Monetary Analysis: Tools and Applications

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Foreword

The importance of monetary analysis

Otmar Issing

Member of the Executive Board of the European Central Bank

These days, few economists would disagree with the statement that inflation is a monetary phenomenon in the long run. Indeed, this statement is one of the central tenets of economic theory. The long-run relationship between money and prices has been confirmed by an impressive number of empirical studies, both across countries and across time. Moreover, the ability to implement monetary policy ultimately hinges on a central bank's monopoly control over the creation of base money. Given the fundamental money-prices relationship and their monopoly power over the legal tender, the monetary authorities have a natural interest in monetary developments. At a more practical level, monetary data are collected in a timely manner and are more accurate than many other economic indicators. All these factors explain why money plays a prominent role in monetary policy-making and thus why the monetary analysis undertaken at central banks is both necessary and important.

The monetary policy strategy of the ECB recognises the monetary nature of inflation by assigning a prominent role to money in the formulation of monetary policy decisions aimed at the maintenance of price stability. This prominence is signalled by the announcement of a quantitative reference value for the growth rate of the broad monetary aggregate M3. In December 1998 the Governing Council of the ECB has set this reference value at 4 ½% and this value was subsequently confirmed in 1999 and 2000. A detailed analysis of monetary developments with the aim of extracting the information relevant for monetary policy decisions represents the first "pillar" of the ECB's monetary policy strategy. Among other things, this analysis includes an investigation of the deviation of M3 growth from the reference value.

Monetary analysis begins with the very definition of a key monetary aggregate. While it is easy to speak about the "M" which appears in economics textbooks, it is much harder in practice to give a meaningful definition of a monetary aggregate. There is now a consensus that broad aggregates, such as euro area M3, tend to perform better as monetary policy indicators than do narrower measures of money, since they internalise the portfolio shifts pervasive in a world of financial innovation and rapid change. In particular, econometric evidence suggests that euro area M3 both has a stable relationship with the price level in the long run and possesses leading indicator properties for inflation over the medium term. As such, this aggregate has the properties required to define the reference value and thus to signal the prominent role of money in the ECB's monetary policy.

To a large extent, monetary analysis represents the analytical work necessary to determine from the available monetary data the underlying relationship between money

and the price level. Monetary developments may be subject to a host of special influences and distortions which render the relationship between money and prices complex in the short run. Extracting the stable long-run relationship – say between euro area M3 and the euro area price level – from shorter-term developments in M3 is, in essence, the filtering of signals from noise. This analysis is demanding, since it requires both a strong command of economic theory and a detailed knowledge of the institutional environment. In particular, monetary analysis should always encompass a close monitoring of financial innovation as this may affect the fundamental relationship between money and prices.

To implement this more detailed assessment, monetary analysis undertaken at the ECB is not limited solely to the analysis of M3. The main components and counterparts of M3 in the balance sheet of the Monetary Financial Institutions sector are also closely monitored. In particular, the developments of credit to the private sector and of the most liquid components of M3, included in the narrow monetary aggregate M1, are followed with particular attention. This broader analysis is necessary to put developments into perspective, to obtain a better understanding of M3 developments and, more generally, to develop a broader insight into monetary conditions and their implications for monetary policy decisions aimed at maintaining price stability.

Monetary analysis can provide many kinds of information. Used as an indicator, monetary developments may signal risks to future price stability. Furthermore, monetary analysis may also be useful to monitor (and possibly offset) macroeconomic risks which are not directly related to price stability *stricto sensu*, but which may nevertheless have important consequences. For instance, historical experience has shown that booms and busts in capital markets, often associated with phenomena of excessive enthusiasm or excessive pessimism about the future, have typically been accompanied by large swings in monetary and credit aggregates.

A broader analysis of the flow of funds may also provide important inputs. In fact, by providing an insight into the composition of the balance sheet of the main actors in the economy (households, firms and intermediaries), a flow of funds analysis can help to assess the likely impact of interest rate changes on spending decisions, allowing a deeper understanding of the monetary policy transmission and therefore a proper calibration of monetary policy instruments. So far, the unavailability of the necessary data has prevented the ECB from carrying out a fully-fledged flow of funds analysis for the euro area as a whole, but the situation should improve substantially in this regard in not too distant a future.

At the ECB, detailed monetary analysis and the announcement of a reference value for M3 growth are closely interwoven, since the reference value constitutes per se a commitment to analyse monetary data carefully. It shows that monetary growth – the ultimate source of inflation in the long run – is taken seriously in the policy-making process. Given that the link between money and prices has a long-run nature, it also signals that monetary policy has an appropriate medium-term orientation. This, in turn, contributes to shaping agents' expectations in a manner which enhances the credibility of the central bank.

The experience of the first two years of Stage Three of Economic and Monetary Union (EMU) has shown that monetary developments in the euro area – and in particular the deviation of M3 growth from the reference value of 4 ½% – have provided consistent and reliable guidance for monetary policy. Interest rate decisions by the ECB

Governing Council have been supported by remarkably consistent information from the first pillar of the ECB's monetary policy strategy. At the same time, some caution needs to be exercised since M3 developments have presumably been influenced on occasion by special factors and distortions. For example, the exceptionally strong rise in M3 growth in January 1999 may have been due, in part, to the special environment at the start of Stage Three of EMU (e.g. the change in the reserve requirement regime associated with the introduction of the Eurosystem's operational framework).

All these considerations demonstrate why monetary analysis is important and, at the same time, show what difficult and far-reaching questions it is expected to answer. Indeed, many issues remain unsettled in economics literature and definitive answers are not easy to find. Nevertheless, there can be no doubt that monetary analysis should be assigned an important role in shaping the monetary policy debate.

Preface

Hans-Joachim Klöckers

European Central Bank

On 20 and 21 November 2000, the ECB's Directorate Monetary Policy organised a seminar for central banks on "Monetary analysis: tools and applications". The aim of the seminar was to obtain an overview of the various approaches used to assess monetary developments in major central banks. The seminar involved presentations and discussions by staff members from the ECB, EU national central banks and other G10 central banks.

As it emerged that the papers submitted to the seminar were of more general interest, it was deemed useful to make them available to the public. This volume presents the ten papers prepared for the seminar, together with a summary highlighting the main themes.

I drew a number of personal conclusions from the seminar. The most important was to see that monetary analysis continues to be "en vogue" among central bankers. As the papers show, the world's main central banks conduct some form of monetary analysis, with an increasing degree of depth and sophistication.

The seminar showed the variety of approaches adopted for the analysis of monetary developments. The tools used range from relatively sophisticated econometric methods to very detailed analyses of institutional factors, monetary counterparts, broader aggregates (on both the credit and the investment side), and flows of funds, etc. Particular importance was also given in some countries to the use of sectoral monetary data. All these approaches appear interesting and promising. However, the Eurosystem still has some way to go to increase the availability of harmonised monetary and financial statistics for the euro area in order to be in a position to replicate all the analyses conducted by other central banks.

As reflected in the contributions to the seminar, differences exist with regard to the approach adopted by central banks to combine monetary analysis with analyses of other economic and financial data in order to prepare monetary policy decisions. At one extreme, at some central banks this analysis is combined at the staff level, with the role of the monetary analysis in the overall assessment remaining to some extent hidden from the decision-maker. At the other extreme, the two forms of analysis are combined only at the level of the decision-maker, or even beyond, in the public discussion of monetary policy.

The seminar showed that these differences relate very much to past experiences in individual countries with the reliability of monetary indicators. However, some of the papers presented at the seminar demonstrated that even in countries where money has on certain occasions appeared to be rather unpredictable (e.g. in the United States and Japan), a deeper analysis of underlying factors could help in finding stable relationships, and this not only ex post.

Finally, a crucial issue raised at the seminar was how monetary analysis should be presented to the public. There is a trade-off here between the complexity of many of the econometric models and the need to communicate in a simple and comprehensible manner. The ECB has chosen to signal the prominent role for money by announcing a reference value for M3. While other approaches are possible, the ECB's choice is well founded given the empirical evidence with regard to the close relationship between M3 and price developments in the euro area.

In sum, I am convinced that the seminar helped to stimulate thinking within many central banks on how to make monetary analysis most useful. In any case, for the ECB and for the Eurosystem as a whole the seminar gave rise to a lot of ideas for further developing its work, both internally and with regard to its external presentation.

At this point, I should once again like to thank all those who participated in the seminar (a list of whom is included at the end of the volume) for their contributions, whether in the form of the papers presented in this volume or with regard to their active involvement in the discussions. At the ECB, I should like to express special thanks to Caroline Willeke and Claire Burns, who, together with Claus Brand, Dieter Gerdesmeier, José Luis Escrivá, Klaus Masuch, Huw Pill and Livio Stracca, took over most of the burden involved in the practical organisation of the seminar.

November 2000

Summary

Monetary analysis: tools and applications

Huw Pill*

European Central Bank

1. Introduction

"*We did not abandon M1. M1 abandoned us.*"
Gerald Bouey, former Governor of the Bank of Canada, March 1983.[1]

"*Inflation is ultimately a monetary phenomenon. The Governing Council therefore recognised that giving money a prominent role in the Eurosystem's strategy was important.*"
ECB Monthly Bulletin, January 1999, p. 47.

These two quotations illustrate the breadth of central bank opinion on the role of money in monetary policy-making. On the basis of a central bank workshop held in Frankfurt during November 2000, this paper goes behind such rhetoric to consider the role monetary analysis plays in monetary policy.

On the one hand, Mr. Bouey's above oft-quoted remark is indicative of the frustration felt by many central banks pursuing monetary targets in the early 1980s. The considerable challenges faced by intermediate monetary targeting strategies during this period have been well documented in the academic literature, particularly for the Anglo-Saxon countries (e.g. Goodhart, 1989). In an environment of financial innovation and structural change, changes in financial structure created instabilities in money demand which rendered developments in the monetary aggregates difficult for policy makers to interpret, let alone explain coherently and consistently to the public. These practical difficulties led several Anglo-Saxon central banks to abandon formal monetary targets in the mid and late 1980s. Furthermore, in many countries – regardless of whether formal targets had been announced – the importance attached to monetary indicators as a guide to monetary policy decisions progressively diminished. The British experience in this regard, culminating in the abolition of the remaining "monitoring ranges" for the growth of monetary aggregates in 1997, is instructive, but by no means unique. For example, the US Federal Reserve, while still announcing ranges for monetary and credit

* This paper summarises the proceedings of the ECB central bank workshop "Monetary analysis: tools and applications" held at the ECB in Frankfurt on 20–21 November 2000. It has benefited from the comments and suggestions of Hans-Joachim Klöckers, Klaus Masuch, José-Luis Escrivá, Caroline Willeke, Livio Stracca, Dieter Gerdesmeier and other colleagues in the ECB's Directorate Monetary Policy. The views expressed in the paper are those of the authors and do not necessarily reflect the views of the ECB or the Eurosystem.

[1] Quoted from the Minutes of Proceedings and Evidence of the Canadian House of Commons Standing Committee on Finance, Trade and Economic Affairs, No. 134, 28 March 1983, p. 12.

growth as required by legislation, also assigned monetary developments a lesser role in policy decisions, especially from the early 1990s onwards, and eventually abolished the announcement of the ranges in July 2000.[2]

On the other hand, the European Central Bank (ECB) statement quoted above is a reflection of a different experience. In continental Europe monetary and credit aggregates continued to play an important role in the conduct of monetary policy throughout the 1980s and 1990s. In particular, the Deutsche Bundesbank – maintaining the intermediate monetary targeting strategy which it had pursued with success since the mid-1970s – continued to announce a target for the growth rate of its broad monetary aggregate M3 until the end of 1998 (when the responsibility for monetary policy passed to the ECB). Other continental European central banks (including the Banque de France, the Banca d'Italia and the Banco de España) also announced monetary targets or reference ranges which complemented and supported other aspects of their monetary policy strategies, such as exchange rate targets and/or direct inflation targets.

The continued prominence of money and monetary aggregates in the monetary policy strategies of continental European central banks was a reflection of the empirical properties demonstrated by the monetary aggregates – in particular, the continued stability of money demand and the leading indicator properties of monetary developments for future inflation. These empirical characteristics were markedly different from those observed in many Anglo-Saxon countries. In the latter, it became almost "conventional wisdom" (at least in the journalistic and academic discussion) that monetary developments were largely "noise", which was naturally of little relevance for monetary policy decisions aimed at price stability. In this light, several countries – notably the United Kingdom and Canada – adopted direct inflation targeting strategies in the early 1990s, since monetary aggregates and other indicators no longer appeared to constitute plausible or meaningful intermediate targets.

It was against this background that, first, the Committee of Governors of the Central Banks of the Member States of the European Community and, later, the European Monetary Institute (EMI) undertook the preparatory work required for the introduction of the euro and the creation of the single European monetary policy. Naturally, one aspect of this preparatory work was an analysis of the pros and cons of various monetary policy strategies which could form the basis of the ECB's approach to monetary policy. Attention focused on the relative merits of direct inflation targeting and intermediate monetary targeting, which were widely viewed as the two plausible candidate strategies for the ECB.

However, in comparing the relative merits of inflation and monetary targeting, the EMI (1997) recognised that the sharp distinction drawn in the academic literature was misleading. This conclusion followed from the observation that central banks targeting inflation, at least in their internal analyses, devote considerable resources to monitoring

[2] Quoting from the U.S. Federal Reserve Board of Governors July 2000 *Report to Congress*: "At its June meeting, the FOMC did not establish ranges for growth of money and debt in 2000 and 2001. The legal requirement to establish and to announce such ranges had expired, and owing to uncertainties about the behavior of the velocities of debt and money, these ranges for many years have not provided useful benchmarks for the conduct of monetary policy. Nevertheless, the FOMC believes that the behavior of money and credit will continue to have value for gauging economic and financial conditions, and this report discusses recent developments in money and credit in some detail."

and analysing monetary developments. At the same time (as illustrated by Reischle (Deutsche Bundesbank) in this volume for the case of the Bundesbank), central banks pursuing intermediate monetary targets also evaluated a very broad range of economic and financial indicators beyond the key monetary aggregate in coming to their monetary policy decisions.

Against this background, in October 1998 – after a comprehensive evaluation of central bank experience and an assessment of the particular circumstances of the euro area – the Governing Council of the ECB decided to adopt neither monetary targeting nor inflation targeting, but rather its own stability-oriented monetary policy strategy (ECB, 1999a). The primary and overriding objective of the single monetary policy is the maintenance of price stability in accordance with a definition published by the ECB. Within the two-pillar framework created by the ECB's strategy, risks to price stability are assessed, on the one hand, on the basis of an analysis of monetary developments (the first pillar of the strategy) and, on the other hand, by an assessment of other economic and financial indicators (the second pillar). The prominent role of money in the ECB's strategy is signaled by the announcement of a quantitative reference value for the growth rate of the broad monetary aggregate M3.

In their public presentation of monetary policy, most central banks currently assign monetary aggregates a less important role in the explanation of monetary policy decisions than does the ECB. In particular, they neither officially accord money a prominent role nor publicly announce a reference value for monetary growth. Nevertheless, a broad spectrum of approaches exists.

On the one hand, the Swiss National Bank (SNB) gives the broad monetary aggregate M3 "a major role as a monetary policy indicator"[3], and is therefore perhaps closest in approach to the ECB. On the other hand, many other central banks do not accord a prominent role to money, focusing at least in their public statements almost exclusively on an analysis of the interaction of demand and supply and cost pressures in the real economy and/or a published inflation forecast based on such analysis.

Against this background, the ECB's Directorate Monetary Policy in the Directorate General Economics organised a central bank workshop in November 2000 to discuss the role of monetary analysis in the monetary policy making processes of central banks. Staff members from each of the EU central banks, the U.S. Board of Governors of the Federal Reserve System, the Bank of Canada, the Bank of Japan and the SNB were invited. The purpose of the workshop was twofold. First, it encouraged comparison of the tools and techniques of monetary analysis employed at various central banks, permitting an exchange of views and ideas of mutual benefit. Second, the workshop was intended to provide a platform for discussing the role of monetary analysis in monetary policy strategies in general, and in the ECB's strategy in particular.

One purpose of this paper – and the accompanying papers contained in this volume – is to extend this clarification of the role and nature of monetary analysis to a broader audience, encompassing those outside the central banking community. It therefore summarises the proceedings of the workshop and comments on them from the perspective of an ECB staff member.

[3] Statement of the monetary policy strategy of the SNB, available at http://www.snb.ch/e/geldpolitik/geldpol.html.

The remainder of the paper is organised as follows. Section 2 notes that there are many similarities among central banks in their internal work. In particular, a broad consensus exists that monetary developments reveal relevant information for monetary policy decisions aimed at price stability (or inflation) objectives. In addition, it suggests that extracting the relevant information requires the adoption of relatively sophisticated techniques. Section 3 focuses on differences between central banks, relating in particular to the way monetary analysis is combined with analyses of other economic and financial indicators, and to how monetary analysis and its role in the policy process is presented to the public. Section 4 briefly concludes.

2. Similarities across central banks: the importance and complexity of monetary analysis

2.1. All central banks monitor monetary developments closely

All the central banks participating in the workshop – regardless of the monetary policy strategy that they formally pursue – recognise that *monetary developments contain information which is potentially important for taking monetary policy decisions aimed at the maintenance of price stability.* All central banks therefore closely analyse monetary developments on a regular basis. In particular, contrary to characterisations typical of the academic literature, central banks targeting inflation (e.g. the Bank of England, the Bank of Canada) analyse monetary developments thoroughly.

2.2. . . . but the approach to monetary analysis can differ . . .

The type of information contained in monetary developments can be seen as lying along a spectrum, ranging from, on the one hand, a structural explanation of the inflation process where money plays an active and dominant part, to, on the other hand, a treatment of money as, at most, a summary indicator with little or no causal role in the determination of price developments.

As recognised by Friedman (1984), monetary aggregates can play an important role as indicators even if they play no structural or causal role in the inflation process or the transmission mechanism for monetary policy. Even if inflation is regarded solely as the result of excess demand or cost pressures, monetary developments can still provide information for monetary policymaking if they allow central banks to identify better the nature of shocks hitting the economy, and/or to predict trends in future price developments and thus identify emerging risks to price stability.

One explanation of the leading indicator properties of money for future inflation is that monetary indicators may be related to observable macroeconomic variables that play an important role in the transmission mechanism, such as real economic activity or interest rates. For example, money demand studies suggest that monetary growth is related (positively) to real GDP growth and (negatively) to interest rates. In this context, GDP growth above sustainable rates will typically increase both monetary growth and inflationary pressures. Similarly, inappropriately low levels of interest rates may both spur monetary growth and lead to risks to price stability. Viewed in this light, monetary growth *summarises* information about developments in the determinants of money demand, which also influence future price developments. Such a summary variable can therefore be a useful indicator for monetary policy.

While such a summary statistic role is useful, monetary developments may also possess *additional* information about future price developments beyond that which is contained in other macroeconomic indicators. In this volume, this approach is adopted by Orphanides and Porter (Federal Reserve Board), Jordan, Peytrignet and Rich (Swiss National Bank) and Altissimo, Gaiotti and Locarno (Banca d'Italia). These papers highlight the role of monetary aggregates as *informational variables*, which can provide additional or complementary information to that derived from conventional macroeconomic models.

One approach to investigating this role for money is pursued by Altissimo et al. for the case of Italy. Following a suggestion by Friedman (1984), they investigate whether the residuals from money and credit demand equations embedded in the Banca d'Italia's large macroeconometric model of the Italian economy are correlated with forecast errors for key macroeconomic variables, such as inflation and GDP growth. Such correlations are found. Therefore, although the Banca d'Italia model does not accord monetary variables an "active" causal role in the transmission mechanism, this exercise nevertheless suggests that there is information in monetary developments beyond that in the determinants of money which helps to forecast macroeconomic variables of interest to central banks.

The results reported by Altissimo et al. can be interpreted as suggesting that monetary and credit developments reveal information about factors which are important for the transmission mechanism – such as interest rate spreads or non-price rationing of credit – yet are neither easily measured (and thus for which statistics are typically not available) nor captured by conventional macroeconometric models. In such circumstances, residuals to money demand equations provide relevant "news" to policy makers.

Monetary and credit variables may also play an active role in the inflation process and/or the transmission mechanism for monetary policy. In this context, central banks are likely to find it important to monitor monetary variables in order to obtain a better insight into the *structural* and behavioural relationships underlying these processes. For example, if bank credit is sometimes rationed using non-price mechanisms (e.g. as investigated in the credit rationing literature following from Stiglitz and Weiss (1981)), monitoring credit aggregates should help to develop a better understanding of the economic situation and the likely impact of monetary policy actions, both of which are, of course, crucial to well-designed policy decisions aimed at the maintenance of price stability.

Some approaches to extracting the information in money represent an amalgam of the "summary statistic" and "additional information" views. The indicator properties of monetary growth for price developments in the euro area are investigated by Nicoletti Altimari (2001) in a simulated out-of-sample forecasting exercise. His results are reported in this volume by Masuch, Pill and Willeke (ECB). They suggest that euro area M3 growth is one of the best predictors of cumulative inflation over the coming three years, out-performing cost and demand indicators (such as unit labour costs and estimates of the output gap), as well as a variety of other monetary indicators. The study therefore supports the view that price developments over the medium term can be predicted on the basis of monetary indicators. Evaluating the indicator properties of headline monetary growth, e.g. in the manner of Nicoletti Altimari (2001), may capture both the summary statistic and additional information contained in M3 growth.

2.3. . . . and a variety of relatively complex approaches are employed . . .

In practice, central banks adopt a pragmatic approach to monetary analysis, encompassing both the structural and informational variable views. The range of approaches employed within a single central bank is therefore typically rather large. On the basis of experience at the Bank of England and the ECB respectively, the papers presented by Hauser (Bank of England) and Masuch, et al (ECB) describe a broad variety of time series models which use money to help predict the path of future inflation, GDP growth and other important macroeconomic variables. While this eclectic approach falls short of providing a single framework for monetary analysis, it helps to ensure that as much relevant information as possible is extracted from monetary developments.

2.4. . . . which embody a judicious mixture of econometric techniques . . .

The range of analytical tools and techniques available for monetary analysis is potentially extremely broad. Several papers presented at the workshop illustrated specific model applications, while others gave a wider overview of the type of models used in the analyses underlying monetary policy decisions.

A natural starting point for econometric modeling of monetary developments is the estimation of *money demand equations*. An enormous academic literature now exists (Goldfeld and Sichel (1990) and Laidler (1993) provide general surveys; Browne, et al. (1997) review the literature relating to EU countries). Central banks have made many important contributions to this literature. Recent papers have almost ubiquitously relied on error correction specifications and used time series modeling techniques based on cointegration.

Kimura's (Bank of Japan) paper in this volume provides an elegant example of this approach in an investigation of the stability of money demand in Japan during the 1990s. Consistent with the results described by other participants in the workshop, he demonstrates that an "intelligent interpretation" of monetary developments in Japan – which in this case accords an important role to the impact of financial volatility on the precautionary demand for money – can account for the evolution of M2 + CDs (the key aggregate monitored by the Bank of Japan) over the last decade. This result overturns the finding (based on more conventional specifications) that money demand in Japan has been unstable in recent years.

As noted above, the Hauser and Masuch, et al. papers provide a broad overview of the econometric techniques developed and used for monetary analysis by staff at the Bank of England and the ECB respectively. The techniques employed are revealed to be very similar. Both the Bank of England and the ECB use a variety of money-based time series indicator models for inflation and other macroeconomic variables. Consistent with the mainstream academic literature, the two main econometric frameworks discussed are vector autoregressions (VARs) and vector error corrections models (VECMs) (Dhar, et al., 2000; Brand and Cassola, 2000). Both these approaches are used to investigate the indicator properties of monetary and credit aggregates for macroeconomic developments, typically in conjunction with developments in other indicators. The main difference between the two types of model is that VECMs impose long-run relationships between the money stock, prices and other key economic variables (e.g. in the form of a money demand equation), whereas VARs focus on shorter-term dynamic interactions.

While the techniques employed are similar, some nuances emerge. On the one hand, the Bank of England places greater emphasis on analysis and modeling of sectoral aggregates. (For the time being, the scope for such analysis at the ECB for the euro area remains restricted by the lack of long-run time series for sectoral money and credit at the area-wide level.) On the other hand, the ECB has placed greater emphasis on evaluating the leading indicator properties of a wide variety of monetary and credit indicators in simulated out-of-sample exercises, as proposed by Stock and Watson (1999) (Nicoletti Altimari, 2001).

One prominent variant of the VECM approach is the so-called *P-star model of inflation* (Hallman, et al., 1991). As illustrated in several papers presented at the workshop, such models use the deviation of the money stock from a level deemed consistent with equilibrium as a leading indicator of future inflation. The P-star model is used at several central banks, including the Federal Reserve System, the ECB, the SNB and the Bank of Japan.

For example, Kimura uses his money demand results to derive a measure of the equilibrium money stock and thus a P-star indicator for Japanese inflation. On the basis of this indicator, he demonstrates that monetary developments, appropriately corrected for the impact of financial volatility, are a leading indicator of inflation in Japan. Similarly, in their study of Swiss data, Jordan, et al. show that a P-star model can forecast price developments at a one to two-year horizon, a result confirmed for the euro area by Gerlach and Svensson (2000), Trecroci and Vega (2000) and Nicoletti Altimari (2001).

In illustrating the performance of the P-star model in the United States, Orphanides and Porter make two important points.

First, they demonstrate that, in order to obtain good forecasts of inflation, the equilibrium level of M2 income velocity has to be modeled in a time-varying manner, rather than be treated as a constant as in the original P-star model (Hallman, et al., 1991). This is consistent with the results obtained by other central banks, which use money demand equations to predict developments in the equilibrium velocity concept underlying the P-star approach.

Orphanides and Porter show that a shift in M2 income velocity in the early 1990s – associated with innovations in the financial and banking sector – severely disrupts the simple P-star model's forecasting performance. This basic story is a familiar one: financial innovation can lead to changes in equilibrium money demand if, for example, they permit some economisation in the money holdings required to undertake a certain level of nominal transactions. If the impact of such structural velocity shifts can be modeled successfully, then the indicator properties of money for future price developments – which would otherwise suffer significantly – can be restored.

Velocity shifts can often be captured by statistical methods ex post. From the policy-making perspective, however, the ability to predict such shifts ex ante, or at least in real time, is of greater importance. Only if shifts in velocity can be predicted contemporaneously or in advance will policy-makers be able to calibrate their assessment of the economic situation accordingly and thus take appropriate monetary policy decisions. This leads to Orphanides and Porter's second – and more striking – result. On the basis of internal Federal Reserve analysis undertaken at the time, they suggest that the structural shift in M2 income velocity which took place in the early 1990s could have been detected "in real time". Specifically, the detailed institutional analysis by monetary

experts at the Federal Reserve allowed, only one year after the structural shift in M2 velocity, M2 growth to be predicted as accurately as it had been prior to the shift. By implication, within one year of the incidence of the velocity shift, the P-star model could have been amended on the basis of such expert assessment so as to provide useful guidance to policy-makers.

This result illustrates the importance of institutional and judgmental forms of monetary analysis to complement and explain the results of analysis based on explicit empirical models. In particular, in an environment of ongoing financial innovation (as observed in the United States in the early 1990s), it is crucial that central banks closely monitor the substitution between monetary assets and other financial instruments which are close substitutes.

2.5. . . . and institutional and judgmental methods

Several of the presentations at the workshop discussed frameworks within which some approaches to this detailed *institutional analysis* could be organised.

For example, Reischle (Deutsche Bundesbank) describes the important role of the consolidated banking sector balance sheet in the Bundesbank's monetary analysis. In the context of the Bundesbank announcement of an intermediate target for broad money, monetary analysis naturally focused on understanding of developments in the key aggregate M3. Using a number of case studies (e.g. the large capital inflows to Germany in 1992–93, associated with the exchange rate mechanism (ERM) crises of that period), Reischle describes how analysis of the consolidated bank balance sheet helped to shed light on developments in M3 that were otherwise rather difficult to explain. Reischle argues that when analysis of the consolidated banking sector balance sheet pointed to caution in the interpretation of M3 growth, on occasion, it exerted an important influence on the Bundesbank's monetary policy decisions. In his view, monetary analysis in the context of the consolidated banking sector balance sheet was a central element of the "pragmatic monetarism" practised by the Bundesbank.

Reischle's discussion should be seen in the broader German context. In comparison with the situation in other countries, the Bundesbank was relatively successful in maintaining price stability during the 1970s and 1980s. Moreover, the German financial sector (e.g. the capital account of the balance of payments) had been liberalised at a relatively early stage. Taken together, these two factors implied smaller incentives for the private sector to introduce the financial innovations seen in many other countries. As a consequence, money demand remained more stable in Germany and money developments thus provided more useful guidance for monetary policy decisions, thereby facilitating the maintenance of price stability. In other words, in contrast to the experience of the Anglo-Saxon countries, a virtuous circle of price stability and money demand stability was created (Issing, 1997).

Reischle's paper focuses on the consolidated banking sector balance sheet. However, in an environment of extensive financial innovation, substitution between bank and non-bank liabilities may be more important than substitution between monetary and non-monetary bank liabilities. In other words, the distinction between monetary and non-monetary instruments is becoming increasingly blurred as disintermediation away from the banking sector becomes more pronounced.

Such experiences have been characteristic of the monetary developments in France over the last fifteen years. The paper by Drumetz and Odonnat (Banque de France) describes how the Banque de France responded by constructing and monitoring extended monetary and credit aggregates. These aggregates encompass instruments with similar economic characteristics regardless of whether they appear on the consolidated banking sector balance sheet. These extended aggregates therefore internalise substitution between monetary and non-monetary instruments and, on occasion, may be economically more meaningful than aggregates which distinguish between instruments, which are otherwise essentially identical, solely on the basis of the issuing sector. In the context of a case study, Drumetz and Odonnat illustrate how monitoring such extended aggregates during a major episode of financial innovation in France in 1993 ensured that developments in M3 (the key monetary aggregate then monitored by the Banque de France) could be interpreted and assessed correctly, thereby avoiding misguided policy advice.

Taking the approach pursued by Drumetz and Odonnat to its logical conclusion, all sectoral balance sheets should be evaluated simultaneously. (In flow terms, this would imply evaluating the flow of funds between all sectors.) In this context, monetary aggregates might then simply constitute one component of a broader system of financial accounts, rather than having a special, distinctive status. Such an approach would be consistent with the view that ongoing financial innovation in France rendered any specific definition of money vulnerable to instabilities and thus potentially less meaningful from an economic point of view.

Analysis of the financial accounts has also been given prominence at the Banco de España, as described in the paper by Peñalosa and Sastre (Banco de España). They note that constructing the financial accounts is, by their nature, very data and resource-intensive. In consequence, the financial accounts are typically available with a considerable time lag and the quality of some of the data is questionable. These shortcomings inevitably restrict the use of the financial accounts for policy purposes. Moreover, despite ongoing financial innovations, monetary instruments retain some distinctiveness (e.g. as the economy's main medium of exchange) and therefore deserve a special status. For these two reasons, analysis of the financial accounts should be seen as a complement to, rather than a substitute for, conventional monetary analysis. Nonetheless, the interpretation of monetary developments can be enhanced considerably by placing them in the broader context of the financial accounts. In particular, substitution between monetary and non-monetary/non-bank instruments can be monitored and evaluated in a systematic manner within this framework.

Analysis of the financial accounts emphasises sectoral financial flows and therefore is a natural complement to analysis of sectoral money and credit. As Hauser describes, sectoral analysis of money and, in particular, credit has been given prominence at the Bank of England. Indeed, such sectoral analyses are considered to provide most of the money-based information that is relevant for policy decisions. In particular, the Bank of England uses sectoral money and credit to forecast developments in the components of aggregate demand.

2.6. A more structural interpretation of monetary developments may be desirable

The discussion at the workshop showed that further progress may be desirable in *developing structural economic and econometric models which accord a role to monetary variables in the inflation process.*

The need for such progress can be viewed from two perspectives.

From the perspective of the macroeconomic modeling literature, it can be argued that the considerable progress made in recent decades with regard to structural modeling of the real side of the economy (e.g. the development of so-called "new neo-classical synthesis" models, such as those proposed by Goodfriend and King (1997) and Rotemberg and Woodford (1997)) has not been matched in the modeling of the monetary and financial sectors. Conventional macroeconomic models therefore suffer from the shortcoming that they neglect financial interactions and thus given an incomplete picture of economic developments.

Alternatively, from the perspective of monetary analyses, the development of structural models can be seen as a prerequisite for exploiting the information in monetary developments more efficiently. The appropriate monetary policy response to an innovation in monetary growth should depend on, inter alia, the cause of that innovation, i.e. the underlying structural economic shock. Non-structural indicator models involving money – while able to provide a broad "warning signal" of the possible emergence of risks to price stability – do not permit the nature of the underlying threat to price stability to be identified and thus the monetary policy response to be calibrated accordingly.

For example, an increase in monetary growth coming from a decline in the velocity of circulation caused by financial innovation might be benign with regard to the outlook for price stability and therefore not require a monetary policy response. In contrast, stronger monetary growth stemming from a positive demand or wealth shock could be a signal of emerging risks to price stability, which would require monetary policy action. Policy advice therefore needs to distinguish (or at a minimum, include a view regarding) the source of the underlying economic shock (see Masuch, et al.). Distinguishing between such shocks requires (at least implicitly) a structural model. Non-structural indicator models treat all innovations in monetary dynamics the same, whereas, in practice, it is intuitively obvious that some innovations matter more for monetary policy decisions than others.

A number of papers presented at the workshop suggested starting points for attempting to develop a more structural view of monetary developments.

For example, much of the institutional and judgmental analysis outlined in Section 2.4 can be viewed (in econometric terms) as attempts to identify "pure" velocity shocks which are seen as benign regarding the outlook for price stability. As noted by Masuch, et al., this approach points towards the construction of corrected monetary series, adjusted for the "special factors" identified by such judgmental methods. However, the practical problems of constructing such series remain formidable. Furthermore, the identification achieved by such an approach is incomplete. Even if applied successfully (something that will always remain difficult to assess given the inevitably judgmental nature of the technique), this approach will only distinguish benign innovations in money from those which may be associated with the emergence of risks to price stability. It will not allow the precise nature of the risk to price stability to be ascertained.

At a more sophisticated level, it was mentioned that the Bank of Canada had undertaken some analysis in the context of various dynamic stochastic general equilibrium models including money, such as the limited participation model proposed by Christiano, et al. (2000). Like the benchmark new neo-classicial synthesis models widely adopted in the academic literature, these models are based on microeconomic foundations

incorporating fully optimising behaviour by firms, households and banks. However, rather than assuming that the non-neutrality of money results from nominal rigidities in the goods and labour markets, limited participation models assume that frictions exist in the financial sector. The latter assumption naturally gives money a more active role in the transmission mechanism for monetary policy and the inflation process.

However, participants cautioned against believing such limited participation models would provide an adequate solution to the lack of structural monetary frameworks. First, the methodological assumptions underlying such models – such as "cash-in-advance" constraints on households' spending decisions – remained rather artificial and thus unconvincing. Second, simulation exercises conducted using calibrated versions of such models sometimes produced results that were at odds with well-established empirical regularities on which practical monetary analysis relies, e.g. conventional specifications of money demand. Nonetheless, it transpired that the construction of similar models was envisaged at several other central banks.

Viewing the issue from a more empirical perspective, Hauser described how identifying restrictions had been introduced into a VECM system for United Kingdom M4 estimated at the Bank of England by Dhar, et al. (2000). Using these restrictions, a variety of economic shocks can be separately identified, although their economic meaning is not always clear. However, as is widely recognised in the academic literature, the results obtained in such "structural VECMs" are often sensitive to the choice of identification scheme, which is itself inevitably somewhat ad hoc. This renders the results of such an exercise potentially difficult to interpret and thus not straightforward to use for policy advice. This notwithstanding, similar approaches are being used or envisaged at other central banks.

Recognising the difficulties in achieving identification in econometric models of money, Masuch, et al. also present a so-called "semi-structural approach". Such an approach takes an econometric model (in practice, a money demand specification) as its starting point, since this provides a clear framework within which to conduct analysis. Using this framework, actual monetary developments can be decomposed in various ways. While such decompositions are purely accounting exercises and thus do not, in themselves, identify the underlying economic behaviour, they may nevertheless provide a good starting point for attempts to understand the causes of monetary developments. For example, they can illustrate the relative contributions of output growth or interest rates to developments in observed monetary dynamics. While this clearly falls well short of a fully structural interpretation of money and credit, it at least represents an advance compared with simply looking at entirely non-structural indicators.

As this discussion illustrates, while the desirability of a more structural economic framework for monetary analysis was recognised by many workshop participants, it was widely acknowledged that progress in this regard has, thus far, proved modest. Considerable scope (and need) for further work remains.

2.7. In sum, money matters

The papers presented at the workshop show that *all central banks represented at the workshop – regardless of the formal monetary policy strategy they pursue (or pursued in the past) – incorporate monetary analysis into their policy-making process and, at least in some circumstances, may accord it an important role.*

Against this background, the main lessons from the workshop and the papers contained in this volume can be summarised as follows. If monetary developments are interpreted in a way which efficiently combines econometric techniques and judgmental and institutional analysis, they can provide relevant and important information for monetary policy decisions aimed at the maintenance of price stability.

The need for a judicious mix of econometric results and expert assessments would be considered mainstream in the context of conventional macroeconomic forecasting or simulation exercises. Yet, at least outside the central banking community, the same approach is often not applied to monetary analysis. One key message of the workshop was that central banks should (and, in practice, do) employ econometric and judgmental analysis in parallel when monitoring and evaluating monetary developments. By doing so, they are able to extract information that is relevant for monetary policy-making and which can thus improve policy decisions.

3. Differences across central banks: presenting monetary analysis internally and externally

While recognising the potential importance of monetary developments as a guide to policy decisions, the workshop also led to the identification of a number of challenges for monetary analysis. The response to these challenges differed across the participating central banks. Although there is consensus about the importance of monetary analysis, a broad spectrum of opinions exists concerning how this analysis should be communicated and presented, both internally (by the central bank staff to the monetary policy-making body) and externally (by the central bank as an institution to the public).

At the heart of this discussion was the relationship between monetary analysis and the analyses of other economic and financial indicator variables.[4] If monetary-policy makers are to identify the nature of underlying economic shocks which pose a threat to price stability (and thereby be able to react in an appropriate manner), they cannot rely solely on money (or indeed any other single indicator). Therefore monetary variables must always be analysed in conjunction with other economic variables, such as output, interest rates, wealth and prices. Unsurprisingly, this view proved uncontroversial at the workshop and is reflected implicitly in the analyses described in Section 2 (e.g. money demand equations, P-star models, VARs and VECMs all evaluate money within a broader macroeconomic context).

It is uncontroversial to state that monetary policy decisions should be based on analysis of a range of indicators in addition to money. However, *the issue of whether and, if so, how monetary analysis should be integrated with analyses of these other economic and financial indicators remains open*. A very broad spectrum of practices exists.

[4] This can be related to the need to develop structural economic models of monetary developments, as discussed in Section 2. In order to identify the different underlying economic shocks affecting both monetary dynamics and future price developments, money must necessarily be analysed in the context of other macroeconomic variables. Expressed simply, if money is evaluated in isolation, only one type of "shock" can be identified (namely innovations in money relative to some univariate time series model). This is the approach implicit in univariate, non-structural money-based indicator models. In order to distinguish between two different types of economic shock, at least two variables (which respond in different ways to the shocks) must be monitored. Similarly, to identify three different types of shock, at least three variables must be monitored, and so forth.

It is helpful to distinguish between two aspects of this issue, which correspond to the two distinct roles played by a monetary policy strategy.

First, the strategy should ensure that the relevant decision-making body (e.g. in the ECB context, the Governing Council of the ECB, which is charged by the Maastricht Treaty with determining monetary policy for the euro area) receives, in a timely and structured manner, all the information and analysis it requires to take monetary policy decisions which maintain price stability. In other words, the strategy should provide for an *efficient internal policy-making process* within the central bank. As regards the discussion in this paper, the internal role of the strategy is primarily concerned with how monetary analysis is presented to policy makers and the weight they should assign it in reaching their final policy decision. This question is taken up in Section 3.1 below.

Second, the strategy should provide a clear, consistent and coherent framework for the *presentation and explanation of monetary policy decisions* to the public. This external role should aim to build up the credibility – and thereby the effectiveness – of monetary policy. Several considerations arise: (inter alia) the need for democratic accountability of an independent central bank; the need for transparency of the procedures of the central bank; and the need for clarity regarding the objective of monetary policy (Winkler, 2000). As regards monetary analysis, the key question is whether and, if so, how such analysis and its implications for monetary policy decisions should be presented to the public. This question is addressed in Section 3.2.

3.1. Monetary analysis in the internal decision-making procedure

There is a broad consensus that monetary policy decisions should be based on the widest possible set of indicators and models, i.e. that no data or analyses should be arbitrarily excluded from the policy-making process.

However, practices differ regarding how such a "full information" approach is to be implemented.

On the one hand, monetary analysis is seen in some central banks as providing input into a single analytical framework which is used to assess the economic situation and identify emerging risks to price stability. This unified framework – within which monetary analysis is only one component among potentially many others – would ultimately provide a single set of advice and guidance results to policy-makers.

As discussed by Hauser, this description captures – albeit inevitably in a rather stylised manner – the approach adopted at the Bank of England. Monetary analysis undertaken by Bank of England staff is presented at an early stage of, and is incorporated into, the regular quarterly forecasting exercise (which constitutes the core of the internal decision-making process).

In other central banks, on the other hand, a diverse set of competing analyses and advice from fundamentally different perspectives is provided, this being seen as necessary for robust (and thus useful) policy guidance. The adoption of such an approach is based on the conviction that only then can policy-makers make a well-informed assessment of the risks and uncertainties they are facing and thereby reach their own conclusions about the appropriate monetary policy stance.

In his paper contained in this volume, Selody emphasises this latter role for monetary analysis. Given uncertainties regarding the true structure of the economy and the transmission mechanism for monetary policy, Selody argues that central banks should adopt

a diversified approach to the analysis of economic information, rather than relying on a single – and inevitably incomplete – analytical framework. Such an approach – which has been adopted at the Bank of Canada – should enhance the robustness of monetary policy decisions. Policy-makers receiving diversified policy advice can choose policy actions which preserve price stability in the range of plausible settings defined by this broad span of advice. They are thus less likely to make large policy errors in the face of an uncertain world.

On this basis, Selody argues that the analysis underlying monetary policy decisions should be based on "multiple paradigms" of the monetary transmission mechanism, i.e. a broad range of economic models of the inflation process which differ from one another in some fundamental respect. Among macroeconomic models, a distinction can be drawn between those which assign an important role to money in the inflation process and those which view inflation as the outcome of excess demand or cost pressures (proxied by developments in estimates of the output gap).

Selody argues that undertaking monetary analysis ensures that money-based models of price developments are encompassed in the analysis underlying policy decisions. Monetary analysis is therefore crucial to spanning the range of plausible models of inflation and providing genuinely diverse policy advice from a range of approaches.

Against this background, Selody's paper describes the internal procedures currently in place at the Bank of Canada. Monetary analysis is presented to the Governor *in parallel* with a conventional macroeconomic forecast, rather than as an *input* to it. Thus monetary analysis provides a different and, in some senses, competing view of the economic situation to that supplied by conventional macroeconomic models and forecasts. This competition between fundamentally different "views of the world" or "paradigms" is seen as strength, rather than as a weakness of the approach (Engert and Selody, 1998). Broadly speaking, the approach advocated by Selody and adopted at the Bank of Canada parallels the two-pillar structure of the ECB's monetary policy strategy (discussed briefly in Section 1), where the two pillars are implicitly interpreted as representing different monetary and non-monetary paradigms of the inflation process (cf. Masuch, et al. in this volume; ECB, 2000).

While important, the distinction between presenting monetary analysis in parallel or using it as an input to a single, unified exercise should not be over-emphasised. Ultimately the policy-making body must take a single decision regarding the level of interest rates on the basis of all available information. In that sense, a unified framework is always in place, at the latest at the level of the highest decision-making body.

The above differences in practices demonstrate that important procedural questions arise when considering how monetary and other analyses should be combined in coming to an interest rate decision. These *procedural* issues are at the heart of practical monetary policy-making and thus at the core of the internal role of a monetary policy strategy. In particular, central banks must resolve the question of whether, on the one hand, staff members should take responsibility for integrating monetary and other analyses or, on the other hand, the responsibility for making an overall assessment should be left to policy-makers.

Yet even framing this question is often difficult. Some central banks (e.g. the ECB) draw a relatively sharp distinction between staff policy advice (which is treated as an input to the decision-making process) and the policy decision itself (which is left to the decision-making body responsible). However, as noted by Kohn (2000), in other central

banks the distinction between the inputs to the monetary policy decision and the decision itself is less clear cut (e.g. the Bank of England, where policy-makers are closely involved in the production of the quarterly inflation forecast, which is seen as the key analytical tool for guiding policy decisions, as well as in the decisions themselves).

Another aspect of this question is the role played by large macroeconomic models in the formulation of monetary policy guidance. On the one hand, some workshop participants were sceptical of the benefits of attempting to build a single, large "eclectic" economic model which encompasses the essence of both monetary and non-monetary paradigms of the inflation process. In their view, such an eclectic model would lack the simplicity, internal consistency and intuitive appeal which are prerequisites for providing good policy advice. On the other hand, others – drawing in part on Altissimo, et al.'s description of the role played by the Banca d'Italia's large macroeconometric model in Italian monetary policy-making prior to the introduction of the euro – suggested that preparing policy guidance in the context of a single model allowed a holistic and rich picture of the economic situation to be obtained. Underlying these two contrasting views was a disagreement on the prior question, namely whether the staff or policy-makers should be responsible for integrating analyses within the overall policy-making process.

However, the appropriate role of large macroeconometric models does not need to be viewed in black and white terms. Giving greater prominence to the analysis of sectoral financial accounts constitutes an intermediate way between the two approaches outlined above. The financial accounts allow balance sheet developments, including developments in the monetary aggregates, to be evaluated together with real economic variables such as the savings rate within a consistent accounting framework. Such an approach permits cross-checking and some integration of monetary and other economic analyses. However, it falls well short of providing a behavioural explanation of the relationships between financial and real variables.

