, the US and the Euro Area, *CEPR Discussion Paper*, No 4337.

²⁰ See J Kremer, G Lombardo, and T Werner, (2003), Money in a New-Keynesian Model Estimated with German Data, Economic Research Centre of the Deutsche Bundesbank, *Discussion Paper*, No 15/2003.

policy purposes. This is especially true if the price-relevant variables cannot be observed sufficiently. In this case, money can serve as an indirect indicator of price developments.

A monetary approach

One transmission channel of this type is described by monetary approaches.²¹ The key element of this class of model is that money holdings are determined by a host of observable returns on assets, such as interest rates and equity returns besides factors which are difficult to measure, such as real estate income or human capital. As a result, the money stock assumes an index or indicator function for a broad range of yields, which, in turn, have a direct impact on the demand for goods and, ultimately, on inflation trends. Nelson (2000) formalised this approach using a theoretical model, and finds empirical evidence of its validity for the USA and the United Kingdom.²² However, his studies are based solely on the isolated analysis of a goods demand equation and permit no conclusions with respect to price effects. The studies by Andres, Lopez-Salido and Nelson (2004) cited above, which are based on a comprehensive model, likewise identify the existence of this effect for the USA and the United Kingdom. Furthermore, they find evidence that this monetaristic indicator function of monetary aggregates for prices is also relevant for the euro area.

Money as a possible indicator of real demand ...

A further information approach is based on the signal function of money with respect to real output and demand. In practice, data are often observable only with a time lag and are subject to statistical noise. This means that central banks' monetary policy decisions are

based on an incomplete knowledge of the current state of the economy. GDP, for instance, is, first, captured only on a quarterly basis and, in the case of the euro area, is not published until there has been a time lag of about two months. Second, the data are often revised several times following publication as the original data are subject to a certain amount of inaccuracy.²³ If the money stock exhibits a correlation with the "true" development of the economy, the analysis of the monetary aggregates in real time could provide an information advantage with respect to assessing economic activity as they, unlike GDP, can be measured accurately and in near-time.

Coenen, Levin and Wieland (2002) and Dotsey and Hornstein (2003) show that a central bank can use the information content of the money stock especially if the money demand function is particularly good at describing monetary developments and/or if autonomous monetary demand shocks barely occur.²⁴ However, this does not apply to the USA, which is why this information channel is

... but hardly relevant empirically

²¹ For a current discussion of such methods, see E Nelson, (2003), The Future of Monetary Aggregates in Monetary Policy Analysis, *Journal of Monetary Economics*, Vol 50, issue 5, pp 1029-1059.

²² See E Nelson (2002), Direct Effects of Base Money on Aggregate Demand: Theory and Evidence, *Journal of Monetary Economics*, Vol 49, issue 4, pp 687-708.

²³ For more on the issue of real-time problems, see Deutsche Bundesbank, Monetary policy under uncertainty, *Monthly Report*, June 2004, pp 15-27, and C Gerberding, F Seitz and A Worms (2004), How the Bundesbank really conducted monetary policy: An analysis based on real-time data, Economic Research Centre of the Deutsche Bundesbank, *Discussion Paper*, No 25/2004.

²⁴ See G Coenen, A Levin and V Wieland (2002), Data Uncertainty and the Role of Money as an Information Variable for Monetary Policy, Working Paper, to appear in *European Economic Review* and M Dotsey and A Hornstein (2003), Should a Monetary Policymaker look at Money?, *Journal of Monetary Economics*, Vol 50, issue 3, pp 547-579.

of no relevance to the monetary policy of the Federal Reserve. Although these stability problems of the demand for money appear to be of lesser relevance to the euro area, the degree of inaccuracy in measuring GDP appears to be relatively small in relation to an indirect observation via monetary growth.

On the whole, there are various possible mechanisms for establishing a relationship between the money stock and prices in the short term. The empirical evidence of the individual channels is mixed for the euro area. To understand monetary developments, it is important to realise there is no monocausal connection between money and prices in the short term. A rising money stock does not always necessarily imply greater risks to price stability as, in some cases, monetary aggregates tend to react passively in the short term. For example, purely demand-related portfolio shifts can also influence shorter-term monetary developments without bearing any direct price risks.

Identifying inflation-relevant monetary growth

Identifying inflation-relevant monetary growth using filter procedures

As the preceding discussion has shown, temporary monetary fluctuations occur frequently which are not always accompanied by a parallel development in prices. Bearing this in mind, it would seem an obvious matter to separate inflation-relevant monetary movements from those which are merely a result of shorter-term money demand effects or portfolio shifts. Some recent studies follow this approach and are based on empirical fil-

ter procedures.²⁵ Such filters are interesting because they can distinguish short-term fluctuations or distortions from the trend development of a time series. Hence, they make it possible to extract from the monetary aggregates temporary movements which are likely to have little or no information content for assessing price developments. Accordingly, the longer-term monetary trend, which is crucial for the inflation dynamics, is captured in a trend component.