Several participants offered more theoretical comments on this theme. For example, consideration was given to Bayesian approaches – which assign subjective weights to the various paradigms of the inflation process – as a way of combining the production of a diversified set of underlying analyses with the creation of a single, unified view of the economy.

In the academic literature, such a Bayesian approach has been advocated by Sims (2001). He contrasts this framework favourably with an emerging literature applying "robust control" methods to monetary policy models (Hansen and Sargent, 2000; Onatski and Stock, 2000). The latter technique has some parallels with the diversified, multiple paradigm approach to policy advice advocated by Selody. It leads to the formulation of robust monetary policy rules, which map out a path for short-term interest rates on the basis of current and lagged values of macroeconomic indicators (potentially including money). The intense and, as yet, unresolved debate in the academic literature on these issues clearly signals that this is a field of potentially fruitful further work at both the conceptual and practical level and represents one of the bigger challenges facing the conduct of monetary analysis by central bank staff.

3.2. Presenting monetary analysis and its implications for monetary policy to the public

A final – and closely related – challenge facing central banks is *the presentation of the analysis of monetary developments and their impact on monetary policy decisions to the*

public. Of course, the presentation of monetary analysis is only one part of the external aspect of a monetary policy strategy, and should be seen in the wider context. Broadly speaking, one can identify a trade-off between, on the one hand, a simple and accessible presentation of the rationale behind monetary policy decisions and, on the other hand, a more honest and open approach which reveals the underlying complexity and uncertainty surrounding the analyses on which monetary policy decisions are based (ECB, 2000).

3.2.1. Should monetary analysis be presented independently?

Central bank communications should foster the credibility and thereby the effectiveness of monetary policy. Considerable controversy exists over how this is best achieved. A spectrum of approaches can be identified, defined by two extremes.

One approach to presenting monetary analysis to the public is to subsume the information derived from it into a single presentational device, such as a published inflation forecast, projection or fan chart. This approach can be justified on the grounds that emphasising developments in individual indicators (possibly including monetary variables) only adds unnecessary complexity to the presentation of monetary policy and potentially distracts the public from the central bank's primary objective. While subsuming the information from monetary analysis into an inflation forecast may help to focus the public's attention on the maintenance of price stability, it inevitably makes the impact of various forms of analysis, including monetary analysis, on policy decisions difficult to see. Thus greater clarity about the objective of monetary policy is achieved only at the expense of reduced transparency about the role of individual variables – including monetary aggregates – in monetary policy decisions.

These shortcomings notwithstanding, there are some reasons to favour this approach to presenting monetary analysis to the public. For example, Selody describes how – despite its commitment to maintaining a distinct role for monetary analysis in internal policy discussions – the Bank of Canada presents policy decisions to the public *as if* they were determined on the basis of a single, unified assessment. As Selody reports, this choice was taken for two reasons. First, the Bank of Canada took the view that it was crucial to adopt a simple framework for the presentation of policy decisions to the general public – the multiple paradigm approach was considered too complex. Second, it was felt that revealing the extent of the uncertainty surrounding policy decisions by discussing the various paradigms underlying policy analysis might trigger undue public concern about the direction and formulation of monetary policy and thereby undermine credibility.

The Bank of Canada's decision throws into sharp relief the trade-off between, on the one hand, presenting monetary policy in a clear, simple and reassuring way and, on the other hand, revealing the underlying internal decision-making process and the way in which it addresses the pervasive complexities faced by policy-makers.

The ECB's monetary policy strategy adopts a different view, namely that the presentation of monetary policy decisions to the public should closely reflect the internal decision-making process, i.e. the internal and external aspects of the strategy correspond closely (ECB, 2000). Keeping this approach in mind, it should be noted that monetary analysis prepared by ECB staff is presented to the policy-making Governing Council *in parallel* with analyses of other economic and financial indicators (including macroeco-

nomic forecasts and projections). This is the essence of the two-pillar structure used to organise the internal policy-making process. As such, monetary analysis is not viewed as input into a single framework for staff policy advice (such as a forecasting exercise). Rather, policy-makers are provided with a diversified set of policy guidance results and are thereby prompted to cross-check among the various analyses.

Given this approach, monetary analysis is presented to the public by the ECB in the context of a distinct pillar of the strategy, rather than integrated or subsumed within a single overarching analytical framework.

Against this background, Masuch, et al. suggest that the first pillar of the ECB's strategy constitutes a visible and public commitment to undertake monetary analysis and present its implications for monetary policy decisions to the public. The first pillar thereby helps to ensure that the important information in monetary developments is not neglected either in the internal decision-making process or in the presentation of decisions to the public. Experience with the conduct and presentation of the single monetary policy since the introduction of the euro supports the view that the separation of the two pillars has helped to maintain an important role for money in the public discussion of monetary policy – reflecting its important role in the internal ECB policy-making process – and has thus added to the transparency and effectiveness of the ECB's strategy and policy decisions.

3.2.2. How shall monetary analysis be presented to the public?

At the ECB, the announcement of a quantitative reference value for monetary growth is viewed as a *signal* of the prominent role of money in the ECB's strategy, not as a comprehensive description of that prominent role. As Masuch, et al. demonstrate, monetary analysis undertaken by staff at the ECB – while taking deviations of M3 growth from the reference value as one natural starting point – extends to a much broader and more complex range of tools and techniques. The reference value should therefore be seen as a simple and intuitive presentational device for the general public, which inevitably obscures some of the necessary complexity of the underlying detailed monetary analysis.

This notwithstanding, it should also be recognised that empirical studies of the euro area support the view that headline annual monetary growth – appropriately interpreted – can be a good leading indicator for price developments over longer horizons. As mentioned in Section 2.2, Nicoletti Altimari (2001) demonstrates that a simple time series model of inflation and M3 growth provides better forecasts of cumulative euro area inflation over the next three years than alternative models.[5]

As described by Jordan, et al., the approach adopted at the Swiss National Bank differs from that pursued by the ECB. Given the results of their econometric study presented in this volume, Jordan, et al. are sceptical of the benefits of announcing a reference value for M3 growth in Switzerland. They show that indicator models for future inflation based on M3 growth alone do not perform particularly well in Swiss data, especially at the one

[5] An important aspect of this result is that the leading indicator properties of headline annual M3 growth are for low frequency price developments. In other words (and speaking loosely), monetary growth is an indicator of the medium-term trend in inflation, not of high frequency (e.g. quarter-to-quarter) developments. When interpreting headline annual euro area M3 growth relative to the ECB's reference value, the medium-term nature of the information provided always needs to be kept in mind.

to two-year horizon that is typically the focus of monetary policy discussions. Rather, they are able to demonstrate that more sophisticated money-based indicator models for inflation, which incorporate both a P-star measure of excess liquidity and a measure of monetary growth, can predict inflation relatively well at these horizons.

On the basis of these empirical results, Jordan, et al. suggest that the announcement of a reference value in the Swiss context would focus public attention on headline annual monetary growth and thus on a too narrow and flawed indicator of emerging risks to price stability. The danger therefore exists that the public could be misled about the future course of monetary policy decisions, threatening the reputation and credibility of the central bank.

In Jordan, et al.'s view, the favoured monetary indicator for Switzerland – essentially a weighted average of a P-star measure of excess liquidity and monetary growth – is too complex to constitute a useful communication vehicle. As mentioned in Section 2.3, if the information relevant for monetary policy decisions can only be extracted from monetary variables using relatively complex techniques, this inevitably complicates the presentation of that information to the public. Against this background – and consistent with the SNB's strategy – Jordan, et al. therefore suggest that monetary analysis be presented to the public largely in the form of inflation projections which also include the information content of money. In their view, such an approach combines the simplicity of the inflation targeting approach adopted by the Bank of Canada (inter alia) with a clear public commitment to monetary analysis.

The argumentation of Jordan, et al. reflects the widespread view that *extracting the information relevant for monetary policy decisions from observed monetary developments is not a trivial task*. In fact, the workshop demonstrated that a wide variety of analytical tools and frameworks are required to extract the information in monetary developments which is relevant for monetary policy-making. The potential sophistication and complexity of such tools – while ensuring that policy-makers are provided with the best possible policy guidance – can complicate the presentation of the role of monetary developments in policy decisions to the public.

4. Concluding remarks

A number of conclusions can be drawn from the workshop proceedings, from the perspective of the ECB's monetary policy strategy.

First, almost all central banks analyse monetary developments closely, using similar tools and techniques.

Second, while the importance of monetary analysis was unanimously recognised, two questions remained open, namely: how monetary analysis conducted by central bank staff should be presented to policy-makers; and how this analysis should be presented to the public. A wide range of possibilities exists with regard to both issues. The approaches pursued by the ECB fall within the broad spectrum of opinions expressed by workshop participants, which itself reflects the range of approaches currently taken by central banks. Nevertheless, given the lack of consensus on these questions, one should anticipate a continued debate in the future.

Finally, the workshop made clear that further work is required at the technical level to develop tools for more effective monetary analysis. Developing structural models of the inflation process which accord a role to monetary variables is one of the key issues.

An exercise from which two lessons were drawn but an equal number of challenges identified is a recipe for further work. The November 2000 monetary analysis workshop should therefore be seen as a beginning, not as an end. As Hauser concludes in his contribution to this volume, a challenging agenda has been drawn up. What remains now is to address this agenda successfully.

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Uncertainty and multiple perspectives*

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1. Introduction

Monetary policy advice is necessarily derived from data and knowledge that are uncertain. Moreover, this uncertainty is unlikely to diminish any time soon, despite the best efforts of economic researchers. Engert and Selody (1998) suggest that monetary policy advisors should deal with such uncertainty by basing their analysis on multiple paradigms – that is, by using a multiplicity of models that differ from one another in some fundamental respect. They suggest that taking a diversified approach to policy analysis would reduce the risk of making serious errors in monetary policy advice. In this paper I extend the discussion in Engert and Selody by examining issues that arise when putting the multiple paradigm approach into practice.

The basic argument for multiple paradigms can be summarized as follows. If knowledge about the economy could be complete and certain, then the monetary policy decision would simply involve using the consensus macro economic model to choose the optimal path for the monetary policy instrument – i.e., the path that maintained price stability while minimizing the volatility of important economic variables such as output and interest rates. However, uncertainty exists, which means that the consensus macro economic model is likely to be wrong in some respect, and using it to derive optimal policy will result in sub-optimal paths for the monetary policy instrument in some circumstances. These paths should be avoided because they produce unnecessary and harmful volatility in important macro economic variables. One way of trying to avoid harmful paths is to look for paths for the monetary policy instrument that produce acceptable outcomes in a variety of macro economic models. In effect, there are two important characteristics of good monetary policy advice: optimality and robustness. Optimality is choosing the best outcome in a single macro economic model. Robustness is avoiding bad outcomes in a variety of macro economic models. Using multiple paradigms contributes to the robustness of monetary policy advice.

Using multiple paradigms improves policy advice because it reduces the central bank's dependency on a single macro economic model to predict inflation and calibrate policy actions. A monetary policy framework consists of five components: an objective, information variables that can be combined to predict future inflation (i.e., indicators),

* This paper contains the views of the author and not necessarily those of the Bank of Canada. Comments from our discussant, Antti Ripatti, and participants of the ECB Monetary Analysis Seminar are gratefully appreciated.

an instrument, a means to calibrate the size of a policy action, and a way to explain policy actions to the public. A macro economic model is used most often in the indicator and calibration components of the framework and this is where the multiple paradigm approach to policy advice is likely to be most effective in mitigating uncertainty.

To see how multiple paradigms can be used to improve policy advice it is useful to identify the ways in which uncertainty affects the economy and macro economic models.

One of the reasons why policy advice derived from macro economic models is uncertain is because the shocks hitting the economy are difficult to identify. Or, more precisely, the future time paths for the exogenous variables and innovations driving the model are unknown. This is *shock or additive uncertainty.* The conventional way of dealing with this type of uncertainty is to follow a 'certainty equivalence' procedure – that is, to use 'expected values' for the exogenous variables. Based on these values, the model is then used to generate the optimal path for the policy instrument – that is, the path that maximizes the hypothetical social welfare function of the hypothetical monetary authority in the model. The sensitivity of this path to uncertainty about expected future values for the exogenous variables can be obtained by calculating alternative optimal paths for the policy instrument under different assumptions, or scenarios, about the future time paths of the exogenous variables. The result of having a variety of paths for the exogenous variables is an array of optimal paths for the policy variable that can be presented as policy advice.

Uncertainty in a macro economic model also arises because the model builders were uncertain about the functional forms, including the parameters in those functional forms, of the economic behaviours they were trying to model, although they were certain that the behaviours they modelled were in fact the proper way to characterize the transmission mechanism. In this case it is the parameters of the model that are uncertain, and one has, *parameter or multiplicative uncertainty.* The conventional way of dealing with parameter uncertainty is to modify the hypothetical reaction function of the hypothetical monetary policy authority as suggested by Brainard (1967) and implemented for Canada in a recent paper by Srour (1999). In this approach, the modified reaction function typically places less weight on variables as their parameters become more uncertain.

Some researchers suggest that when dealing with parameter uncertainty it is also useful to generate confidence bands around the proposed path for the policy instrument. Such bands can be generated by simulating the macro economic model with parameters drawn repeatedly from an estimated or imagined parameter distribution. However, the confidence bands produced by this methodology are often too wide to be helpful to policy advisers. Moreover, it is not clear how policy advice should change when the width of a confidence band changes.

Uncertainty also affects policy advice when model builders are uncertain about which economic behaviours to model – that is, when there are different views about which economic behaviours underlie the transmission mechanism. More precisely, the economic model itself is uncertain. This is called *model uncertainty.* For example, there is much uncertainty about whether inflation is better modelled as a real phenomenon or as a financial phenomenon, that is, whether it is the output gap or excess money growth that is the fundamental cause of inflation. It is here where Engert and Selody (1998) argue that the best way to deal with uncertainty is to use a multiplicity of models to generate policy advice. However, there are a variety of ways to use multiple models to generate this advice.

Perhaps the most straightforward way of using multiple models to deal with model uncertainty is to generate the optimal path for the monetary policy instrument from each model, and then choose the path from the model that is most consistent with current economic behaviours. This is appropriate when the economic behaviours underlying the transmission mechanism change from time to time as the economic environment changes – that is, different models are true or false depending on the economic environment. In this case, the optimal policy reaction should come from the single 'true' model. For example, the output-gap model may adequately capture the transmission mechanism in times of financial tranquility whereas the money model may be best in times of financial turmoil when consumers and producers are liquidity constrained. In tranquil times, advice from the output-gap model would be more reliable whereas in times of financial turmoil advice from the money model would be preferred.

An alternative approach to presenting policy advice from multiple models would be to construct a single best robust policy rule that would reflect the important features from all models and would be used in every model. Such a rule would produce policy advice that would not do badly in any model but neither would it be optimal in any model. This approach is appropriate when each model includes unique behaviours not present in other models. In this case a combined rule is better because it weights all behaviours operating in economy. An example of such a rule would be a robust form of the generalized rule suggested by Taylor (1993, 1999), or a robust rule constructed using a game theoretic (or minimax) approach suggested by Sargent (1999).

The issues that arise when putting multiple paradigms into practice are discussed in the remainder of the paper. These issues can be bundled into three broad groups.

The first set of issues concern model construction: what types of models to build, the number of paradigms and approaches to model building that an institution can afford to support, what makes a good alternative paradigm, whether or not each paradigm should be supported by a separate group of policy modellers, whether or not future research should be aimed at constructing an all-encompassing paradigm. The second set of issues involves how best to use multiple models so that policy makers can choose a single path for the monetary policy instrument. Should the results from multiple paradigms be combined before they are presented to policy makers, how should one choose the weights to place on the alternative paradigms, what should policy makers be told about the alternative paradigms? The third set of issues involve how best to communicate multiple paradigms to the public. Should research on the alternative paradigms be published, should the weights applied to the alternative paradigms be made public, should one paradigm be chosen as the dominant paradigm for purposes of communication to the public?

2. Modelling Issues

2.1. How different should models be?

Economic models exist to simplify the 'real world'. The 'real world' needs to be simplified for policy analysis because the economic interconnections in it are too complex to be understood in their entirety. Models are built to highlight elements or aspects of the transmission mechanism that are considered to be particularly important or interesting. This means that two economic models competing to explain the transmission mechanism can be 'true' simultaneously in the sense that both represent some aspect of the

economic behaviour that underlies the transmission mechanism. Alternatively, the two models may be 'true' in different circumstances or states of the world. For example, output-gap models may explain the transmission mechanism well in tranquil times whereas money-disequilibrium models may explain the transmission mechanism well in times of financial disruption or crisis. In either case, the fact that one model closely captures an economic phenomenon does not necessarily imply that the competing model is false.

Policy makers benefit from access to multiple models because good policy requires that policy makers understand all aspects of what goes on in the economy. Advice based on a single model cannot give a complete picture of what goes on in the economy because it necessarily ignores elements of the true economy in order to be tractable. Only by obtaining advice based on different and multiple simplifications of the real economy can policy makers gain a complete appreciation of what is going on in the economy.

This line of reasoning suggests that the greater the differences between models, the greater the value added from using different models, providing that each model explains an important element of the real economy. Thus, for an additional model to be useful it must offer a fundamentally different perspective of the monetary transmission mechanism, that is, a different explanation of the links between the policy instrument and the policy goal. Examples of differences that meet this criterion are different theories of what causes inflation – i.e., excess money growth versus excess demand for goods and services – and different approaches to model identification – i.e., data-driven versus economic-theory-driven methodologies for identifying macro economic models.

2.2. How many paradigms?

It is useful to think of an economic paradigm as a class of economic models that describe in mathematical terms a particular theory of economic behaviour. For example, the idea that the output gap, along with inflation expectations, causes inflation constitutes a single economic paradigm even though there are many different models of how output gaps cause inflation. Similarly, the idea that money growth causes inflation constitutes a single but separate economic paradigm even though there are many ways of modelling the links between money and prices, some of which involve output gaps and inflation expectations as well. What makes these paradigms separate is that they offer two fundamentally different theories about what causes inflation. In the output-gap paradigm, excess demand for goods and services causes inflation with money responding passively to reflect this excess demand. In the money paradigm, money supply is active in the transmission mechanism. What is common to both paradigms as applied to today's economies and institutional arrangements is that monetary policy works initially through interest rates, and ultimately can be used to control inflation. What is different between the paradigms is that output-gap models focus on real economic behaviour whereas money models focus on financial behaviour. Of course, modelling both real and financial behaviour is crucial to a complete understanding of the monetary transmission mechanism, but including both behaviours in a single macro economic model in a complete and consistent way is beyond the current abilities of economic researchers.

A class of alternative models does not necessarily have to be based on an alternative economic paradigm to offer a different perspective to monetary policy makers. Different perspectives can also be obtained from models that use different model identification strategies or different methodologies for extracting information from data or different methods for combining theory and data. For example, atheoretic time series models constitute one class of economic model whereas highly consistent theoretic dynamic general equilibrium models constitute another class. What differentiates these two classes is their approach to model identification. Time series models are identified by placing zero restrictions on parameters where there is no observed correlation in the data. Such restrictions are only loosely constrained by economic theory. In contrast, dynamic general equilibrium models are identified by restricting parameters to conform to economic theory and are only loosely constrained by correlations in the data. Of course, the perfect dynamic general equilibrium model would fit the data, and the perfect time series model would conform to theory, but such perfection is not yet in sight.

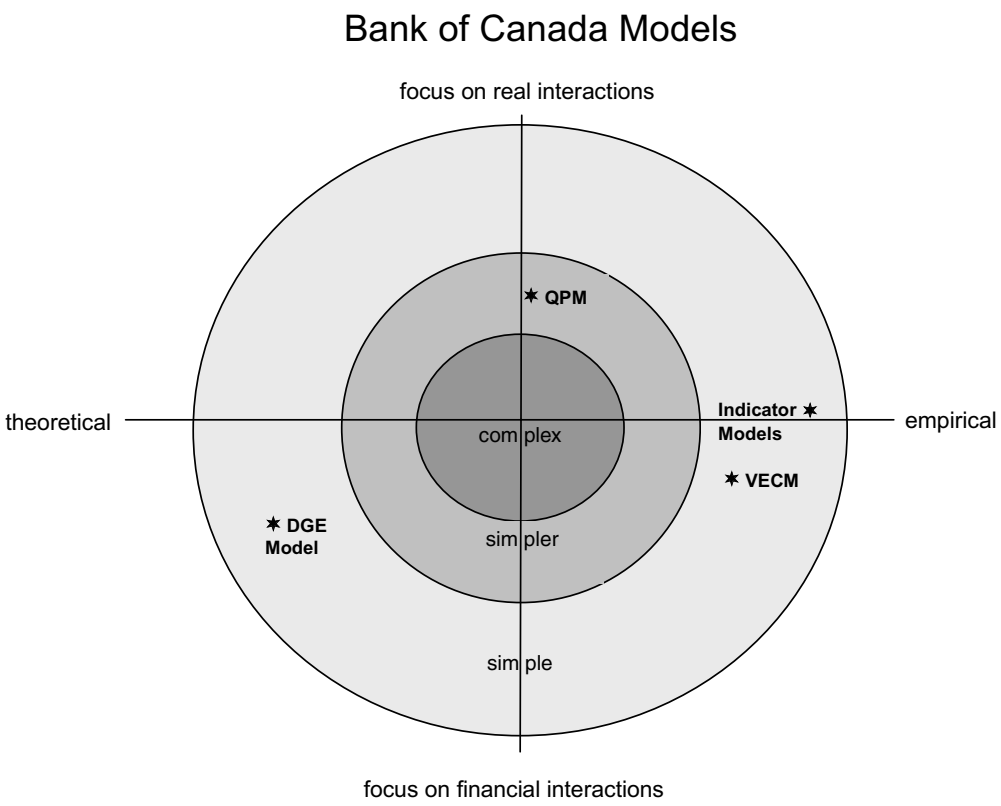
To maximize model diversity, a central bank should support a broad range of models, limited only by the availability of suitable paradigms, suitable model identification approaches, and analytic resources. Economic researchers at the Bank of Canada, for example, currently support two basic paradigms and two basic approaches to model identification.[1] The two paradigms capture different behavioural theories about what causes inflation – the output gap or excess money growth – and what causes lags in the transmission mechanism – real frictions or financial frictions. The dominant model is QPM (Quarterly Projection Model) which focuses almost exclusively on real economic behaviour. The main alternative model is the M1 VECM (M1 Vector Error Correction Model, see Adam and Hendry (2000)) which includes financial and real economic behaviours, and imposes the restriction that money is the cause of inflation in the long run. In QPM, inflation is pinned down by its targeted (and thus expected) value in the long run. Both models draw on theoretical and empirical identification techniques, and both incorporate the idea that monetary policy determines inflation in the long run and that (given the institutional set up in Canada) the instrument of monetary policy is the overnight interest rate.

The two approaches to model identification supported by the Bank of Canada are time-series estimation techniques as used in indicator models and calibration techniques as used in dynamic general equilibrium models. Time-series techniques are essentially empirical in nature, relying on correlations in the data to identify models. The time series models at the Bank of Canada use both real and financial variables, although usually not in the same model because of the large number of parameters that would need to be estimated. Muller (1992) presents examples of linear monetary indicator models of the type used at the Bank of Canada and Tkacz and Hu (1999) present an example of a non-linear empirical model. Calibration techniques are used to obtain parameter values when indentifying restrictions are obtained from economic choice theory. QPM is partially calibrated. Other calibrated dynamic general equilibrium models are being developed to put financial institutions and financial agents into a standard real business cycle model. The idea here is that the long and variable lags between

[1] See Longworth and Freedman (2000) for a description of the models used to provide policy advice at the Bank of Canada.

monetary policy actions and their effect on inflation are caused by frictions in the financial economy as opposed to the real economy. An early example of such a model is Hendry and Zhang (1998), and more recently Amano, Hendry and Zhang (2000).

The diagram below illustrates the diversity of models used by economists at the Bank of Canada. The two axes represent the different paradigms and the different model identification strategies – a focus on theory-based or data-based estimation techniques (horizontal axis) versus a focus on real or financial economic behaviour (vertical axis). Models farther from the origin along a single axis focus on a single paradigm. One can also imagine a third axis that rises out of the page. Models higher on this third axis are more complex as denoted by the different shading on this two dimensional diagram. Models in the darkly shaded areas are more complex, in part because they include many elements from different paradigms. One can imagine that a model that captured all elements of the 'real economy' would be in the darkest ring of this diagram. Models in the outer ring are simpler models, in part because they specialize. The models used by the Bank of Canada are well distributed on this grid, except that the Bank does not as yet have a predominantly financial model.



So, how many models should a central bank support? The answer is enough to adequately cover the space mapped out in the diagram above. There is a trade off, of course: the greater the complexity of the models chosen, the fewer that can be supported with available resources. In other words, there is a trade off between having a

greater number of points in the outer ring of the space, or fewer points near the centre of the space. At the Bank of Canada, we have chosen to support a greater number of simpler models.

2.3. Should each paradigm be supported by a separate group of researchers?

When a central bank decides to support multiple paradigms, how should it organize its modellers, researchers and policy analysts to maximize their effectiveness? Is it better to develop and maintain models in a cooperative or competitive environment? A cooperative environment is more likely to be attained if all paradigms are developed and maintained by a single set of economists. A competitive environment is more likely to evolve if different models are developed and supported by different groups.

The advantage of a cooperative environment for model development and maintenance is that it encourages policy researchers to arrive at a consensus of how best to model an economic phenomenon. It also encourages the use of the same elements in different models – for example, the same concepts and measures of energy prices would likely appear in both real and financial models. The disadvantage of using similar elements in different models is that sometimes such elements are themselves uncertain and so it is sometimes useful to use a variety of methodologies to construct a given concept.

An environment which has different groups supporting different models is more likely to expose the weaknesses of the competing paradigms as each modelling group is likely to work towards demonstrating the superiority of its paradigm. Such competition could also lead to more rigorous testing of competing models. For example, researchers working on the money-growth paradigm at the Bank of Canada work in a different department from those working on the output-gap paradigm. One of the features that distinguishes the money and output-gap paradigms is the micro behaviour of price setters: price setters in the money paradigm are presumed to look predominantly at cash flow when setting prices, whereas price setters in the output-gap paradigm are presumed to look predominantly at inventory levels or at the excess demand for their particular service. A competitive environment encourages researchers to test these competing hypotheses in order to demonstrate the superiority of their paradigm. The disadvantage of such competition is that it highlights the differences between paradigms, rather than the similarities, which may give outside observers the mistaken impression that researchers at the central bank are more uncertain about the transmission mechanism than is in fact the case.

The best environment for conducting policy analysis is one that emphasizes the positive elements of both the competitive and cooperative environments while playing down, or finding ways to mute, the negative elements. There is no unique way of achieving this objective. At the Bank of Canada we have adopted what is essentially a competitive environment while encouraging economists to recognize the value of a multiple paradigms approach, which encourages cooperation between competing groups. The separation of the financial and real departments is motivated in part by a desire to keep the policy advice generated by the two paradigms as independent as possible. It also recognizes the fact that the Bank of Canada has some responsibility for collecting financial data but not real data. Also, the output-gap paradigm is the dominant paradigm at the Bank of Canada, and therefore the real economic department is

more oriented towards the production of forecasts and current analysis than is the department that maintains the money paradigm, which is more oriented towards conducting research aimed at developing the financial paradigm.

On the other hand, both departments use multiple identification strategies for building the models that represent their paradigm. These include pure time series indicator models, structural vector auto-regressive models, ad hoc decision-rule models based on concepts such as the IS curve and the Phillips curve, and choice theoretic dynamic general equilibrium models. There is much cooperation between the departments on developing model identification techniques. Thus, technical advances in modelling are disseminated rapidly to researchers and policy analysts working in both departments.

2.4. Does it make sense to build a model that encompasses all relevant paradigms?

This issue is about a trade off between consistency and completeness. Consistency in a macro economic model means that the behaviour attributed to an economic agent in one part of the model is derived from the same choice theory that determines the behaviour of that agent in another part of the model. It also means that all agents act in an optimal manner in all their interactions in the model, basing their decisions on a consistent set of information. And, it means that budget constraints – on both income and wealth – are respected in the model. The current state of economics is such that it is impossible to build a single macro economic model that encompasses all aspects of the transmission mechanism in a consistent manner. That is, it is currently impossible to build a macro economic model that is both consistent and complete.

The multiple paradigm approach to policy analysis advocates putting consistency ahead of completeness within a single macro economic model. Completeness is then obtained by building an collection of consistent but separate macro economic models. Once such a collection of macro economic models has been amassed, it is natural to ask whether there is a need for an additional, more pragmatic model that sacrifices consistency for completeness – that is, a model that captures all relevant aspects of the transmission mechanism even though such a model would not be fully consistent internally.

The main argument against maintaining a pragmatic model is that it would be hard, if not impossible, to interpret the policy advice generated from such a model. The reason interpretation is difficult is that such a model would not be a good representation of any paradigm because of its lack of internal consistency. As an example, consider a model that would incorporate both the output-gap and the money paradigms. The output-gap paradigm explains the transmission mechanism in a complete and consistent way using mostly 'real' variables. The money paradigm explains the transmission mechanism in a complete and consistent way using mostly financial variables. To merge the two paradigms, the internal consistency of both the real and financial behaviours of agents in the model would have to be compromised, and the resulting model would not be entirely representative of either paradigm. Thus, the policy advice derived from the model would be based on behaviour that was inconsistent with both paradigms.

An additional argument against a pragmatic model is that it would have to ignore important details of both paradigms in order to remain tractable. There do exist, for example, simple IS-LM type models that incorporate both real and financial elements.

However, such models do not describe the monetary transmission mechanism in enough detail to satisfy most policy analysts. And, obtaining model consistency in a larger more detailed model is currently impossible.

3. Distillation of advice issues

3.1. Which policy path to choose?

When policy advisers use different models to generate multiple paths for the policy instrument, most likely they will be asked to recommend a best path. Even when the choice between alternative paths is left to the policy makers, it is likely that policy advisors will be asked for analysis on how to choose between competing paths. So, how might policy advisors choose a single recommended path?

The most straightforward way of constructing a single recommended path is to combine alternative paths using a fixed weighting scheme. The weights could mirror the relative accuracy of the different models in predicting inflation two years into the future, for example. The setting for the policy instrument at each point along the recommended path would then be a weighted average of the settings at each point along the paths from the alternative models.

The problem with this approach is that the resulting 'best' path will be inconsistent with the individual paths from all models. It may therefore be difficult to explain and defend the policy actions that would result if policy makers followed this 'compromise' path. This will not be a problem when the policy paths from the alternative models are similar. But, in this case, choosing between policy paths is not an issue. A weighted, or compromise, path is more likely to be a problem when the recommendations from the alternative models diverge considerably. In this case, policy in one of the model has likely reacted to an economic event or feature of the transmission mechanism that is not present in the other models. Moreover, in the case where such events happen infrequently, the weight that should be applied to this event or feature is unlikely to be directly related to the average of the historical forecast performance of the model in which it resides, and therefore weighting schemes derived from the average relative forecast performance over the historical sample are unlikely to be appropriate.

An alternative approach to choosing the recommended path is to identify one of the models as the dominant model and to generate the policy path from this model using a generalized Taylor rule that is robust in the sense that it does not produce bad outcomes in any of the alternative models. The dominant model could be chosen by a consensus of the policy makers, advisors, and researchers within the institution. Research on alternative models would continue. The policy advice from the alternative models would still be presented to policy makers as it would help them understand the limitations of the policy advice coming from the dominant model.[2]

One disadvantage of this approach is that the dominant model excludes elements of the transmission mechanism that can be important from time to time, and the generalized Taylor rule can produce advice that is far from optimal under some conditions. This means that using the dominant model with a generalized Taylor rule is inappropriate

[2] This approach is similar, although not identical, to the approach followed at the Bank of Canada. See Longworth and Freedman (2000) for a complete description of the elements and processes that constitute the conduct of monetary policy at the Bank of Canada.

in some, albeit unusual, circumstances. In particular, the policy advice from the dominant model might be quite inappropriate in large episodic events, such as credit crunches and booms, since the dominant model has not been constructed to explain such events. In these cases it is necessary for policy advisors, or the policy makers themselves, to apply judgement to the advice coming from the dominant model. However, given institutional inertia, it is possible that the inappropriate nature of the policy advice coming from the dominant model may not be appreciated rapidly enough to formulate and apply the necessary judgement in a timely manner.

To avoid contributing to institutional inertia, it is important that policy makers take the alternative models seriously. When advice from alternative models is not taken seriously it indicates to researchers that further research on alternative paradigms is unlikely to be appreciated, and so it will become increasingly difficult to develop and maintain alternative models. And, if the alternative models are not continually maintained, it may be difficult for policy advisors to recommend that more weight be given to an alternative model in those cases where economic circumstances warrant such advice. As an incentive to maintain the alternative models, it is useful to give them a formal role in the policy discussion.

One way of giving the alternative models a formal role in conditioning the recommended path for the policy instrument is to identify explicitly the conditions under which the policy recommendation from the dominant model is unlikely to be appropriate. For example, the policy advice coming from an output-gap model is unlikely to be optimal in the face of a credit crunch or financial market crisis because it does not take account of the financial aspects of the transmission mechanism. In cases where such economic conditions arose, or in which the economy started behaving in ways not explained by the dominant model, optimal advice from alternative models could be applied at the margin. This optimal advice could come from using a generalized Taylor rule in the alternative model, or it could be derived optimally from the hypothetical social welfare function of the hypothetical monetary authority in the alternative model.

3.2. What process should be used to present advice to policy makers?

Good information leads to better decisions. This means that a full and balanced discussion and debate of policy issues prior to a policy decision is likely to result in better policy. Thus, one of the goals of the process by which policy advice is presented to policy makers is to encourage discussion and debate of the issues. Looking at the issues using multiple paradigms facilitates such discussion and debate.

Essentially, there are five groups of people who are critical to a full and complete policy debate. (1) The model builders and policy analysts who conduct research and build macro economic models such that they have first hand knowledge of the strengths and weaknesses of the models that are used in the central bank. This group of people tend to have great technical expertise. (2) Policy advisors who understand the models and the context in which they are used. (3) Policy makers who understand the context within which policy is implemented and whose judgement forms the basis of the policy decision. (4) Outside technical experts who understand the strength and weaknesses of the models being used, but who have not built or used the models in question and therefore are likely to have a different perspective from those inside the central bank. (5) Members of the general public who will be affected by the policy decision.

Groups (1) through (3) tend to participate in the internal policy debate. Groups (3) through (5) tend to participate in the external policy debate. Both debates are important to the policy decision. This said, the remainder of this section is devoted to processes that make the internal policy debate most effective.

Given the different levels of technical expertise of the three groups involved in the internal policy debate, it is logical to take a sequential approach to the internal debate. The benefit of a sequential approach is that it is efficient in that technical modelling issues will be debated separately from issues that cannot be adequately modelled. Of course, the policy decision makers must be aware of all important issues, technical or not, if their decisions are to be based on all available information.

If policy makers are to have full information, they should be presented with the information from all models. There is no unique way to ensure that policy makers obtain all relevant information. If the policy makers themselves have a good understanding of modelling technology then it is probably best to present the advice from the alternative models separately and directly to the policy makers. This is the approach taken at the Bank of Canada. Alternatively, if the policy makers have a strong desire to focus the internal debate around a single dominant paradigm, the advice from the multiple models can be reconciled by policy advisors before being presented for discussion to policy makers. In this case, the risks identified by the alternative models should be highlighted, but the advice coming from the alternative models will have been incorporated into the advice from the dominant model at the margin and therefore need not be shown separately. Where the desire to have a single dominant paradigm is very strong, it may be sufficient to conduct research into the alternative paradigm and to use the results of this research to improve the dominant model at the margin. In this case, the alternative model does not become fully articulated, nor is it used to produce alternative policy advice, but research into the paradigm is used to identify issues that can be explored within the dominant paradigm.

An example of a process that results in full information being given to the policy makers would be one that gave separate policy advice from alternative models directly to policy makers. The first stage of debate would be technical discussions of the models used to represent each paradigm. Such a discussion would no doubt concentrate on the latest modifications to the models that would have resulted from on-going research into the paradigm. Such modifications would help the users of each model better interpret recent events consistent with their separate paradigm.

The second stage of the debate would start after the models had generated an array of possible paths for the policy instruments conditional on different future values for their exogenous variables and conditional on different assumptions about the economic behaviours included in the model. This debate would involve the policy advisors who, after a discussion with the technical experts, would choose what they considered to be the most reasonable policy path from each paradigm to present to the policy makers. This need not be the optimal path from each model as the policy advisors may want to exercise judgement at this point. For example, the policy advisors may think that the current economic environment is particularly uncertain and so emphasize robustness over optimality in choosing the path. Again, this discussion would take place separately for each paradigm to keep the advice coming from the different models as independent as possible. At this stage, it would sometimes be useful to construct a policy path that combines elements from both models. In this case there would be three proposed policy

paths – the most reasonable path from the dominant model, the most reasonable path from the alternative model, and a compromise policy path.

It is these three paths, along with a discussion of how the paths were obtained, why they were chosen, and perhaps some interesting alternative paths that were not chosen, that could be presented to the policy makers to support the third stage of the debate. This information could be augmented by scenarios that would highlight the risks associated with the assumptions used to generate the proposed policy paths and any controversial features of the model that were affecting the proposed policy paths. Policy makers would then choose a single path for implementation based on this information, their own judgement about the future paths of exogenous variables, what emphasis to place on the different models, as well as their own assessment of economic conditions. In choosing this path, the policy makers would have obtained all relevant information from the competing models as well as from their advisers on how to interpret and combine that information, judgement from their staff about the most likely paths of the exogenous variables driving the models, as well as judgement about what behaviours are currently dominating the transmission mechanism. The chosen path would then be communicated back to the model builders and policy analysts so that it could form the basis of the next policy exercise. Of course, in practice, the chosen path would be followed only for a single quarter as the policy exercise would be repeated each quarter as new information became available, including information on the forecast accuracy of the different models.

4. Communication issues

Explaining monetary policy decisions to the public can be difficult even in the best of circumstances. The relationship between interest rates and inflation is complicated and difficult to explain. There are many elements of the monetary transmission mechanism that are not well understood. The lags between interest rates and inflation are long and variable. The conditional nature of forecasts and policy statements is often difficult for market participants, journalists and the public to appreciate fully. And few commentators fully appreciate the degree of uncertainty that affects economic data, theory, and the policy decision. Given such conditions, it might seem that explaining multiple paradigms – that is, explaining that there are multiple ways of viewing the transmission mechanism – would be an unnecessary complication that could hinder good public communication.

Yet many central banks already use more than one paradigm, at least implicitly, to communicate their policy decisions. In public commentary, many central bankers refer to inflation as a monetary phenomenon even though their main macro economic model does not reflect this view. In effect, the paradigm that central bankers use for communication purposes is necessarily less precise and consistent than the models they use for policy decisions. One reason for this disconnect is that many of the elements that condition the policy decision are not found in a single macro economic model. Thus, central bankers take a pragmatic approach to communicating their policy decisions by talking about a variety of economic indicators, influences, and economic behaviours.

Even though many central banks take a pragmatic, multiple paradigm approach to communicating their policy decisions, not all central banks formalize this to the same extent. Some central banks maintain a formal distinction between the two paradigms in

public such as the European Central Bank with its two pillars approach to communicating monetary policy. This approach encourages specialized communication in the context of both paradigms that should help support the public debate about policy issues and contribute to better policy decisions. Such an approach also has the potential to provide the greatest consistency between the discussions that take place within the central bank and those that take place outside the central bank. Other central banks take a less formal approach to communicating multiple paradigms, preferring to present the different elements that go into a policy decision in a consistent way, even though the elements have not been reconciled within a single macro economic model. Such an approach may make it easier to understand the policy decision, but it does less to highlight the different perspectives that arise from the multiple paradigm approach. Either approach can support effective communication, and both approaches can contribute to the public policy debate if the communication with the public is open and transparent.

The Bank of Canada takes a pragmatic approach to communicating its policy decisions to the public, even though the policy analysis behind the decisions is the product of separate paradigms. That is, the analysis behind monetary policy decisions is communicated to the public as if it were the product of a hypothetical complete macro economic model that incorporates all relevant economic behaviour, even though a formal mathematical model with such characteristics does not exist, nor can it be constructed today. For example, in the *Monetary Policy Report* there is a through discussion of monetary aggregates and what they suggest about inflation and output growth, as well as a discussion of aggregate demand and supply imbalances. Such pragmatism – which also characterizes the way most central banks communicate – is flexible enough to communicate all the analysis behind policy decisions.

A pragmatic approach to communication does not discourage the publication of technical documents that describe the different macro economic models used by economists at the central bank. As is the case at the Bank of Canada, the authors of such documents should be encouraged to make explicit reference to the paradigm behind the model, and to discuss the limitations of that paradigm. Research that compares the relative performance of the paradigms should also be produced. Being explicit about multiple paradigms in technical documents, while taking a pragmatic approach to communication in more accessible publications, allows communication to different audiences in a way that maximizes their understanding of the policy decision, and thus enhances their ability to contribute to the policy debate.

5. Summary

A multiple paradigm approach to monetary policy advice can lead to better advice because it adds robustness to that advice. Good monetary policy advice is both near optimal within a single model and robust across models. Different models emphasize different aspects or interpretations of the monetary policy transmission mechanism and, therefore, advice that is appropriate across multiple models should be less sensitive to errors in analysis that arise when knowledge of the transmission mechanism is uncertain.

This paper discussed issues that arise when implementing a multiple paradigm approach to monetary policy advice. The discussion identified three broad sets of issues.

The first set of issues involved the type of models that might be built to represent the different paradigms. Given limited research and analytic resources within a central

bank, there is a trade-off between the number of paradigms that can be supported by a central bank and the complexity of the models. In addition, different paradigms should be as distinct as possible to avoid duplication and redundancy. Consistent with this approach, the Bank of Canada supports two paradigms and two approaches to model identification – models that focus on real or financial interactions when explaining inflation, and empirical or theoretical approaches to model identification.

One of the main values that a macro economic model brings to the policy debate is internal consistency between the concepts and behaviours that appear in the model. To preserve consistency, each model should be maintained separately from the other models in order to avoid the introduction of extraneous concepts and incongruous behaviours. This would suggest that it is best that each paradigm be maintained by a separate group of economic researchers and policy analysts, and that each group maintain multiple models to represent their paradigm. This said, these groups should communicate extensively to ensure that advances in modelling methodology are disseminated rapidly.

Maintaining consistency also means that no single model or paradigm can capture all aspects of the monetary transmission mechanism because knowledge of the transmission mechanism is incomplete, even though our knowledge is based on a wide range of information and interpretative tools. Introducing pragmatism into a single macro economic model would cloud the interpretation of the output of the model, which would reduce the usefulness of the policy advice generated from the model.

Monetary policy advice is better when it is formed in an environment of vigorous and open debate. The process by which policy advice reaches the policy decision makers is therefore as important as the models that are used to generate policy advice. There is no best way of combining the information from multiple models, be it at the research stage, the policy analysis stage, or the policy decision stage. Whatever process is adopted, it should aim at encouraging a vigorous and open debate of the policy issues at all stages. The process should also be structured to allow broad participation in the debate without wasting too much time. This would suggest that a technical debate about the merits of each paradigm should take place separately from the debate about the recommended policy outcome. A technical debate should be conducted for each model separately to ensure that the advice being generated by one model is as independent as possible from that of the other models. The debate about the recommended policy outcome should be based on the advice coming from the alternative models separately in order to ensure that all relevant information is available to the policy decision makers.

The external policy debate on monetary policy is as important to good monetary policy decisions as is the internal monetary policy debate. This means that good communication of the reasons for a monetary policy decision and outside scrutiny of the models, research and analysis that go into the policy decision are important elements of the process that generates policy advice. Information aimed at the external audience should be clear and concise in order to enhance understanding. For the non-expert audience this may be achieved either by a pragmatic approach to communicating policy decisions or by maintaining the distinction between paradigms in communication to the public. The expert external audience, however, is aware of the uncertainty that surrounds knowledge of the monetary transmission mechanism, and so for this audience it is likely better to be clear about the distinction between paradigms by offering a formal

explanation of the models used to represent each paradigm and by publishing the results of tests of the relative performance of these models. Clear and effective external communication will lead to better monetary policy decisions by helping experts and the general public participate in the policy debate.

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The role of M3 in the policy analysis of the Swiss National Bank*

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Swiss National Bank

1. The new policy approach of the Swiss National Bank and the role of money

1.1. New approach based on inflation forecast

At the end of 1999, the Swiss National Bank (SNB) modified its monetary policy approach. It abandoned monetary targeting in favour of a policy concept based on an inflation forecast. The SNB's new approach entails three elements.[1]

First, the SNB announced a definition of price stability, expressed in terms of the headline CPI. It defines price stability in the same manner as the European Central Bank (ECB). According to the SNB, price stability equals a CPI inflation rate of less than 2 percent per year. Although the lower bound of the range in the inflation rate consistent with price stability remains undefined, the SNB made it clear that it will endeavour to prevent deflation, i.e., a decline in the CPI.

Second, the SNB publishes an inflation forecast twice a year. The inflation forecast, which is announced at press conferences in June and December, is offered for three years ahead. The three-year forecasting period takes account of the long time lag in the effects of Swiss monetary policy. In Switzerland, as many as three years tend to elapse until a change in monetary policy fully affects the inflation rate. In addition, the SNB provides a forecast of real growth in the following two years.

The SNB compares its inflation forecast with its definition of price stability. If the SNB expects the inflation rate to move outside the price-stability range, it must contemplate adjusting monetary policy. However, the SNB does not alter monetary policy mechanically in response to deviations in the inflation rate from the price-stability range. It is mainly concerned about keeping the inflation trend within this range. The SNB is prepared to tolerate temporary deviations from the price-stability range, caused by such factors as fluctuations in energy prices and exchange rates, as well as changes in indirect taxes. For example, due to the recent sharp increase in the oil price, inflation may rise temporarily above the threshold of 2 percent in 2001 or 2002. Yet, the SNB has

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[1] See Meyer (2000) and Rich (2000) for more detailed discussions of the new approach.

emphasised that it does not intend to tighten monetary policy further, despite the expected departure from the price-stability range. In the SNB's view, attempts to keep the inflation rate within the price-stability range at all times would unnecessarily exacerbate fluctuations in Swiss output and employment. Because of its focus on the inflation trend and on headline inflation, the SNB is reluctant to treat its definition of price stability as a binding inflation target even though its policy approach is akin to inflation targeting as pursued by the Reserve Bank of New Zealand, the Bank of Canada, the Bank of England, the Sveriges Riksbank and other central banks.

The third element in the SNB's new approach involves modifications to its operational procedures. Before the end of 1999, the SNB translated its policy intentions into operational targets for bank reserves. Since the beginning of 2000, it has fixed an operational target band for the three-month Libor for Swiss francs, with the bandwidth amounting to 100 basis points. The SNB does not control the three-month Libor directly, but indirectly by way of changes in the overnight-lending rate.

1.2. Importance of money and other policy indicators

The SNB did not entirely discard the approach followed before the end of 1999 and retained important ingredients of monetary targeting in its new monetary policy concept. At various occasions, the SNB stressed that it continues to monitor two sets of indicators providing leading information on future price developments in addition to using econometric forecasting models. The first set of indicators is useful for forecasting short-run price developments, i.e., over a horizon of up to 1 ½–2 years. It includes various indicators on the cyclical state of the economy, notably the output gap and supply and demand conditions in the labour market, as well as the real exchange rate of the Swiss franc. The second set of indicators comprises the monetary aggregates, which provide useful leading information on long-run price developments. A substantial body of evidence suggests that the growth in the Swiss money stock M3, in particular, is stably related to inflation and output growth, and serves as a key determinant of inflation in the long run (Peytrignet, 1996, 1999; Peytrignet and Stahel, 1998). Both sets of indicators are used together with the forecasts from various econometric models to produce a broadly based consensus inflation forecast, which now forms the centre stage of Swiss monetary policy.

In addition to being important inputs to the consensus forecast, the SNB monitors these policy indicators for two other reasons. First, while the SNB tends to adjust monetary policy, if necessary, upon announcing a new inflation forecast, it cannot content itself with reviewing its policy course only twice a year. Shocks threatening to jeopardise price stability may occur at any time. Therefore, the SNB must be prepared to act whenever shocks call for a change in monetary policy. Under monetary targeting, the SNB already reviewed its policy course at quarterly intervals and, if necessary, more often. It has maintained this practice under the new regime although two of these quarterly reviews do not result in the publication of a new inflation forecast. Moreover, the SNB is willing to change the target band for the three-month Libor in between its quarterly policy reviews, should there be a need for such actions. If a policy change is not accompanied by the publication of a new inflation forecast, the SNB justifies its policy measure by referring to the leading indicators of inflation that it monitors regularly.

A second – and even more important – reason for monitoring policy indicators lies in the SNB's accountability to the public. The public must be able to judge whether the SNB's policy stance is appropriate for achieving the ultimate objective of price stability. Under the approach followed before the end of 1999, the intermediate monetary target provided the main yardstick for assessing Swiss monetary policy. According to Svensson (1997; 1999), central banks following inflation targeting or similar approaches should treat their inflation forecast as an intermediate target. In this case, the central bank produces a forecast of inflation conditional upon various paths for the policy instrument. The policy makers in turn select the instrument path that generates an inflation forecast conforming to the inflation target.[2] If the inflation-forecast target is to be effective in enforcing accountability, the central bank must not only publish its inflation forecast, but also explain to the public how it arrived at its prediction. Otherwise, the public will be unable to judge whether the operational framework chosen by the central bank is suitable for achieving the inflation target.[3]

The main difficulty with this approach lies in the subjective nature of inflation forecasts. There is an important difference between intermediate targets for a monetary aggregate and an inflation forecast. The money stock is a variable that can be measured objectively, while the inflation forecast rests on the central bank's subjective views about the future. If the central bank is under strong political pressure to pursue objectives that are likely to be at variance with price stability in the long run, it may produce inflation forecasts biased in favour of the politicians' preferences. This may be particularly true of forecasts for inflation two or three years ahead. A willingness to monitor the development of monetary aggregates may serve as a remedy against biased inflation forecasts provided these aggregates are reliable leading indicators of inflation, as is the case in Switzerland.[4] Thus, monitoring indicators such as the monetary aggregates may improve policy performance in two ways: It may help the central bank in elucidating its policy analysis and in communicating its inflation forecasts to the public. Furthermore, it may discourage the central bank from publishing biased inflation forecasts.

Although the leading-indicator role of Swiss monetary aggregates is uncontested, it is difficult to explain to the public how they enter into the monetary policy decisions. When the SNB developed its new policy framework, it discussed the possibility of adopting the two-pillar strategy of the ECB. A two-pillar strategy would have allowed the SNB simultaneously to shift its policy focus to inflation forecasts and to retain the monetary aggregates as important policy indicators. After much reflection, the SNB decided against a two-pillar strategy. Instead, it emphasised that it would base its policy decisions mainly on an inflation forecast. The money stock M3, along with the other

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[2] Svensson (1999, pp. 623–630) actually suggests more complex procedures, under which the central bank engages in "flexible" inflation targeting, i.e., its loss function comprises an output-gap target, in addition to an inflation target. As indicated above, the SNB takes account of output in setting monetary policy.

[3] Informing the public about the intricacies of a conditional inflation forecast is a difficult task indeed. In our experience, even policy makers themselves are sometimes at a loss to grasp fully the meaning of such forecasts.

[4] Forecasts produced by the private sector may also help in detecting biases in central-bank forecasts. However, it is possible that private forecasters are swayed by the same political considerations as the central bank.

indicators mentioned above, would serve as important input into the inflation forecast. Moreover, monitoring M3 and other indicators would help the public to understand the reasoning behind the SNB's forecast. These indicators would also be used to justify policy changes at times at which the SNB did not publish a new forecast.

The SNB was concerned that – with a two-pillar strategy – it would reintroduce to the new approach a problem that had plagued monetary targeting. Its concern derived from the reference value for M3 growth, a key ingredient of the ECB's strategy. The SNB was reluctant to follow the example of the ECB and to fix a reference value for M3 growth. Such a reference value would have closely resembled the multi-year target for money growth that the SNB had set under the policy regime in operation before the end of 1999. The SNB did not wish to fix a multi-year target under a new guise because this target had created complex problems of signal extraction that are typical for monetary aggregates whose demand is highly sensitive to changes in interest rates. As we have shown elsewhere (Peytrignet, 1996, 1999; Rich, 1999, 2000), if money demand responds strongly to changes in interest rates, steady expansion in the money supply is unlikely to constitute an optimum policy strategy. In the case of Swiss M3, for example, money growth should normally rise above and fall below its long-run average during cyclical contractions and expansions in economic activity respectively. Thus, taken by themselves, the deviations in M3 growth from a long-run average or reference value may provide misleading information about the stance of monetary policy. During the contraction phase of the business cycle, a positive deviation may indicate that the policy stance is in sympathy with price stability. During the expansion phase, by contrast, a positive deviation of the same size may point to the SNB following an inflationary policy course.[5] Observers of Swiss monetary policy frequently believe that a mechanical relationship exists between money growth and inflation. Fixing a reference value for M3 growth might have reinforced these misconceived views about the link between money growth and inflation.

In the following, we attempt to resolve the signal-extraction problem just described. In Section 2 we develop an empirical procedure designed to extract useful information on future inflation from the Swiss aggregate M3, while Section 3 offers conclusions.

2. The empirical importance of M3 as an information variable

The procedure used for extracting information rests on the observation that the demand for Swiss M3 is stable in the long run and that the variables entering into the money demand function are therefore cointegrated. This allows us to explore the predictive power of two measures of M3.[6] The first measure consists of the growth in the seasonally-adjusted money stock M3, as recorded in Swiss monetary statistics. It will be called "money growth" in the subsequent analysis. The second measure will be called "excess money" and equals the error term in the cointegrating relation, i.e., the logarithmic difference between the seasonally adjusted recorded levels of M3 and the corresponding trend values derived from the cointegrating relation.

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[5] The same conclusion holds for the monetary base, the SNB's intermediate target variable until the end of 1999, and the aggregates M1 and M2. Of course, the SNB was aware of this problem when it targeted money.

[6] Swiss M3 consists of Swiss-franc-denominated currency, sight and other transactions deposits, as well as time and savings deposits, in the hands of domestic nonbank residents.

The measures of M3 are used to forecast both the time path of future inflation and cumulative price increases over periods exceeding one year. Moreover, the predictive power of these measures is determined for forecasting horizons of varying length. In this paper, we will consider only in-sample evidence because the available data series are relatively short and thus unsuitable for computing meaningful out-of-sample results. Nevertheless, in-sample results provide interesting evidence on the robustness of the information contained in M3 over a longer period of time.

2.1. Money growth and excess money

Studies on money demand in Switzerland, using a variety of approaches, lead to the conclusion that the aggregate M3 is cointegrated with the price level, output, and the long-term interest rate. Money demand functions for M3 consisting of these variables are therefore stable in the long run. Recent examples of such studies are Baltensperger, Jordan and Savioz (2000), Peytrignet (1996), and Peytrignet and Stahel (1998). For the purpose of this paper, we do not estimate the cointegrating vector of the demand for M3. Rather, we calibrate the long-run demand for M3 by drawing on the results from existing studies. We are forced to rely on calibration because subsequently we will use rolling estimation to forecast inflation. The sample size is not sufficiently large to allow rolling estimation to be applied to the cointegrating relation too. Our calibrated long-run demand for M3 is

$$m3_t = -1.65 + 1.0 \cdot p_t + 1.3 \cdot q_t - 0.05 \cdot R_t + ec_t\,, \tag{1}$$

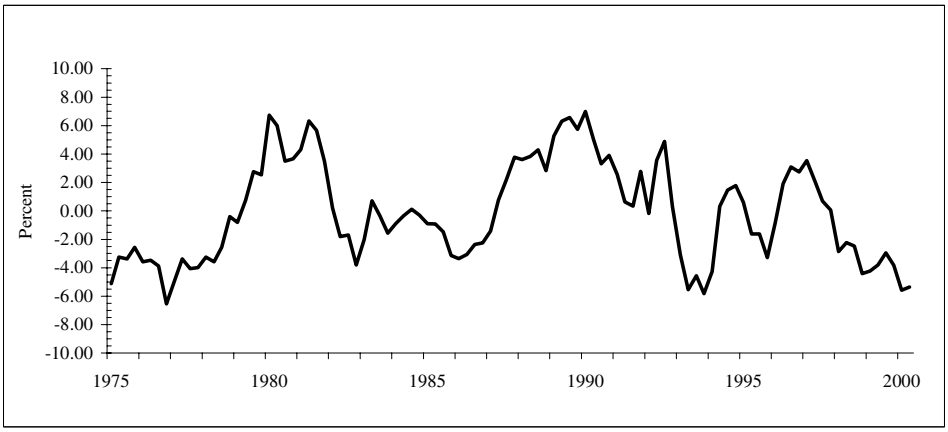
where $m3$ denotes M3, p the GDP-deflator, q real GDP and R the long-term interest rate (the yield of bonds issued by the Swiss Confederation with a maturity of ten years), while t is a time index. All the variables except the long-term interest rate are expressed in logs. The elasticities appearing in Eq. (1) are in line with economic theory. The non-unit income elasticity of 1.3 can be explained by the fact that M3 is used not only for transaction purposes but also for the accumulation of wealth. The elasticity of M3 with respect to income as a proxy of wealth is clearly higher than one.

This long-run money demand equation allows us to compute excess money in the economy, equalling the error correction term *ec* or the difference between the actual level of M3 and the value derived from Eq. (1), given the actual levels of prices, output and the interest rate. The empirical analysis covers the period from the first quarter of 1975 to the second quarter of 2000. Panel A of Figure 1 shows the evolution of excess money, expressed in percent of the equilibrium level of M3, over the sample period. From this figure it can be seen that over long periods of time, M3 fluctuated strongly about the equilibrium path explained by Eq. (1). Panel B of Figure 1 shows the annual growth of M3. As a reference, annual CPI-inflation is reported in Panel C of Figure 1. Since the demand for M3 is cointegrated, excess money or the *ec* term – in addition to money growth – should potentially be an exploitable indicator of future inflationary pressure.[7] In the following, we analyse to what extent money growth and excess money – alone or together – provide information on future inflation in Switzerland.

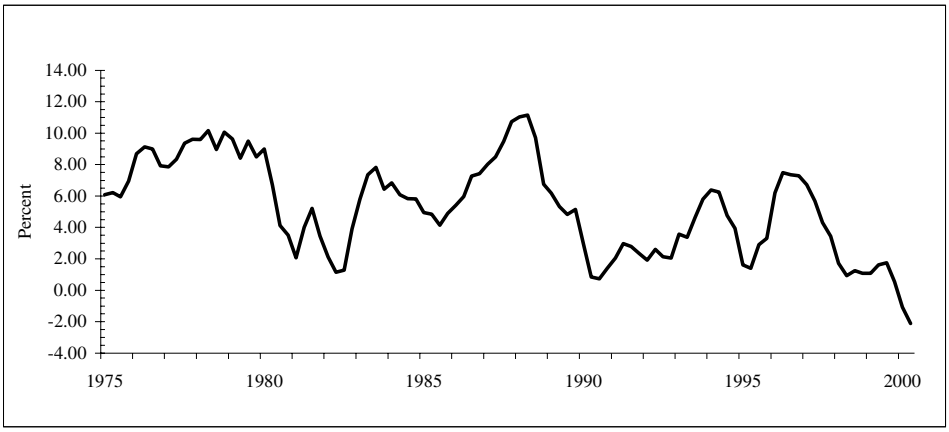
[7] Baltensperger, Jordan, and Savioz (2000) found that prices are not weakly exogenous to the error correction term. Thus, they found Granger causality running from M3 to prices.

Figure 1. Data

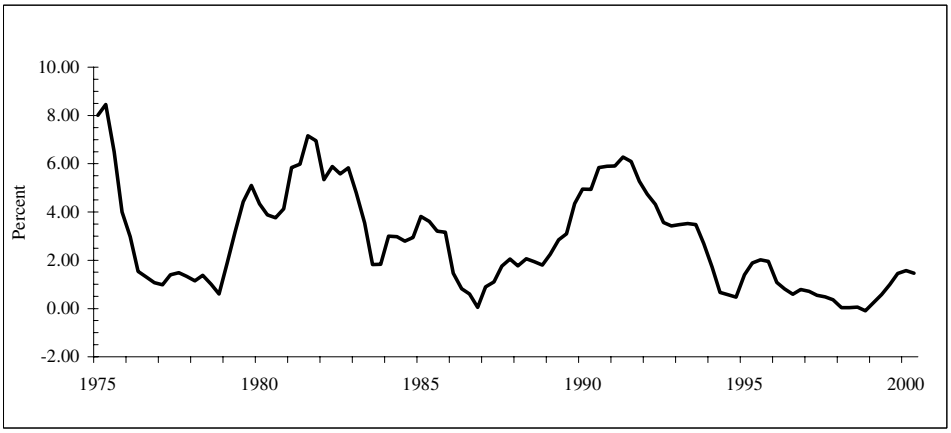
Panel A: Excess M3



Panel B: M3 Growth



Panel C: CPI Inflation



2.2. *Some evidence from correlations*

In this section, we search for the maximum correlation over different forecasting horizons k between money growth and excess money, on the one hand, and inflation on the other. Inflation is defined as the change in consumer prices over the preceding four quarters, i.e., $\Delta_4 pc_t = pc_t - pc_{t-4}$. Money growth in measured analogously as $\Delta_4 m3_t = m3_t - m3_{t-4}$. Thus, we consider the correlation between $\Delta_4 m3_t$ and $\Delta_4 pc_{t+k}$ and between ec_t and $\Delta_4 pc_{t+k}$. We focus on Δ_4-differences because in Switzerland monetary policy decisions are based on percentage changes in economic data over the preceding year, rather than on annualised quarterly growth rates. In order to get information on the link between money and inflation for different time periods, we estimate the correlations recursively by lengthening the sample period gradually. The first sample used in the computations covers the period 1976:4 to 1986:4, the second the elongated period 1976:4 to 1987:1, and so on. We also check whether the results change over time, by estimating the same correlations with a moving window encompassing 52 observations. Thereby, the first window covers the period from 1976:4 to 1989:3, the second window covers the period from 1977:1 to 1989:4, and so on.

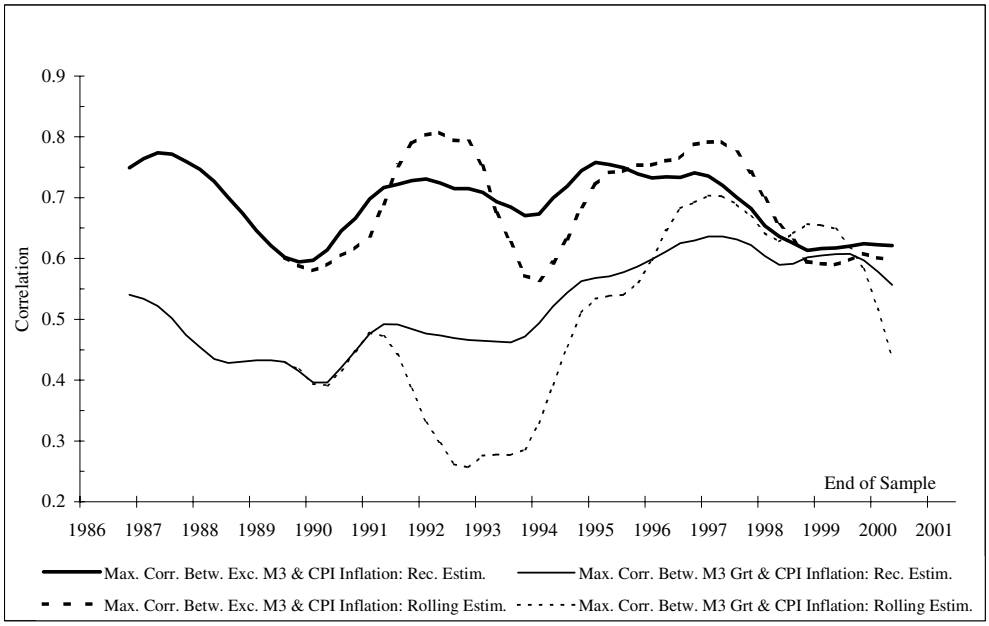
Figure 2 reports the results. The horizontal axis depicts the date of the last observation of the estimation sample. In Panel A of Figure 2, the regular thin line refers to the recursively estimated maximum correlation between money growth and inflation. Lengthening the sample period shows that the maximum correlation between money growth and inflation remains relatively stable between 0.4 and 0.6. Note that if we estimate the correlation with a rolling window of 52 quarters (dashed thin line), the maximum correlation of money growth with inflation is much more volatile. In Panel B of the same figure, we find that the maximum correlation occurs between lag $k = 11$ and lag $k = 17$ provided the correlations are estimated recursively (regular thin line). Most of the time, the lag with the maximum correlation is 15 quarters. The lag of maximum correlation with rolling window estimation (dashed thin line) differs only slightly from the results of the recursive approach.

Panel A of Figure 2 also exhibits the recursively estimated maximum correlation between excess money and inflation (regular bold line). As in the case of money growth, the maximum correlation varies little over time and is quite high (between 0.6 and 0.75). As a matter of fact, it is even higher for excess money than for money growth. If estimated with rolling windows of 52 quarters (dashed bold line), the maximum correlation between excess money and inflation becomes slightly more volatile than under recursive estimation. Panel B indicates that the maximum correlation with recursive estimation always occurs at lag $k = 4$ (regular bold line), i.e., much earlier than in the case of money growth. With rolling window estimation, by contrast, the lag varies slightly (dashed bold line).

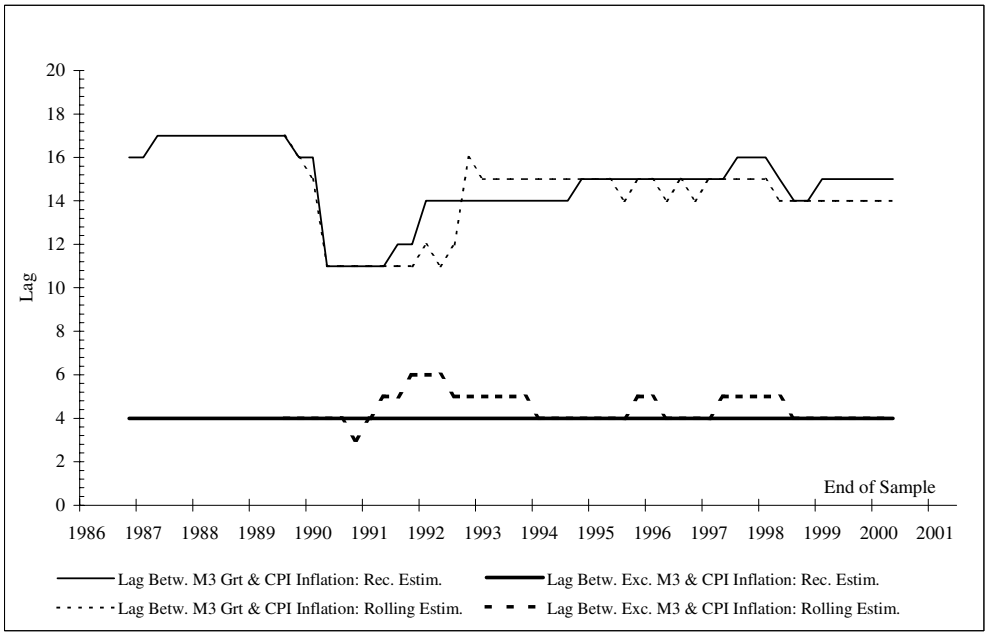
This exercise provides first insights into the information content of M3. Changes in money growth lead subsequent changes in inflation by long time spans. The maximum correlation between money growth and inflation is relatively high; however, it fluctuates if different time windows are considered. In addition to money growth, excess money also incorporates information. For excess money, the lag of maximum correlation is much shorter, but the maximum correlation is even higher than for money growth. These results suggest that M3 indeed possesses predictive power for future inflation. However, the analysis presented thus far is not complete. It is also necessary

Figure 2. Correlation Analysis

Panel A: Maximum Correlation Between Money and Inflation



Panel B: Lag of Maximum Correlation Between Money and Inflation



to examine the information content of money growth and excess money simultaneously. Moreover, we should not only consider the lag with the maximum correlation, but also determine the information content for other forecasting horizons.

2.3. Goodness of fit of forecasting regressions

This section examines the information content of M3 for different forecasting horizons and over different sample periods. We also compare the information content of money growth with that of excess money. For this purpose, we use the indicator model

$$\Delta_4 pc_{t+k} = \beta_0 + \beta_1 \Delta_4 pc_t + \beta_2 \Delta_4 m3_t + \beta_3 ec_t + \varepsilon_t \,. \tag{2}$$

The dependent variable is annual consumer price inflation in time $t+k$, where t is the current period and k the forecasting horizon. The indicator variables comprise the current annual inflation rate, $\Delta_4 pc_t$, the current annual growth rate of M3, $\Delta_4 m3_t$, and the error correction term ec_t (excess money) in time t. The error correction term ec_t is computed according to Eq. (1). The forecast error ε_t follows a moving average process of order $k-1$.[8] We consider three forecasting horizons of one ($k=4$), two ($k=8$), and three years ($k=12$) since these are the most relevant for monetary policy purposes.

To determine the information content of M3, four specifications of Eq. (2) are used. Specification (2I), which may be regarded as a "naive" benchmark forecast, only takes account of current inflation. In Specification (2II), money growth is added in order to assess its marginal information content. Specification (2III) allows us to examine the marginal information content of the error correction term. Finally, specification (2IV) includes both money growth and the error correction term in order to assess the full information content of M3:

$$\Delta_4 pc_{t+k} = \beta_0^{\mathrm{I}} + \beta_1^{\mathrm{I}} \Delta_4 pc_t + \varepsilon_t^{\mathrm{I}} \tag{2I}$$

$$\Delta_4 pc_{t+k} = \beta_0^{\mathrm{II}} + \beta_1^{\mathrm{II}} \Delta_4 pc_t + \beta_2^{\mathrm{II}} \Delta_4 m3_t + \varepsilon_t^{\mathrm{II}} \tag{2II}$$

$$\Delta_4 pc_{t+k} = \beta_0^{\mathrm{III}} + \beta_1^{\mathrm{III}} \Delta_4 pc_t + \beta_3^{\mathrm{III}} ec_t + \varepsilon_t^{\mathrm{III}} \tag{2III}$$

$$\Delta_4 pc_{t+k} = \beta_0^{\mathrm{IV}} + \beta_1^{\mathrm{IV}} \Delta_4 pc_t + \beta_2^{\mathrm{IV}} \Delta_4 m3_t + \beta_3^{\mathrm{IV}} ec_t + \varepsilon_t^{\mathrm{IV}} \tag{2IV}$$

The adjusted coefficients of determination ($\bar{R}^2$) shed light on the in-sample information content of money growth and excess money. Money is a valuable indicator if it carries information about future inflation not already contained in current inflation. Thus, if money is a useful indicator, the regressions including money growth or excess money should display a higher $\bar{R}^2$ than the benchmark equation.

We also test whether the information content of money changes over time by applying rolling regression methods. Rolling estimation of Eq. (2) yields time series of the adjusted coefficient of determination $\bar{R}^2$ for different forecasting horizons k. The $\bar{R}^2$ for horizon $k=4$ are computed as follows: Eq. (2) is estimated over the period from 1976:1 to 1988:4, i.e., with 52 observations. The $\bar{R}^2$ of this regression is in turn saved as $\bar{R}^2_{1988:4}$. Then, the estimation sample is shifted one period ahead and the equation is re-estimated with data running from 1976:2 to 1989:1. The $\bar{R}^2$ of this regression is saved as $\bar{R}^2_{1989:1}$. This procedure is continued until the end of the sample period. For the fore-

[8] Standard errors and t-statistics have thus to be corrected accordingly.

cast horizons $k = 8$ and $k = 12$ the $\bar{R}^2$ are computed analogously, but with the first sample starting 4 and 8 quarters, respectively, later.

Figure 3 reports the results for predicting inflation over different forecasting horizons. Panel A shows the $\bar{R}^2$ from the regressions for forecasting inflation one year ahead. Adding money growth to current inflation in the regression equation does not improve the $\bar{R}^2$. The values of the $\bar{R}^2$ for both Specifications I and II also fluctuate considerably over time. By contrast, Specification III comprising current inflation and excess money yields higher and more stable values of $\bar{R}^2$, ranging from 0.6 to 0.7. Comparing Specification I and Specification IV, we conclude that money growth does not help much in predicting inflation at the one-year horizon. However, the inclusion of excess money improves the fit of these regressions substantially.

Panel B shows the $\bar{R}^2$ obtained from the regressions for forecasting inflation two years ahead. Adding money growth to current inflation in the regression equation (Specification II) now clearly raises $\bar{R}^2$. The values of the $\bar{R}^2$ derived from Specification III with excess money, in most instances, are even higher than those from Specification II, and substantially more stable. An interesting result is that Specification IV, where both money growth and excess money are included, now achieves the highest values of $\bar{R}^2$ for all sample periods considered. The combined information extracted from money growth and excess money is thus crucial for predicting inflation two years ahead.

In Panel C the results of forecasting inflation three years ahead are reported. The regression equations taking account exclusively of current inflation explain very little of the variation in inflation over this long forecasting horizon. By contrast, money growth plays a crucial role in forecasting inflation three years ahead, while Specification III with excess money yields slightly smaller values of $\bar{R}^2$ than at shorter forecasting horizons. For many samples, the values of $\bar{R}^2$ from Specification II are now higher than those from Specification III. However, the largest values of $\bar{R}^2$ are obtained from Specification IV, which allows for both money growth and excess money.

We now turn to cumulative inflation ("pipeline" inflation), measuring the increase in prices over periods exceeding one year. A good indicator of future cumulative inflation is useful because it provides information on the potential rise in prices over the entire forecasting horizon. Such indicators are valuables early warning signals for central banks in situations where no forecasting models exist that are capable of accurately predicting the time path of future inflation.

If cumulative inflation measured over two ($\Delta_8 pc_{t+8}$) or three years ($\Delta_{12} pc_{t+12}$) is substituted for the annual inflation rate as the dependent variable, Eq. (2) may be rewritten as follows:

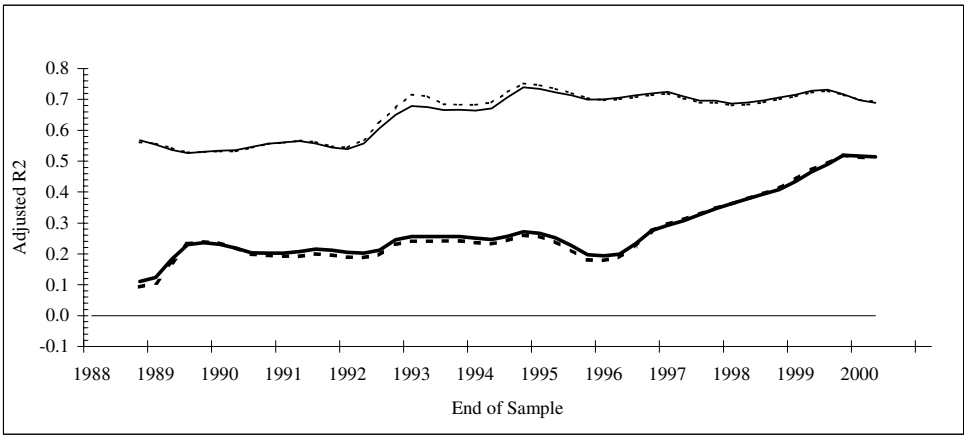
$$\Delta_8 pc_{t+8} = \beta_0 + \beta_1 \Delta_4 pc_t + \beta_2 \Delta_4 m3_t + \beta_3 ec_t + \varepsilon_t \,. \tag{3}$$

$$\Delta_{12} pc_{t+12} = \beta_0 + \beta_1 \Delta_4 pc_t + \beta_2 \Delta_4 m3_t + \beta_3 ec_t + \varepsilon_t \,. \tag{4}$$

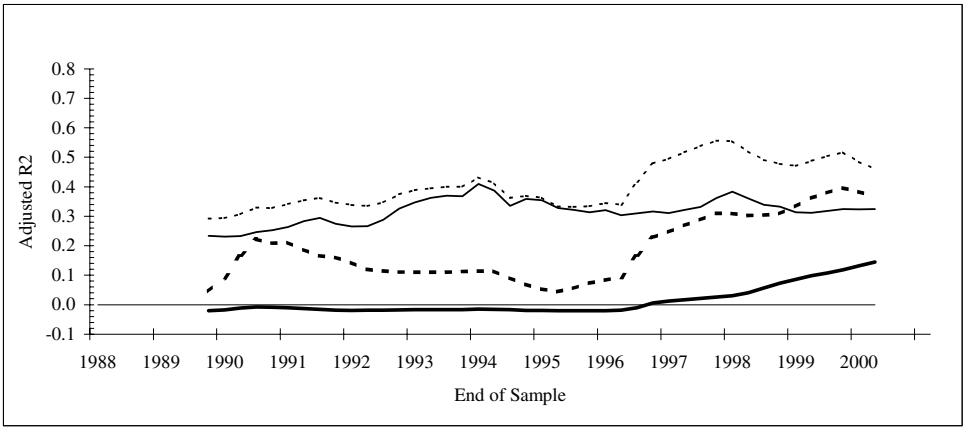
For both Eqs. (3) and (4), we estimate the analogous Specifications I to IV as for Eq. (2). The results are reported in Figure 4. To facilitate comparison with the results for annual inflation, Panel A of Figure 4 reproduces the evidence displayed in Figure 3 for the one-year forecasting horizon. Panel B shows the $\bar{R}^2$ obtained from the regressions for forecasting cumulative inflation two years ahead. The results from Specification III and IV are almost identical. These regressions yield high values of $\bar{R}^2$, which remain

Figure 3. Goodness of Fit: Annual Inflation Regressions

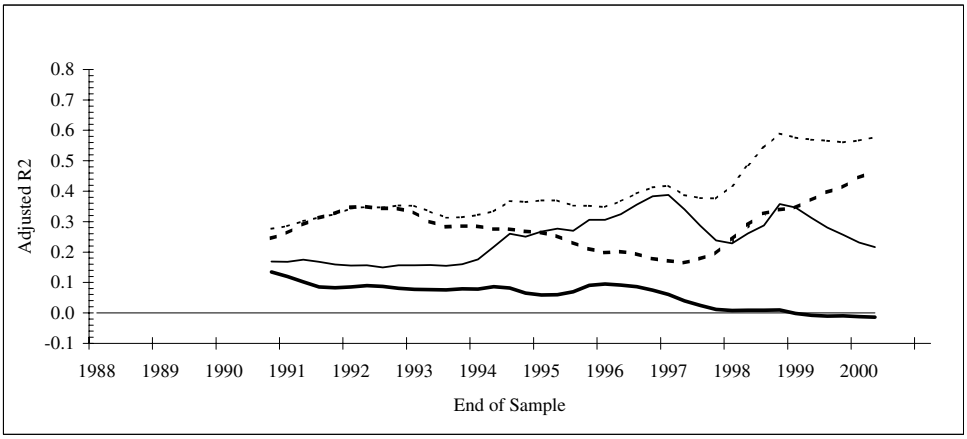
Panel A: Annual Inflation 1 Year Ahead



Panel B: Annual Inflation 2 Years Ahead



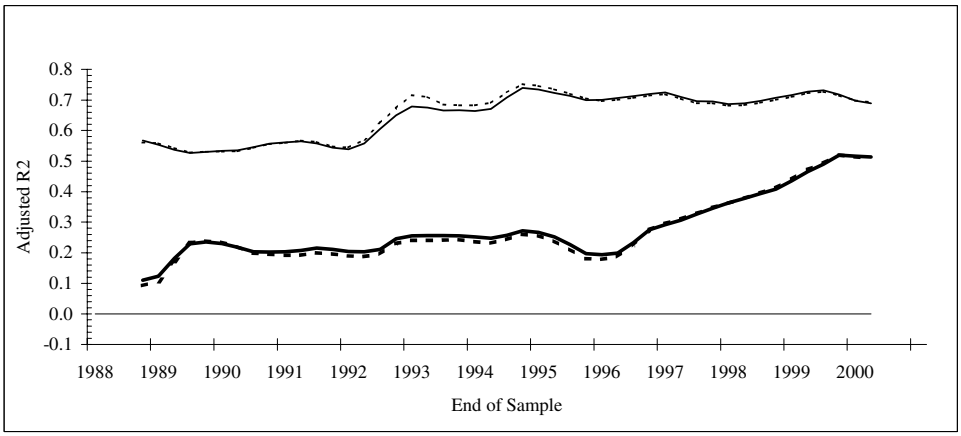
Panel C: Annual Inflation 3 Years Ahead



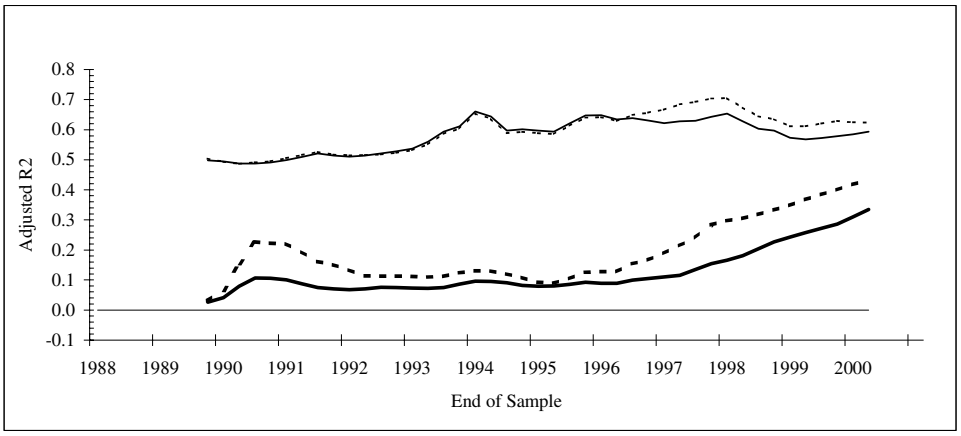
Regular Bold: Spec. I Dashed Bold: Spec. II Regular Thin: Spec. III Dashed Thin: Spec. IV

Figure 4. Goodness of Fit: Cumulative Inflation Regressions

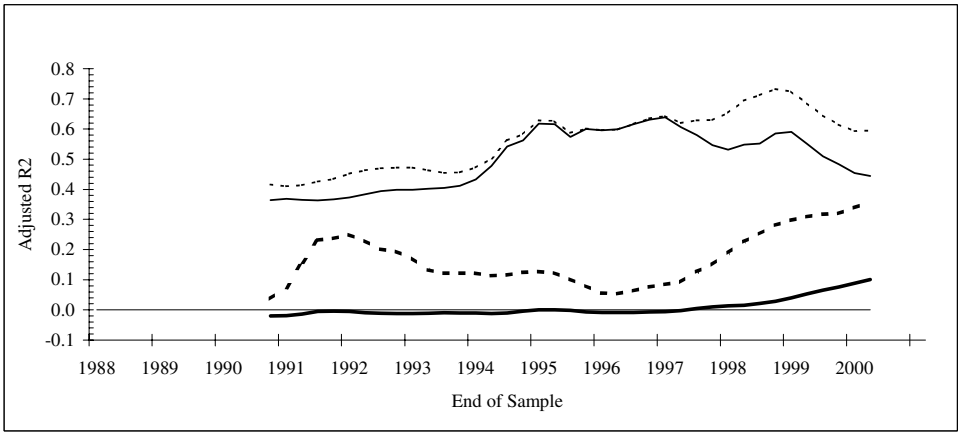
Panel A: Annual Inflation 1 Year Ahead



Panel B: Cumulative Inflation 2 Years Ahead



Panel C: Cumulative Inflation 3 Years Ahead



Regular Bold: Spec. I Dashed Bold: Spec. II Regular Thin: Spec. III Dashed Thin: Spec. IV

quite stable over time with a size of about 0.6. The values of $\bar{R}^2$ derived from Specification II are volatile, with low values attained for early samples, and relatively high ones for later samples.

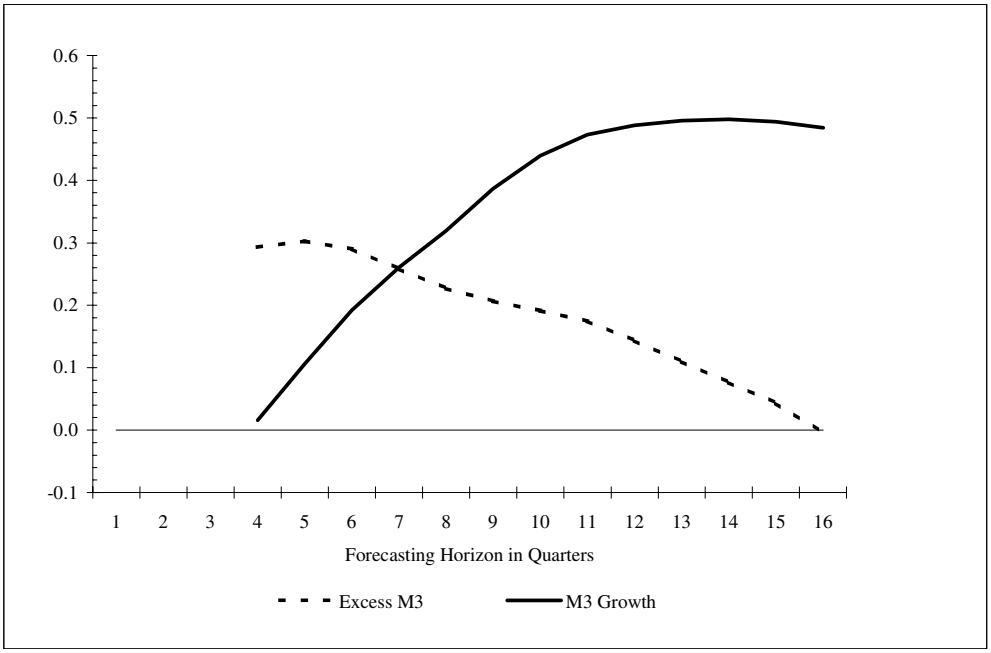
Panel C reveals a similar picture for the three-year horizon. The regression fit of Specification II is not robust over time. Specification IV with money growth and excess money achieves high values of $\bar{R}^2$ and outperforms all other specifications over the sample periods considered. These results confirm that excess money, in addition to money growth, should be used in forecasting cumulative inflation. Thus, in cases in which variable lags in the transmission of monetary disturbances preclude reliable predictions of the future inflation path, the SNB should at least be able to get a rough idea of the inflationary dangers by monitoring excess M3 together with M3 growth.

2.4. Forecasting horizon and regression coefficients

In the previous sections we analysed how the information content varies over time for different forecasting horizons. In this section, we examine more closely the effects of a continuous increase in the forecasting horizon on the coefficients in the forecasting regressions for annual inflation. In this case, the estimation sample remains fixed and covers all available observations. This exercise shows how the relative importance of money growth and excess money evolves as the forecasting horizon is lengthened. We thus estimate the regression

$$\Delta_4 pc_{t+k} = \beta_0 + \beta_1 \Delta_4 pc_t + \beta_2 \Delta_4 m3_t + \beta_3 ec_t + \varepsilon_t \,, \tag{5}$$

Figure 5. Coefficients on Forecasting Equations

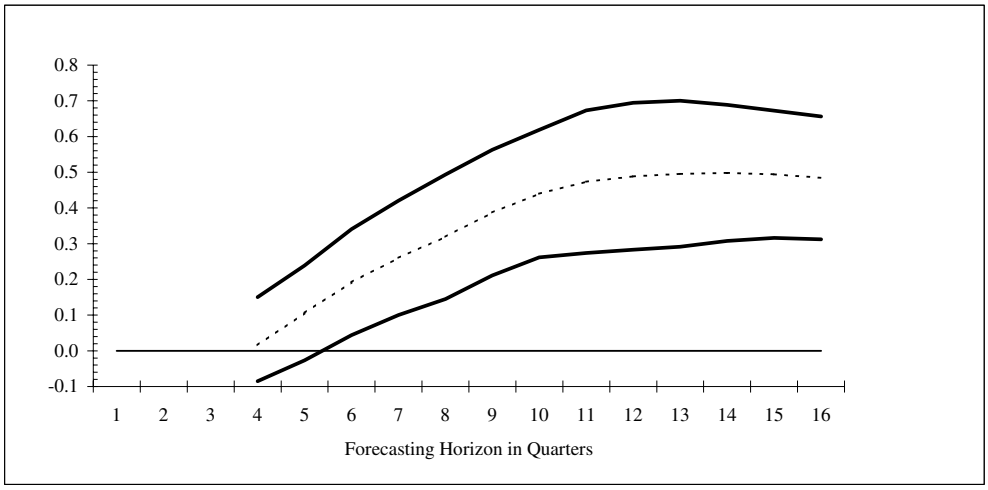


for each forecasting horizon k, with k increasing successively from 4 to 16 quarters. We then report the estimates for β_2 and β_3 for each forecasting horizon k. Moreover, we compute the 90-percent confidence interval for these coefficient estimates.[9]

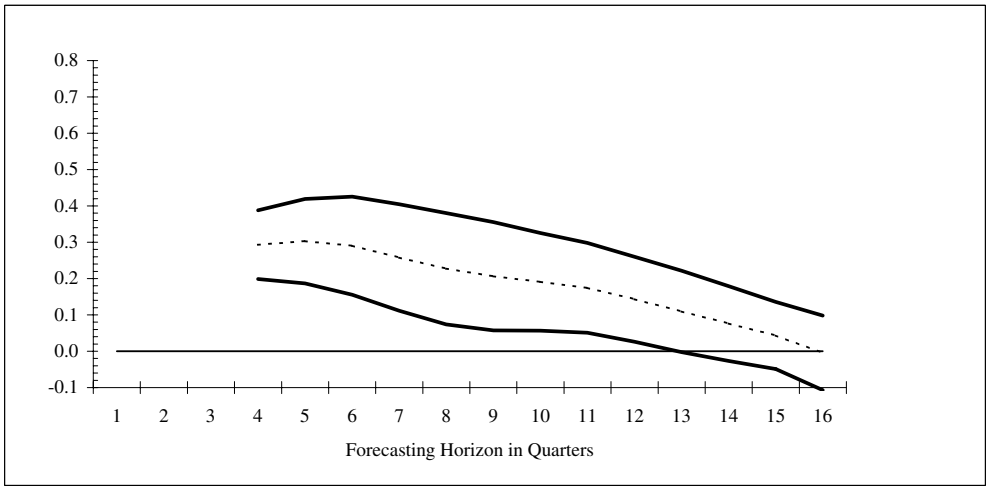
Figure 5 reports the point estimates of these regressions. For very short forecasting horizons, the coefficient on money growth is small, but it increases steadily as the forecasting horizon is lengthened. The coefficient for money growth reaches its highest values for forecasting horizons between 12 and 14 quarters. Exactly the opposite result

Figure 6. Coefficients with 90-Percent Confidence Invervals

Panel A: M3 Growth



Panel B: Excess M3



[9] The confidence interval is computed with standard errors corrected for serial correlation.

is obtained for excess money. The coefficients are the highest for forecasting horizons between 4 and 6 quarters. If the forecasting horizon is lengthened, the coefficient declines gradually and reaches zero at about $k = 16$. These findings confirm the results from the correlation analysis of Section 2.2.

Figure 6 shows the 90-percent confidence interval of these estimates. Panel A displays the results for money growth. The coefficient on money growth is significant only at forecasting horizons of 6 quarters and longer. As can be inferred from Panel B, the coefficient on excess money remains significant until a forecasting horizon of 13 quarters is reached. Thus, although the coefficient on excess money diminishes as k rises, it remains significant for all the forecasting horizons that are relevant for Swiss monetary policy. This analysis again underlines the importance of considering both money growth and excess money for extracting information from M3 in order to forecast future inflation.

3. Policy conclusions

This paper argues in favour of using money as an important indicator for Swiss monetary policy. Monitoring indicators such as money is useful even if policy decisions are based mainly on an inflation forecast. These indicators help the SNB to explain to the public the reasoning behind its inflation forecast and to strengthen its accountability. The paper explains how the money stock M3 is used as information variable in the SNB's decision making process.