A simple quantity theory relationship forms the basis of such an analysis. It measures the share of inflation-driving liquidity growth which exceeds the amount necessary to finance potential macroeconomic growth. Account is also taken of the fact that economic agents' money holdings might not increase proportionally with their income, meaning the income elasticity of the money demand may not be equal to one.²⁶ In formal terms, this inflation-driving liquidity growth may be expressed as the following

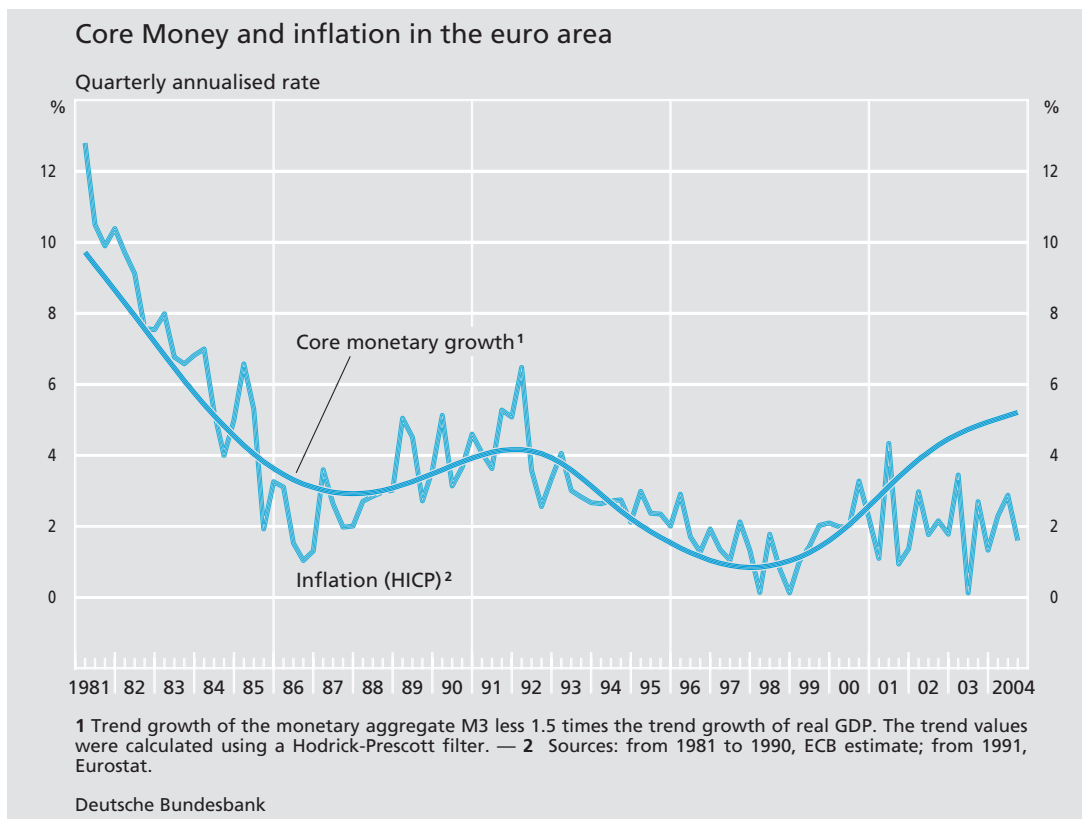
Core money

$$\Delta \bar{m} - \lambda \Delta \bar{y},$$

where $\Delta \bar{m}$ denotes trend money stock growth and $\Delta \bar{y}$ denotes trend real GDP

²⁵ The following arguments are based essentially on M J M Neumann and C Greiber (2004), Inflation and Core Money Growth in the Euro Area, Economic Research Centre of the Deutsche Bundesbank, *Discussion Paper*, No 36/2004. For similar approaches, see also J von Hagen and B Hofmann (2003), Monetary Policy Orientation in Times of Low Inflation, manuscript of a paper for the Conference on Monetary Policy under Low Inflation, Federal Reserve Bank of Cleveland, November 2003 and S Gerlach (2004), The Pillars of the ECB, *Economic Policy*, Vol 19, No 40, pp 389-439.

²⁶ Applied to the equation of exchange, this means that the velocity of circulation exhibits a trend.



growth.²⁷ The factor λ describes the income elasticity of the money demand. The expression is referred to as the core component of monetary growth, or “core money”.

Very close correlation between core money and inflation in the euro area

The chart shows that the core money time series is able to replicate the trend inflation rate in the euro area over most of the observation period.²⁸ Furthermore, econometric tests prove that, in the long term, a one-to-one relationship exists between the core component of monetary growth and inflation. Hence, the quantity theory is valid – as a trend, an increase in monetary growth is accompanied by an equal increase in the inflation rate.²⁹ Over and above that, estimates show that the information content of the core money component is also relatively high for the current inflation rate.

The chart above also indicates, however, that the empirical parallel movement of core money growth and inflation no longer obtains in the recent past. This phenomenon may nevertheless be explained by the above-mentioned uncertainty-related portfolio shifts in the M3 components. The portfolio hypothesis is supported by a chart showing two particular features of equity market develop-

Special feature of equity market developments ...