The paper presents empirical evidence of the importance of M3 for predicting future inflation in Switzerland. The empirical analysis is based on a monetary indicator model for inflation, incorporating a stable cointegrated money demand function for M3. The indicator model exploits both the information from recorded money growth and from excess money, i.e., from the error correction term of the cointegrated money demand function. We draw three conclusions from our empirical analysis:

First, in order to exploit the information contained in M3, money growth and excess money should be considered simultaneously. Combining the information drawn from money growth and excess money substantially improves the indicator quality of M3, not only in the short run but also in the long run. If used in isolation, money growth and excess money may give misleading signals about future inflation. Thus, for monetary policy decisions it is important to take both indicators into account. This result shows that using a reference value for the recorded growth rate in a monetary aggregate may have its pitfalls.

Second, money growth has a comparative advantage in predicting annual inflation over long forecasting horizons, whereas excess money dominates in predictions over short ones. Excess money is also crucial for predicting future cumulative inflation. This is basically due to the long and variable lags in the transmission mechanism. Excess money provides important information about potential increases in the price level already in the pipeline.

Third, the information content of money growth is quite volatile. In contrast, the combined predictive power of both money growth and excess money is relatively stable over time. Thus, by itself, money growth is likely to provide misleading information on future inflation.

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Money and credit in an inflation-targeting regime: the Bank of England's Quarterly Monetary Assessment

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Bank of England

1. Introduction

As Milton Friedman famously observed, inflation is a monetary phenomenon. In the long run, persistently high rates of money growth are associated with high inflation.[1] Monetary variables therefore play a fundamental role in the Bank of England's assessment of the outlook for inflation. Extracting information from monetary developments is not a mechanical process, however. Over policy-relevant horizons, money and credit may be influenced by many factors, including cyclical shifts in the demand for money and credit, and innovations to financial structure, products and regulation. Views may also differ about the role that money plays in the transmission mechanism. So a central task of monetary analysis is to understand and quantify these various possible effects, drawing out the key implications for the inflationary outlook.

In carrying out this task, the Bank of England can draw on a substantial quantity of published research in monetary economics,[2] together with a wide variety of other tools for economic, institutional and statistical analysis. These tools are used in many different ways to brief the Bank's Monetary Policy Committee (MPC). This paper focuses on how formal theoretical and empirical models are used to provide a quantitative evaluation of the information in money and credit aggregates as an input to the MPC's quarterly inflation forecast. This process is known as the Quarterly Monetary Assessment (QMA).

The remainder of this paper is structured as follows. Section 2 sets out the role of money and credit as information variables in the United Kingdom's inflation-targeting regime. Section 3 describes how the MPC is briefed on developments in the data. Section 4 turns to the inflation forecast, and explains the place of monetary models in the Bank's 'suite of models' approach. Section 5 outlines the key objective of the QMA,

* This paper draws heavily on the work of many colleagues, past and present, at the Bank of England. I am particularly grateful to Peter Andrews, Laura Edmunds, Norbert Janssen, Nigel Jenkinson, John Power, James Proudman, James Talbot and Ryland Thomas for comments and assistance with earlier drafts. Any views expressed in this paper are, however, the author's own and should not be interpreted as those of the Bank of England or the Monetary Policy Committee. Comments from our discussant, Jim Nugent and participants of the Seminar were gratefully appreciated.

[1] See, for example, 'Some monetary facts' by G.T. McCandless Jnr and W.E. Weber, *Federal Reserve Bank of Minneapolis Quarterly Review*, Summer 1995.

[2] A comprehensive list is given in the bibliography at the end of this paper.

which is to provide a 'menu' of alternative projections based on money, conditional on alternative views about the role of money and credit in the transmission mechanism. Section 6 describes the nature of these projections in greater detail. Section 7 discusses some of the ways in which monetary models, as part of the suite of models, might influence the MPC's inflation projection. And Section 8 concludes, noting some challenges for future research.

2. The role of money and credit in the United Kingdom's policy framework

The operational target for UK monetary policy is an underlying inflation rate, measured by the twelve-month increase in the retail prices index excluding mortgage interest payments (RPIX), of 2½%.[3] In pursuing this target, the Bank's Monetary Policy Committee (MPC) has discretion over whether to employ intermediate targets or monitoring ranges for money. But since its inception in 1997, it has decided not to do so. As explained in the November 1997 *Inflation Report*, instability in the velocity of circulation of money was judged to have been such that the announcement of monitoring ranges might be confusing if, because of unpredicted changes in trend velocity, the ranges chosen turned out to be inconsistent with the inflation target.[4]

Data on money and credit nevertheless remain important information variables in judging the outlook for inflation. The rest of this paper explains how this is put into practice at the Bank of England.

3. The role of money and credit in the MPC's policy assessment process

The MPC meets monthly to consider its interest rate decision. Ahead of this meeting, Bank staff brief the Committee on the latest economic developments in each part of the economy, including money and credit. The briefing focuses mainly on identifying and interpreting the economic news on the month. Examples of the types of data analysed during the monthly round are shown in Charts 1 and 2. In addition to studying whole economy monetary aggregates, there is a long-standing practice at the Bank of England of looking carefully at sectoral breakdowns of the data, reflecting the view that sectoral money demand relationships may be more stable than those at an aggregate level. Chart 1 shows one such disaggregation of broad money growth, which allows the MPC to assess the recent path of growth in deposit holdings of the household, corporate and non-bank financial intermediary sectors. Policy-makers also take a close interest in developments in credit markets. For example, Chart 2 shows a time series of consumer borrowing, broken down into unsecured credit and a Bank estimate of 'mortgage equity withdrawal' (credit secured on housing which is not reinvested in the housing stock).

These charts are merely illustrative of the range of information made available to the MPC. Ahead of each monthly meeting, the Committee receives a background

[3] Further details on the specification of the inflation target are given in 'Changes at the Bank of England', *Bank of England Quarterly Bulletin,* August 1997, pages 241–247.

[4] See pages 8–9 of the November 1997 *Inflation Report*.

Chart 1. Sectoral broad money growth[(a)]

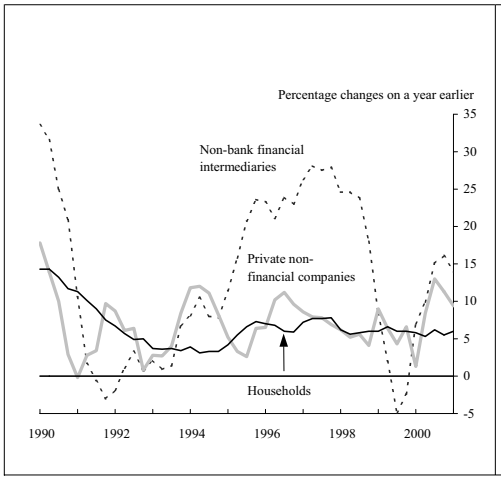
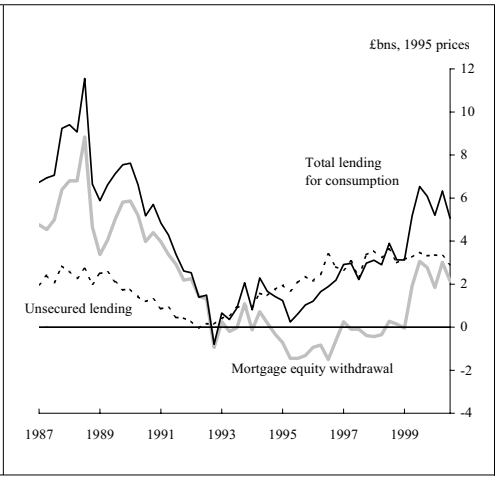


Chart 2. Real total lending for consumption



(a) Quarterly data to 2000 Q3, plus monthly observations for Oct.–Nov.

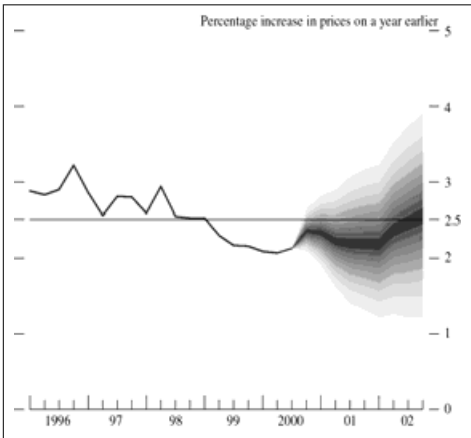
chart-pack, which contains nearly 600 charts and tables, including more than 60 on the latest money and credit data. A wide variety of subsidiary analysis is also prepared, both ahead of the briefing meetings, and in response to questions from the Committee.

The MPC meets to make its interest rate decision a few days after the monthly briefing, according to a pre-announced timetable. Minutes of this meeting are published two weeks later, showing the reasoning behind the decision. These minutes include the MPC's assessment of monetary and financial conditions, and a summary of the data presented to the Committee is also published in an annex.

Once a quarter, the MPC goes through a more formal forecast process designed to quantify its best collective view about the outlook for inflation. There are many elements to this process, drawing on data from each of the key parts of the economy. From the monetary side, a range of material using formal models and analysis of both money and credit data is provided to the MPC, and brought together in the QMA. The MPC's final projections, and the key issues considered, are subsequently published in the quarterly *Inflation Report*. An assessment of developments in money and credit is given in Section 1 of the *Report*. Later sections deals with demand and output, the labour market and costs and prices.

An important aspect of the Bank of England's approach is that the MPC's best collective projections for inflation and GDP growth are not point forecasts but probability distributions, presented in the form of fan charts (see Charts 3 and 4 for recent examples). The width of each chart represents a measure of the MPC's overall degree of uncertainty about the outlook. How far the bands stretch out on one side of the central band compared with the other – the skew of the distribution – is determined by an assessment of the balance of risks. And a table in Section 6 of the *Inflation Report* records any alternative views amongst the Committee about components of the inflation and activity outlook.

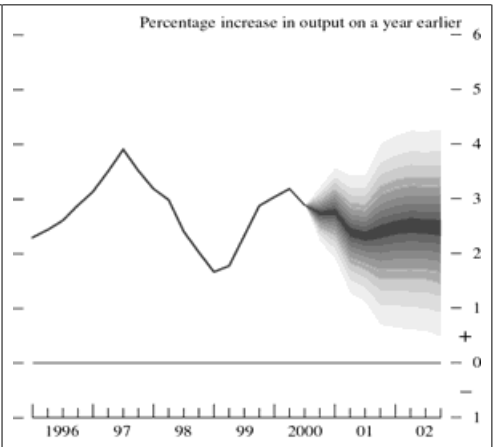
Chart 3. RPIX inflation projection in November 2000 based on constant nominal interest rates at 6%



Note: the fan chart depicting the probability distribution for inflation is rather like a contour map. At any given point during the forecast period, the depth of shading represents the height of the probability density function over a range of outcomes for inflation. The darkest band includes the central (single most likely) projection and covers 10% of the probability. Each successive pair of bands is drawn to cover a further 10% of the probability, until 90% of the probability distribution is covered. The bands widen as the time horizon is extended, indicating increasing uncertainty about outcomes.

Source: November 2000 *Inflation Report*

Chart 4. GDP projection in November 2000 based on constant nominal interest rates at 6%



Note: The fan chart depicting the probability distribution for output growth is rather like a contour map. At any given point during the forecast period, the depth of shading represents the height of the probability density function over a range of outcomes for output. The darkest band includes the central (single most likely) projection and covers 10% of the probability. Each successive pair of bands is drawn to cover a further 10% of the probability, until 90% of the probability distribution is covered. The bands widen as the time horizon is extended, indicating increasing uncertainty about outcomes.

Source: November 2000 *Inflation Report*

4. Money, credit and the Bank's suite of models

In forming their inflation projection, MPC members use a 'suite' of economic models to organise their thoughts and provide a starting-point for their overall forecast judgments. One element of this suite is a macroeconometric model (MM), which includes equations for each of the key behavioural relationships in the UK economy. The model is kept under continual review, and the most recent version was published in September 2000.[5] But it is clear that, given substantial uncertainty over the true structure of the economy, and the need in any model-building exercise to focus on some economic interactions at the expense of others, no single model is likely to be able to encompass all possible factors bearing on the inflation outlook. The MM is therefore supplemented by a suite of auxiliary models designed to address potential omissions from the core model, to analyse specific policy issues, or to act as a potential check on the output of the MM.

Money and credit provide a good example of the suite in action. The MM has three central properties desirable of any modern model used for providing monetary policy advice. First, the long-run equilibrium path for real variables is independent of the level of prices in money terms. Second, there is no long-run trade-off between inflation and output. And, third, the level of prices in money terms, and the rate of inflation, depend

[5] 'Economic models at the Bank of England: September 2000 update', Bank of England. The suite of models approach is set out at more length in the previous edition of 'Economic models at the Bank of England', published in April 1999. Both publications are available on the Bank's web site, www.bankofengland.co.uk.

on monetary policy. In common with nearly all large-scale macroeconometric models used in other central banks and research institutions, however, whilst the MM contains a money demand equation, the potential active roles for money or credit in the transmission mechanism are less well-developed. If such models were the only tools used for generating inflation projections, these projections might miss important factors affecting the outlook for inflation, at least under certain shocks or at certain points in the cycle.[6] It is therefore important that the MPC has access to alternative models capable of capturing and quantifying any incremental information in money and credit, and acting as a cross-check on the output of the MM and other models in the suite. Extensive research work at the Bank of England over the past few years has generated a rich set of empirical and theoretical models suitable for this purpose. Most of this material has been published, and is available on the Bank's web site.[7] As part of the QMA, Bank staff use these models to provide the MPC with an updated analysis of the potential information in money and credit at an early stage in each forecast round.

5. The objectives of the Quarterly Monetary Assessment

Implicit in the suite of models approach is a recognition that views about the role played by different variables, including (alternative definitions of) money and credit, may vary across academics, informed commentators and policy-makers. A central aim of the QMA is to reflect this range of views by offering policy-makers a menu of alternative projections and simulations, depending on the extent to which monetary variables are thought to be playing an active role in the transmission mechanism.

Broadly speaking, monetary variables may be thought of as having three roles in setting policy, and the content of the QMA reflects this. First, money and credit may be useful *indicators* of developments elsewhere in the economy. Monetary statistics are available more rapidly than most other economic data, and are usually drawn from a complete population, making them less vulnerable to sampling variation. So they may assist policy-makers by providing an early, independent read on economic events in a world of lagged and noisy data. Statistical evidence on the value of this information is given in Astley and Haldane (1995).

Money and credit can be useful indicator variables even if they have no causal, or amplifying, role in the transmission mechanism. If they do play such a role, however, they can also help policy-makers by providing incremental information on the transmission of shocks through the system, at least at certain points in the cycle. This is likely to be more of a medium-run exercise, and is one area where the models used in the QMA can clearly complement the output of the macroeconometric model, and help to illuminate key issues in the preparation of the inflation projection. Encompassing this information reduces the probability of making policy mistakes.

The third potential role for money and credit lies in signalling the long-run *stance* of monetary policy – i.e. pressures likely to affect the medium to long-run determination of inflation. On this view, money provides incremental information on the tightness or looseness of policy over and above other measures, such as the short-term interest rate

[6] See, for example, Nelson (2000b) for a recent study of the possible incremental information contained in monetary variables.

[7] A selection of references is given at the end of this paper; most are also available on the Bank's web site.

and the output gap. Though related to the second view, in the sense that money contains incremental information to other variables, the distinguishing characteristic of this view is the explicit link to the long-run stance of policy itself.

6. The content of the Quarterly Monetary Assessment

6.1. Money and credit as indicator variables

The aim of the first strand of the QMA is to extract information from the money and credit aggregates about the short-run outlook for activity and inflation. Models based on household and corporate data are used to draw conclusions about the near-term outlook for consumption and investment, and models based on whole economy aggregates are used to generate projections for aggregate nominal demand. As explained in Section 3, the weight given to sectoral money and credit data follows a long-standing tradition at the Bank of England, reflecting a view that sectoral relationships may be more stable than those at an aggregate level.[8]

6.1.1. The short-run outlook for consumption

Most of the indicator-variable projections in the QMA are based on a modelling philosophy set out in Thomas (1996, 1997a, 1997b) and Janssen (1996b). The approach begins with the specification of a money demand function, which summarises the relationship between households' money holdings and their income, wealth and relative opportunity costs of holding alternative assets. Single-equation estimates of money demand relationships can be useful tools in monetary analysis, but they do not allow for the fact that – for broad money aggregates in particular, which consist largely of the liabilities of the banking sector – money and nominal income/expenditures are likely to be jointly endogenously determined along with credit quantities, interest rates and other variables. From an econometric perspective, this suggests that system estimation will be required to obtain consistent estimates of the parameters of interest.

Table 1. Long-run money demand function and long-run consumption function

Long-run household money holdings

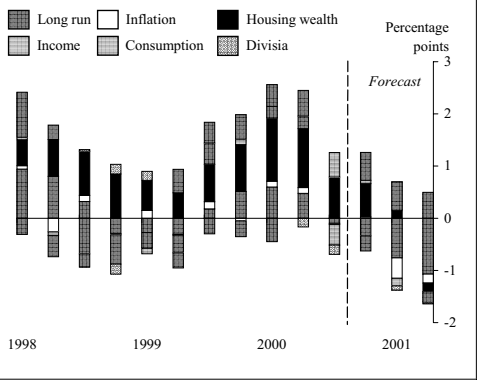
$$m^* = 0.5y_t + 0.5w_t + 0.44\,(i_{dt}-i_t) - 1.6\,\pi_t$$

Long-run consumption function

$$c^* = 0.9y_t + 0.1w_t - 0.64(i_t-\pi_t) - 1.21\Delta u_t$$

m = log real household sector M4
y = log real household disposable income
w = log gross real household sector wealth
i_d = own-weighted average interest rate on household sector M4
i = three-month Treasury bill rate
π = annualised inflation rate in consumption deflator
c = log real consumption expenditure
u = unemployment rate

Chart 5. Detrended contributions to annual real consumption growth



[8] For further details on this see, for example, Thomas (1997a).

The next stage of the Bank's approach is therefore to specify a general vector autoregression (VAR) in households' money holdings, consumption, income, wealth, inflation and interest rates. From this system, two long-run relationships are identified, which – after imposing and testing a series of theory-consistent restrictions – are interpreted as a long-run consumption function and a money demand equation. Table 1 shows examples of the type of equations achieved, taken from Thomas (1997a). Households' real long-run broad money holdings are increasing in both income and wealth, with a joint coefficient of unity, increasing in the *relative* interest rate on deposits, and decreasing in inflation, proxying the relative return between real and financial assets. Real consumption is increasing in income and wealth – again with a joint unit coefficient – decreasing in a measure of the real interest rate, and decreasing in the change in unemployment, a proxy for precautionary saving.

If households' actual money holdings were continuously demand-determined, if the estimated money demand equation correctly captured the true structural relationship and if all of the right-hand side variables in the equation were measured without error in real time, money would contain no incremental information about the economy over and above that contained in those variables. In practice, however, none of these conditions is likely to hold. Even if money holdings were entirely demand-determined, data on money are available earlier, and with less chance of error,[9] than those on incomes, prices and wealth, so can provide policy-makers with valuable indicator information. And the buffer-stock theory of money demand suggests that agents may not always lie on their long-run demand function. If adjusting portfolios is costly, or yields are sluggish to adjust, households may be willing temporarily to accept higher or lower money balances as an abode of purchasing power. Money demand equilibrium is then restored only gradually, as individual agents attempt to eliminate any excess holdings through purchases of goods and real and financial assets. In this scenario, money plays an incremental role in the transmission of shocks.

These considerations suggest that there may be useful information in both money growth, and in any gap between actual money holdings and the estimated long-run demand. To capture both of these potential effects econometrically, the estimated long-run relationships are embedded in a first-difference VAR, and this system is then tested down to give a parsimonious vector error correction mechanism (VECM) representation. Consistent with the discussion above, residuals from the long-run money demand function are found to help explain the path of consumption. So the resulting system expresses consumption growth as a function of both monetary growth and 'money gaps'. For given assumptions about the exogenous variables, the model can therefore be used to generate 'money-based' projections for future consumption growth. The QMA involves a full description and analysis of these projections, together with a comparison with other non-money based profiles.

An example of the type of analysis which can be presented to the MPC using this class of model is given in Chart 5, which shows detrended contributions of the major determinants of real consumption growth from a version of the Janssen (1996b) household Divisia[10] model. For this particular projection, strong past growth in household

[9] Because they are drawn from a complete, or near-complete, population, so there should be little or no sampling variation.

[10] Divisia is a measure of money holdings that weights each component by a measure of its liquidity and hence the likelihood that it will be used for consumer spending. The construction of the Bank's Divisia indices is described in Fisher, Hudson and Pradhan (1992).

Divisia is predicted to lift consumption growth over the forecast period, but this effect is offset by other factors.

Even within the class of monetary models, there is debate about which monetary aggregate best captures the concept of money likely to be most closely associated with activity. So, as part of the QMA, forecasts are presented from both the household M4 and household Divisia models, together with output from a model based on narrow money. These projections have been helpful in highlighting influences on consumption which may have been missed by other forecasting approaches that omit an explicit role for money.

6.1.2. The short-run outlook for investment

A similar exercise is carried out for the corporate sector, using sectoral information on the financial position of the corporate sector. The model used is based on Brigden and Mizen (1999), and is functionally similar to the consumption model described above. The main difference is that, in addition to equations for corporate money demand and investment expenditure, the model also includes a long-run relationship describing firms' bank borrowing. The rationale for this is that firms have greater capacity to manage their net liquidity position than households, so looking at only one side of their balance sheets could give a particularly misleading picture. It also allows the model to capture elements of any credit channel effects, which may affect certain firms (these are discussed in greater detail in Section 6.2). As with consumption, the model relates investment to both change and disequilibrium terms in firms' net liquidity position. The QMA shows projections for investment based on these relationships. And, as with consumption, the models also provide a range of diagnostics, such as that given in Chart 6, which plots corporate borrowing and deposits relative to their estimated long-run levels. This type of analysis can help to enrich the analysis of particular forecast issues even where the QMA projections themselves are not given a central role in the MPC's own assessment.

Recent years have seen significant changes in the structure of corporate finance in the UK. A stronger government fiscal position and lower inflation, together with increased internationalisation and innovation in capital markets, have led firms progressively to shift more of their liabilities from bank to market-based finance (see Chart 7).

Chart 6. Corporate money and credit: deviation from estimated equilibrium levels

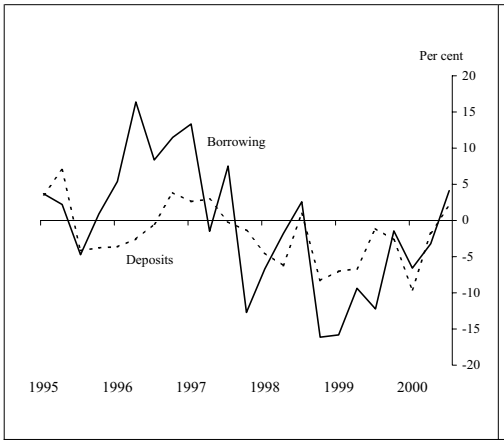


Chart 7. Bank borrowing as a proportion of the total financial liabilities of the corporate sector

As a result, some of the traditional relationships between bank deposits, credit and investment have become less reliable over time. The links between firms' overall financial position, activity and inflation remain a key focus of policy-makers' concerns, however, and this has suggested a number of new avenues for research. Recent Bank work has, for instance, included the development of a calibrated corporate 'financial accelerator' model for the UK, along the lines of that proposed by Bernanke, Gertler and Gilchrist.[11] This class of model links firms' spending behaviour to their overall financial position via an external finance premium, and offers a potentially rich range of insights into the role of credit in the transmission mechanism, the effects of financial innovation, and the impact of bubbles and other asset price phenomena.

6.1.3. The short-run outlook for aggregate nominal activity

The final element of the indicator-variable component of the QMA uses VECMs based on whole-economy money aggregates to derive short-run forecasts for nominal GDP, inflation and real activity. Again, a range of projections are presented from models based on alternative monetary aggregates: narrow money (M0), retail money (M2) and broad money (M4). Those who believe that base money contains most information about the stance of monetary policy, and therefore inflationary pressures, may place greatest weight on the output of the M0 model. And those who place more faith in broader aggregates may take greater notice of the M2 and M4 model projections.

The reason for producing models based on both M2 and M4 relates mainly to the behaviour of non-bank financial firms, or 'OFCs', the money holdings of which are captured in M4, but have little impact on M2. Recent years have seen sharp growth in OFC balance sheets, associated with the structural changes to the corporate sector discussed above, the growth in asset prices, the increased use of securitisations of retail portfolios, and so on. This growth has also been associated with sharp fluctuations in OFCs' money holdings, and therefore in M4 (see Chart 8). Some commentators believe that the money holdings of at least part of the OFC sector may have a causal impact on inflation via their effects on asset prices. Others prefer to see OFCs' money as primarily reflecting volatile financial activity, or the precise way in which financing arrangements are constructed, with little implication for the prices of goods and services.[12] In the absence of conclusive evidence it is important that policy-makers have access to projections consistent with either interpretation. The QMA therefore presents forecasts from both M2 and M4 models.

One simple way of deciding on which model to rely most is to weight the projections of each model according to their past performance. The QMA therefore also provides a summary set of forecasts formed by weighting together the outputs of the M0, M2 and M4 models. To the extent that the explanatory power of each model may vary according to the nature of the shocks hitting the economy, however, such a fixed weighting scheme may be less appropriate. The summary diagnostic is therefore shown in addition to, and not instead of, the output of the individual models.

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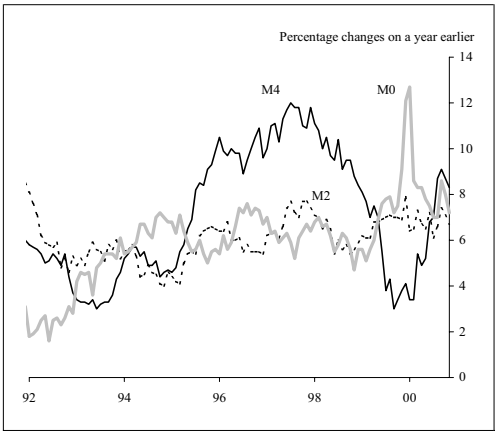
[11] See, for example, 'The financial accelerator in a quantitative business cycle framework' in Taylor, J.B. and Woodford, M. (eds), *Handbook of Macroeconomics*, Amsterdam: New Holland.

[12] These issues have been regularly discussed in the Bank's *Inflation Report.* See, for instance, the box on pages 6–7 of the May 1998 *Report*.

Chart 8. Monetary growth



6.2. Money, credit and the transmission mechanism

The second component of the QMA covers money, credit and the transmission mechanism. Much of this involves a careful assessment of prevailing credit conditions. A key insight from the recent 'credit channel' literature[13] is that – contrary to the predictions of simple neoclassical models – credit may play a separate role in the propagation of economic shocks. This issue is likely to be most acute at times of potential financial instability, such as the events related to Russia and LTCM in 1998, when policy-makers spent considerable time assessing the financial health of the UK financial and private sectors.[14] But it is not necessarily limited to such periods. As the recent financial accelerator literature stresses, if the effective cost of capital depends not just on observed rates but also on agents' financial positions, credit conditions could also contain incremental information relevant to an assessment of the true cyclical position of the economy.

At present, much of the QMA assessment in this area is based on careful data analysis, backed by a substantial pack of charts and tables summarising the latest developments in credit conditions. The analysis includes a review of households and firms' financial positions – including an assessment of gearing levels – a review of non-price credit effects and an appraisal of the private sector's borrowing capacity. A simple example of the type of data on which this analysis is based is given in Chart 9, which compares households' debt/wealth and debt/income ratios, two alternative measures of household gearing.

Increasingly, however, this analysis is also being informed by the type of more formal theoretical and empirical work discussed elsewhere in this paper. As mentioned above, the Bank has developed a calibrated financial accelerator model of the UK corporate

[13] A summary of key aspects of this literature is given in 'Inside the black box: the credit channel of monetary policy transmission' by Bernanke, B. and Gertler, M., *Journal of Economic Perspectives*, 1995, Vol. 9, pages 27–48.

[14] See, for instance, section 1 of the November 1998 *Inflation Report*.

Chart 9. Household sector gearing ratios

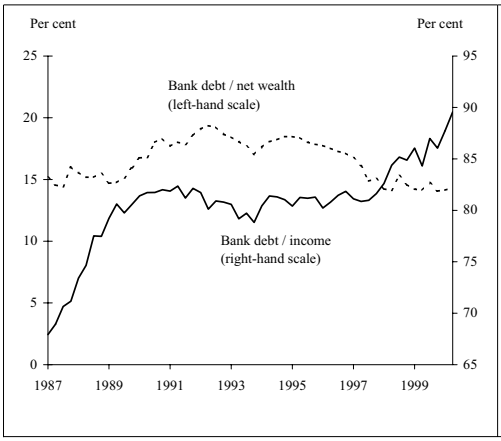
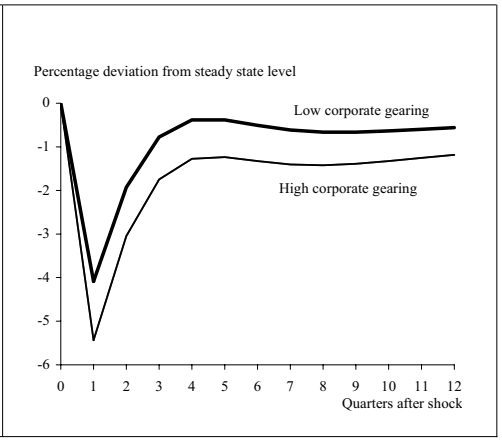


Chart 10. Response of investment to a 100 basis points monetary policy shock



sector. Work is currently under way on a similar model for the household sector. And it is hoped that in the future these theoretical models will be supplemented by more detailed econometric studies based on micro data sets. An attractive aspect of the calibrated theoretical models is that they not only provide a quantitative link between measures of financial health and expenditures, they also allow staff to perform a wide variety of scenario analyses based on alternative hypotheses about possible future shocks or changes to the structure of the economy, such as financial innovation. An example of this type of analysis is given in Chart 10, which shows how the response of investment in the model to a monetary policy shock varies under alternative assumptions about gearing levels. Because of its relative simplicity, the model does not capture every aspect of the data – such as the speed of adjustment in response to shocks – particularly well. But it can, for example, be used to provide an estimate of the incremental effect of higher gearing on the level of investment under alternative scenarios.

6.3. Measures of the longer-term monetary stance

The final element of the QMA is based on the idea that data on money and credit may contain information relevant to the assessment of the monetary stance – and therefore longer-run inflationary pressures. As a simple cross-check, the MPC is presented with the output from some simple monetary policy rules, including a McCallum rule[15] estimated for the United Kingdom and a Taylor rule.[16] It also includes a rule based on an empirical implementation of the Brainard[17] result, which suggests that policy-makers who are uncertain about key parameters in the economy may in certain circumstances

[15] McCallum's original rule for the United States is given in 'Robustness properties of a rule for monetary policy,' *Carnegie-Rochester Conference Series on Public Policy*, Volume 29, 1988, pages 53–84.

[16] Taylor's original rule for the United States is given in 'Discretion versus policy rules in practice', *Carnegie-Rochester Conference Series on Public Policy*, Volume 39, 1993, pages 195–214.

[17] See 'Uncertainty and the effectiveness of policy', Brainard, W., *American Economic Review*, Volume 57, 1967, pages 2–19.

behave more conservatively, and draws on published work by Martin and Salmon (1999). Bank staff are developing a range of other measures of the monetary stance, which may be used in future QMAs.

In addition to these measures, the MPC is provided with an analysis based on a monetary structural VAR (or SVAR) of the UK economy developed by Dhar, Pain and Thomas (2000). An important lesson drawn from experience with earlier models was that, in general, there is no single deterministic link between money, activity and inflation. In practice, all three are endogenous to some degree, so the precise relationships will depend on the fundamental shocks driving the economy at any point in time. Policy-makers should therefore beware of drawing firm inferences about future inflationary pressures solely on the basis of simple monetary statistics. Before drawing policy conclusions, a view must be taken on the likely structural shocks driving the economy. SVARs represent one way of attempting to identify these shocks.

The model used in the QMA is estimated as follows. Starting from an eight-variable levels VAR in real money, incomes, inflation and a vector of asset prices, four long-run relationships are identified, including a money demand equation, a term structure relationship, and an asset pricing function. Theory-based restrictions are then used to identify four permanent and four temporary shocks. These include both temporary and permanent monetary policy shocks, and two types of velocity shock, one reflecting changes in the provision of credit by the banking system, and one reflecting changes in liquidity preference.

In the model, different shocks have different implications for the cross-correlation patterns of money, activity and prices. This has long been understood in a relatively informal way from the monetary assessment side. But the formalisation and quantification of this idea represents a key advance from this research. The model also provides Bank staff with a highly flexible tool for use in longer-term policy analysis and advice.

7. The MPC's inflation projection, the suite of models and the QMA

The inflation projection published in the quarterly *Inflation Report* is drawn up by, and owned by, the MPC. In producing its forecast, assisted by Bank staff, the Committee is able to draw on the analysis prepared in the QMA, other parts of the suite of models, or any other sources. In principle, the MPC might use the QMA output in several different ways. First, the indicator-variable projections might be used to help set the short-term constraints for the MPC's own central projection, improving the data set for the very near-term outlook. Second, the material on money and credit in the transmission mechanism might be used to adjust the output of simpler equations on the MM or elsewhere where it was thought that the money or credit data contained incremental information. Third, the longer-run projections and measures of monetary stance provide a potential cross-check on the provisional outputs of the forecast. And, fourth, any or all of the QMA material could help the MPC to assess the risks around possible central projections, reflected in the inflation and GDP fan charts, or the table in Section 6 of the *Inflation Report*, which records alternative views about the inflation and activity outlook.

By providing a menu of alternative projections, the QMA recognises that different policy-makers may have different interpretations of, or put different weights on, developments in the money and credit data. Some of the models described here may also be

thought to have more relevance at some points in the cycle, or in certain market conditions, than others. There is therefore no mechanical link between the material provided, and the MPC's final projections for GDP and inflation. Nevertheless, it is important that Committee members are made aware of, and are able to draw on, the best possible technical representations of these alternative paradigms if they are to minimise the risks of making policy mistakes.

8. Conclusions and challenges for the future

Whilst understanding of the role of money and credit has developed considerably over the past twenty years, much remains to be done. Reflecting this, Bank staff are highly active in monetary research and analysis, and the results of this work are regularly used to update and extend the contents of the QMA. There are many potential avenues for investigation, but three broad themes stand out.

First, the difficulty of predicting trend velocity remains a key challenge, both for policy analysis and for technical modelling. After a period of relative stability in the first half of the 1990s, both narrow and broad money velocity has fallen sharply in the UK. Lower inflation and nominal interest rates may be able to explain part of this shift, but by no means all. Understanding the reasons for this shift, and predicting when and where it may end, is a key priority.

Second, and closely related, monetary analysts need to remain abreast of the developing role of money and credit in a world of constant structural change. The financial structure in the UK and elsewhere continues to evolve rapidly. Recent years have seen a substantial shift of corporate finance away from bank, and towards non-bank, sources (a trend accompanied by a sharply increased role for non-bank financial intermediaries). There has been extensive innovation in retail markets. And the move to a lower-inflation environment has had a series of effects on the demand for money and credit. These and other developments create new challenges for our understanding of the role of financial quantities variables.

Third, experience at the Bank of England in recent years has underlined the importance of understanding the nature of the economic shocks affecting the money and credit aggregates. Whilst central banks have accrued enormous experience in shorter-term analysis of the monetary data, more work needs to be done in using these lessons to shape and inform our more formal technical and empirical models. And there are important lessons to be learned from real-side research and analysis, much of which is grappling with similar issues.

This is a challenging agenda. But it emphasises the importance of continuing to push forward our understanding of monetary developments. The Bank of England hopes to play a full part in this debate.

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Money and inflation: the role of information regarding the determinants of M2 behavior

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Board of Governors of the Federal Reserve System

1. Introduction

The principle that inflation and deflation are fundamentally monetary phenomena has been one of the best understood and empirically well founded notions in monetary economics. Over history, whenever central banks have allowed money growth to systematically surpass the natural growth of the economy, sooner or later inflation inevitably followed. Likewise, serious deflationary episodes have invariably been associated with sustained shortfalls in money growth.

Recognition of this fundamental principle over the years has led many central banks to place special emphasis on reigning in money growth in a continuing effort to pursue and maintain price stability over time. And consequently, monitoring the growth rate of money has long been part of the standard monetary practitioner's toolkit.

In the United States, it is by now well understood that the two episodes most commonly seen as major monetary policy failures since the founding of the Federal Reserve, namely the Great Depression of the 1930s and the Great Inflation of the 1970s, were episodes where policymakers failed to properly monitor and heed the warnings present in the behavior of money. In large part because of these experiences, the Federal Reserve has regularly monitored the growth of money since the late 1970s.

However, the behavior of monetary aggregates may not always serve as a particularly reliable guide to inflation. Over shorter horizons, in particular, cyclical developments and transitory changes in the velocity of money present non-trivial complications. Simple measures of money growth may not always reliably foreshadow subsequent movements in inflation. From this perspective, the benefits of close monitoring of the behavior of monetary aggregates as indicators of inflation over shorter horizons may not always appear very large.

The process of constructing monetary aggregates is inherently an empirical enterprise, fraught with the difficulties of any such enterprise. Over longer horizons, financial

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innovation and secular changes in the economy imply that the meaning and usage of money may evolve over time in ways that may require reevaluation of existing empirical concepts and measurement methods regarding the aggregates. The creation of a new financial instrument, for instance, typically requires a judgment regarding its placement within existing definitions of the monetary aggregates and could lead to long-run changes in the velocity of circulation of existing measures. Such innovations often require time and internal debate before the appropriate treatment can be determined. They also highlight that, as a practical matter, there is not, indeed there cannot be, a unique satisfactory empirical definition of money. And this difficulty is one reason why multiple measures are typically defined and monitored.

Because of these difficulties, the empirical usefulness of monetary aggregates as indicators of inflation over various horizons depends on the ability of central banks to distinguish movements in the aggregates that reflect underlying inflationary developments from those that arise as a result of other factors. This ability may be quite difficult to quantify in practice. For example, despite their general usefulness, simple statistical techniques mechanically applied to aggregate data cannot capture information regarding special factors influencing specific monetary aggregates at any given time. Such techniques may also fail to detect important structural shifts in statistical relationships that could be explained – sometimes even predicted – if additional information were brought to bear. Indeed it is precisely for this reason that judgment plays an important role in interpreting monetary aggregates in practice.

Surely, interpreting monetary aggregates may be a highly uncertain task, especially during periods when structural change is potentially occurring. However, central banks by the very nature of their operations, such as the close contact with financial institutions and markets, and the continuous monitoring of banking institutions, including the systematic collection of detailed information on bank balance sheets, are in a unique position to accumulate and interpret information regarding monetary aggregates. Failing to account for this central bank capability may easily obscure the usefulness of monetary aggregates. But neither the uncertainty involved in the process, nor the difficulty of quantifying the usefulness of monetary aggregates imply that the emphasis placed by central banks on monitoring monetary aggregates is misplaced.

In this paper, we examine the relationship between the behavior of M2 and inflation in the United States over the past forty years and attempt to draw some lessons regarding the usefulness of employing this aggregate for guidance regarding inflation. In particular, we investigate the role of changes in equilibrium velocity in understanding the relationship between M2 and inflation and also examine the role of special factors in assessing the underlying strength of money growth. Examining the behavior of M2 in this regard is particularly helpful for two reasons. First, because the behavior of M2 has been monitored relatively closely by the Federal Reserve during the past two decades and was one of the aggregates emphasized by the Federal Reserve for communicating monetary policy during this period. Second, because a number of factors including a major wave of restructuring in the banking sector and financial innovation dramatically changed the velocity of the aggregate over a period of several years during the early 1990s. These developments created considerable difficulties and uncertainty in interpreting the behavior of the aggregate during that period.

We use the experience of M2 during the 1990s as an example to illustrate how failing to account for changes in equilibrium velocity could have obscured the usefulness of

M2 in providing information regarding inflation. In addition, using examples from the 1990s, we discuss the relevance of taking into account special factors in evaluating the movement in this aggregate.

2. Velocity and the equation of exchange

The equation of exchange defines the velocity of money and serves as the cornerstone for virtually any examination of the relationship between money and inflation. Let M denote the stock of money in circulation, Q real output and P its price. The equation of exchange defines the velocity of money, V, such that

$$MV = PQ\,. \tag{1}$$

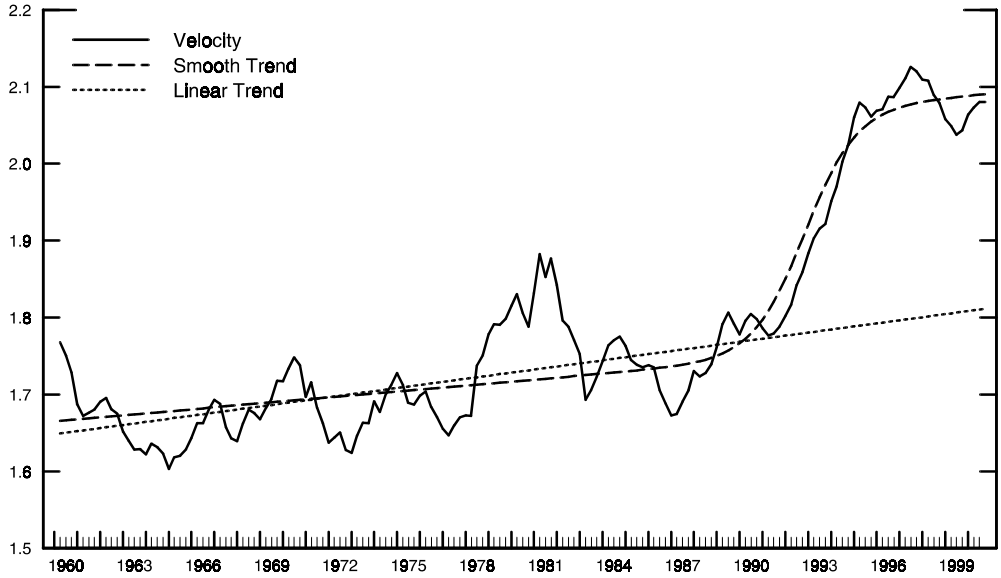
If the velocity of money were nearly constant over time or nearly perfectly predictable, this relationship would present a direct and immediate link between money and nominal income so that, controlling for cyclical fluctuations in real output, the price level and inflation could be read simply by observing money. In practice, the velocity of money may vary considerably over time and, as a result, understanding its movements becomes essential in assessing the inflationary implications of particular patterns of money growth. The solid line in Figure 1 plots the velocity of M2 in the United States from 1960 to 2000.[1] The plot confirms that there has been significant variation in this measure of velocity.

It is useful to be aware of and distinguish between two potential sources of this variation, namely changes in the underlying trend of velocity such as due to the continuing improvement of financial services and financial innovation, and cyclical changes associated with short-run deviations of velocity from its underlying long-run trend. Two alternative estimates of the underlying trend are plotted in Figure 1. The first represents a linear trend fit through the logarithm of velocity using data from 1960 to 1989 only (the dotted line). As can be seen, since perhaps 1992, actual velocity has deviated systematically from this underlying trend in a way that suggests a possibly gradual upward shift in equilibrium velocity. Thus, based on the history of velocity during the 1990s, the linear trend estimated and evident over the earlier sample does not appear as an adequate representation of the underlying trend over the full period. The plot also shows an alternative estimate, which is represented by the smooth trend plotted with a dashed line. This measure captures a gradual increase in velocity during the early 1990s, suggesting a significant upward shift by the mid 1990s, which lies above the earlier established trend in velocity.

Although this figure indicates that the underlying trend in velocity veered upwards, it does not make clear how one could determine with any accuracy when exactly this upturn may have occurred and whether the change was gradual or not. Equally importantly, it does not offer guidance as to how one could have detected this shift early in the 1990s based on this one series alone. Compare, for instance, the increase in velocity from 1976 to 1980 and the increase from 1989 to 1993. The two appear about as steep and virtually equally dramatic. In retrospect, the late 1970s shift appears to have been almost certainly transitory in nature while the early 1990s shift appears to be a permanent feature of the data. Such a distinction, however, cannot be reliably made without

[1] This chart utilizes quarterly data available as of November 2000.

Figure 1. M2 Velocity and Underlying Trends



Notes: The linear trend is estimated by regressing the logarithm of M2 velocity on a time trend from 1960 to 1989. The smooth trend extends the sample to 1999 and is estimated as explained in the text.

additional information. Though making such a distinction may appear problematic at first, it can actually be quite simple and straightforward once additional information is brought to bear.

Traditional theories of the demand for money posit that velocity fluctuates from its underlying trend with the opportunity cost of holding money, OC. Letting $\widetilde{OC}$ denote deviations of the opportunity cost of money from its average norm, a simple way to capture this relationship is as follows:

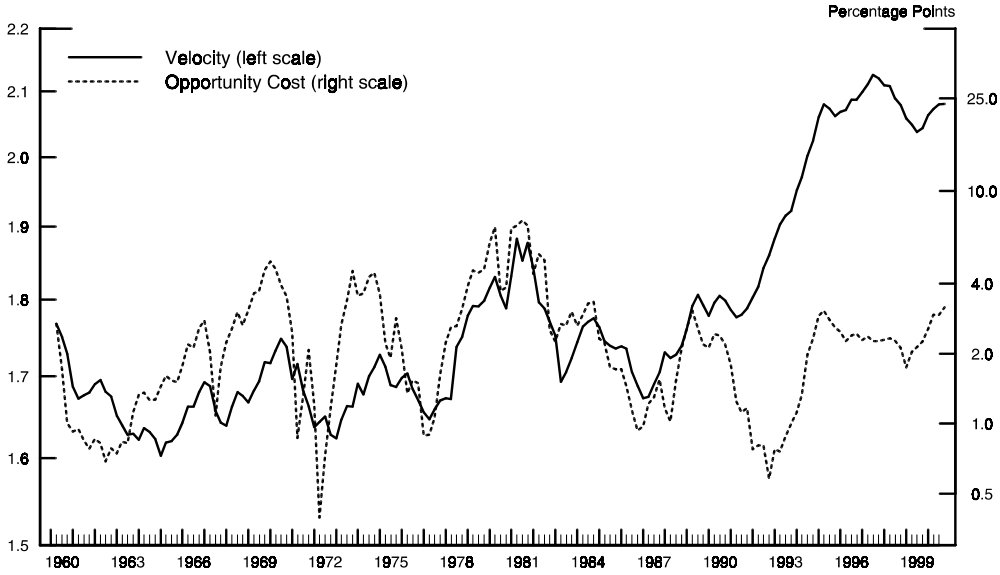
$$\log(V_t) - \log(V_t^*) = \alpha_1 \widetilde{OC} + u_t \,. \tag{2}$$

If the variation in the opportunity cost accounts for a large fraction of the variation of velocity from its underlying trend, V^*, using this relationship would make detection of changes in the underlying trend much easier. Figure 2 plots M2 velocity against the opportunity cost of M2 and confirms that such costs do explain a large fraction of the cyclical movements in velocity. We construct the opportunity cost of M2 as the difference between the yield on the 3-month Treasury bill and the average rate paid on M2 balances. As shown, while a small linear trend may have indeed been an adequate characterization of the underlying trend in V2, starting as early as 1990 a divergence in the behavior of velocity relative to the behavior of its opportunity cost could be observed. By 1991 the evidence for a significant structural change was becoming overwhelming.

The following regression combines the systematic money demand relation posited in equation (1) with a smooth underlying trend for velocity:

$$\log(V_t) = \alpha_0 + \alpha_1 \widetilde{OC} + \alpha_2 TIME_t + \alpha_3 S_t + u_t \,, \tag{3}$$

Figure 2. Velocity and Opportunity Cost



where

$$S_t = \frac{1}{1 + e^{-\xi(t-\tau)}} \,. \tag{4}$$

The estimation defines implicitly the trend underlying equilibrium velocity as:

$$\log (V_t^*) = \alpha_0 + \alpha_1 TIME_t + \alpha_3 S_t \,. \tag{5}$$

This specification nests the linear trend specification, $\alpha_3 = 0$, as well specifications allowing for a one time shift in the equilibrium velocity as could be captured by a dummy variable. To see this point, observe that for very large values of ξ, S_t essentially collapses to a step function that equals zero when $t < \tau$ and equals one when $t > \tau$. In this case, the estimate of τ offers the best estimated location of the structural break represented by introducing a dummy variable into the demand function.[2]

Estimation of equation (3) with non-linear least squares yielded the estimated smooth trend for equilibrium velocity shown in Figure 1. The estimated midpoint of the transition (determined by τ) is 1992Q3. The data suggest that this shift did not take place overnight with the speed of the transition (determined by ξ) indicating that about one quarter of the adjustment had taken place by 1991Q2 and about three quarters by 1993Q4.[3]

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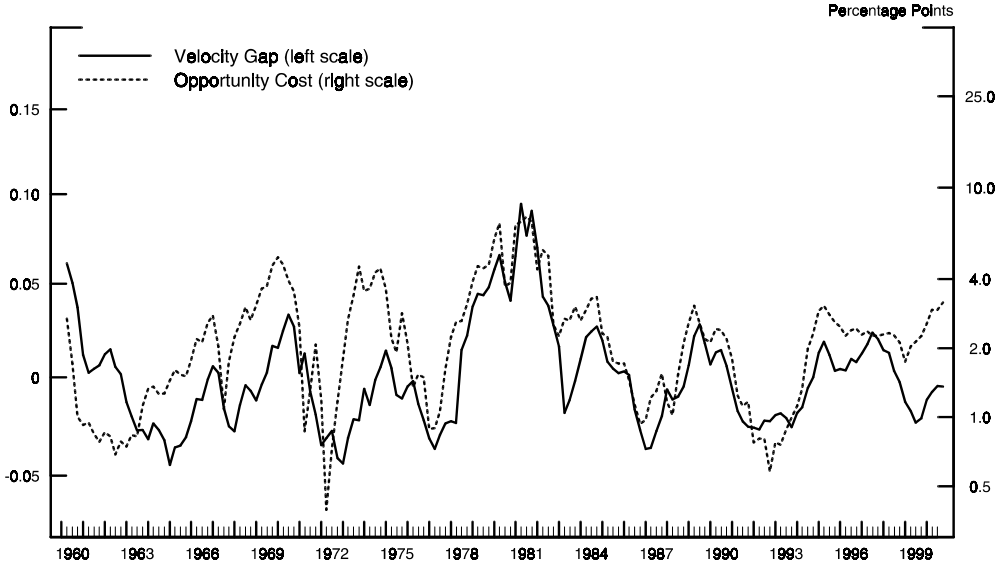
[2] This specification, of course, should be seen as one of several possible approximations for detecting and capturing the 1990s shift in M2 velocity. For instance, Carlson, Craig and Schwartz (2000), Carlson, Hoffman, Keen and Rasche (2000) and Sephton (2000) examine alternative treatments.

[3] While our argument does not depend on what caused the shift in velocity in the early 1990s, our assessment is that the inclusion of the smooth velocity shift term may be an appropriate modeling strategy, at least given our understanding of the forces at work. One of the most important forces was the thrift and banking crisis. The resulting closure of institutions greatly disrupted de-

Figure 3. Velocity Gap and Opportunity Cost



Notes: The velocity gap is defined as the logarithmic difference between M2 velocity and the estimated equilibrium velocity corresponding to the smooth trend in Figure 1.

Figure 3 plots the resulting velocity gap, that is the difference between actual velocity, V, and its underlying equilibrium trend, V^*, against the opportunity cost of M2 balances. As can be seen, once the gradual increase in equilibrium velocity is accounted for, the variation in the velocity gap can in large part be accounted for by the variation of the opportunity cost of M2 balances both before the 1990s as well as during the 1990s.

An important question is the extent to which the dramatic shift in equilibrium velocity reflected in the smooth estimate in Figure 1 was detected in real-time or could have been detected during the transition e.g. around 1992–1993. In an earlier study, Orphanides and Porter (2000), we demonstrated how the shift could have been picked up in real-time, as it was in actuality. Indeed, the shift in equilibrium velocity was

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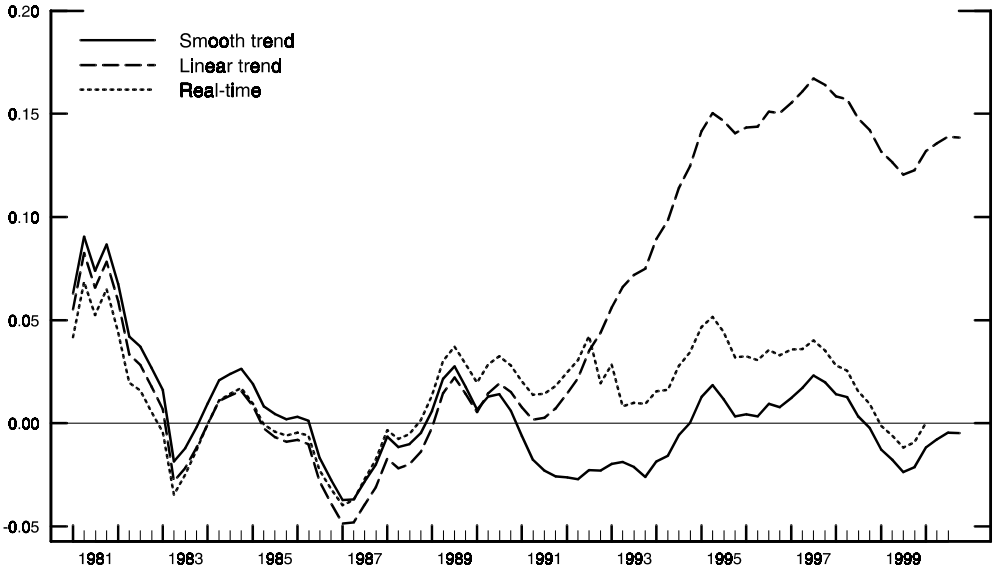
posit relationships, sometimes repeatedly, particularly in the case of brokered CD accounts at high-flying thrifts. This crisis also altered the legislative and regulatory landscape in significant ways. It lowered the safety net on deposits. It made banks and not the government bear more of the burden for mistakes, and it led to a significant tightening up on lending standards. At the same time, as depositors were feeling more uncertain about their banking relationships, stock and bond mutual funds were successfully gearing up to market an array of attractive fund products in an environment of a very steep yield curve, which apparently induced many households to reach for yield. The forces, which produced the shift, were thus numerous and undoubtedly interacted with one another. But, the most important thing to note is that none of the forces were primarily cyclical in nature but were secular, suggesting that a smooth time trend may be an adequate way to represent them. Thus, their existence does not in itself have to necessarily disrupt the cyclical part of the relationship embedded in the opportunity cost term. See Feinman and Porter (1992) for a contemporaneous attempt to understand the resulting weakness in M2, Orphanides, Small and Reid (1994) for an analysis of the resulting substitution of M2 balances with stock and bond mutual funds and Lown, Peristiani, and Robinson (1999) for a more recent perspective on the episode.

detected as early as 1991, although at the time it was obviously quite unclear how large and how long lasting the shift in equilibrium velocity would be. And, as we illustrated in our earlier study, simple statistical techniques, which recursively estimated new levels of V^* by incorporating the information regarding the divergence of V2 from its earlier relationship with the opportunity cost of M2, also captured this change, though with somewhat less precision and after some lag. Figure 4 compares the velocity gap obtained from one such recursive real-time estimate of V^* with the gaps based on the linear and smooth trend estimates shown in Figure 2. The recursive estimate shown corresponds to Estimate B in our earlier study. It allows for a time trend in velocity and one discrete shift captured by a dummy variable. Of the alternatives discussed in our earlier study, this specification is the one most closely related to our simple ex post characterization of equilibrium velocity shown in equation (5).[4] As is evident, incorrect reliance on a constant trend would have resulted in estimated velocity gaps that deviated substantially from the more accurate representation offered by the smooth trend estimate. On the other hand, the recursive estimates are much closer to the gaps based on the smooth trend and in that sense much less misleading.

The necessity of accounting for the movements of velocity for interpreting the behavior of money and its relationship to inflation is well understood. As we illustrate in this section, ignoring readily available information regarding changes in the underlying trend of velocity can lead, at least temporarily, to misleading interpretations of velocity.

Figure 4. Alternative Velocity Gaps



Notes: Each velocity gap is defined as the logarithmic difference between M2 velocity and an estimate of equilibrium velocity. The gaps based on the linear and smooth trends are based on the corresponding estimates shown in figure 1. The real-time gap is based on the recursive estimates described in the text.

[4] The V^* estimates used here were updated using current data to extend the sample coverage and maintain consistency with the other series employed in this study.

In the next two sections we investigate how accounting for this information regarding the changes in the equilibrium velocity of M2 during the first part of the 1990s could influence inference regarding the usefulness of M2 as both an anchor and indicator of inflation.

3. Money growth and inflation

Rewriting the equation of exchange in growth terms, approximated by logarithmic differences, allows restating this identity in terms of money growth and inflation. In this section, we use this well-known relationship to illustrate in a simple manner the significance of properly accounting for changes in equilibrium velocity in assessing the usefulness of money growth as an anchor for inflation.

For notational convenience, we use lowercase letters to denote logarithms, and adopt the standard notation $\pi = \Delta p$ for inflation and $\mu = \Delta m$ for money growth. Writing the equation of exchange in logarithmic form, $m + v = p + q$, and taking differences gives:

$$\mu + \Delta v = \pi + \Delta q\,. \tag{6}$$

As with the equation of exchange, this relationship is an identity and holds for any horizon over which growth rates are computed. To allow for a more convenient interpretation, it is useful to decompose the growth of output and growth of velocity into their long-run equilibrium components and cyclical components. Defining Q^* to denote the natural level of output (potential output), the cyclical component of output growth can be captured by the growth rate gap, $(\Delta q - \Delta q^*)$. Likewise, the cyclical component of velocity growth can be captured by the velocity growth gap, $(\Delta v - \Delta v^*)$. By definition, both of these gaps tend towards zero as the growth rates are computed over longer horizons.

Equation (6) can be restated in terms of the cyclical and long-run components of output and velocity growth as follows:

$$\mu + \Delta v^* + (\Delta v - \Delta v^*) = \pi + \Delta q^* + (\Delta q - \Delta q^*)\,. \tag{7}$$

Rearranging terms to express this relationship in terms of inflation yields:

$$\pi = \mu - \Delta q^* + \Delta v^* - (\Delta q - \Delta q^*) + (\Delta v - \Delta v^*). \tag{8}$$

This equation suggests a convenient decomposition of inflation into a cyclical component and a component determined by money growth adjusted both for the natural growth of output and changes in equilibrium velocity. Let μ^* reflect this adjusted money growth:

$$\mu^* \equiv \mu - \Delta q^* + \Delta v^*. \tag{9}$$

Collecting the two cyclical terms:

$$\eta = -(\Delta q - \Delta q^*) + (\Delta v^* - \Delta v)$$

and rewriting equation (8) yields:

$$\pi = \mu^* + \eta\,. \tag{10}$$

As this equation makes obvious, apart from cyclical effects that tend towards zero over medium- and long-term horizons, inflation should track adjusted money growth closely. Equation (10), of course, is simply a restatement of a relationship that is both fundamental and well understood. If the central bank's long-run objective is to achieve and maintain inflation at a low and stable level, π^*, then this relationship indicates that the central bank must ensure that money growth is set such that $\pi^* = \mu^*$ over time.

The relationship embedded in equation (10) has served as the basis for determining reference and monitoring values for the growth of monetary aggregates for a long time. Milton Friedman's famous prescription during the late 1960s and early 1970s that monetary policy in the United States should aim to keep the growth rate of M2 stable at four percent serves as an example. His prescription was based on the observation that equilibrium M2 velocity appeared to be close to a constant and the consensus view at the time that the natural growth rate of output was four percent. The prescription suggested that abstracting from cyclical effects, stable M2 growth at a four percent level would achieve near price stability. Another example is the monetary framework adopted by the Bundesbank from the mid 1970s until the 1990s.

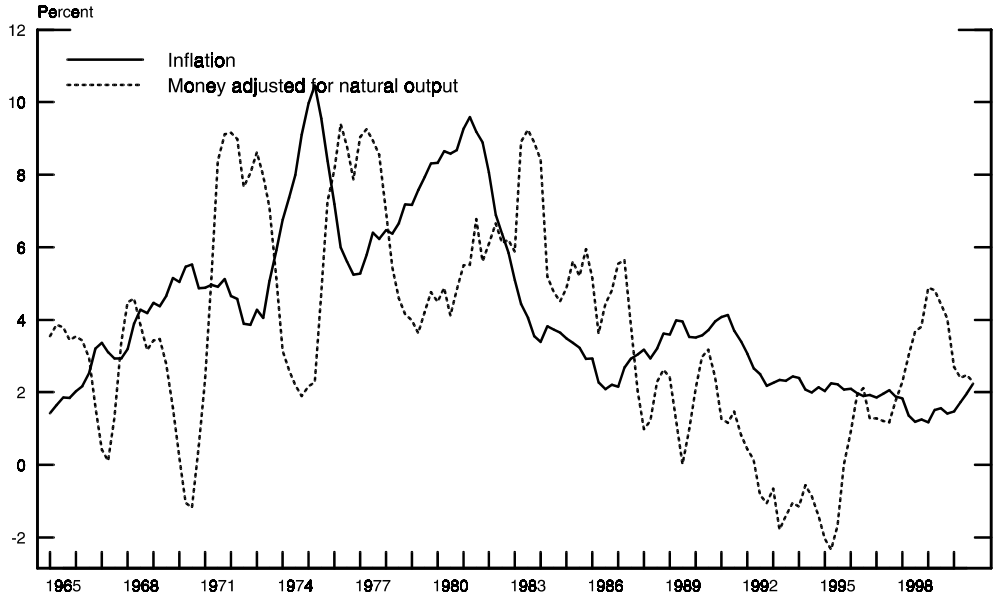
Although the relationship between inflation and money growth in equation (10) follows from an identity and should be beyond dispute, it is not always sufficiently appreciated. There are at least two reasons for this confusion. First, over short horizons, this relationship is in large part overshadowed by cyclical factors. Second, without the proper adjustment for changes in Q^* and V^*, money growth and inflation may not appear to track each other even over medium-run horizons. We illustrate each of these difficulties in turn.

In Figure 5 we plot inflation over four quarters against the growth rate of money over the same horizon adjusted for the natural growth rate of the economy.[5] (As mentioned earlier, this adjustment alone suffices if V^* is believed stable or has only a small constant trend. We examine shifts in V^* below.) The figure covers the 1965–2000 period, which includes the Great Inflation of the late 1960s and 1970s and the subsequent disinflation. Although the long inflation/disinflation cycle is evident in the inflation series, the growth rate of money exhibits such a high degree of volatility, especially during the first half of the sample, that the strong correlation over the medium run between the trend in inflation and that of money growth is rather difficult to detect in this figure. Concentrating on the period from 1965 to 1979 it is also clear from the figure that if the relationship between inflation and money growth were examined after first detrending the series, the data would suggest a strong *negative* correlation between inflation and money growth instead of a positive one. The obvious pitfall here, of course, comes from the fact that the most useful piece of information provided by money growth regards lower frequency movements in inflation so that *any* detrending of the series removes a crucial piece of information from the analysis. Although it is not uncommon in practice, detrending of inflation may be a seriously flawed procedure in disentangling the relationship between monetary aggregates and inflation.

To illustrate the usefulness of money growth in tracking inflation over longer horizons, Figure 6 shows the same data as Figure 5 but with each observation plotting the

[5] For Q^* we employ the most recent estimate available from the Congressional Budget Office.

Figure 5. Inflation and Money Growth: One-Year Horizon Adjusted for Natural Output Growth



five-year moving average of money growth (adjusted for changes in Q^*) and inflation ending at the quarter the observation is shown. Concentrating in the period from 1965 to 1990, Figure 6 presents quite clearly the co-movement in the two series that was much less evident with the shorter horizon shown in Figure 5.

Figure 6. Inflation and Money Growth: Five-Year Horizon Adjusted for Natural Output Growth

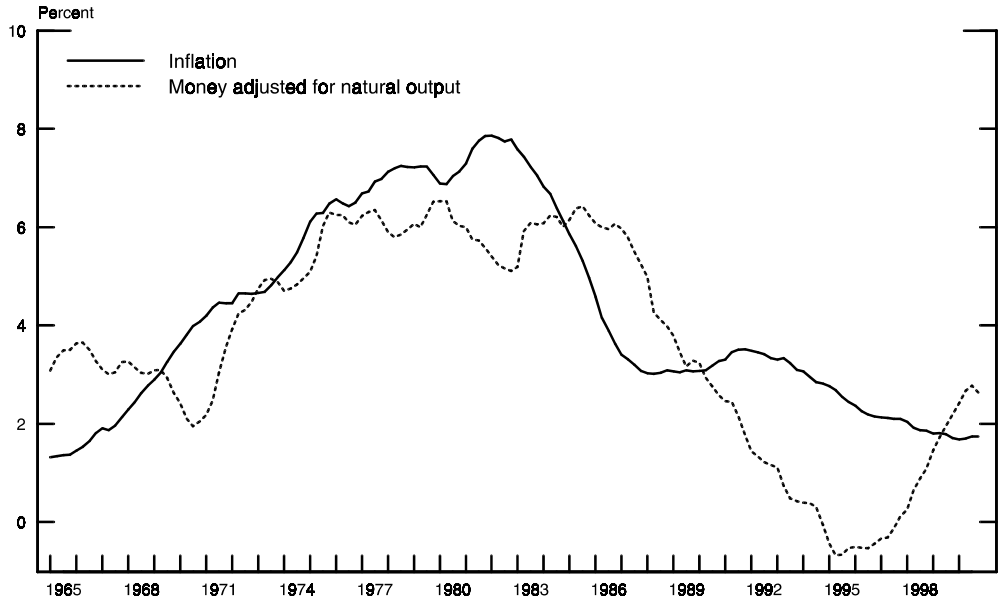


Figure 7. Inflation and μ^*Adjusted Money Growth Five-Year Horizon

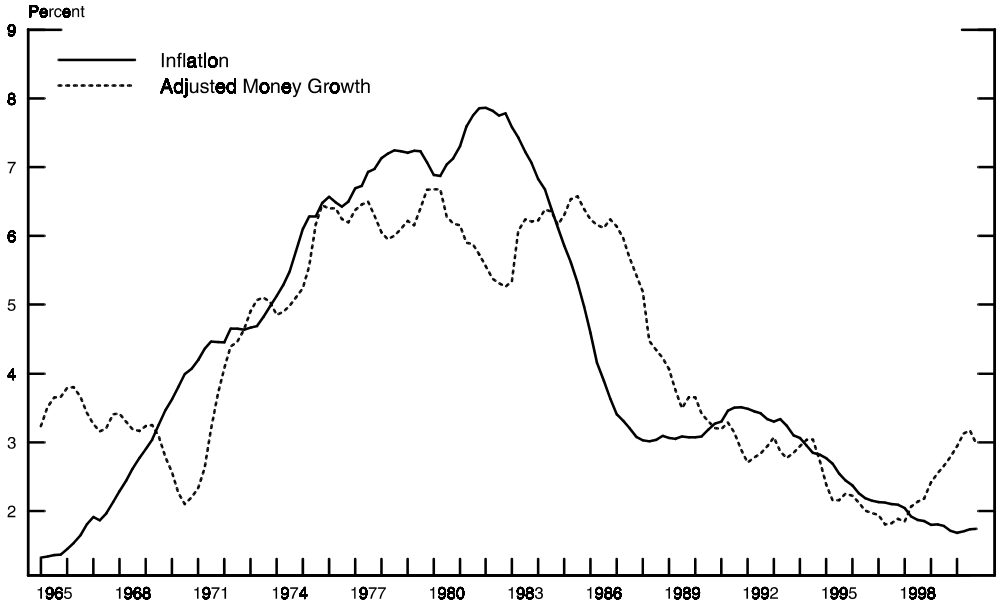
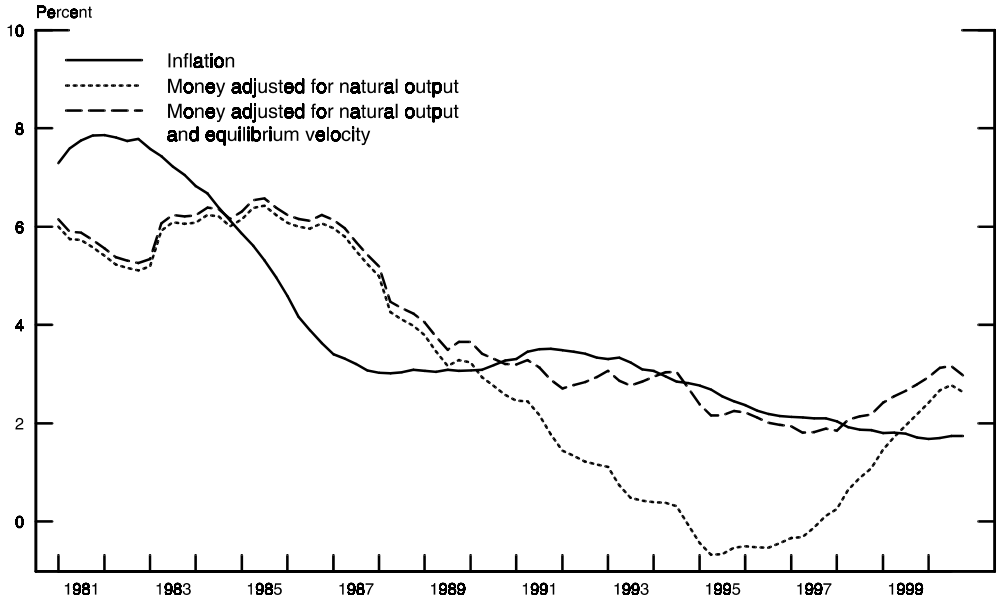


Figure 6 is also of interest because it illustrates the second difficulty complicating money growth and inflation relationship mentioned above. Specifically, an examination of the 1990s appears to suggest that, while money growth and inflation may have closely tracked each other until then, their relationship appears to have broken down dur-

Figure 8. Inflation and Adjusted Money Growth Alternatives Five-Year Horizon



ing the 1990s. The issue here is the failure to control for changes in equilibrium velocity, V^*. To see this point, Figure 7 shows the same data as Figure 6 but uses instead the properly adjusted measure of money growth, μ^*. Once money growth is properly adjusted for changes in Q^* and V^*, it tracks inflation quite well throughout the entire sample.

The significance of properly accounting for movements in equilibrium velocity is highlighted in Figure 8, which plots together inflation, the μ^*growth rate of money, and money growth adjusted for Q^* but not for V^*. In short, failing to properly adjust for underlying movements in natural growth or equilibrium velocity may obscure the fundamental link between money growth and inflation but does not in any sense reduce its significance and value for monitoring inflation.

4. Inflation forecasts based on P^*

Another long-run equilibrium concept based on the current money stock and motivated by the equation of exchange is that of P^*. The P^* concept is defined as the equilibrium level of prices supported by the current quantity of money in circulation, M, that would be expected to prevail at the natural level of output and the equilibrium level of velocity:

$$P^* \equiv \frac{MV^*}{Q^*} .$$

As shown originally by Hallman, Porter and Small (1991) and confirmed by a number of subsequent studies, P^* can potentially provide a useful anchor for the price level and as such be utilized as a tool for predicting inflation. The framework for understanding the monetary dynamics of inflation relies on the simple idea that if the current price level, P, deviates from its equilibrium level, P^* then inflation will tend to move so as to close this gap between the actual and equilibrium price levels—the price gap. Implementation of this framework relies on a firm understanding of what the level of equilibrium velocity is. In this section, we use the change in equilibrium velocity of M2 during the 1990s to illustrate the crucial nature of accounting for such developments in a proper implementation of this framework.

We concentrate on a specification motivated by the simplest inflation forecasting equation introduced in Hallman, Porter and Small (1991), which uses the framework to provide one-year-ahead forecasts of inflation.

$$\pi_{t+4} = \pi_t + \alpha(p_t - p_t^*) + u_{t+4} \tag{11}$$

Here, π_t denotes inflation over four quarters ending in quarter t and, similarly, $p_t - p_t^*$ denotes the average price gap over four quarters ending in quarter t. Although we measure time in quarters, the equation is best understood in annual terms. Given the price gap and inflation in the current "year" it provides a forecast of inflation for the subsequent "year." Note that from the definition of P^* and the equation of exchange, the price gap, $p_t - p_t^*$, can be decomposed into two components: the velocity gap, $v_t - v_t^*$, and the output gap, $q_t - q_t^*$,

$$p_t - p_t^* = (v_t - v_t^*) - (q_t - q_t^*) .$$

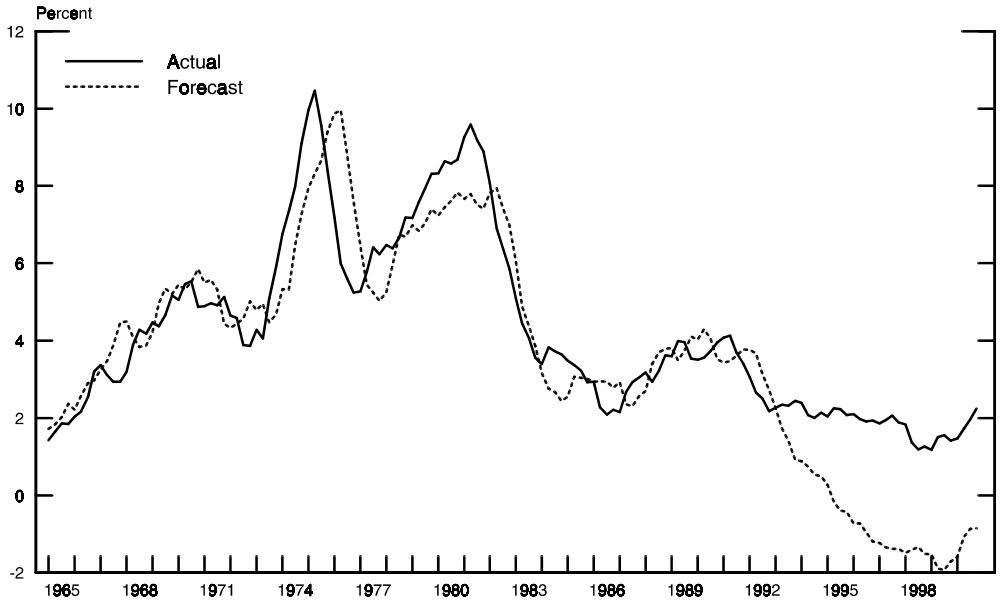
This equation brings into focus the importance of properly accounting for changes in equilibrium velocity in using the model. It also highlights a weakness of the model that

is shared by many alternative forecasting models of inflation that are not based on monetary aggregates, namely the reliance on the output gap.

To compare the forecasting performance of this simple model with alternative assumptions regarding the behavior of velocity during the 1990s, we obtained an estimate of α in equation (11) based on data from 1960 to 1989 only. As a benchmark, we employed data for the price gap based on the assumption that V^* follows the linear trend shown in Figure 1. The resulting point estimate for α was -0.21 with a standard error of 0.034.[6]

Figure 9 shows the in-sample inflation forecasts obtained from this equation as well as the out-of-sample forecasts based on the linear trend assumption for equilibrium velocity. As can be seen, while the forecast appears to move closely with realized inflation for most of the sample, since about 1992 forecasted inflation diverges from actual inflation and the forecast error becoming progressively larger. These errors simply confirm that over this period, the underlying assumption for V^* embedded in the forecasts was likely systematically smaller than it should have been. This assessment, in turn, is in agreement with the estimated upward shifting V^* implied by the relationship between velocity and opportunity costs. Figure 10 shows the comparable inflation forecasts obtained from the same equation but where we have replaced the price gap based on an inappropriate assumption of a linear trend V^* with the price gap based on the smooth trend estimate shown in Figure 1. As can be seen, and in stark contrast to the picture painted in Figure 9, once this correction is incorporated in the model, the resulting forecasts of inflation during the 1990s appear extremely accurate.

Figure 9. Inflation: Actual and P^* Based Forecast Without Equilibrium Velocity Adjustment



[6] The estimate is based on 120 overlapping quarterly observations and the standard error reflects the asymptotic correction for the induced serial correlation.

Figure 10. Inflation: Actual and P^* Based Forecast

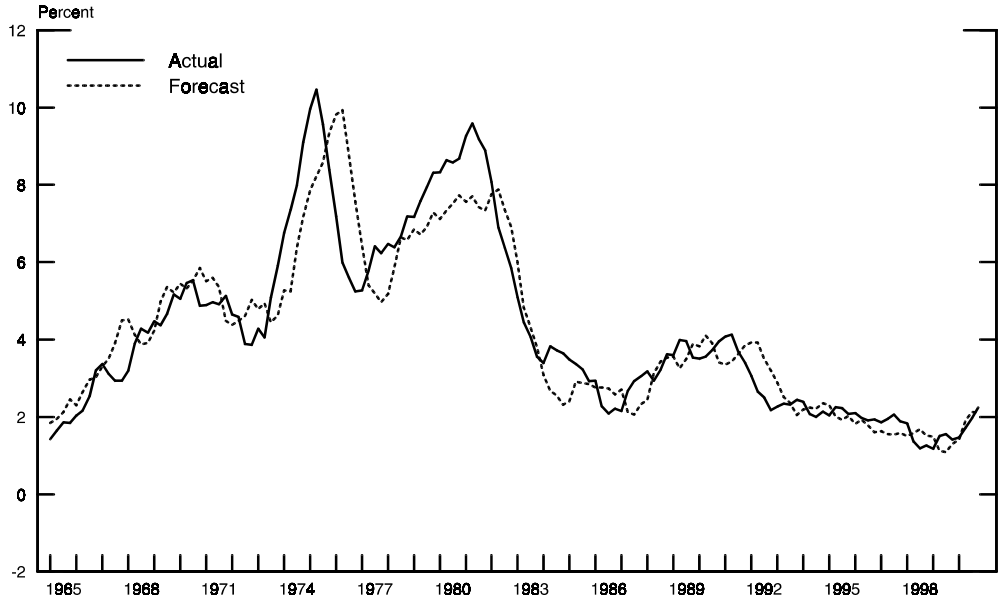


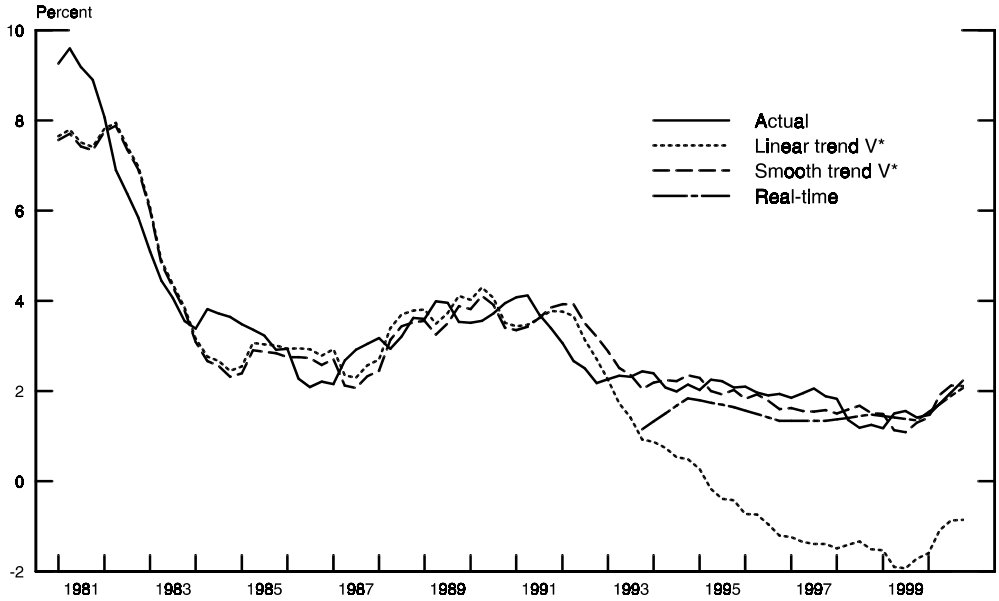
Figure 11 compares the two alternative forecasts shown in the two earlier figures with a more realistic forecast meant to reflect more closely the information available in real-time. In particular, the real-time forecast shown with the dash-dot line is based on a price gap, $p_t - p_t^*$, that combines real-time measures of both an output gap and a velocity gap. The first observation, corresponding to the forecast of inflation ending in 1993Q3, is based on real-time data capturing the four quarters ending in 1992Q3. Given the one-quarter lag in the publication of output data, this corresponds to information first available in 1992Q4. For the output gap, we use the estimate shown for the fiscal year 1992 as published at the time by the Congressional Budget Office.[7, 8] For the velocity gap, we rely on the reconstructed real-time estimates of the velocity gap shown in Figure 4. As can be seen, although the reconstructed real-time forecasts do not appear nearly as accurate as the ones based on the ex post characterizations of Q^* and V^* embedded in the smooth trend based forecasts, they are much closer to it than forecasts obtained when the changes in the underlying trend of velocity is erroneously omitted.

One lesson that can be drawn from this experience is that although application of the P^* model that failed to account for changes in the underlying equilibrium velocity of M2 during the 1990s could have easily provided misleading inflation forecasts, this difficulty was not nearly as important in practice as proper care could be taken to incorporate available information regarding the likely change of V^*. As a result, proper

[7] To be exact, this publication is typically available in January of the following year.

[8] This timing is determined by the availability of this real-time data. The Congressional Budget Office publishes their estimates of historical output gaps on a fiscal year basis, which corresponds to a four-quarter average ending in the third quarter.

Figure 11. Inflation: Alternative P^* Based Forecasts



Notes: The smooth and linear trend V^* based forecasts correspond to those shown in Figure 1. The real-time forecast employs real-time estimates of the price gap, $P - P^*$, based on the real-time (recursive) estimates of the velocity gap shown in Figure 4 and real-time estimates of the output gap. Eight observations are shown corresponding to forecasts of inflation ending at the third quarter of each year from 1993 to 2000. These observations are connected with linear segments in the plot.

evaluation of whether money remained a useful indicator of inflation during this episode or not hinges crucially on the appropriate treatment of information regarding the behavior of velocity.

5. The influence of special factors

A central bank has access to a variety of information and analytical tools with which it can sort out various movements in the aggregates. In particular, on a routine basis it may be able to filter out high or low frequency movements in the aggregates that have nothing or very little to do with domestic activity or prices. From time to time such factors may be quite significant quantitatively. They could influence the growth rate of narrow monetary aggregates by several percentage points and could often influence the quarterly growth rate of even a broad monetary aggregate such as M2 by over one percentage point. Although judgmental interpretations of the information in monetary aggregates routinely make allowances for such factors, simple time-series models cannot systematically account for them. As a result, examination of the information content of monetary aggregates based on traditional estimated time series models may suggest that the aggregates are less useful than they truly are in practice, perhaps by a considerable margin. To illustrate this difficulty, in this section we offer some examples of special factors that have been closely monitored at the Federal Reserve during the 1990s.

Two examples of major innovations that have affected the demand for the narrow aggregates in the United States during the 1990s are retail sweep programs at banks and large outflows of U.S. banknotes abroad. In 1994, falling costs of computing and programming made it practical for banks to begin to introduce retail sweep programs that allowed them to profitably reduce the effective reserve requirements on *individual* household accounts. In effect, this was achieved by transferring checkable deposits, which are subject to a reserve requirement tax, to money market deposit accounts, which are free of any such tax. At about the same time, events in Russia induced another distortion in the aggregates, massive currency outflows from the United States. Though by the early 1990s dollars already had a substantial foothold in Russia, their usage grew significantly further during the period of rapid inflation, which occurred in the middle of the decade. On average, Russians imported about $2 billion per month in U.S. currency from about 1994 to 1996, see Secretary of the Treasury (2000, p. 22). Over time, the combination of these two innovations greatly distorted the behavior of the currency to deposit ratio, a popular gauge used by Cagan (1958) and others as an indirect measure of underground activity. Porter and Weinbach (1999) show an adjusted ratio that removes the effects of the two distorting influences–retail sweep programs and overseas demands for U.S. currency. The unadjusted ratio rises by over 60 percent, while the adjusted ratio falls. Indeed, movements in the adjusted ratio appear to be largely explained by the expected differential effects of interest rates on the components of the ratio, suggesting that there has not likely been a resurgence in underground activity in the United States.

More generally, the Federal Reserve has attempted to distinguish between movements in the aggregates that reflect sources of strength or weakness in underlying demands for the aggregate from other distortions that are either transitory in nature or do not reflect such underlying demands, at least within the United States. Both sweeps and overseas currency outflows fall into the latter category, though only currency flows have any effect on M2.[9] In each case, Federal Reserve staff relies on independent data series to gauge the volume of the various distorting factors.

On balance, currency flows have tended to boost M2 but for reasons that have virtually nothing to do with domestic output and prices, while sweeps have tended to lower M1 with no effect on M2. The effect on the level of M2 of such overseas holdings is perhaps as large as $375 billion, or about 7-3/4 percent of the aggregate itself, Judson and Porter (2000).

Two other special factors that are routinely monitored at the Board involve tax payments and mortgage refinancings, both of which may lead to distortions in the aggregates. Typically in April when individual tax payments are due, M2 surges as the current seasonals do not embody the outsized tax payments that come due and individuals must boost their liquid balances prior to paying their taxes by more than ordinary amounts. Estimates of these effects on M2 are made by drawing upon data on individual non-withheld tax receipts. The mortgage effects show up in the liquidation of mortgage backed security (MBS) pools.

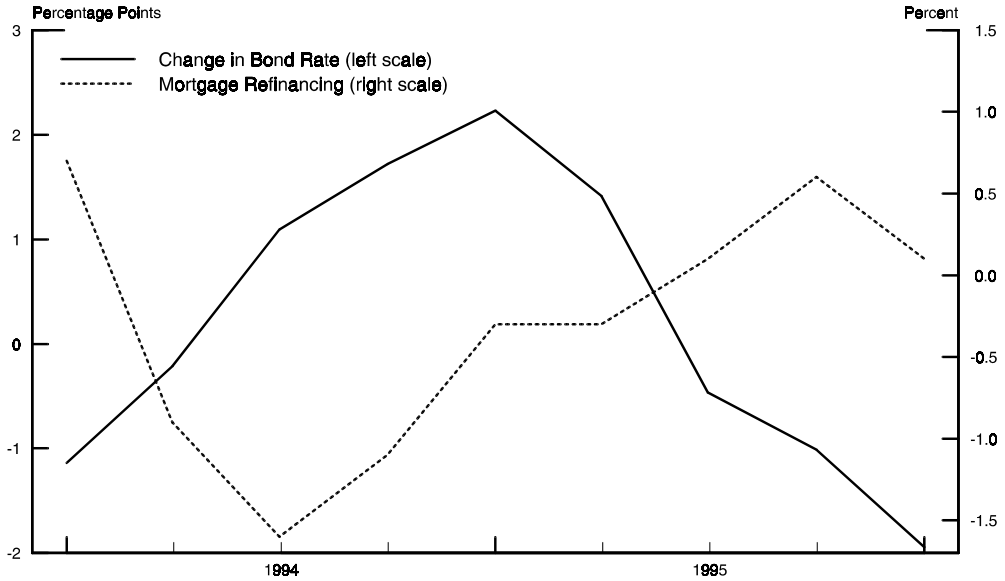
To illustrate, suppose longer-term interest rates fall sufficiently to reach a new lower threshold, which induces households in increasing numbers to refinance their mortgages

[9] Estimates of currency abroad are published by the Board in its flow of funds accounts and by the BEA in the International Investment Position of the United States on a quarterly basis, see Judson and Porter (2000) and Secretary of the Treasury (2000).

to take advantage of the lower interest rates that now prevail, and the process triggers liquidation in a MBS pool. Regulations require that balances in the pool being liquidated be held in an account within M2 for up to seven weeks before the pool is paid out to investors, resulting in a temporary surge in the aggregate during this interval. Figure 12 shows a judgmental estimate of the contribution of such refinancings surges on M2 growth in 1994 and 1995. When longer-term rates backed up in 1994, a decline in such refinancings was induced which contributed to an estimated 1-1/2 point decline in M2 by the middle of 1994.[10] The effect was reversed later in the period, when rates began to decline, setting off a massive surge in refinancings that boosted M2 in the latter part of the period.

Some events occur that, in principle, one would wish to capture within the framework of a special factor decomposition (as is done for MBS effects, overseas currency flows, sweeps, and tax effects) but are such that there is insufficient data to make an independent quantitative assessment. A crisis that arose in the late summer and early fall of 1998 provides a striking illustration of this phenomenon. A worldwide crisis struck capital markets after the Russian default in August and the subsequent difficulties at the hedge fund, Long Term Capital, emerged soon thereafter. The immediate effect on global markets was to reduce the risk-bearing capacity of the system in part because of losses that had accrued and because of an apparent increased sensitivity to

Figure 12. Mortgage Refinancing Activity and M2 Growth



Notes: The solid line indicates the percentage point change in the 10-year Treasury Bond Rate from four quarters earlier (left axis). The dotted line shows an estimate of the contribution of mortgage refinancing activity to M2 growth during a quarter (right axis).

[10] The bond rate shown is the monthly year-over-year change in the rate aggregated to a quarterly frequency at which the MBS effect is also shown.

the attendant risks in the marketplace. The resulting distress spilled over to global financial markets events and sparked a simultaneous large flight to quality and to liquidity, which boosted liquid accounts in M2 drastically. M2 jumped from a 6.8 percent annual rate of growth in August to a 12.1 percent growth rate in September and accelerated from a 7 percent annual rate in the third quarter to 10.7 percent in the fourth quarter of the year. On the credit side, funding shifted radically from the open capital market to depositories, as turbulences in financial markets apparently altered financing terms and induced many firms to substitute bank loans for funds raised in markets. While these events in the latter half of 1998 were disruptive and led to a corrective monetary policy reaction to restore confidence and liquidity in financial markets, the effects on M2 were generally well understood contemporaneously. It was clear at the time that the surge in M2 in the fall of 1998 largely represented just a shift in liquidity preference with little likelihood of accelerating pressures on aggregate price measures in the economy.

6. Conclusion

Interpreting the behavior of monetary aggregates involves a considerable degree of judgment and detailed analysis. Although it may be straightforward for central bank practitioners to acquire the appropriate level of expertise to make sensible judgments on these matters, it may be quite difficult, if not impossible, to quantify with much precision such judgments. Simple statistical techniques examining the usefulness of monetary aggregates as guides for inflation may fail to provide an accurate reading of this usefulness when information routinely available to monetary practitioners to screen special factors and detect changes in equilibrium velocity is not incorporated in the analysis. However, central banks remain in a unique position to accumulate and interpret information regarding monetary aggregates. In light of the fundamental nature of money growth for inflation, we believe that continued monitoring of the monetary aggregates remains well advised.

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The impact of financial anxieties on money demand in Japan*

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Bank of Japan

1. Introduction

Japan's economy underwent an extremely severe recession in the years 1997 and 1998, which turned out to be the worst ever experienced by Japan in the postwar era. Real GDP recorded negative growth for five consecutive quarters from the fourth quarter of 1997 on a quarter-to-quarter basis.[1] This recession was largely influenced by the disturbance in the financial system that occurred reflecting the failures of large financial institutions from autumn 1997.[2] As a result, several unusual phenomena were observed in the business cycle. (See Chart 1)

During the depressed phase of the economy from the end of 1997, for instance, the financial system shock decreased private consumption by discouraging consumer sentiment. Business fixed investment also declined substantially, especially at small firms, reflecting a decrease in the lending capacity of private banks. In particular, when global concern over credit risks was heightened in the second half of 1998, the deterioration of the economy and tightening of financial conditions created a vicious cycle. Paradoxically, however, the growth rate of money (particularly the monetary base) accelerated amid the depressed real economy. On the other hand, the growth rate of money has been slowing down gradually since 1999, while improvements have been observed in the economy such as a recovery in industrial production and an improvement in corporate sentiment. Thus, the relationship between money and income in recent years differs from that depicted by orthodox economic theory .