²⁷ The trend variables were calculated using a Hodrick-Prescott filter. See Hodrick and Prescott *loc cit*.

²⁸ Where λ equals 1.5. This value is produced by an estimation of the impact of core money on the inflation rate in the euro area.

²⁹ Conversely, it can be shown that fluctuations in monetary growth which are not part of the core component, are irrelevant for inflation.

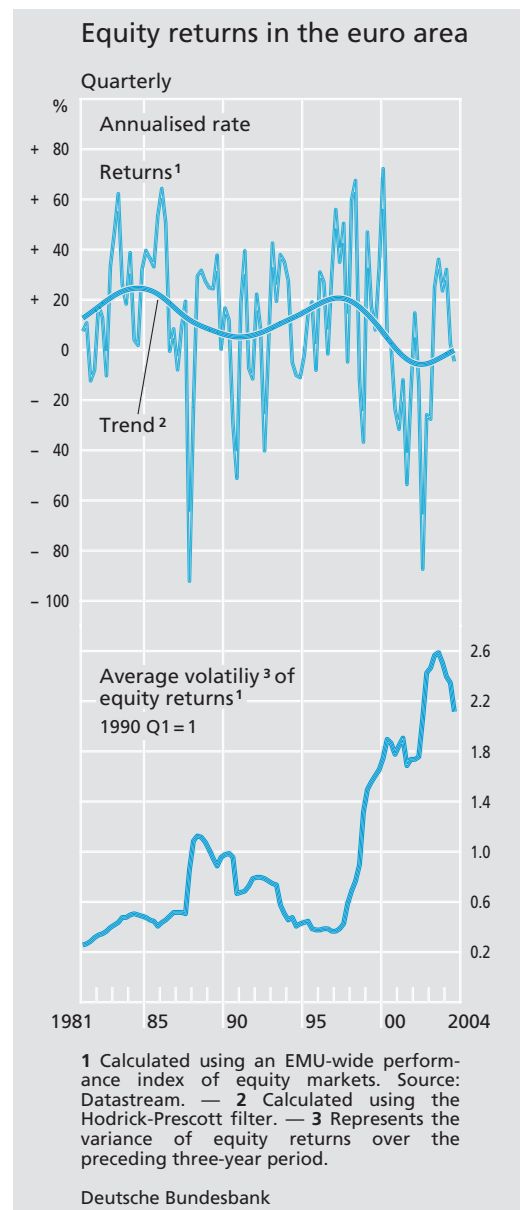
ments in the past few years.³⁰ First, the longer-term trend component of the equity returns in the euro area since the start of 2001 was negative for an extended period (see the adjacent chart). This reflects the marked decline in stock market prices, which, by historical standards, trended downwards for a long period of time, continuing until around early 2003. Second, the average volatility, measured here as the variance of the past returns over a moving horizon of three years, was exceptionally high in the last few periods. Although this measure increased sharply over the course of 1998 in the wake of the Russia crisis, the rise in volatility at that time was accompanied by high trend growth of equity returns. The ensuing turbulence in the equity markets further increased the volatility measured in this way with equity returns now falling at the same time. This encouraged the general demand for secure and liquid forms of investment – which are included in the money stock.

... fuelled
monetary
growth

The time pattern of these two indicators suggests that the sharp core money growth (compared with the inflation rate) from 2001 onwards was connected with the portfolio shifts. Hence, this does not appear to be a break in the relationship between money and prices, but rather a case of liquidity-demand-related special effects, which do not necessarily indicate additional inflation potential in the euro area.

Implications for monetary analysis

On balance, many recent empirical studies show that monetary growth contains valu-



able information on price developments in the euro area. In the long term, there is a

³⁰ This chart is based on daily observations of a Datastream euro-area-wide performance index of equity prices. The quarterly averages of equity returns were modelled using these data. The trend was calculated using a Hodrick-Prescott filter. The cumulative volatility is the variance of the daily real equity returns over each of the past three years. To adjust for the 1987 stock market slump when calculating the volatility, the return for the third quarter of 1987 was replaced by the mean value derived from the three preceding and three following quarters.

close correlation between the two variables. In the short term, however, the relationship between money and prices is very complex. First, there are various transmission mechanisms which influence both variables. Second, these relationships can hardly be integrated within a single approach. As a result, the monetary pillar of the Eurosystem's monetary policy strategy cannot be reduced to a single indicator or a particular model. Various analytical methods therefore have to be used to extract the price-relevant signals from monetary developments.³¹ As the discussion

of the recent portfolio effects shows, special factors may arise, which, in the medium term, lead to monetary growth deviating from the reference value without necessarily signifying a risk to price stability. However, a thorough analysis of the assessment of the monetary developments is invariably necessary in order to identify longer-term inflation potential in good time.

³¹ For an account of new instruments of monetary analysis, see, for example, Monetary analysis in real time, *ECB Monthly Bulletin*, October 2004, pp 43-66 for an account of the recent instruments of monetary analysis in the euro area.