One explanation for this phenomenon is that mounting financial anxieties increased precautionary demand for liquidity. The financial system shock caused fixed investment

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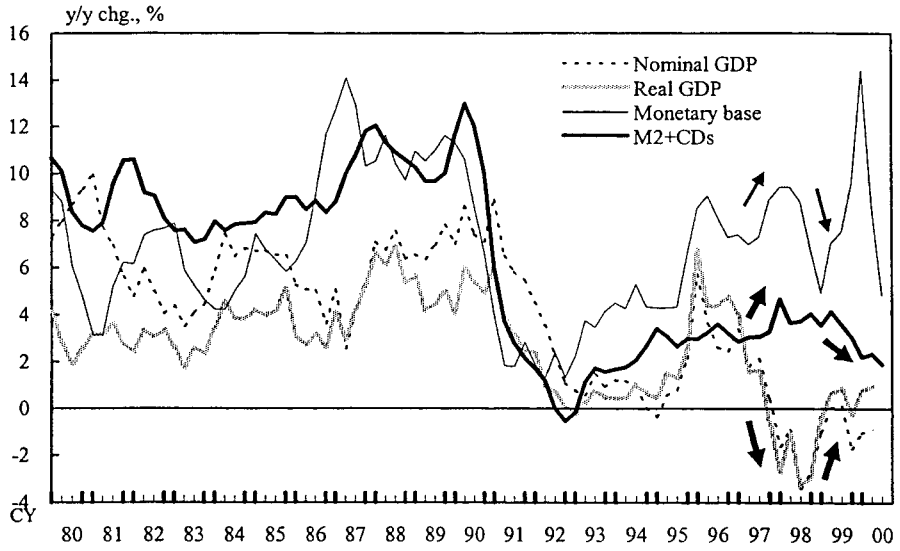
[1] This development of real GDP is based on 68SNA. (In October 2000, the data of real GDP was revised to the new series, which is based on 93SNA.)

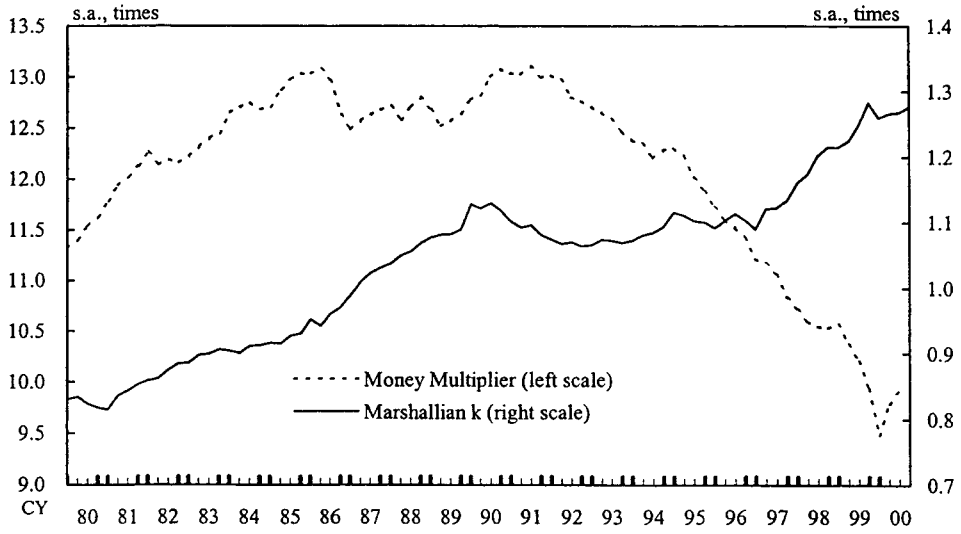
[2] See Hayakawa and Maeda [2000] for a survey on Japan's Financial and Economic Developments since autumn 1997.

Chart 1. Money

(1) Money and Nominal GDP



(2) Money Multiplier and *Marshallian k*



Note: Money multiplier = (M2+CDs)/monetary base
Marshallian K = (M2+CDs)/nominal GDP
Monetary base = cash currency in circulation+reserves (reserve requirement rate change adjusted)

Sources: Bank of Japan, "Economic Statistics Monthly"
Economic Planning Agency, "National Income Statistics."

and private consumption to decrease, and simultaneously caused the precautionary demand for money to increase significantly from the end of 1997 to 1998. On the other hand, since 1999, easing anxieties over the financial system have resulted in the recovery of the economy, but the growth rate of money has been moderated by a decrease in precautionary demand. The empirical analysis in the following sections supports these interpretations.

Following this Introduction, in order to investigate the extent of the impact from the financial system shock, Section 2 presents a time series model and tests the stability of the model. The results demonstrate that the financial system shock in autumn 1997 was substantial enough to break the long-run equilibrium relationship that had existed among economic variables, especially the relationship between money and income. Section 3 quantifies financial anxieties as a proxy for the precautionary demand for money, and incorporates this proxy into the model. The results demonstrate that taking the precautionary demand for money properly into account in the money demand function leads to a stable relationship between money and income, even when including the years 1998 and 1999. Section 4 uses the conventional IS-LM analysis framework and simulates the estimated model to consider how the financial system shock influenced Japan's economy after autumn 1997 and how the policies taken in those circumstances can be evaluated. Finally, Section 5 provides a brief conclusion.

2. Magnitude of the financial system shock

In this section, in order to examine the impact of the financial system shock on Japan's economy, I specify the following vector error correction model (VECM) for seven major economic variables, and test the stability of the model.

$$\Delta X_t = \Gamma(L)\,\Delta X_t + \Pi X_{t-1} + \mu_t\,, \tag{1}$$

where X_t is the vector of the seven variables, M2 + CDs, monetary base, real GDP, CPI, stock prices (Nikkei 225), long-term interest rates, and short-term interest rates. $\Gamma(L)$ is a coefficient matrix for a k-th order lag process. The hypothesis of cointegration is expressed as a reduced rank of the matrix $\Pi(7 \times 7)$:

$$\mathrm{H}_0(r) : \Pi = \alpha\beta'\,, \tag{2}$$

where β' is an $(r \times 7)$ matrix of r cointegrating vectors and α is a $(7 \times r)$ matrix of loading vectors. $\beta' X_t$ are the so-called cointegrating relations.

Cointegration tests are obtained using Johansen's [1988] trace statistic, estimated from the VECM with lag-length $k = 2$. I estimate the model over the two periods 1977/1Q–1997/3Q and 1977/1Q–1998/3Q to examine the impact of the financial system shock that occurred in autumn 1997.[3,4]

[3] The sample period is chosen to avoid the high inflation period of the first-round increases in oil prices, since the expectation formation process of the private sector may have changed after transition to a moderate or low inflation period.

[4] The analysis in Section 2 is based on Kimura and Tanaka [1999], which was written in February 1999. When that paper was written, the data for 1998/4Q and after were not available. Hence, the end of the sample period is set to 1998/3Q.

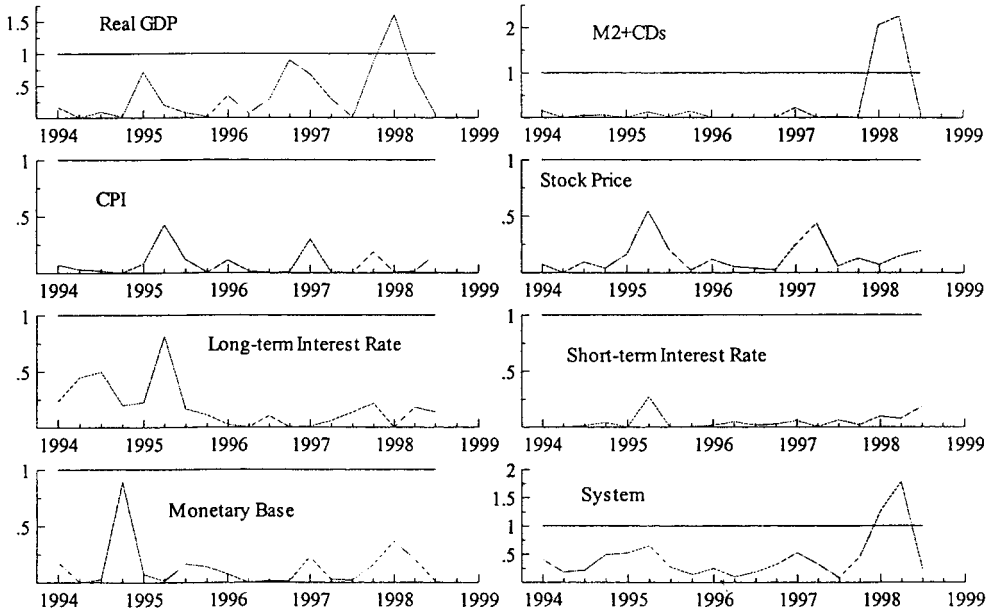
Chart 2. Magnitude of Financial System Shock

(1) Cointegration Test [Johansen trace tests]

H_0 :	sample period	
	1977/1Q-1997/3Q	1977/1Q-1998/3Q
$r = 0$	226.11**	217.77**
$r = 1$	150.16**	145.51**
$r = 2$	98.74**	96.79**
$r = 3$	65.62*	58.33
$r = 4$	43.86*	31.61
$r = 5$	23.15	12.38
$r = 6$	6.24	2.37

Notes: ** indicates that the null hypothesis can be rejected at the 1% significance level. * indicates that the null hypothesis can be rejected at the 5% significance level.

(2) One-Step Chow Test

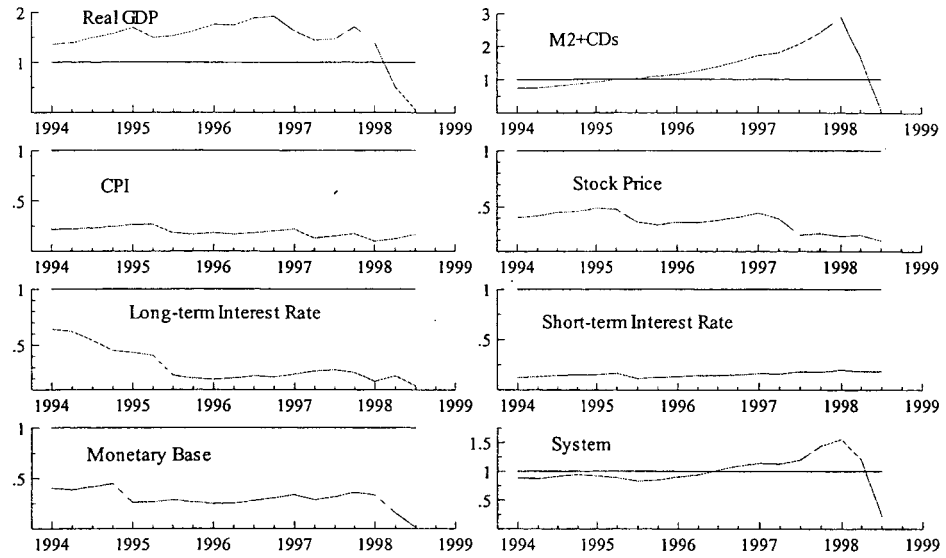


Note : The statistics of Chow test are scaled by 1-off critical values from the F-distribution at the 1% significance level as an adjustment for changing degrees of freedom, so that the significant critical values become a straight line at unity.

The estimation results are shown in Chart 2. While the trace statistic indicates that there are five cointegrating relations over the period 1977/1Q–1997/3Q at the 5% significance level, the number of cointegrating relations decreases from five to three when the sample for 1998 is included.[5] This suggests that some of the long-run equilibrium

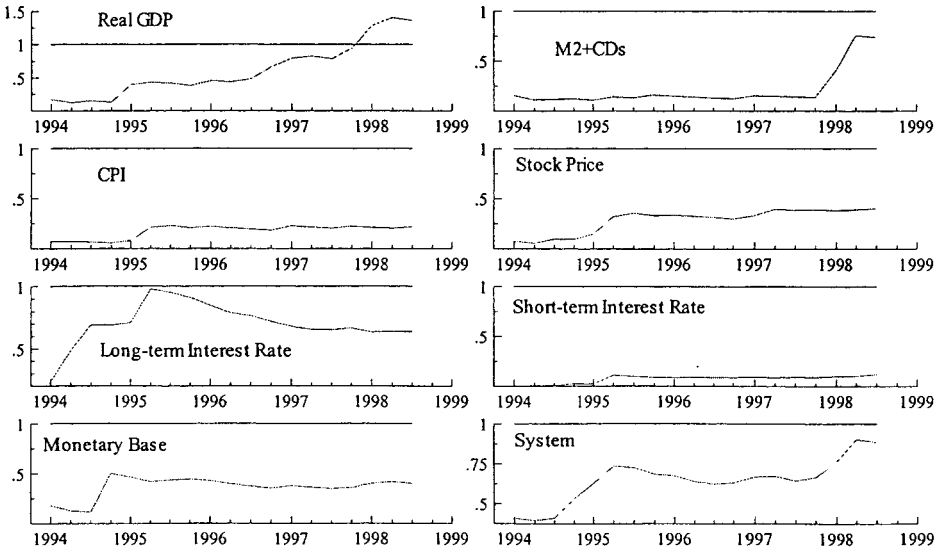
[5] Over the period 1977/1Q–1997/3Q, it is possible to make natural economic interpretations for five cointegrating relations, that is, (1) the money demand function, (2) the money multiplier, (3)

(3) Break-point Chow Test



Note: The breakpoint Chow test is based on a comparison of the sum of squared residuals obtained by fitting a single equation to the entire sample with the sum of squared residuals obtained when separate equations are fit to each subsample of the data.

(4) Forecast Chow Test



Note : The forecast Chow test estimates the model for a subsample comprised of the first T_1 observations. The estimated model is then used to predict the values of the dependent variable in the remaining T_2 data points. A large difference between actual and predicted values casts doubt on the stability of the estimated relation over the two subsamples.

relationships between economic variables broke down in 1998. In addition to cointegration tests, I conduct three kinds of Chow tests to confirm the stability of the model. The results of the Chow tests indicate that the parameters of both real GDP and M2 + CDs equations become unstable in 1998.[6]

These results imply that the financial system shock in autumn 1997 was substantial enough to break the long-run equilibrium relationship that had existed among economic variables, especially between money and income. In order to deepen our understanding of the impact of the financial system shock, we need to analyze the relationship between money and income in more detail.

3. Cointegration analysis of money and income

In the following analysis, for the simplicity of the model, I focus not on the relationship among the seven economic variables, but only on the relationship between real money and real GDP.

I postulate the VECM as follows:

$$\Delta rm_t = \alpha_m EC_{t-1} + \sum_{i=1}^{k} \gamma_i^m \Delta rm_{t-i} + \sum_{i=1}^{k} \theta_i^m \Delta y_{t-i} + \sum_{i=0}^{k} \lambda_i^m \Delta rs_{t-i} + \sum_{i=0}^{k} \varrho_i^m \Delta R_{t-i} + c_m + \varepsilon_t \tag{3}$$

$$\Delta y_t = \alpha_y EC_{t-1} + \sum_{i=1}^{k} \gamma_i^y \Delta rm_{t-i} + \sum_{i=1}^{k} \theta_i^y \Delta y_{t-i} + \sum_{i=0}^{k} \lambda_i^y \Delta rs_{t-i} + \sum_{i=0}^{k} \varrho_i^y \Delta R_{t-i} + c_y + \delta_t \tag{4}$$

$$EC_t = rm_t - \beta_y y_t - \beta_s rs_t \tag{5}$$

where rm_t, y_t, rs_t, R_t are the real money stock (M2+CDs deflated by the GDP deflator), real GDP, real stock prices (Nikkei 225 deflated by the GDP deflator) and long-term interest rates, respectively. c_m and c_y are constant terms, and ε_t and δ_t are error terms. The reason why real stock prices are included as an exogenous variable in (3)–(5) is to control the wealth effect in money demand.[7]

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the Fisher relation, (4) the term structure spread linking the short-term rate and the long-term rate, and (5) the stable relationship between nominal GDP and stock prices. The parameter constraints which satisfy the above five relations cannot be rejected at the 5% significance level. (The estimation results are omitted.) However, a natural economic interpretation cannot be made regarding the three cointegrating relations for the period 1977/1Q–1998/3Q.

[6] The breakpoint Chow test for the real GDP equation indicates that the null hypothesis on the stability of the parameter can be rejected for the sample period 1994/1Q–1998/1Q. This result means that there was a breakdown in the real GDP relation somewhere between 1994/1Q and 1998/1Q, since the breakpoint Chow test is based on a comparison of the entire sample (in this case 1977/1Q–1998/3Q) with the subsample whose staring point is 1977/1Q. With the breakpoint Chow test, we cannot specify the timing of the breakdown in the real GDP relation, but we can conclude that it was 1998/1Q based on the results of the one-step Chow test and the forecast Chow test.

[7] It is very important to take asset prices into account in estimating Japan's money demand function, because Japan experienced the bubble economy in the late 1980s and the bursting of the bubble in the early 1990s.

EC_t in equation (5) is an error correction term, which represents the deviation from the long-run equilibrium relationship among real money, real GDP and real stock prices.[8] The expected sign of the loading vector is negative for α_m, and positive for α_y.

3.1. Estimation Results

Cointegration tests are conducted using Johansen's [1988] maximal eigenvalue statistic and trace statistic, estimated from the VECM. I estimate the model over the two periods 1980/1Q–1997/3Q and 1980/1Q–1991/1Q to focus on the impact of the financial system shock that occurred in autumn 1997 on money demand.[9]

The estimation results are presented in Chart 3. The results show that the cointegrating relationship between real money and real income exists for the sample period 1980/1Q–1997/3Q and that the loading vector (α_m, α_y) is of the right sign.[10] On the contrary, when extending the sample period up to 1999/1Q, it is no longer possible to reject the null hypothesis that there is no cointegration.

Why does the inclusion of the recent sample result in the breakdown of the long-run equilibrium relationship? I hypothesize that this is because the model ignores the impact of financial system shock. The financial system shock increased the uncertainty of future financing in the private sector, which led to an increase in the precautionary demand for money as well as a decrease in private sector expenditures. Because the impact of the financial system shock was very large, as shown in Section 2, ignoring the rise in the precautionary demand for money in the model (3)–(5) means the missing variable in the VECM. A natural strategy for resolving this problem is to quantify the financial anxieties as a proxy for the precautionary demand and to incorporate this into the VECM.

Chart 3. Cointegation Analysis of Money and Income (without taking financial anxieties into account)

Sample period	Johansen's Cointegration Test		Cointegrating vector		Loading vector	
	Maximal eigenvalue statistic	Trace statistic	β_y	β_s	α_m	α_y
80/1Q–97/3Q	16.37* (14.10)	20.23** (15.40)	1.451 (0.032)	0.076 (0.012)	–0.101 (0.072)	0.245 (0.079)
80/1Q–99/1Q	8.61 (14.10)	11.52 (15.40)	1.595 (0.079)	0.032 (0.031)	0.000 (0.039)	0.136 (0.049)

Notes: 1. Values in parentheses in the "Johansen's Cointegration Test" columns are critical values at the 5% significance level. ** indicates rejection of the null hypothesis (= there is no cointegration) at the 1% significance level and * indicates rejection of the null hypothesis at the 5% significance level.
2. Values in parentheses in the "Cointegrating vector" and "Loading vector" columns are standard errors for the estimated parameters.
3. The lag-length of the VECM is set to 3 (k = 3), obtained from the likelihood-ratio test.

[8] The long-run equilibrium relationship between money and income is based on the quantity theory of money.

[9] The analysis in Section 3 is based on Kimura and Fujita [1999]. When that paper was written, the data for 1999/2Q and after were not available. Hence, the end of the sample period is set to 1999/1Q.

[10] Income elasticity β_y is around 1.5. Income elasticity above unity is consistent with the observed upward trend in the *Marshallian k*. (See Chart 1.)

3.2. *Quantification of financial anxieties*

Although it is difficult to quantify unobservable financial anxieties, they are estimated here using the Corporate Financial Position Diffusion Index from the Bank of Japan's *Tankan – Short-term Economic Survey of Enterprises*. The Financial Position DI depends roughly on the interest rate on loans (See Chart 4). Hence, I postulate this relationship as the following equation.

$$DI_t = \beta_0 + \beta_1\, rate_t + \beta_2\, rate_{t-1} + \varepsilon_t\,, \tag{6}$$

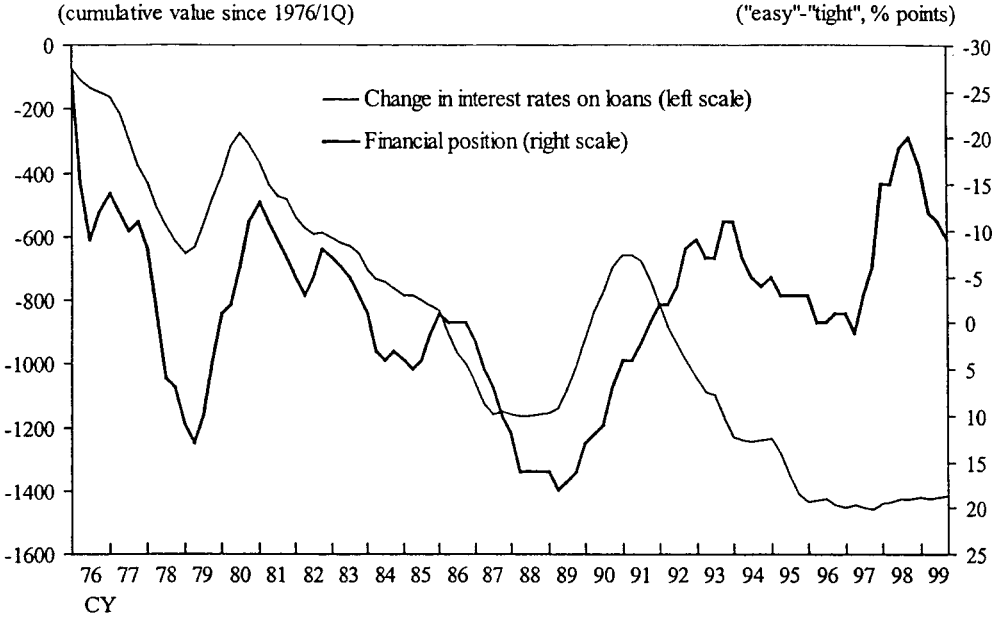
where DI_t, and rate_t are the diffusion indexes for the financial position of firms ("easy" minus "tight") and the interest rates on loans ("rise" minus "fall"), respectively. ε_t is an error term, which represents the influence of irregular or unexpected factors other than interest rates on loans. We can regard the variance of this error term as the uncertainty of financing (i.e. financial anxieties). Even when the interest rate on loans is constant, the financial position may change due to financial anxieties. Such a phenomenon can be represented as a time-varying variance, and in order to take it into account I estimate equation (6) by using the following TARCH (Threshold AutoRegressive Conditional Heteroscedasticity) model.

$$\varepsilon_t \mid I_{t-1} \sim N(0, h_t^2)\,, \qquad h_t^2 = \alpha_o + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 \varepsilon_{t-1}^2 d_{t-1} + \alpha_3 h_{t-1}^2\,, \tag{7}$$

where I_{t-1} is the information set available at period $t-1$.

d_t is a dummy variable. $d_t = \begin{cases} 1\,, & \text{if} \quad \varepsilon_t < 0 \\ 0\,, & \text{if} \quad \varepsilon_t \geq 0 \end{cases}$.

Chart 4. Diffusion Indexes for the Financial Position of Firms and the Interest Rate on Loans



Note: All industries, All enterprises
Source : Bank of Japan, "*Tankan* Short-term Economic Survey of Enterprises in Japan"

The third term on the right-hand side of the h_t^2 equation indicates the asymmetric impact of the shock on the conditional variance h_t^2. If parameter α_2 is positive, negative shocks ($\varepsilon_t < 0$) make the variance h_t^2 larger than positive shocks ($\varepsilon_t > 0$) do. This asymmetry means that large negative shocks such as financial system shocks will raise financial anxieties (i.e. h_t^2) and the precautionary demand accordingly, while positive shocks, which make the financial position easier, do not increase financial anxieties.

The estimation results are presented in Chart 5. The coefficients of the explanatory variables are all of the right sign and are statistically significant. The positive and significant parameter α_2 suggests that there exists an asymmetric impact of the shock on the conditional variance h_t^2. Although this variance h_t^2 stays at a low level in the 1980s and the early 1990s, it increases sharply in 1998/1Q. After h_t^2 peaks at 1998/3Q, it declines rapidly. Although we do not deny that there may exist a better proxy for financial anxieties, this movement of the estimated h_t^2 is quite consistent with the general view that financial anxieties rapidly increased in 1998 and decreased in 1999.

3.3. Re-estimation incorporating financial anxieties

I estimate the following VECM, taking financial anxieties into account.

$$\Delta rm_t = \alpha_m EC_{t-1} + \sum_{i=1}^{k} \gamma_i^m \Delta rm_{t-i} + \sum_{i=1}^{k} \theta_i^m \Delta y_{t-i} + \sum_{i=0}^{k} \lambda_i^m \Delta rs_{t-i} + \sum_{i=0}^{k} \varrho_i^m \Delta R_{t-i} + \sum_{i=0}^{k} \zeta_i^m \Delta DV_{t-i} + c_m + \varepsilon_t \quad (8)$$

Chart 5. Quantification of Financial Anxieties (Uncertainty towards Financing)

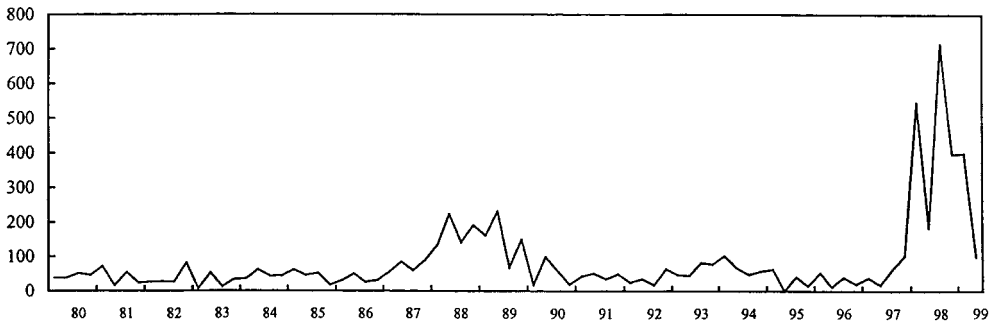
(1) Estimation Results of TARCH Model

$$DI_t = \underset{(-8.571)}{-5.466} + \underset{(10.050)}{0.055}\, rate_t - \underset{(-10.765)}{0.061}\, rate_{t-1} + \varepsilon_t, \quad \varepsilon_t \mid I_{t-1} \sim N(0, h_t^2)$$

$$h_t^2 = \underset{(6.436)}{41.205} + \underset{(6.219)}{1.059}\, \varepsilon_{t-1}^2 + \underset{(2.337)}{0.732}\, \varepsilon_{t-1}^2 d_{t-1} - \underset{(-7.333)}{0.696}\, h_{t-1}^2$$

Sample period : 1976/2Q-1999/2Q. t-values for the estimated parameters appear in parentheses.

(2) Conditional Variance h_t^2



$$\Delta y_t = \alpha_y EC_{t-1} + \sum_{i=1}^{k} \gamma_i^y \, \Delta rm_{t-i} + \sum_{i=1}^{k} \theta_i^y \, \Delta y_{t-i} + \sum_{i=0}^{k} \lambda_i^y \, \Delta rs_{t-i}$$

$$+ \sum_{i=0}^{k} \varrho_i^y \, \Delta R_{t-i} + \sum_{i=0}^{k} \xi_i^y \, \Delta DV_{t-i} + c_y + \delta_t \tag{9}$$

$$EC_t = rm_t - \beta_y y_t - \beta_s rs_t - \beta_D DV_t \,, \tag{10}$$

where DV_t is the conditional variance h_t^2 shown in Chart 5. The expected sign of β_D, the coefficient of DV_t in equation (10), is positive, because financial anxieties (i.e. the rise in DV_t) make the precautionary demand for money increase.

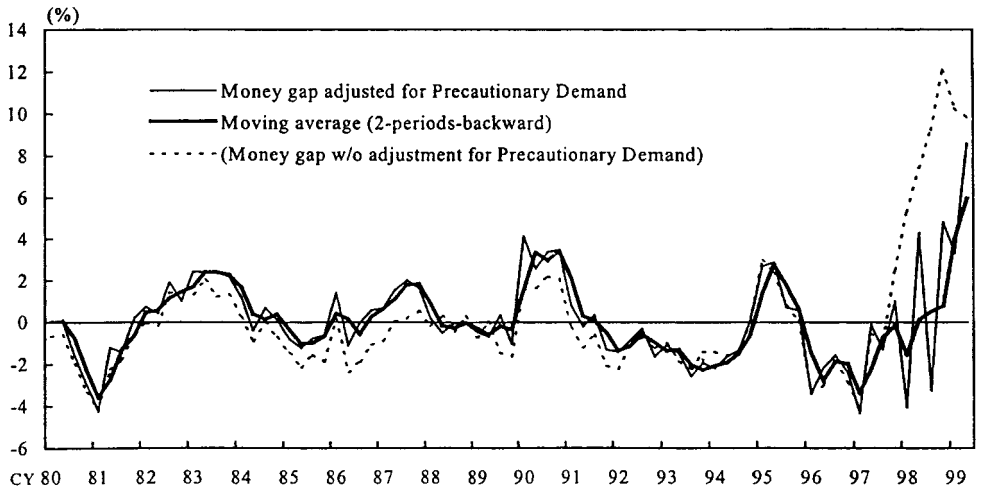
Chart 6. Cointegation Analysis of Money and Income (with taking financial anxieties into account)

(1) Cointegration Test

Sample period	Johansen's Cointegration Test		Cointegrating vector			Loading vector	
	Maximal eigen-value statistic	Trace statistic	β_y	β_s	β_D	α_m	α_y
80/1Q–97/3Q	16.59* (14.10)	20.28* (15.40)	1.458 (0.038)	0.072 (0.017)	0.415 (1.199)	–0.097 (0.072)	0.247 (0.080)
80/1Q–99/1Q	17.68* (14.10)	21.25** (15.40)	1.498 (0.036)	0.053 (0.014)	1.721 (0.637)	–0.080 (0.063)	0.236 (0.069)

Notes: 1. Values in parentheses in the "Johansen's Cointegration Test" columns are critical values at the 5% significance level. ** indicates rejection of the null hypothesis (= there is no cointegration) at the 1% significance level and * indicates rejection of the null hypothesis at the 5% significance level.
2. Values in parentheses in the "Cointegrating vector" and "Loading vector" columns are standard errors for the estimated parameters.
3. The lag-length of the VECM is set to 3 (k = 3), obtained from the likelihood-ratio test.
4. The cointegration Vector β_D and its standard error are shown multiplied by 10000 times.

(2) Money Gap adjusted for the Precautionary Demand for Money

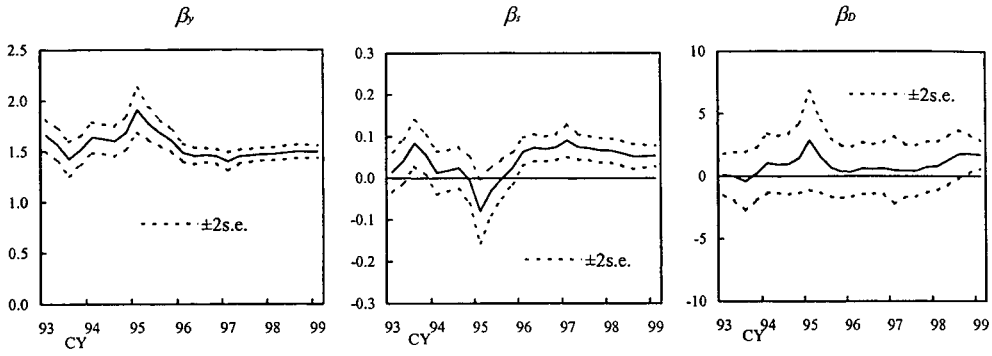


In Chart 6, the estimation results are shown for both the 1980/1Q–1997/3Q and 1980/1Q–1999/1Q sample periods. We now find a cointegrating relationship between real money and real GDP for both sample periods. We also find that the cointegrating vectors (β_y, β_s) and loading vectors (α_m, α_y) seem to be stable. Actually, the null hypothesis that parameters $(\beta_y, \beta_s, \alpha_m, \alpha_y)$ estimated for 1980/1Q–1997/3Q are the same as those estimated for 1980/1Q–1991/1Q can not be rejected at the 10% significance level (likelihood ratio test: $\chi^2(4) = 2.31$, p-value = 0.68).

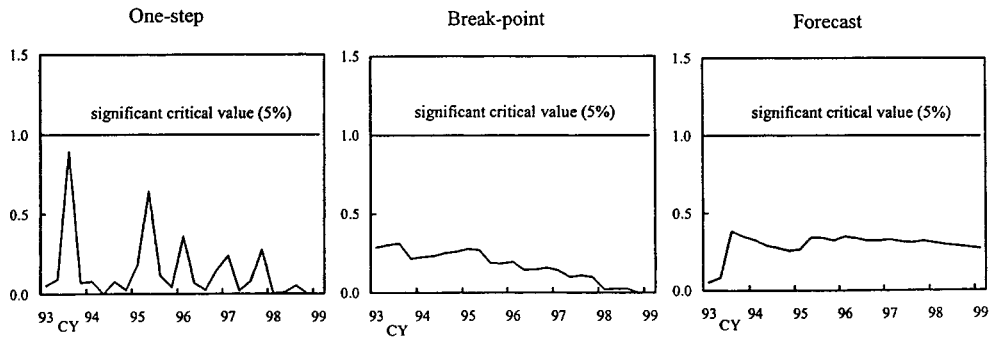
To test the stability of the VECM more strictly, I conduct rolling regression analyses and Chow-tests. Chart 7 shows the estimates of the cointegrating vectors from rolling

Chart 7. VECM Stability Test

(1) Recursive Estimates of Cointegrating Vector



(2) Chow Tests for the Money Demand Function



Note1: The statistics of Chow test are scaled by 1-off critical values from the F-distribution at the 1% significance level as an adjustment for changing degrees of freedom, so that the significant critical values become a straight line at unity.

Note2 : The breakpoint Chow test is based on a comparison of the sum of squared residuals obtained by fitting a single equation to the entire sample with the sum of squared residuals obtained when separate equations are fit to each subsample of the data.

Note 3: The forecast Chow test estimates the model for a subsample comprised of the first T_1 observations. The estimated model is then used to predict the values of the dependent variable in the remaining T_2 data points. A large difference between actual and predicted values casts doubt on the stability of the estimated relation over the two subsamples.

regressions with the horizontal axis showing the end of sample for each regression.[11] The results show that β_y and β_s have remained stable since 1996.[12] Moreover, the three kinds of Chow tests suggest that all the parameters of the money demand function (8) remained stable in the 1990s.

In this way, the long-run equilibrium relationship between money and income remains stable even when the recent sample period is included in the VECM. This is because the revised model properly takes into account the impact of the financial anxieties on money demand.

3.4. Evaluation of the money gap

The lower figure of Chart 6 shows the money gap, that is, the gap between equilibrium and actual money stock, which is indicated by EC_t in equation (10). Although the money gap without adjustment for precautionary demand shows a wide spread from 1998, that adjusted for precautionary demand was around zero during 1998, and then expanded widely from the beginning of 1999.

In this sense, taking the precautionary demand properly into account, we can conclude that the monetary conditions were not easy but rather just at equilibrium in 1998, even though the growth rate of money and the *Marshallian k* increased rapidly in 1998 (See Chart 1.).[13] From 1999, monetary conditions finally became easy, even though the growth rate of money began to decrease in 1999.

4. Theoretical framework for the impact of financial system shock on money and income

On the basis of the empirical analysis above, let us now consider how financial system shock influenced Japan's economy after autumn 1997 and how the policies taken in those circumstances can be evaluated, using the conventional IS-LM analysis framework (Chart 8).

(a) Financial system shock exerts a negative impact on business fixed investment and private consumption, shifting the IS curve to the left.[14] At the same time, financial system shock creates a precautionary demand for money, which means heightened liquidity preference, thus increasing the demand for money under constant GDP.

[11] The starting point of the regressions is fixed at 1980/1Q.

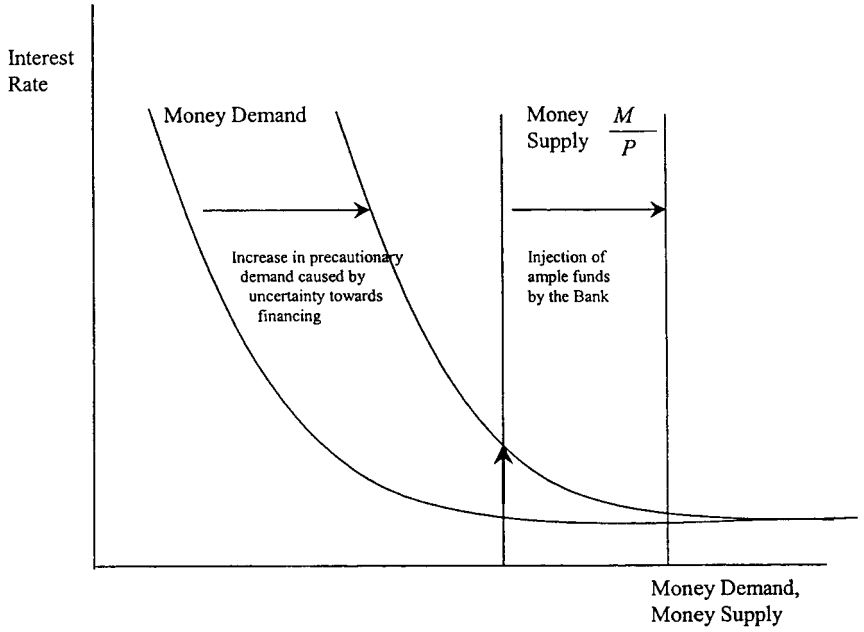
[12] It is not until 1998 that parameter β_D becomes significant, but this does not imply the instability of β_D. It just means that before 1997 we cannot estimate the impact of financial anxieties on money demand precisely, because in that period DV_t hardly changes.

[13] The increase in money was attributed to the following two factors: (i) there was a shift of funds from financial assets not included in M2+CDs, such as investment trusts and bank debentures, to bank deposits with higher liquidity, due to rising anxieties over the financial system; (ii) some firms gathered a large amount of on-hand funds (deposits) by issuing CP (Commercial Paper) and borrowing from banks due to concerns about the future availability of funds. Also the rise in the monetary base is due to an increase in cash demand in line with financial anxiety, and the accumulation of reserves by financial institutions in preparation for unexpected account withdrawals and fund-raising difficulties in the market. Thus, the growth rate of money increased, although the transaction demand for money declined as the economy receded.

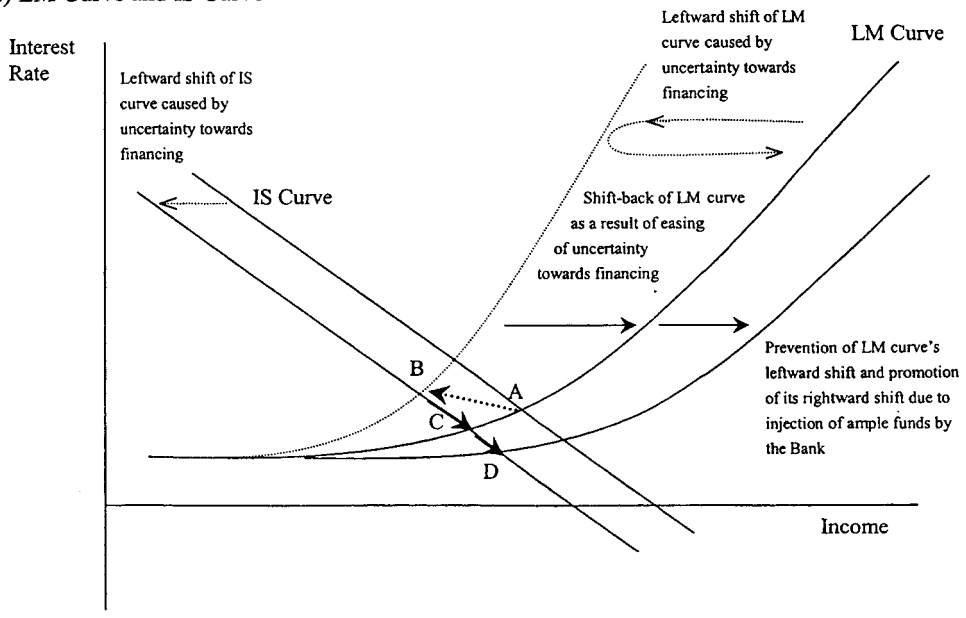
[14] Financial system shock may also make the IS curve steeper, which means that investment becomes less sensitive to changes in interest rates.

Chart 8. Impact of Financial System Shock (IS-LM Framework)

(1) Liquidity Preference



(2) LM Curve and IS Curve



This leads to a rise in interest rates under constant money supply, that is, a shift of the LM curve to the left. In other words, the financial system shock brings about "an unintended monetary tightening" under constant money growth. As a result of these leftward shifts of both the IS and LM curves, the real economy contracts significantly.

(b) The hypothesis that there was a substantial leftward shift of the LM curve is consistent with the upward pressure on interest rates on term instruments after the financial system shock and the tightening of corporate finance, particularly in the second half of 1998.[15,16] The Bank of Japan attempted to prevent the leftward shift of the LM curve by providing ample funds.[17] This can be confirmed by the fact that the money gap, adjusted for precautionary demand, did not contract but was at equilibrium on the whole during 1998. That is, the ample supply of funds by the Bank avoided a drastic increase in interest rates on term instruments, and then led to the higher growth of money.

(c) After 1999, the LM curve at last shifted to the right owing to the zero interest rate policy implemented from February 1999[18] and the easing of financial anxiety reflecting the injection of public funds.[19,20] This point can be confirmed by the fact that the adjusted money gap became wide in 1999. This means that the effects of monetary easing permeated further or were fully manifest. Also, in this process, the decline in interest rates on term instruments and the slowdown of the money growth rate occurred simultaneously, due to the decrease in the precautionary demand for money.

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[15] After autumn 1997, the degree of the leftward shift pressure of the LM curve was larger than that of the IS curve, resulting in upward pressure on interest rates.

[16] In the financial market, there was upward pressure on funding costs for the private sector. Interest rates on term instruments such as three-month Euro-yen rates and yields on bank debentures rose through the beginning of 1998. Yields on corporate bonds with low ratings also rose. As for short-term funds, the differential between Euro-yen and TB (Treasury Bills) interest rates expanded to around 1 percent at the end of 1997, after the failures of major financial institutions were revealed. The so-called Japan Premium (a premium imposed on Japanese banks when raising funds in U.S. dollars) also increased substantially.

[17] The Bank of Japan encouraged a lowering of interest rates on term instruments and tried to facilitate corporate finance by conducting longer-term operations to provide funds maturing after the fiscal year-end. In September 1998, the Bank decided to further ease its monetary policy. This was done by lowering the overnight call rate to "around 0.25 percent" from levels "around slightly below the official discount rate (0.5 percent)." Then, in November the Bank decided to adopt the following three policies in order to alleviate corporate financial conditions: (i) expansion of CP repo operations; (ii) establishment of a temporary lending facility to support firms' financing activities; (iii) establishment of a new market operation scheme which utilizes corporate debt obligations as eligible collateral.

[18] The Bank of Japan, at the Monetary Policy Meeting on February 12, decided to further ease its policy stance by encouraging the uncollateralized overnight call rate, which had been around the 0.25 percent level, to move as low as possible. This monetary easing was decided so as to "avoid possible intensification of deflationary pressure and to ensure that the economic downturn will come to a halt." Along with the further supply of ample funds, the overnight call rate declined, gradually dropping to zero by mid-March.

[19] The government injected a total of 7.5 trillion yen worth of public funds into 15 major banks at the end of March.

[20] The IS curve also shifted back to the right to some extent, in line with easing financial anxiety. An increase in public expenditures was also a factor in the rightward shift of the IS curve.

To quantify these interpretations, I conduct a simulation in which the financial system shock (i.e. financial anxieties) is incorporated into the VECM estimated in Section 3, assuming that this shock would dissipate completely after two years. The results are as follows (Chart 9):

(a) The financial system shock pushes down GDP at the beginning (leftward shift of the IS curve), and it simultaneously causes the precautionary demand for money to increase substantially, pushing down the adjusted money gap (shortage of money, large leftward shift of the LM curve).
(b) As a result of the decrease in the money gap (disequilibrium), such forces work to restore the equilibrium. That is, they push GDP further down and increase real money (rise in the *Marshallian k*).
(c) About a year later, as the precautionary demand for money decreases due to easing anxieties about the financial system, the money gap comes to surpass the baseline (excess money, rightward shift of the LM curve).
(d) While excess money along with the decreased uncertainty leads to an increase in real GDP, real money itself turns to a decrease (decline in the *Marshallian k*).[21]
(e) GDP surpasses the baseline after about two years.

It should be emphasized that the simulation results do not necessarily guarantee a steady economic recovery, since they are based on various assumptions.[22] The results, however, provide a useful framework to understand that the real economy and money may move in opposite directions with the outbreak and ease of financial system shock. On the basis of these results, it is important to recognize that money growth may slow during economic recovery, if the economy recovers as a result of easing financial anxieties. After the currency crisis in November 1997, Korea also underwent a recession accompanied by a disturbance in the financial system. In that case, the economy was depressed even though money growth rose, but as financial anxieties eased gradually from the start of 1999, the economy has recovered notably while money growth has slowed (Chart 10). This observation supports the above view that financial system shocks change the orthodox relationship between money and the economy.

I would also point out that, in a situation where money demand becomes extremely volatile due to financial system shocks, interest rates rather than money stock should be targeted to implement monetary policy, as the classical paper by Poole [1970] showed thirty years ago. When the money demand becomes extremely volatile (i.e., the LM shock is extremely large), there is a high possibility that interest rates will rise significantly and damage the economy when keeping money growth constant. Furthermore, since it is difficult to quantify and forecast the extent to which such a shock fluctuates the demand for money, setting a proper target for money becomes an extremely tough task. Therefore, we may conclude that a policy that focuses on interest rates and promotes their decline is preferable.

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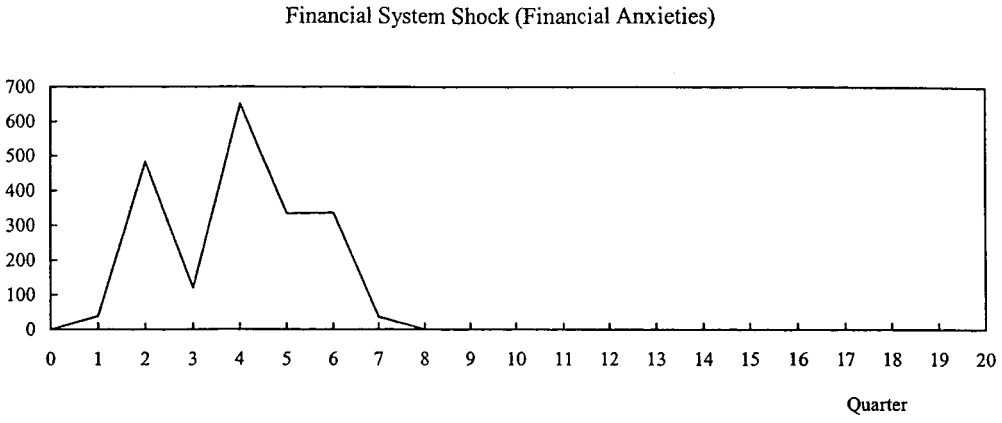
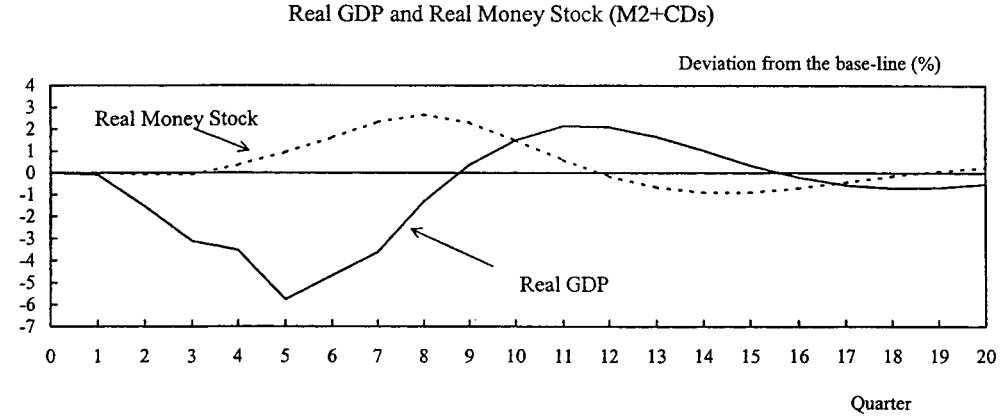
[21] A positive money gap leads to an increase in real GDP and a decrease in real money. The latter is caused by either a decrease in nominal money or rises in price levels. In Appendix, I estimate the P* model of inflation to investigate the impact of the money gap on the price level.

[22] In addition, under the conditions in which various structural problems exist and corporate restructuring exerts downward pressure on the economy, the effects of monetary easing alone cannot bring about a self-sustaining recovery led by private demand.

Chart 9. Impact of Financial System Shock (VECM Dynamic Simulation)





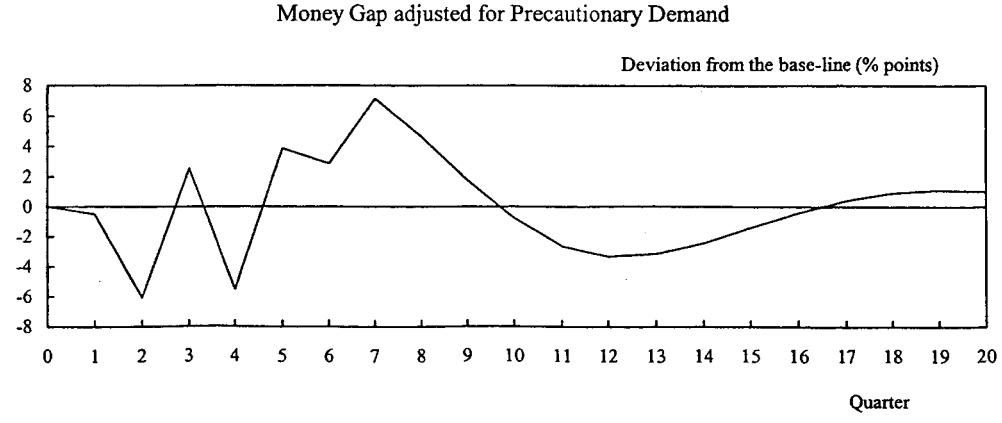
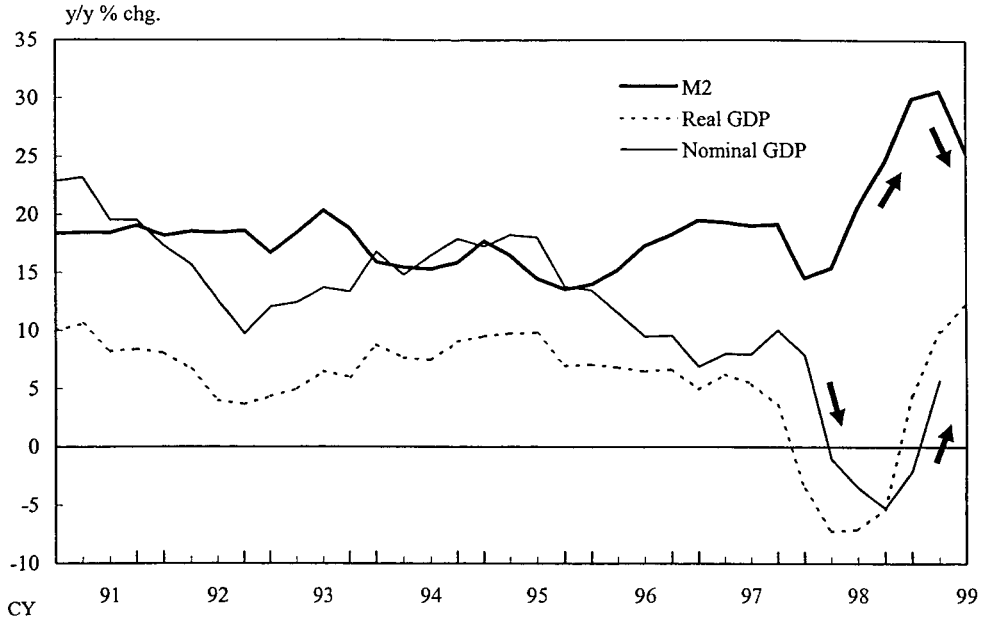


Chart 10. Money Stock and GDP (Korea)

(1) Money Stock and GDP



(2) Velocity (Nominal GDP / M2)

Source: Bank of Korea, "Monthly Bulletin."

5. Concluding remarks

This paper has examined Japan's financial and economic developments after the financial system shock in autumn 1997, and the findings may be summarized as follows:

(a) Developments in the real economy have had strong interactions with financial developments since the financial system shock occurred in autumn 1997. In particular, when global concern over credit risks was heightened in the second half of 1998, the deterioration of the economy and tightening of financial conditions created a vicious cycle. Since the beginning of 1999, the opposite developments have been observed due to an easing of financial anxiety.
(b) Looking at the relationship between money and the economy during this period, the growth rate of money increased while the real economy became depressed during 1998, but it started to decelerate as the economy began picking up in 1999. Thus, in the last three years, money and the economy have shown a relationship that is significantly different from the traditional one.
(c) This relationship has been influenced by the rise and fall in the precautionary demand for money along with the mounting and easing of financial anxiety.
(d) In terms of monetary policy, the Bank of Japan supplied ample funds to meet the increase in precautionary demand and tried to suppress overall interest rates during 1998. In 1999, precautionary demand declined as financial anxiety receded and the Bank continued to supply additional ample funds. As a result, interest rates decreased further and various risk premiums also contracted in the financial market. Thus, the effects of monetary easing became full-scale.

Appendix: Estimation of the P* model of inflation

The simulation in Section 4 suggests that a positive money gap will lead to an increase in real GDP and a decrease in real money. The latter is caused by either a decrease in nominal money or a rise in price levels. In this appendix, I estimate the P* model of inflation to investigate the impact of the money gap on price levels.

I modify the original P* model, which was proposed by Hallman, Porter and Small [1991], by following Atta-Mensah [1996]. The form of regression is:

$$\pi_t^k = \alpha MG_{t-k} + \beta GG_{t-k} + \gamma IPI_t^k + \theta \pi_{t-k}^k + c + \mu_t \tag{A1}$$

π_t^k is the annualized k-quarter growth rate of prices. This is defined as:

$$\pi_t^k = [\log(p_t) - \log(p_{t-k})] \times 400/k\,, \tag{A2}$$

where k is the quarter (1,4,6,8) and p_t is the price level (CPI and the GDP deflator).[23] MG_t is the money gap created from equation (10), that is, the error correction term EC_t. GG_t is the GDP gap estimated using a Cobb-Douglas type production function. IPI_t^k is the annualized k-quarter growth rate of import prices, which is defined similarly by equation (A2).[24] I assume that the error term μ_t follows MA $(k-1)$ process, because the overlapping data generate a moving-average error of order $k-1$.

[23] The price index is seasonally adjusted by X-12-ARIMA.
[24] When using the GDP deflator as the dependent variable, I exclude IPI_t from the model, since the GDP deflator can be regarded as home-made inflation.

Chart 11. Estimation Results of P* Model

(1) CPI Model

	Parameter of Money GAP α	Parameter of GDP GAP β	Parameter of Import Price γ	Parameter of Own Lag θ	$AdjR^2$	SE (%)
$k = 1$	0.040 (0.636)	0.188 (2.454)	0.012 (2.007)	0.639 (8.565)	0.677	1.047
$k = 4$	0.055 (2.873)	0.224 (5.529)	0.022 (4.452)	0.364 (7.508)	0.949	0.294
$k = 6$	0.118 (4.611)	0.296 (6.745)	0.024 (4.441)	0.278 (5.495)	0.953	0.256
$k = 8$	0.003 (0.364)	0.123 (3.155)	0.023 (2.537)	0.522 (5.382)	0.959	0.217

(2) GDP Deflator Model [$\gamma = 0$]

	Parameter of Money GAP α	Parameter of GDP GAP β	Parameter of Own Lag θ	$AdjR^2$	SE (%)
$k = 1$	0.138 (1.434)	0.443 (4.090)	0.357 (3.567)	0.413	1.618
$k = 4$	0.124 (3.009)	0.419 (5.938)	0.160 (2.177)	0.888	0.485
$k = 6$	0.179 (4.734)	0.440 (6.401)	0.145 (1.930)	0.908	0.394
$k = 8$	0.135 (3.823)	0.338 (4.855)	0.200 (1.755)	0.926	0.328

Note 1. Sample period is 1980/1Q–1999/1Q.
2. Values in parentheses are t-values.

(3) Forecast Perfomance (Unit: %)

	CPI Model		GDP Deflator Model	
	RMSE	MAE	RMSE	MAE
$k = 1$	0.766	0.594	1.621	1.265
$k = 4$	0.358	0.282	0.588	0.463
$k = 6$	0.302	0.249	0.600	0.458
$k = 8$	0.531	0.405	0.714	0.632

Note: Suppose the forecast sample is $t = S, S + 1, S + h$ and denote the actual and forecast value in period t as π_t^k, $\hat{\pi}_t^k$, respectively.
Then, RMSE and MAE are computed as follows:

$$RMSE\ (Root\ Mean\ Squared\ Error) = \sqrt{\frac{1}{h+1}\sum_{t=S}^{S+h}(\hat{\pi}_t^k - \pi_t^k)^2}$$

$$MAE\ (Mean\ Absolute\ Error) = \frac{1}{h+1}\sum_{t=S}^{S+h}|\hat{\pi}_t^k - \pi_r^k|$$

The estimation results are shown in Chart 11. The sample period for the estimation is 1980/1Q–1999/1Q, which is same as in Section 3. The coefficient of the GDP gap is found to be statistically significant at the one- to eight-quarter horizon for both the CPI model and the GDP deflator model. While the coefficient of money gap is not statistically significant at the one-quarter horizon for both models, it is significant at the four- and six-quarter horizons for the CPI model and at the four- to eight-quarter horizons for the GDP deflator model. The coefficient of the money gap is the largest at the six-quarter horizon for both models.

I also examine the out-of-sample forecasting performance of the modified P^* model and calculate the root-mean-square error (RMSE) and mean absolute error (MAE).[25] According to these criteria, the out-of-sample forecast performance of both models is reasonably good at the six-quarter horizon.

Thus, these estimation results suggest that the money gap is useful for forecasting the inflation rate at the six-quarter horizon, although we need more time and data to conclude that money remains to be an useful information variable under low inflation.

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[25] The predictive performance of the models is assessed by running recursive regressions over the sample period. This method involves the estimation of the model from 1980/Q1 to 1995/Q1 and a k-quarter-ahead forecast, where k=1,4,6 and 8. The models are re-estimated by extending the sample size by a quarter at a time and k-quarter-ahead forecasts are made each time. The process continues until the data points are exhausted.

Framework and tools of monetary analysis

Klaus Masuch, Huw Pill and Caroline Willeke*

European Central Bank

1. Introduction

In October 1998, the Governing Council of the ECB announced the main elements of its monetary policy strategy.

First, it provided a quantitative definition of the primary objective of monetary policy in the euro area, namely price stability. Price stability was defined as an annual increase in the Harmonised Index of Consumer Prices (HICP) for the euro area of below 2%.

Second, the Governing Council defined a framework for structuring the analysis and assessment of economic data which underlies monetary policy decisions. In recognition of the fundamentally monetary nature of inflation over the medium term, the ECB assigned a prominent role to money in the formulation of policy decisions aimed at the maintenance of price stability. This "first pillar" of the strategy was signalled by the announcement of a quantitative reference value for monetary growth. Moreover, acknowledging the influence of non-monetary factors on price developments and recognising the important information relevant for monetary policy decisions contained in other indicators, the ECB announced that, in addition to a thorough analysis of monetary developments, a broadly based assessment of a wide range of other economic and financial variables would also be undertaken and constitute a further basis for monetary policy decisions. This assessment is labelled the "second pillar" of the strategy.

This paper describes the framework and tools of monetary analysis from the point of view of ECB staff. It explains in more detail some of the tools and approaches which are used by ECB staff for monetary analysis under the "first pillar" and others which are under development or may be used in the future. The remainder of the paper is organised as follows. Section 2 recalls some general issues underlying the strategy as a whole. Against this background, Section 3 outlines the main arguments

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* The authors of this paper are staff members of the Directorate Monetary Policy in the Directorate General Economics of the European Central Bank (ECB). (Since the paper was finalised, Huw Pill has moved to the Graduate School of Business Administration, Harvard University). The contents of this paper represent the views of the authors and not necessarily those of either the ECB or the Eurosystem. It has benefited from the comments of our discussant, H. Dillén of Sveriges Riksbank, other participants in the workshop and our colleagues at the ECB, in particular P. Moutot, H.-J. Klöckers, J.-L. Escrivá, S. Nicoletti Altimari, C. Brand and A. Calza. The underlying analysis and tools presented in the paper are based on the collective work of the staff of the Directorate Monetary Policy at the ECB.

for assigning a prominent role to money in the strategy and briefly describes the general role of the quantitative reference value for monetary growth. Section 4 discusses the features of the regular monitoring of various monetary aggregates and their components and counterparts. Section 5 describes various tools and concepts based on money demand models which may contribute to deriving the information content of monetary aggregates for monetary policy. Section 6 provides some evidence regarding the information content of monetary aggregates for future price developments and discusses the uses and limitations of money-based projections. Section 7 briefly concludes.

2. General strategic issues

Before turning to a description of the role of monetary analysis in the ECB's strategy, it is worth making a number of more general observations regarding the strategy. In particular, several common misconceptions should be clarified.

First, the ECB's strategy is often misunderstood by external observers as implying multiple targets for monetary policy. On the one hand, the prominent role for money is associated with an intermediate monetary target, whereas, on the other hand, the "second pillar" is often characterised as a direct inflation target.

However, at the outset it should be emphasised that the maintenance of price stability in the euro area is the only target (or, more formally, "primary objective") of the ECB's strategy. Both pillars of the strategy should be understood as instrumental in facilitating the achievement of this ultimate and overriding objective. Taken together, the two pillars of the strategy form a framework which organises the analysis and presentation of the broad set of information relevant for monetary policy-making. Monetary analysis is therefore of value insofar as it helps policy-makers take decisions which serve the maintenance of price stability. Specific rates of monetary growth are not assigned a status of intermediate target. Monetary analysis is given prominence which reflects its relevance for policy decisions aimed at achieving price stability.

Second, in the academic discussion of monetary policy strategies, the long-running debate on the respective merits of rules and discretion is often couched in rather extreme terms. On the one hand, a rule-based monetary policy is characterised as following a contingent path in an entirely mechanical fashion. On the other hand, a discretionary policy is viewed as one which pursues varying and intransparent objectives[1] and/or which is formulated in an inconsistent manner over time.[2] The practical discussion of monetary policy has eschewed such extremes and emphasised the need to create policy-making frameworks that facilitate the implementation of a credible, consistent and forward-looking policy which remains focused on the maintenance of price stability over the medium term.

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[1] Walsh (1998) talks of "targeting rules" which restrict the discretion available to policy-makers by imposing "rules under which the central bank is judged in part on its ability to achieve a prespecified value for some macroeconomic variable" (pp. 362-3).

[2] In other words, approaching the problem afresh each period, instead of following a consistent approach which recognises the interdependency of current and future policy decisions, for example in the sense of a contingent rule, e.g. Barro and Gordon (1983).

The ECB's strategy should be viewed in this light. While the strategy is intended to facilitate the policy-making process and provide both a discipline to, and useful benchmarks for, monetary policy decisions aimed at price stability, neither the first nor the second pillar of the strategy are seen by the ECB as providing "mechanical" guidance for interest rate settings. Rather the two pillars represent distinct, but nonetheless complementary, frameworks for analysing macroeconomic data and their implications for monetary policy (ECB, 2000).

Against this background, monetary policy decisions should always be based on an overall assessment of the analysis and information evaluated under both pillars of the strategy. An assessment of the role of monetary analysis in the ECB's strategy should always keep this in mind. Basing monetary policy on information from both pillars naturally implies that the relationship between policy decisions and monetary developments will always be conditional on developments in other indicator variables, and therefore may, at times, be complex.

3. A prominent role for money

3.1. Rationale behind the prominent role for money

With these strategic issues in mind, this section first briefly reviews the main arguments for assigning money a prominent role in the ECB's strategy and then outlines the role of the reference value for monetary growth.

One of the most remarkable empirical regularities in macroeconomics is the ubiquitous long-run relationship between the price level and the money stock. A positive and often almost one-to-one relationship between monetary growth and inflation at longer horizons has been illustrated for a wide variety of countries, using a number of different analytical and empirical tools and employing various definitions of money and data sets.[3] There is a broad consensus in the literature that any well-specified model of a monetary economy should exhibit this feature. On both empirical and theoretical grounds, the literature provides ample justification for assigning money an important role in monetary policy-making.

In this context, it should also be recognised that ultimately it is the power to control the supply of base money which gives a central bank its influence over short-term interest rates and, ultimately, price developments. If the central bank injects more liquidity than the economy needs to service a sustainable level of real activity, this will eventually be reflected in higher prices.

The connection drawn between money and prices has a long pedigree, dating back at least as far as Hume's work in the eighteenth century. More recently, "monetarist" approaches to economic analysis, which place the evolution of monetary aggregates at the centre of explanations of price developments, have exerted a powerful influence on developments in both economic theory and policy-making.[4] The Chicago monetarist "oral tradition"[5] and the "classical monetarism" of Milton Friedman and his associates[6] emphasised the importance of assigning an important role to monetary developments for prices and the economy more broadly.

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[3] Lucas (1995); McCandless and Weber (1995).
[4] De Long (2000).
[5] Tavlas (1997).
[6] Friedman (1956, 1960); Brunner (1968); Brunner and Meltzer (1972).

More recent literature has also assigned an important role to the analysis of monetary aggregates and, in particular, credit, for understanding the transmission process. For example, Bernanke has offered an explanation of the Great Depression which emphasises the importance of the collapse in credit (associated with the US banking crisis) as a determinant of real outcomes. Investigations of the credit channel of monetary transmission also analysed the sectoral pattern of credit growth. At the same time, theoretical advances have been made in "cash/credit" and "limited participation" models, which introduced financial market frictions into real business cycle models and thereby assigned an "active" causal role to money. Advocates of such models have argued that they offer a better empirical explanation of the economy's response to monetary policy than alternative "sticky price" models with frictions in goods markets which attribute no or only a purely passive role to money.

As yet, these theoretical models have not been used extensively in regular policy analysis. Rather, the models inform an empirical approach which relates various measures of monetary and credit growth or "excess liquidity" to inflationary pressures. As argued by Laidler (1997), these models have a "disequilibrium character". The main behavioural explanation of why current monetary developments contain information about the future price outlook follows from the view that *excess* money holdings are spent (so as to re-establish monetary equilibrium), thereby increasing demand and inflationary pressures. The theoretical basis for such a disequilibrium approach is not as elegant as for alternative equilibrium models. Yet this framework has a strong intellectual tradition (albeit more "oral" or qualitative than based on an explicit set of structural equations) and appears to have empirical relevance (e.g. in the context of so-called P-star models[7]).

Regarding the euro area, the available empirical evidence continues to point to the existence of a stable relationship between broad monetary aggregates (in particular M3) and the price level over the medium term.[8] Moreover, monetary and credit aggregates appear to demonstrate some leading indicator properties for future price developments, especially at longer horizons.[9] Thus evidence for the euro area provides justification for the prominent role of money in the ECB's strategy.

As argued by Engert and Selody (1998) (and Selody (2001) in this volume), the large body of theoretical and empirical literature emphasising the role of monetary and credit developments in the transmission of monetary policy and the determination of the price level provides ample justification for giving monetary analysis an important role in the monetary policy process in parallel with the analysis of other cyclical and real economy indicators. In the ECB context, these arguments also support the prominent role assigned to money in the ECB's strategy.

Furthermore, compared with plausible alternative indicators of future price developments, money exhibits a number of desirable practical features. Monetary data are typically available in a more timely fashion and may be of better quality than other macroeconomic data (e.g. real GDP, which is only available quarterly after a significant lag and is often revised substantially). Monetary analysis may therefore provide prompter

[7] Hallman, et al. (1991). See also Orphanides and Porter (2001) in this volume.
[8] Coenen and Vega (1999); Brand and Cassola (2000).
[9] Trecroci and Vega (2000); Gerlach and Svensson (2000); Nicoletti Altimari (2001).

and more accurate guidance for policy-makers.[10] Finally – and this is of relevance for the ECB – monetary data have a euro area-wide focus. In contrast, even after the introduction of the euro, indicators such as GDP and inflation often continue to be viewed and analysed in national terms by outside observers. Emphasising money may therefore be conducive to fostering the appropriate area-wide perspective in public discussion of the single monetary policy.

Of course, as a practical matter, the successful example of other central banks which assigned an important role to money and monetary analysis in their monetary policy strategies in the past (e.g. by announcing an intermediate monetary target or monitoring ranges) naturally encouraged the ECB to study whether assigning a prominent role to money should also be a central component of its own strategy. As a new central bank assuming monetary sovereignty in an environment of considerable uncertainty, the ECB naturally wished to draw on the experience of its predecessor national central banks (NCBs), thereby inheriting some of their credibility.[11] However, attributing the choice of the prominent role of money in the ECB's strategy to a process of learning from successful central banks does not diminish the relevance of the economic argumentation presented here.

3.2. Signalling the prominent role for money: the reference value for monetary growth

The prominent role assigned to money in the ECB's strategy was signalled by the announcement of a reference value for broad monetary growth.

In line with the general strategic framework outlined above, the reference value represents a public commitment by the ECB to analyse monetary developments thoroughly in a manner that offers a coherent guide for monetary policy aimed at the maintenance of price stability, ensuring that monetary developments are given an appropriate weight in the assessment on which policy decisions are based. Moreover, the public nature of this commitment helps to ensure that adequate weight (which honestly reflects their role in the decision-making process) is given to monetary analysis in the presentation of monetary policy decisions to the public.

Against this background, in order to fulfil the role assigned to it by the ECB, the reference value should exhibit two key features.

First, the reference value should be derived in a manner which is consistent with – and serves the achievement of – price stability. In order to fulfil this criterion, the monetary aggregate used to define the reference value *should exhibit a stable (or at least predictable) relationship with the price level* at some time horizon. Typically, the stability of the relationship between money and prices is evaluated in the context of a money demand equation. The existence of a stable long-run money demand equation implies that the relationship between money and the price level, conditional on developments in other key macroeconomic variables such as interest rates and real GDP, is stable over the longer-term.

Second, prolonged and/or substantial deviations of monetary growth from the reference value should, under normal circumstances, signal risks to price stability. This criter-

[10] Orphanides (2000): This issue may be of particular relevance for the euro area since – especially at the start of Stage Three – many other macroeconomic data series are not constructed or consolidated on an area-wide basis.

[11] European Monetary Institute (EMI, 1997).

ion requires that the monetary aggregate used to define the reference value should normally *contain information regarding future price developments.*

The reference value was given an explicitly medium-term orientation (see ECB, 1999b). In consequence, the reference value represents the rate of M3 growth *over the medium term* which is consistent with the maintenance of price stability over the medium term.

This approach has two main advantages. First, it emphasises the necessarily medium-term orientation of a monetary policy aimed at price stability, given the long and uncertain lags in the monetary transmission mechanism. Second, the derivation of a reference value with such a medium-term orientation is based on the longer-term empirical relationship between money and prices, which is simpler, and likely to be more reliable and more stable than the relationship at shorter horizons. If the reference value is given such a medium-term orientation, it will naturally have an open horizon rather than be applied to a specific period.[12]

The ECB has made clear that it does not set its instruments with the aim of controlling monetary growth so as to hit the reference value at a specific horizon (ECB, 2000). Such a mechanical approach to interest rate decisions would not be consistent with the general strategic principles outlined in Section 2. In particular, in an economy where major shocks to money demand cannot be excluded, gearing interest rate changes to controlling monetary growth in order to achieve a pre-announced target would clearly not always be consistent with taking monetary policy decisions which best serve the maintenance of price stability.[13]

Notwithstanding the importance of the reference value as a commitment and a communication tool, it should be emphasised that the ECB does not interpret the prominent role of money solely in terms of the reference value. In practice, various monetary and credit aggregates and the Monetary Financial Institution (MFI) balance sheet are analysed for the information they contain which is relevant for a monetary policy aimed at price stability.

The remainder of this paper describes various aspects of the broader analytical framework and of the evaluation and interpretation of monetary data under the "first pillar", without claiming to be exhaustive.

4. Monitoring monetary developments

4.1. Definition of monetary aggregates

Based on conceptual considerations and in line with international practice, the ECB has defined a narrow (M1), an intermediate (M2) and a broad monetary aggregate (M3). These aggregates differ with respect to the degree of "moneyness" of the assets included. The narrow aggregate M1 includes currency in circulation as well as balances that can immediately be converted into currency or used for cashless payments, i.e.

[12] In line with this approach, the Governing Council announced its *first* reference value in December 1998, *confirmed* this value in December 1999 and *re-confirmed* it in December 2000, rather than announcing a value for the years 1999, 2000 and 2001 respectively.

[13] Since the ECB's strategy does not commit it to controlling monetary aggregates in the shorter term by manipulating short-term interest rates, the issue of controllability – a topic of intense debate in the literature on intermediate monetary targeting – does not arise in the context of the reference value.

overnight deposits. M2 comprises M1 plus deposits with an agreed maturity up to two years and deposits redeemable at a period of notice of up to three months. M2 has been defined in this way to facilitate the analysis and monitoring of a monetary aggregate that includes, in addition to currency, liquid bank deposits. The broad aggregate M3 includes M2 plus repurchase agreements, money market fund shares, money market paper and debt securities issued by MFIs with an original maturity up to two years. These "marketable instruments" have a high degree of liquidity and price certainty and, hence, can be regarded as close substitutes for deposits.

The decision to identify M3 as the key aggregate used to define the reference value was taken on the basis of both conceptual considerations and empirical investigations. The former suggested that broader monetary aggregates such as M3 were likely to exhibit a more stable relationship with the price level, since they internalised much of the substitution between conventional bank demand deposits and other MFI liabilities which had the potential to lead to instabilities in money demand. As regards the latter, the preliminary empirical studies available in Autumn 1998 also tended to support this conclusion as they showed a relative advantage of M3 regarding the stability of money demand and the leading indicator properties in respect of inflation.[14,15]

4.2. Monitoring M3 developments over different time horizons

A natural starting point for a regular monetary analysis is the comparison of M3 growth with the reference value (see Chart 1). Although, as already emphasised, conclusions cannot be mechanically drawn from such a comparison, the evolution of the deviation of actual M3 growth from the reference value over time may give a first indication of potential news in the data.

The key growth rate for the ECB's analysis of M3 developments in relation to the reference value is a centred three-month moving average of annual M3 growth rates. It was decided to focus on annual growth rates as these tend to attract most attention in the public debate and therefore are a natural focus for the comparison of monetary developments relative to the reference value. Moreover, seasonal adjustments for the euro area monetary aggregates were initially deemed rather unreliable, since a detailed study of the seasonal patterns had been precluded by the absence of long runs of data. Using annual growth rates largely avoided the need to make seasonal adjustments. Taking a three-month average of these annual growth rates has a smoothing effect which avoids over-emphasising monthly changes in the annual growth rate. This is important as, for example, end-of-month peculiarities may, on occasions, have a temporary but visible effect on the annual growth rate.

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[14] These preliminary econometric studies were complicated by the lack of reliable historical data series on monetary aggregates for the euro area with which to assess the empirical properties of the various series. Because the statistical definitions underlying euro area money and banking statistics did not correspond in all cases to those underlying the previous national systems, historical series for the euro area monetary aggregates had, in part, to be based on approximations and estimations.

[15] The choice of the specific definition of M3 (e.g. the decision to include the shares of money market funds (MMFs) within M3) was also based on preliminary empirical investigations into the stability of demand for variants of M3 and the leading indicator properties of these aggregates for inflation.

Chart 1. M3 growth and the reference value
(annual percentage changes, monthly data)

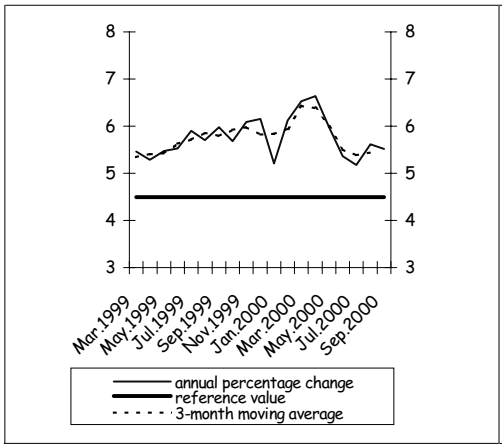
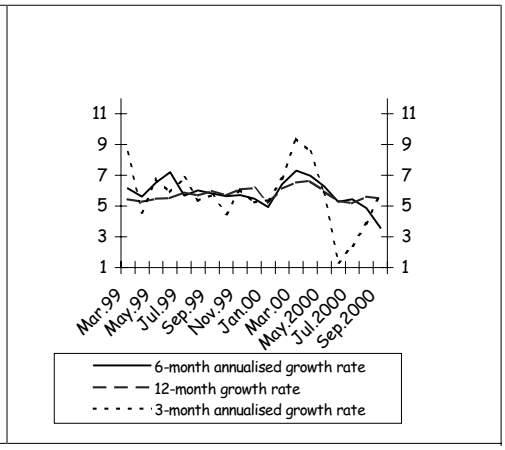


Chart 2. Growth rates of M3
(annualised percentage changes based on seasonally adjusted data)



Note: The time series shown in these charts (and the charts provided elsewhere in the paper) are based on (estimates of) data available in early November 2000 up to and including the third quarter of 2000.

However, not only the three-month average of the annual growth rates but also the annual rate of growth itself and shorter-term (seasonally adjusted) growth rates are closely monitored (see, for example, Chart 2). Looking at several growth rates in parallel ensures that changes in the underlying monetary trend are detected in a timely manner. Moreover, this approach avoids confusion between base effects and recent developments when analysing changes in growth rates.[16] At the same time, it always needs to be taken into account that shorter-term developments have to be interpreted with caution. The shorter the time horizon, the more volatile the growth rates are and the higher the possibility that changes reflect pure noise (see, for example, the volatility of the three-month annualised growth rate of M3 shown in Chart 2).[17] Moreover, monetary growth over a period of only a few months is not so relevant per se for future price developments unless it adds to a cumulated deviation from the reference value or signals a fundamental change in future growth dynamics.

In spite of the medium-term character of the reference value, multi-annual growth rates do not play a prominent role in regular monetary analysis. While in situations where there is a high degree of volatility in monetary variables the focus on longer periods may help to detect the underlying trend, multi-annual growth rates have the disadvantage that they react very sluggishly to changes in monetary dynamics and, hence, changes in the monetary situation may be signalled too late. Overall, it seems to

[16] Growth rates which are calculated against a moving base entail the difficulty that changes in the growth rate from one month to another are not necessarily due to the development in the last month. By contrast, the growth in the month which drops out of a specific growth rate is equally important.

[17] This volatility is partly due to the fact that euro area monetary statistics are only available as end-of-month figures while, for example, in some of the euro area countries prior to Stage Three of EMU monthly averages were available at least for the key monetary aggregate.

be more appropriate to supplement the monitoring of annual and shorter-term growth rates by also analysing the level of M3 in order to guarantee the medium-term character of monetary analysis (see Section 5.6).

4.3. Analysis of components and counterparts

A significant element of both the monthly and the quarterly monetary assessment is an analysis of the components and the counterparts of M3. The motivation for such an analysis is twofold. First, it can help to better explain M3 growth. Second, some of these variables are directly informative in respect of inflation or GDP growth.

Among the components, M1 – consisting of currency in circulation and overnight deposits – receives much attention. This component is the most liquid one and is immediately available for transactions. Moreover, under normal circumstances, movements in M1 do not reflect pure portfolio motives. In the euro area there is some evidence that M1 growth may exhibit leading indicator properties for real GDP growth. However, this narrow aggregate seems to be inferior to M3 regarding its information content about future inflation, partly as M1 is much more sensitive to interest rate changes and, therefore, more volatile.

Other short-term deposits and marketable instruments are also closely monitored, mainly to obtain additional information for explaining and assessing M3 growth. Such an analysis is of particular importance in periods of frequent interest rate changes. As these components bear interest rates which are in part closely linked to market rates, they may in the short run react positively to short-term market rates. Hence, in the months after a change in ECB interest rates the same M3 growth rate may be interpreted differently according to the structure of M3 growth.

Regarding the counterparts to M3, the focus of the analysis is mainly on loans to the private sector.[18] Among the counterparts, loans are not only the most important candidate among possible driving forces behind M3 in the longer-term but are also the indicator which is most informative about the state of the economy. A close monitoring of loans is essential in order to detect changes in the demand for loans or the availability of loans in a timely manner. This information, in turn, complements the picture of the monetary situation in the euro area gained on the basis of the analysis of M3.

On a monthly basis, only data for total loans to the private sector (including seasonally adjusted data) are available in the euro area. This allows for a first inspection of whether recent developments are continued or whether there are signs of a change in growth dynamics. In addition, on a quarterly basis data on loans by sector (in particular, non-financial corporations, households, financial corporations), purpose (loans to households are broken down into consumer credit, loans for house purchase and other loans), and maturity are provided. These data are a valuable source of information regarding the main determinants of loan developments and their assessment.

Monetary analysis usually also encompasses the other main counterparts to M3, namely credit and loans to the general government, longer-term financial liabilities, net external assets of the MFI sector and the deposits of the central government sector. A

[18] Credit to the private sector includes, in addition to loans, the MFI holdings of shares and securities other than shares. Changes in these balance sheet items, however, often reflect secondary market transactions and, hence, not necessarily the granting of new credit to the respective issuers.

reliable interpretation of these items for the euro area, however, faces some difficulties which are mainly related to data problems. Since time series only start in September 1997, systematic studies of the relationship between the individual counterpart items and their determinants, between the counterparts and M3, or between different counterparts are difficult to undertake. Hence, the assessment of particular developments in counterparts is still surrounded by significant uncertainty.[19]

As a first step towards explaining and assessing developments in M3, its components and counterparts, the movements in these variables need to be linked to factors which systematically or on occasion are behind monetary developments. Close attention should be paid, for example, to news about economic activity, market and retail interest rates, the overall financial market situation, mergers and acquisitions and real estate markets. Such an analysis does not only improve the understanding about what is behind the monetary data but also helps to assess the extent to which the latter might be of relevance for future inflation or growth.

The national contributions to euro area monetary variables as such lack any political content in the context of Monetary Union. The monetary policy of the Governing Council of the ECB is geared towards the euro area as a whole and, hence, based on an assessment of area-wide developments. At the same time, however, a close monitoring of the national contributions can also provide, on occasion, insights which are helpful for the assessment of euro area variables. For example, since the financial systems and money holding behaviour in the individual countries of the euro area are still quite heterogeneous and financial integration between the countries in some sectors (in particular, retail banking) remains relatively low (e.g. within the euro area there are only limited cross-border holdings of deposits), the analysis of national contributions adds information to that obtained by monitoring the area-wide aggregates. A close inspection is, inter alia, useful for obtaining a first hint of the existence and relevance of special factors influencing monetary growth. Moreover, explanations of (short-term) monetary developments which seem reasonable on the basis of euro area data can be cross-checked on the basis of national data (e.g. whether a specific development in M3 growth can be reasonably linked to real activity). Obviously, the existence of cross-border flows within the euro area has to be duly taken into account when interpreting those national contributions.

5. The information content of monetary aggregates for monetary policy – approaches based on money demand models

5.1. Money demand frameworks

One natural starting point for the econometric analysis of monetary developments is a money demand equation. A number of specifications have been estimated for the euro area.

[19] Moreover, additional problems exist for individual counterparts. For example, the monitoring of longer-term financial liabilities which, in principle, could give valuable insights into the relative demand of economic agents for short-term or long-term assets and also for financial and real assets is hampered by the fact that this item also includes the purchases of debt securities by non-euro area residents. The current statistical framework of the Eurosystem does not allow to identify the holders of the debt securities issued by banks (with the exception of the holdings of the Monetary Financial Institutions themselves).

The Brand/Cassola (BC) money demand system for euro area M3 has been developed using a structural cointegrating vector autoregression (VAR) approach (Brand and Cassola, 2000). The core of the model consists of three long-run economic relationships: a money demand function for euro area M3 which establishes a stable relationship between real M3 balances, long-term interest rates and real GDP; a Fisher parity relationship between long-term nominal interest rates and inflation; and a stable relationship between short-term and long-term interest rates (the yield curve). An important feature of the resulting dynamic system is that these three long-run relationships have implications for changes of inflation, interest rates, money and income. Therefore, all the variables in the system are simultaneously determined.

From an economic perspective, the salient features of the model can be summarised as follows. First, if M3 grows faster than originally foreseen on the basis of the model, this may (in part, by generating higher GDP growth) lead to higher inflation. Second, M3 developments are relevant in two respects: on the one hand, they reflect current developments in GDP and, on the other, they help to predict future GDP growth. Finally, in the long term (although not at the shorter horizons typically considered for the controllability of monetary aggregates), higher short-term rates would lead to a decrease in money growth.

Given the results reported in Coenen and Vega (1999) (henceforth CV), the CV specification makes it possible to model money demand as a single equation, rather than within a system. The single equation relates changes in real M3 to deviations from a long-run money demand relationship, changes in GDP growth, inflation, short and long-term interest rates. The long-run money demand relationship links the level of real M3 to that of real GDP, the spread between short-term and long-term rates and inflation. Both inflation and the yield curve spread are incorporated in order to capture opportunity costs of holding M3.

More recently an attempt has been made to model M3 demand in a system which includes the spread between the short-term market interest rate and the own rate of return on M3 balances. Preliminary results based on this new specification support the stability of M3 demand and the velocity assumptions underlying the reference value.

Given the important role of M3, it is not surprising that most studies focus on this aggregate. Nevertheless evaluation of other monetary aggregates has also taken place. A study by Calza, Jung and Stracca (2001) is available which investigates the components of M3. Moreover, recent preliminary analysis has suggested that (for the sample period 1980–98) a stable money demand relationship can be found for the narrower aggregate M1 if the interest rate semi-elasticity of money demand is allowed to vary positively with the level of interest rates.[20]

5.2. Money demand and the derivation of the reference value

From an empirical point of view, the studies presented above (see Section 5.1) have largely supported the decision to identify M3 as the key aggregate used to define the reference value. In particular, they suggest that M3 exhibits the required stable relationship with the euro area price level at longer horizons.

[20] See Stracca, 2001.

With M3 identified as the key aggregate, the quantitative derivation of the reference value for monetary growth was presented using the well-known quantity equation relationship between, on the one hand, monetary growth (Δm) and, on the other hand, developments in the price level (Δp), real GDP (Δyr) and the income velocity of circulation (Δv).

$$\Delta m = \Delta yr + \Delta p - \Delta v\,.$$

Within this framework, the derivation was based on the ECB's definition of price stability and medium-term assumptions for developments in real GDP and M3 income velocity.

As noted in the introduction, the ECB has defined price stability as an annual increase in the HICP for the euro area of below 2%. In the derivation of the first reference value in December 1998, it was assumed that the trend growth rate of real GDP was in the range 2% to 2 ½% per year. This assumption was based on an assessment of the historical behaviour of GDP in the euro area over the preceding twenty years and estimates of potential GDP growth made by various international organisations and the ECB itself.[21]

In the derivation of the reference value, it was also estimated that the trend decline in M3 income velocity was in the range ½% and 1% each year. Based on the assumptions mentioned above, the first reference value for monetary growth was set at an annual rate of 4 ½% for M3.[22, 23]

The assumption for the velocity trend can be derived from historical trends estimated using data from 1980 onwards.[24] The analysis underlying the velocity assumption also drew on money demand studies. In this context, attention focused on the long-run money demand relationship, which – together with the assumption on real trend growth – was viewed as capturing the medium-term velocity behaviour relevant for the reference value. Given that price stability is to be maintained according to the ECB's

[21] Relying on an analysis of historical trends is essentially a backward-looking approach. Nevertheless, neither in 1999 nor in 2000 was there clear evidence that future trends would deviate from the 2% to 2 ½% growth rate observed in the past.

[22] The first reference value was announced as a specific rate rather than in the form of a range. The ECB decided that announcing a specific reference rate would help to avoid suggesting to the public that interest rates would be manipulated in a quasi-automatic manner in order to maintain observed M3 growth of a particular "threshold" magnitude. Suggesting such a mechanical response was deemed to be inconsistent with the ECB's monetary policy strategy in general, and the concept of a reference value in particular (ECB, 1999a).

[23] The Governing Council arrived at this figure by noting that summing the three upside extremes of the assumed ranges for the components of the reference value would lead to a rate of 5.5%. In view of the definition of price stability, which indicates that inflation should be *below* 2%, and noting that the actual trend decline in velocity was likely to lie somewhat below the extreme of the range described above, the reference value was then set at an annual growth rate of 4½%. By taking the mid points of the ranges mentioned above, some observers have derived an implicit point inflation objective of 1½% (in terms of the GDP deflator) from the derivation of the reference value. However, the ECB has not endorsed this view and has not identified a specific focal point within the range of inflation rates below 2% it deems consistent with price stability.

[24] A more detailed analysis of the time series properties of M3 income velocity shows that while conventional unit root tests were inconclusive as to whether velocity can be described as stationary around a deterministic trend, analysis has shown that the likely behaviour of velocity over the medium term (e.g. a horizon of around ten years) remains consistent with the assumed decline of ½% and 1% per annum.

definition in the euro area in the future, inflation and, more arguably, nominal interest rates will be stationary time series in the future. This implies that the medium-term behaviour of M3 velocity can be determined solely on the basis of the long-run income elasticity of the demand for M3 and the assumption for trend real GDP growth, i.e. if the money demand relationship is represented by (1), where m represents the logarithm of M3, p is the logarithm of the price level, y is the logarithm of real GDP, i is the interest rate and π is inflation, then:

$$m - p = \alpha + \beta \cdot y + \gamma \cdot i \tag{1}$$

Given the definition of velocity and taking differences, this implies:

$$\Delta v \equiv \Delta y + \Delta p - \Delta m = \Delta y + \Delta p - \Delta p - \beta \cdot \Delta y - \gamma \cdot \Delta i \tag{2}$$

Assuming an environment of price stability and stationary real interest rates, this yields:

$$\Delta v = (1 - \beta) \cdot \Delta y \tag{3}$$

In the context of a money demand equation, the reference value can also be derived directly as the steady-state rate of monetary growth that is consistent with price stability and the assumed trend behaviour of real GDP. Using the generic money demand equation (1) above, taking first differences and substituting the inflation rate consistent with price stability and the assumption for trend real GDP growth gives:

$$\Delta m_t^{\text{ref val}} = \pi^* + \beta_y \, \Delta y_t^{\text{potential}} \tag{4}$$

For example, given the income elasticity of real M3 demand from the long-run BC money demand equation (of approximately 1.3), the 4 ½% reference value for M3 growth is consistent with an inflation rate of 1 ½% (which is consistent with the definition of price stability) and the steady-state growth rate of real GDP of 2 ¼% which is implied by the model.

5.3. Decomposing money growth based on money demand models

The money demand models can be used to explain monetary developments. The models allow for a quantitative analysis of the contributions of the various determinants of money demand to monetary growth.

At least two exercises are possible. First, on the basis of a M3 demand equation, M3 growth can be decomposed into the contribution driven by the error-correction term (i.e. the deviation of the actual money stock from its long-run equilibrium value); the contribution caused by the dynamic elements of the money demand model; and the component of current monetary growth that is not explained by the model (i.e. the residual). Second, M3 growth can be decomposed into the contributions arising from each of its determinants in a money demand equation (i.e. output, interest rates etc.), thereby combining the dynamic and the "error-correction" factors for each variable.

Obviously, such decompositions rely on the specification and estimated parameters of the underlying equation. If more than one money demand equation is available – as is the case for M3 in the euro area – then it is possible to decompose monetary growth on the basis of several approaches, allowing scope for cross-checking and the exercise of judgement regarding which approach better explains current developments.

5.4. A semi-structural approach based on money demand – combining the model-based and the judgmental approach

5.4.1. Starting from a money demand model

While accounting and decomposition exercises may be helpful for developing a deeper understanding of the causes of monetary growth, a more ambitious approach would be to identify and classify (or to estimate) the type of shock underlying monetary developments and their implications for future price developments on the basis of a *semi-structural* analysis.

Taking a money demand model as starting point, this section illustrates an attempt to offer an explanation of *why* monetary developments have implications for the risks to price stability, thereby providing information needed for designing the appropriate monetary policy response. In this sense the approach may be called "structural".

To illustrate, a money demand equation is outlined below, where the notation is conventional. Δm_t denotes the change in the logarithm of nominal stock of money; p_t and y_t denote the logarithm of the price level and of real output, respectively; i_t is an interest rate (or a spread) and ε_t denotes shocks to (or the unexplained part of) money growth. Volatility in financial markets (denoted *vol*) is included within the specification, on the basis that such volatility may increase the demand for money if individuals wish to hold deposits as a safe haven.

$$\Delta m_t = k + \Delta p_t + \gamma_{\mathrm{p}} \Delta y_t + \gamma_{\mathrm{s}} \Delta i_t + \gamma_v \, vol_t - \alpha(m - p - \beta_y y - \beta_{\mathrm{s}} i)_{t-l} + \eta_t + \varepsilon_t \quad (5)$$

In this context, broadly speaking, four different categories of monetary development can be distinguished.

First, monetary developments may be attributable to identifiable "special factors" and "distortions" (represented in equation (5) by the dummy variable, η_{t}) which are seen as benign with regard to prospective price stability, since they represent the effects of statistical or institutional distortions which are not of economic relevance. In other words, "headline" monetary growth would have to be adjusted for these special factors in order to yield a measure of "corrected" monetary growth which can be used more directly as an indicator of future price developments (i.e. the corrected M3 growth figure would be $\Delta m_t - \eta_{\mathbf{t}}$). This highlights the importance of both detailed institutional analysis and explicit model-based assessment of monetary developments in order to identify and extract such effects.

Second, monetary developments that result from current changes in the determinants of money (e.g. high current monetary growth caused by high current output growth ($\Delta \boldsymbol{y}_t > 0$) or lower interest rates ($\Delta i_t < 0$)) may be a signal of future price developments. For example, higher monetary growth resulting from real GDP growth above its sustainable level may signal inflationary pressures associated with overheating of the economy. Similarly, if monetary growth is strong because of an inappropriately low level of interest rates, this may also be associated with the emergence of inflationary pressures.

Although the monetary developments caused by other underlying economic phenomena simply reflect information available from other indicators, it may nevertheless be useful to evaluate them in monetary analysis. A monetary aggregate may, in practice, summarise the information relevant for monetary policy decisions that is contained in a variety of other indicators. If this is the case, using money as a convenient summary is likely to ease communication with the general public.

Third, monetary developments may be caused by developments in other determinants of money which are *not* associated with the emergence of risks to price stability. For example, higher short-term volatility in financial markets may increase the demand for money in the short run, even if it does not suggest threats to price stability. Monetary developments arising from these sources may therefore not signal (new) risks to price stability. In principle, one would also wish to correct monetary growth for such effects (e.g. to obtain a measure of "underlying" monetary growth, such as $(\Delta m_t - \gamma_v vol_t - \eta_t)$) in order to obtain a truer indication from monetary data of the evolution of those determinants (namely output and interest rates) which are likely to have implications for price developments.

Furthermore, some specifications of money demand model the portfolio shifts between monetary and non-monetary assets explicitly using a proxy for the difference between the own rate of M3 and the return on alternative assets. To the extent that shifts between monetary and non-monetary assets simply reflect portfolio allocation based on yield differentials (rather than deriving from the general level of interest rates), they may not signal the emergence of risks to price stability. In monetary analysis, the assessment of the information in money should take account of such identifiable portfolio shifts, e.g. by deducting their estimated amount from headline money growth (as indicated above for the effects of financial market volatility) in order to derive underlying money growth.

Finally, price developments may be influenced by "monetary shocks", i.e. monetary developments which are not caused by other variables included in the money demand equation (ε_t). Since these developments are not associated with the evolution of other variables, they constitute information about economic shocks – and thus the risks to price stability – that would be ignored if money were not analysed thoroughly. Obviously, if underlying M3 growth (once adjusted for possible identifiable distortions) were relatively strong even though output growth was estimated to be modest and interest rates were relatively high, all other things being equal this would be a cause for greater concern regarding upward risks to price stability than if M3 growth were lower, and thus in line with its determinants.

One example of such a monetary shock would be the impact of a – possibly temporary – increase in the efficiency of the banking sector. In this context, the cost of financial intermediation may fall, credit become more readily available and, in consequence, demand pressures rise, building inflationary pressures. A positive monetary shock may also result when financial intermediaries' and/or investors' expectations regarding productivity growth, and thus the equilibrium real interest rate, increase, but short-term real rates are kept unchanged. As variables such as expected productivity growth or the equilibrium real interest rate are not directly observed by the central bank, it could be higher money and/or credit growth – triggered by the optimism of financial intermediaries or investors and thus their increased willingness to lend or borrow at the same (i.e. unchanged) level of central bank rates – which signals that monetary policy would need to be adjusted if price stability is to be maintained in the medium term. In both of these examples, monetary shocks may largely reflect developments in underlying "latent" variables, such as credit spreads or a diverse set of other yields and financial prices relevant for monetary transmission, which are not readily observable.

5.4.2. Combining econometric models and judgement

The advantage of applying a model-based contributions exercise in general is that the explanation of past developments is footed on firmer grounds and does not exclusively

rely on experts' judgement. At the same time, it is important to recognise that for a number of factors which may determine money demand no reliable long-term data series are available. These factors are therefore not captured in estimated money demand models. Moreover there is always uncertainty regarding the appropriate specification of money demand models and for a number of aggregates and components satisfactory estimated models are not available. Furthermore, it is sometimes not straightforward to identify those determinants of money demand which do not signal new risks to price stability. Against this background, experts' judgement is indispensable. Reconciling the explicit model-based analysis with the judgmental approach should help to improve the overall analysis, as it allows a more comprehensive explanation of the developments in M3, its components and counterparts. Close attention should be paid, for example, to news about economic activity, market and retail interest rates, the overall financial market situation, mergers and acquisition and real estate markets.

In particular some efforts should be made to analyse the part of M3 growth which cannot be explained by the determinants contained in the estimated money demand models. Assuming that there are no structural breaks in the models, the unexplained part can either be the consequence of transitory special factors or reflect the existence of monetary disequilibria (i.e. a deviation of the money stock from its long-run equilibrium level). In order to distinguish these two effects using the money demand models, it would be necessary to identify and, to the extent possible, quantify "special factors" on the basis of detailed institutional analysis and time series models so that the monetary data can be corrected for their effect. Then an M3 series could be constructed which is adjusted for all special factors which were relevant in the past.

Given that, in reality, such an undertaking is not possible with a sufficient degree of reliability, the analysis needs usually to be restricted to an ad hoc consideration of the most important special factors in the latest data and the recent past. If there is still a sizeable unexplained element after due account has been taken of these special factors, it can be concluded that either a structural break has occurred in the demand for money or that some monetary shocks or disequilibria had built up in a specific period (which normally tends to signal risks to price stability).

5.4.3. Identifying special factors – an example

As emphasised above, one part of judgmental analysis is to see whether there is any evidence of M3 growth being affected by special factors, i.e. those factors affecting M3 which fall outside the range of the main traditional determinants of estimated money demand models for which long and reliable data series are available (e.g. output and interest rates). Special factors can be identified and roughly quantified by applying an institutional and statistically-oriented approach.

In order to detect the existence of special factors, several sources of information need to be combined. The national contributions to euro area monetary variables are a valuable source for identifying distortions which may be of relevance also at a euro area-wide level. Finally, at least in some cases, events which may trigger distortions in monetary aggregates are known in advance (e.g. changes in the tax system).

For example, portfolio shifts triggered by the change in the minimum reserve system at the start of 1999 had an impact on M3 growth. This special factor worked in different directions in different countries. For German MFIs, the introduction of remuner-

ated minimum reserves was advantageous in comparison to the system prior to Stage Three of Economic and Monetary Union (EMU). Hence, more attractive conditions for short-term deposits and negotiable instruments could be offered to customers. As a consequence, funds were repatriated from Luxembourg and the United Kingdom. In order to approximate the impact on M3 growth in the euro area, use can be made of the Deutsche Bundesbank's statistics on the foreign branches and subsidiaries of German banks (including a regional breakdown). These data allow for an analysis of the developments of the short-term deposits held at branches and subsidiaries in the United Kingdom with past trends. In Luxembourg and Italy the switch to the new system of minimum reserves had the opposite effect than in Germany and led to a flow of funds outside M3.[25] In these cases, the impact on M3 can be estimated by comparing actual developments with those developments which could have been expected to occur in the absence of the special factor. It is self-evident that such estimations are surrounded by a considerable degree of uncertainty and have to be interpreted with due caution.

5.5. Implications for analysis of deviations from the reference value

As explained above, the reference value has a medium-term orientation which helps to emphasise consistency with the maintenance of price stability over the medium term. The above discussion indirectly also shows that the medium-term orientation of the reference value implies that shorter-term deviations of monetary growth from the reference value may not in all circumstances be a good indicator of (new) threats to price stability.

Consequently, the ECB has made clear that it will not react mechanistically to deviations of M3 growth from the reference value. The reasons for such deviations should always be carefully analysed in order to identify the economic disturbance that caused the deviation (ECB, 1999a). The analysis of current monetary developments should recognise the context (and, in particular, take note of explanations of monetary developments gained on the basis of model-based analysis and judgement[26]) in order to obtain a richer picture of the overall liquidity situation from a medium-term perspective. This may also include analysis of the level of the money stock – and by implication the potential existence and magnitude of any excess liquidity, as discussed in the following section.[27]

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[25] In the case of Italy, additional institutional factors, for example the tax reform implemented in July 1996 and structural shifts in portfolio preferences, also contributed to the downward distortion of the national contribution to euro area M3.

[26] For example, if annual M3 growth is more rapid in the short term because the stock of money was initially below its "equilibrium" level (associated with the current level of prices and real activity), as would be implied by conventional error-correction money demand specifications, then a positive deviation of annual M3 growth from the reference value would be expected in the future under the assumption of stable money demand. However, in this instance, the resulting monetary growth at rates above the reference value would be an equilibrating phenomenon, which does not, in itself, contain new information about price developments. Detailed analysis of monetary developments in the context of other variables can reveal such an interpretation and can therefore inform the policy discussion.

[27] The medium-term nature of the derivation of the reference value implies that estimates of the medium-term trend in monetary growth (which may be defined as a longer-term growth rate of "headline money" corrected for some predictable short-run dynamic effects on M3 growth, which are not considered as signalling risks to price stability, and corrected for the impact of identifiable distortions and special factors; see Section 5.4) are typically also useful for making a comparison with the reference value.

5.6. Various measures of excess liquidity derived from monetary aggregates

As mentioned above, although the reference value is expressed as a growth rate, a thorough analysis should also made of the level of the money stock and various measures of excess liquidity. These measures constitute additional money-based indicators that may be useful for the monetary analysis undertaken as part of the first pillar. The remainder of this section defines and compares various measures of excess liquidity derived by subtracting from the observed money stock various measures of equilibrium money balances. These measures of the equilibrium money stock share the feature that they abstract from the short-term or dynamic aspects of the money demand equation and thus are more medium term-oriented concepts.

While the following three sections introduce various concepts of excess liquidity, the final section discusses their usefulness and limitations.

5.6.1. The money gap

One measure of excess liquidity (which is labelled the "money gap") is the deviation of the actual stock of M3 from the level implied by the reference value. Since the reference value is expressed as a growth rate of 4 ½% per annum, a base period must be chosen to obtain this reference value-consistent stock. The choice of base period is to some extent arbitrary, yet it will have important implications for the magnitude of the gap measured in this way.[28]

$$\begin{aligned} m_t^{\text{ref val}} &= m_0 + 0.045t \\ &= m_0 + t(\pi^* + \beta_y \, \Delta y_t^{\text{potential}}) \end{aligned} \tag{6}$$

The second expression in (6) simply substitutes the reference value from (4). This definition of excess liquidity is normative, since the reference value is derived to be consistent with price stability. Charts 3 and 4 illustrate the calculation of the money gap using quarterly data, taking the last quarter of 1998 as the base period.

5.6.2. The monetary overhang/shortfall

Alternative measures of excess liquidity can be explicitly derived from the money demand equations. For example, the "monetary overhang" (or "shortfall") could be defined using the long-run money demand relationship, substituting in the observed values of the determinants of M3, in order to determine "equilibrium (nominal) money", viz. (taking a generic description of money demand which could be seen as encompassing both of the actual frameworks used in the regular analysis outlined above):

$$m_t^{\text{eqm}} = k' + p_t + \beta y_t + \gamma i_t \, . \tag{7}$$

The overhang/shortfall would then be defined as the difference between the actual nominal money stock and m_t^{eqm} (the equilibrium money stock consistent with the observed value of other variables). A positive shock to the actual price level, all other things being equal, directly reduces this measure of excess liquidity.

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[28] For example, December 1998 (the date the reference value of 4 ½% was first announced) can be used as the base period. In expression (6), potential output growth is assumed to be 2.25% per annum, an inflation objective consistent with the Eurosystem's definition of price stability is 1.5% per annum and the long-run income elasticity of the demand for M3 is 1.33.

Chart 3. M3 consistent with the reference value and actual M3
(base period 1998 Q4 = 100)

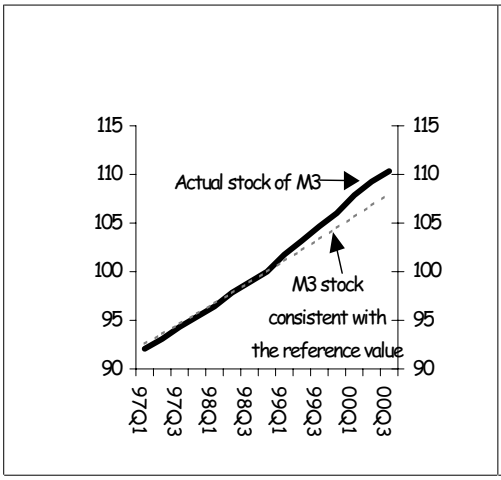
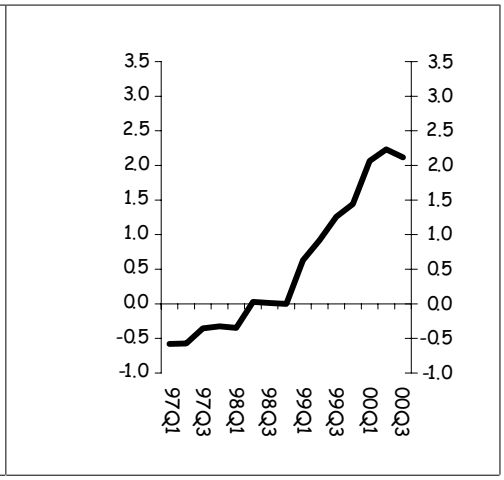


Chart 4. An estimate of the money gap
(as a percentage of the stock of M3)



Such a monetary overhang/shortfall measure can be constructed for example on the basis (of the long-run relationship) of the BC money demand framework (see Chart 5).[29]

5.6.3. The real money gap (or the P-star-based measure of excess liquidity)

A third measure of excess liquidity can be derived by comparing the actual money stock with a measure of equilibrium money holdings evaluated at potential output and actual prices. This concept can be labelled $m_t^{\text{eqm}*}$, where:

$$m_t^{\text{eqm}*} = k' + p_t + \beta y_t^{\text{potential}} + \gamma i_t^*. \tag{8}$$

This concept also implicitly underlies the "P-star" model of inflation (Hallman, et al., 1991). Conventionally, the P-star model relates the evolution of inflation to the "output gap" (capturing the deviation of output from potential) and the "velocity gap" (capturing the deviation of velocity from its long-run equilibrium level).[30]

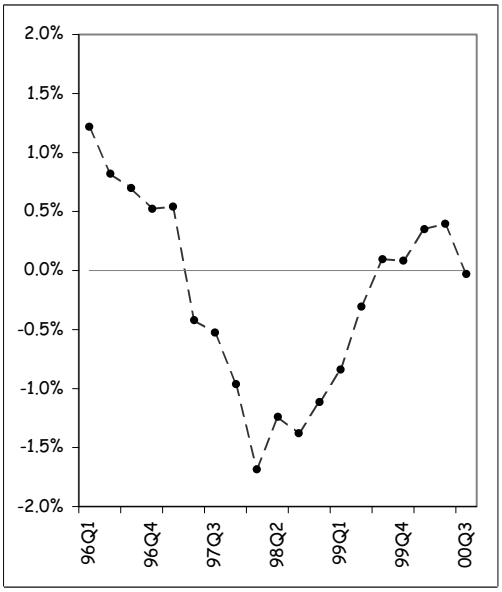
In order to allow comparisons to be drawn, it is useful to compare the characterisation of the P-star-based measure of excess liquidity in equation (8) with the derivation

[29] If equilibrium money is not evaluated at the current price level, but at a normative price level, then an overhang/shortfall measure *based on a normative price level* could be derived. Such a "normative monetary overhang" (or "shortfall") could be defined using the long-run money demand relationship, substituting in the observed output value and a price level which would be consistent with a price level objective, in order to determine "equilibrium money":

$$m_t^{\text{eqm}*} = k' + (p_0 + t\pi^*) + \beta y_t + \gamma i_t \tag{7a}$$

[30] Since the P-star model relies on an equilibrium notion of velocity, in the context of the money demand framework discussed in this paper it would be natural to use the equilibrium or "neutral" nominal interest rate (consistent with price stability) in the money demand equation. This contrasts with other measures (such as the real monetary overhang/shortfall) where it is more sensible to include actual interest rates, thereby creating consistency with the choice of actual price level and actual output in deriving the measure of excess liquidity.

Chart 5. A measure of the monetary overhang *(as a percentage of the stock of M3)*



presented in Orphanides and Porter (2001) (a paper which also appears in this volume). Using the quantity identity expressed in logarithms,[31] Orphanides and Porter define p^* as the price level consistent with the current stock of money and equilibrium value of velocity (v^*) and the potential level of output. p is the current price level (note that because the quantity relationship is an identity, this is the price level consistent with the current money stock and *actual* levels of velocity and output). Therefore:

$$p^* = m + v^* - y^{\text{potential}} \tag{8a}$$

$$p = m + v - y \tag{8b}$$

Using an error correction approach, inflation is then related to the "price gap" between p and p^*, assuming that the price gap is a leading indicator of inflation:

$$\pi_{t+l} = \pi_t + \alpha(p_t - p_t^*) \tag{8c}$$

In practice, the price gap is typically decomposed into a velocity gap and an output gap by subtracting (8b) from (8a) and substituting in (8c).

$$\pi_{t+l} = \pi_t + \alpha'(v_t - v_t^*) - \alpha''(y_t - y_t^{\text{potential}}) \tag{8d}$$

The relationship between this approach and the characterisation offered in equation (8) is as follows. Rather than defining an equilibrium level of velocity explicitly, the approach adopted here defines v^* implicitly using the money demand equation.[32] Moreover, rather than deriving p and p^* as in equations (8a) and (8b), the approach derives

[31] For simplicity, notation is used consistently throughout this paper. When making comparisons, it should be recalled that in the Orphanides and Porter paper, output is denoted as q (rather than y) and potential output is denoted as q^* (rather than $\boldsymbol{y}^{\text{potential}}$).

[32] In practice, this implies that $v^* = -k' + (1 - \beta)\, y_t^{\text{potential}} - \gamma i_t^*$, where i_t^* is the "neutral" or equilibrium nominal interest rate consistent with price stability.

the level of the money stock consistent with equilibrium velocity and potential output (i.e. $m^* = m_t^{\text{eqm}*}$) and compares this with the actual money stock.

Using the quantity identity rather than money demand equations, the relationship between the price gap from Orphanides and Porter (2001) and the P-star-based measure of excess liquidity is demonstrated in equations (8e) through (8g).

$$m^* = m_t^{\text{eqm}^*} = p + y^{\text{potential}} - v^* \tag{8e}$$

$$m = p + y - v \tag{8f}$$

$$(m - m^*) = -(v_t - v_t^*) + (y_t - y_t^{\text{potential}}) = -(p - p^*) = (m - m_t^{\text{eqm}^*}) \tag{8g}$$

In other words, the price gap and the P-star-based measure of excess liquidity (or the real money gap) represent the same concept, but simply express it using different variables and with the sign reversed. If the P-star-based measure of excess liquidity is positive, the price gap is negative and vice versa.

As shown by Gerlach and Svensson (2000) in an application to the euro area, this framework can be re-expressed in terms of a relationship between inflation and the real money gap, $[(m_t - p_t) - (m_t^{\text{eqm}^*} - p_t])$, thereby facilitating comparisons with other measures of excess liquidity.[33] The P-star model therefore suggests that deviations of the stock of real money balances from their equilibrium level defined by the relationship with potential output help to predict future developments in inflation.

5.6.4. Comparisons of various measures of excess liquidity

The money gap defined above can also be expressed in terms of a money demand framework, since (as shown in Section 5.2) the reference value can also be derived using a money demand equation. In that case, the difference between the money gap (based on a normative price level) and the monetary overhang/shortfall is:

Money Gap – Monetary Overhang

$$\begin{aligned}
&(m_t - m_t^{\text{ref val}}) - (m_t - m_t^{\text{eqm}}) \\
&= (k' = p_t + \beta y_t + \gamma i_t) - (m_0 + t(\pi^* + \beta\, \Delta y_t^{\text{potential}})) \\
&= (m_0^{\text{eqm}} - m_0) + (p_t - (p_0 + t\pi^*)) + \beta(y_t - (\mathbf{y}_0 + t\, \Delta y_t^{\text{potential}})) + \gamma(i_t - \boldsymbol{i}_0)
\end{aligned} \tag{9}$$

The difference between the money gap $(m_t - m_t^{\text{ref val}})$ and the monetary overhang $(m_t - m_t^{\text{eqm}})$ is therefore related to: (a) the extent to which the money stock in the chosen base period differs from a level consistent with long-run money demand at the macroeconomic variables obtained in the base period; (b) the difference between the actual price level and that extrapolated from the base period on the basis of the inflation objective; (c) a term related to the cumulated output gap since the base period; and (d) a term related to the difference between nominal interest rates in the current and base periods.

If the base period is chosen appropriately, component (a) of this difference will be zero.[34] If nominal interest rates are broadly speaking unchanged (as one might expect over a period of several years in an environment of price stability), then component (c) is also zero. Therefore, there are two main substantive differences between the money gap and the monetary overhang, as each concept is defined above.

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[33] Gerlach and Svensson (2000) also set the interest rate terms to their equilibrium level.

[34] This statement defines a criterion for determining the base period, namely it should be a period during which the actual money stock was at the level consistent with long-run money demand at equilibrium or normative values of the determinants of money.

First, the money gap measure of excess liquidity implicitly includes the cumulated impact on the money stock of deviations of the actual price level from a price level path which is determined ex ante (e.g. a price level objective determined by the base period and the desired inflation rate). In contrast, the monetary overhang automatically accepts "base drift" in the price level. In other words, at a conceptual level the money gap is an indicator more consistent with price level objectives, whereas the monetary overhang as defined above is more consistent with an inflation objective (and allows the price level to behave as a random walk, accepting one-off shifts in the price level on the principle that "bygones are bygones").

Second, the money gap increases relative to the monetary overhang in proportion to the output gap. In other words, the money gap incorporates the impact on the money stock of cumulated deviations of actual output from potential. Thus, if real growth since the base period is higher than potential growth, the money gap is larger than the overhang. In this sense, the money gap is a form of summary statistic, whereas the overhang merely reflects the additional information in money which is not included in its determinants (e.g. GDP and interest rates).

A similar comparison can be made between the money gap and the real money gap (i.e. the P-star-based excess liquidity indicator).

Money Gap – Real Money Gap

$$\begin{aligned}
&(m_t - m_t^{\text{ref val}}) - (m_t - m_t^{\text{eqm}*}) \\
&= (k' + p_{\text{t}} + \beta y_t^{\text{potential}} + \gamma i_t) - (m_0 + t(\pi^* + \beta\, \Delta y_t^{\text{potential}})) \\
&= (m_t^{\text{eqm}} - m_0) + (p_t - (p_0 + t\pi^*)) + \gamma(i_{\text{t}} - i_0)
\end{aligned} \tag{10}$$

A comparison of expressions (9) and (10) demonstrates that the real money gap from the P-star approach represents an intermediate approach, where the impact of the output gap (i.e. cumulated deviations of actual output growth from potential) on the money stock is included in the measure of excess liquidity (in this respect the real money gap is similar to the nominal money gap), but the impact on the money stock of cumulated deviations of the actual price level from an implicit price level objective are not (in this respect the real money gap is similar to the overhang concept).

In assessing which of the measures of excess liquidity is most useful for monetary policy purposes, a number of considerations have to be borne in mind.

First, at a conceptual level, the importance of price level objectives, as opposed to inflation objectives, needs to be considered. If price level objectives are deemed important, a money gap measure may be more appropriate since this measure incorporates the impact on the money stock of deviations of such an objective.

Second, consideration should be given to whether money should be used, at least in part, as a *summary* statistic of developments in the determinants of money or whether the focus of attention should be on the information in monetary developments which is not provided by alternative indicators which are included in the money demand framework. In the former case, focusing on estimates of the money gap or real money gap (the P-star approach) may be more useful, since, for example, these measures encompass developments in the output gap. Alternatively, if analysing the *additional* information in monetary developments is deemed more useful, a focus on the monetary overhang/shortfall may be more appropriate since this does not incorporate the effects of

the output gap or deviations of the price level from a desired level on the stock of money and measure of excess liquidity. Obviously, the weight assigned to the gap measure relative to the overhang measure may thus also depend on the uncertainty regarding the estimates of the output gap in real time.

Third, the usefulness of the various measures of excess liquidity can be assessed on empirical grounds, in terms of their relation with future price developments. A systematic comparison of the indicator properties of various measures of excess liquidity for future price developments has not, as yet, been undertaken. Gerlach and Svensson (2000) and Trecroci and Vega (2000) find that P-star-based measures of the real money gap (using certain specifications of money demand) help to predict future inflation in within sample exercises. In simulated out-of-sample forecast exercises, Nicoletti Altimari (2001) also finds favourable results for the P-star model, although other indicators of excess liquidity (and headline M3 growth) perform better at some longer horizons.

6. The information content of monetary aggregates for future price developments and money-based projections

6.1. A brief summary of empirical results on the leading indicator properties of monetary variables[35]

The above discussion has described a number of techniques used to analyse monetary variables. Many of these approaches involve decomposing monetary developments on the basis of various accounting frameworks (most of which follow from money demand equations), with the aim of developing a better understanding of the underlying causes of monetary dynamics.

A natural complement to such a semi-structural approach is to treat money as an indicator variable for future price developments. Naturally, such an approach does not allow the causes of monetary developments to be identified – and thus does not provide information about the nature of potential threats to price stability to policy-makers – but instead simply gives an indication of the future path of price developments. On this basis, the various decompositions described above can also be interpreted as methods of constructing monetary indicators of various types. The relative performance of such indicators as predictors of future inflation is then an empirical question.

Nicoletti Altimari (2001) performs an extensive systematic evaluation of the leading indicator properties of monetary and credit aggregates for future inflation in the euro area. The forecasting performance of models including money-based indicators is assessed in a simulated out-of-sample forecasting exercise over the period 1992–2000. Forecasts are evaluated for horizons varying from one quarter to three years ahead. The performance of money-based indicators is compared with the forecasting performance of models based on a broad range of non-monetary indicators.[36]

One reassuring message from these studies is that monetary indicators do appear to contain information which helps to predict price developments in the euro area. Broadly speaking, the relative forecasting performance of money-based indicator mod-

[35] This section has benefited greatly from the contribution of S. Nicoletti Altimari and draws on his working paper (Nicoletti Altimari, 2001).

[36] The methodology used to perform the simulated out-of-sample exercise closely follows Stock and Watson (1999). The details of the procedure and of the specification of the models used can be found in Nicoletti Altimari (2001).

els tends to improve with the length of the forecast horizon. At forecast horizons up to one year ahead only a few models based on a single indicator outperform a simple univariate model of inflation. Among the money-based indicators, only the P-star indicator derived from the Brand and Cassola (2000) M3 demand framework outperforms the univariate model. As the forecast horizon is enlarged, however, many models – in particular those including money-based indicators – show an improved relative performance and eventually outperform the forecasts based on the simple univariate model.

At forecast horizons between one and two years ahead the best performing models are those based on loans to the private sector and the P-star indicator. The latter result accords both with theoretical priors – since the P-star model is essentially an error-correction framework where the P-star indicator would help to predict inflation at relatively short horizons – and with the results for other countries (in particular, the results for Switzerland (Jordan, et al., 2001) reported in this volume).

At forecast horizons between two and three years, the best performing models are those based on M3 and its main counterpart credit, together with the models including the M3-based real money-gap and money-overhang measures. At forecasting horizons close to three years ahead these models result in a substantial reduction of the forecast mean squared error (MSE), in some cases up to 50% of that produced by the simple univariate model. The M3-based model is the best performing model among those considered at the longest forecast horizon (three years ahead). In general, broader aggregates show better leading indicator properties with respect to future price developments, with the models based on M3 and loans outperforming the M2-based model, which in turn outperforms the M1-based model.

These results provide some supporting evidence for the reference value announced by the ECB. Cumulative inflation over the next three years ahead is relatively well predicted by headline annual M3 growth (and lagged values of M3 growth). This result is consistent with the view that medium-term and low frequency trends in inflation can be predicted using M3 growth. Consequently "large or prolonged" deviations of M3 growth from the reference value – although not deviations on a month-to-month or even quarter-to-quarter basis – can be interpreted as signals of emerging risks to price stability. Such an interpretation would be consistent with the medium-term orientation of the reference value.

Nicoletti Altimari (2001) also shows that, on the basis of tests of the relative information content of different indicators, monetary aggregates appear to provide useful *additional* information for forecasting future inflation relative to the best non-monetary indicators. The additional information content is particularly significant at longer horizons. Vice versa, indicators based on real activity or price and costs measures appear to provide useful information relative to M3 in forecasting inflation, especially at horizons up to two years ahead. Among monetary indicators, P-star and money gap/overhang measures appear to contain additional information with respect to M3, especially at horizons up to two years ahead.

The above results seem to be robust to all measures of price inflation considered. Broadly speaking, the same indications arise when using the HICP index, the consumption deflator or the GDP deflator.

Overall, the findings in Nicoletti Altimari (2001) support the idea that monetary and credit aggregates provide significant and independent information for future price developments in the euro area, especially at horizons beyond one and a half years.

6.2. Uses and limitations of money-based projections and forecasts

Before concluding, the preceding results should be placed in the context of a broader discussion of the role of money-based forecasts in the analysis underlying monetary policy decisions.

In general, an "optimal" monetary policy needs to be based on an analysis of the current economic situation and the underlying economic shocks. However, to the extent that a satisfactory and fully structural model which gives a prominent role to money and helps to clearly identify structural monetary and other shocks is not available, non-structural or reduced form money-based projections of inflation may be useful for illustrating the information content of past and current monetary developments, provided that the limitations of such analysis are taken into account.

Against this background, monetary models of the transmission mechanism can also be used to make forward-looking analyses of price and output prospects. For example, the BC money demand framework is embedded within a system which includes equations for inflation and real GDP growth. In the context of vector error correction models (VECMs) like the BC model, the simultaneous determination of all model variables implies that simultaneous predictions of all the variables involved, including inflation and real GDP growth can be produced. Moreover, a projected path for short-term interest rates is also produced. The resulting projections are therefore based on an assumed set of monetary policy responses (i.e. an implicit "reaction function"), rather than being based on the assumption of unchanged rates typically embodied in central banks' conventional macroeconomic forecasting exercises. This always needs to be kept in mind when interpreting the projections and cross-checking and comparing them with those produced under the "second pillar" of the ECB's strategy in the context of conventional macroeconomic forecasting exercises (ECB, 2000).

The inflation and GDP growth outlook produced using the BC system (the former, given the specification of the model, applies to the GDP deflator rather than HICP inflation) are limited in the sense that the BC model was not explicitly designed for the purpose of making projections for real GDP or inflation, but rather for analysing the role and stability of M3 growth in the context of a system approach.

In parallel with the semi-structural analysis described in Section 5.4 above, monetary and credit aggregates can also be used in *reduced-form indicator models*. Various studies suggest money-based indicators may predict inflation well, especially at a medium-term horizon.

When used in this pure indicator role, these monetary indicators do not distinguish among the various explanatory roles of money outlined above, but rather treat them (implicitly) as follows. First, a simple (headline) measure of monetary growth does not control explicitly for special factors. Implicitly, special factors are assumed to cancel out (i.e. to be "white noise") over the sample period in which indicator properties are investigated (or to be introduced ex post as a matter of judgement). Second, monetary growth typically summarises the information in a range of likely inflation indicators, e.g. money growth is related to output growth, and therefore implicitly incorporates a component related to output growth (inter alia), which in itself may be a useful inflation indicator. Finally, measures of monetary growth incorporate monetary shocks and thereby encompass both shocks to money demand and measurement errors in the determinants of money.

However, because they are not associated with a structural interpretation, the indicator properties of monetary growth may break down out of sample. For example, infla-

Chart 6. Real M1 and real GDP
(annual percentage change)

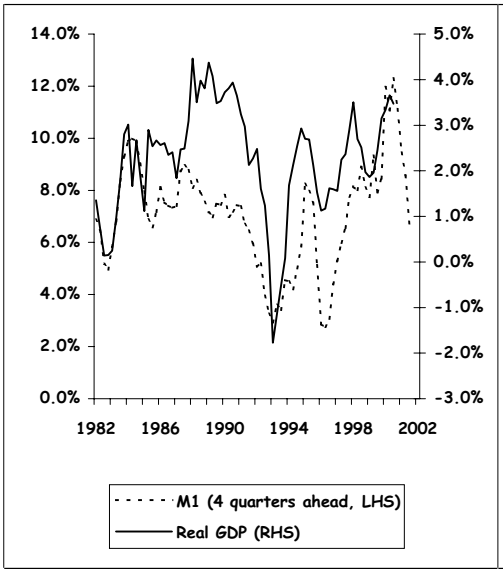


Chart 7. Assessment of real GDP prospects from the M1 vector autoregression
(annual percentage change, 95% confidence bands)

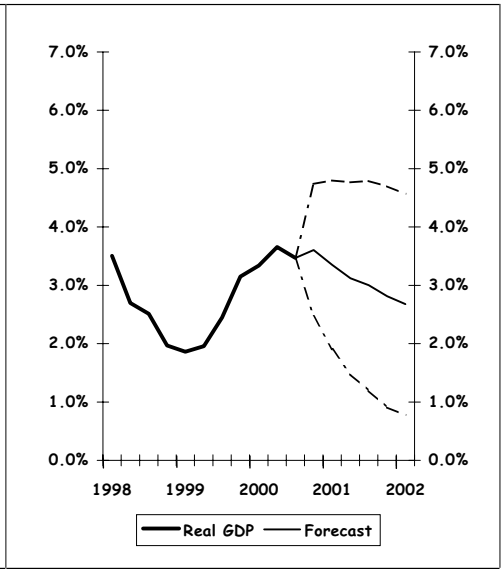


Chart 8. HICP inflation assessment based on developments of M3
(annual percentage change; 90% confidence bands)

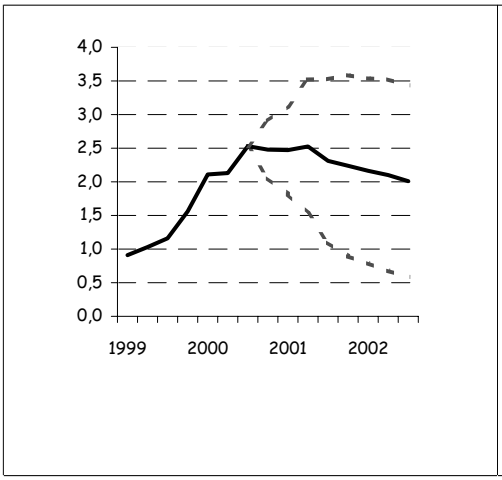
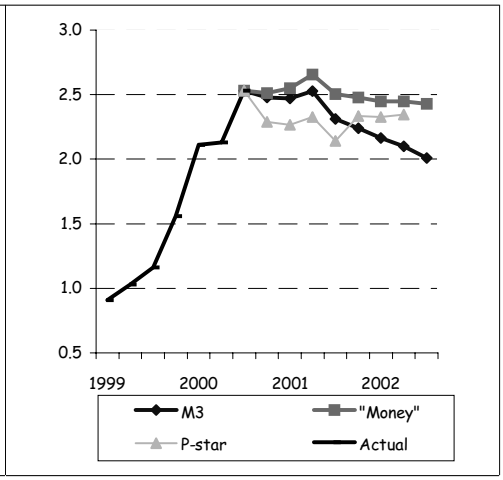


Chart 9. HICP inflation assessment based on alternative monetary indicators
(annual percentage change)



Note: In Chart 9, "money" is the average of the forecasts obtained with models based on M1, M2, M3 and loans to the private sector. P-star is the forecast based on a measure of a measure of excess money growth computed as the difference between current money growth and "equilibrium" money growth, as derived from a standard money demand equation.

tion projections over the medium term based on simple monetary indicator models have to be treated with caution also because they incorporate an implicit reaction to monetary growth. This reaction reflects the past response of the monetary authorities to developments in the monetary indicator. To the extent that monetary policy reacts differently to monetary developments now than on average in the past, medium-term forecasts of inflation using monetary indicator models would not be the best-unbiased money-based forecast. Therefore, the structural or semi-structural and reduced-form indicator approaches should be treated as complements and conducted in parallel.

For real GDP growth M1 has been found to have good leading indicator properties (which are illustrated in simplified form in Chart 6). Therefore a small vector autoregression (VAR) model can be used to produce short-term projections for real GDP which are partly based on M1 developments (see Chart 7).

Regarding money-based inflation projections, M3, other monetary aggregates, the components of M3 and the counterparts (notably credit) may be used. The projections produced by the indicator models estimated in the study by Nicoletti Altimari (2001) can be presented in the form shown in Charts 8 and 9 above.

7. Concluding remarks

Analysis under both pillars of the ECB's monetary policy strategy focuses on extracting the information in monetary and other economic and financial developments that is relevant for monetary policy decisions, and therefore focuses mainly on evaluating the economic situation, identifying the nature of the economic shocks to the euro area and the resulting risks to price stability. The "first pillar" represents a set of analytical approaches and tools which all share the feature that monetary developments or, more generally, various measures of liquidity derived from monetary aggregates, have important implications for monetary policy and determine, or at least provide useful information regarding, the evolution of the price level over the medium term.

This paper has described a number of tools and approaches of monetary analysis. The experience over the last two years suggests that adopting a variety of approaches to explain and assess monetary and credit developments is helpful in achieving a well-founded and detailed picture of the monetary situation in the euro area. This illustrates that the "first pillar" of the ECB's strategy does not consist solely of the reference value. This pillar should be understood to encompass a broad range of monetary analyses extending to the components and counterparts of M3, in particular credit. Of course, this analysis always takes place in the context of other indicators (e.g. the determinants of money demand, such as real income and interest rates). While simple comparisons of annual M3 growth with the reference value alone cannot encompass the rich set of analyses presented in this paper, the reference value constitutes an important commitment device in giving monetary analysis the prominent role it has been assigned within the ECB's strategy. Moreover, although obviously and necessarily in a highly simplified form, the reference value provides a useful starting point for analysis and presentation which facilitates communication with the general public. Experience during the first two years of Monetary Union has demonstrated that the prominent role assigned to money in the ECB's monetary policy strategy, signalled by the announcement of a reference value and underpinned by thorough econometric and judgmental analysis, has helped to ensure that discussions of monetary policy decisions and their justification, both within the ECB and in the public domain, include a medium term-oriented monetary dimension.

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Monetary analysis in the Bank of Italy prior to EMU: The role of real and monetary variables in the models of the Italian economy

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1. Introduction

This paper discusses the experience of the Bank of Italy with monetary analysis in the 1990s, prior to the start of EMU. An interesting feature of the Italian experience, which may be relevant for the Eurosystem, is that the overall policy strategy was explicitly characterised by the coexistence of more than one reference variable (in different periods, these were money, credit, the exchange rate or direct inflation forecasts). The paper describes some of the tools (namely structural econometric models) used by the Bank of Italy to analyse developments in monetary variables for policy purposes within such a framework. The use of these tools to give advice to policy-makers and for external presentation of the monetary strategy is also discussed. The focus is centered on three aspects concerning the use of econometric models to support the process of monetary policy making: i) as a theoretical framework ensuring the mutual consistency of the objectives and the reference variables announced by the monetary authorities and helping the central bank to present and explain its actions to the general public; ii) as an analytical device for gauging the information content and the controllability of monetary and credit aggregates; iii) as a forecasting tool, providing the reference path for intermediate variables.

A brief review of the monetary framework adopted by the Bank of Italy and the features of its strategy since the mid-1980s is provided in section 2; section 3 briefly summarizes the econometric models used by the Bank, describing the role played by monetary and financial variables. The information role of monetary variables in a structural model is then assessed, reviewing the theory (Section 4), the existing evidence for Italy (Section 5) and describing the practical use of monetary indicators in month-to-month analysis, in the policy-decision process and in communication (Section 6).

In the last section, the information content of monetary variables for the Italian economy is assessed within the framework of the quarterly model of the Italian economy and tested using new data from the 1990s. This period is an interesting benchmark, since a number of structural changes affected the behavior of both real and nominal variables over the last decade.

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* Bank of Italy, Research Department. The opinions expressed are those of the authors and do not necessarily reflect those of the Bank of Italy. The authors thank Pedro Neves, who discussed a previous draft of this paper, for his useful comments and suggestions.

2. The monetary strategy of the Bank of Italy since the mid-1980s and the use of monetary indicators

Monetary analysis at the Bank of Italy in the period 1984–1998 is better understood when viewed within the overall framework of the monetary strategy. For our purposes, two features are relevant: monetary aggregates always played an important role; but there was more than one intermediate variable (in today's terms, there was not just one 'pillar'). The following aspects are worth mentioning.

Announcement of monetary growth paths. Between 1984 and 1998, growth paths were announced for the aggregate M2. These were initially expressed as point values (in 1984 and 1985), but were subsequently replaced by ranges. In 1995 they returned to point values.[1] Although the term 'target' was often used, it was repeatedly said that they would in fact be used more flexibly, as information variables. In any case, the announcement of a growth rate for money was always considered important as a 'nominal anchor' in the communication strategy of the Bank of Italy. For instance, according to the Governor's concluding remarks in 1989, "intermediate monetary targets, even in the form of broad target ranges, have not lost their usefulness. The announcement of such targets encourages market behavior that is consistent with the monetary guidelines and they give the central bank a yardstick for assessing the divergence of the economy from its planned course" (Bank of Italy, 1989, p. 160).

Other objectives: the exchange rate, inflation. Monetary targets did not play an exclusive role, though, but were used in conjunction with a larger set of variables, both objectives and indicators. Up to the end of the 1980s, targets for money and credit to the private sector were announced jointly. However, the weight attached to the latter rapidly decreased, both in the view of the Bank of Italy and in the perception of the general public, due to the observed instability of credit demand (see Angeloni-Passacantando, 1991). Until 1992, the announcement of growth ranges for M2 was complemented by the exchange rate committment represented by the lira's participation in the European Monetary System. The exchange rate played a pivotal role through the whole process of disinflation in the 1980s; it provided a clear signal to economic agents and represented a quick and effective channel through which the central bank succeeded in curbing inflationary pressures. In the short run, the coexistence of monetary growth paths and the exchange rate constraint was justified by the degree of flexibility granted to monetary policy by controls on capital movements (until 1987), by the broad ERM fluctuation band of the lira (until 1990) and by the realignments of the lira's central parity (until 1987). In the medium run, a consistent monetary policy was indispensable to enforce the exchange rate constraint (a full discussion of the relative role of the exchange rate and monetary policy is provided by Gressani-Guiso-Visco, 1988).

After the lira abandoned the exchange rate mechanism of the EMS in 1992, greater emphasis was put on monetary growth.[2] However, in 1994, the focus of monetary policy

[1] A complete description of the role of monetary targets from 1984 to 1991 can be found in Angeloni-Passacantando (1991).

[2] This was clearly announced soon after the exit of the lira from the EMS. "The aim of monetary policy will be to provide a stable frame of reference that will shape expectations and conduct (...). With the exchange rate weakened as a means of exerting a direct restrictive effect, the money supply growth target takes on greater importance for liquidity management and interest rate policy in the short term." *Economic Bulletin*, October 1992, p. 68.

switched towards the behavior of actual and forecasted inflation, as signs of structural instability in money demand emerged. Beginning in 1995, the Governor of the Bank of Italy announced upper limits for inflation in the following year and stated explicitly how the management of official rates would be linked to the behavior of actual and expected inflation with respect to this benchmark.[3] In this process, model-based inflation forecasts were actively used; monetary policy actions were based on deviations of internal inflation forecasts from the desired path (Siviero-Terlizzese-Visco, 1999 discuss the role of inflation forecasts over the period and provide econometric evidence of the role of internal forecasts in the Bank's reaction function).

In addition, in conducting monetary policy a large set of variables was used to gauge the future behavior of output and inflation. Different indicators were used to identify the nature of the shocks hitting the economy (the approach is discussed in Angeloni-Cividini, 1990 and Angeloni-Passacantando, 1991), including credit variables, the term structure of interest rates, expectations surveys, etc.

A framework to interpret the different variables and indicators. Although several monetary and real indicators and 'reference' variables were used, these were not interpreted as pertaining to completely separate conceptual frameworks. In the presence of multiple announcements of intermediate variables and a large set of indicators, it was deemed very important to present, to the extent possible, a common framework of interpretation, in order not to confuse the public and to preserve clarity and credibility in announcing and commenting the monetary strategy. This would enable the information content of shocks hitting real or monetary variables to be compared and evaluated, and the policy choices explained to the public in a consistent manner. According to Governor Ciampi, a common framework was essential, as "the use of too many indicators, ... if they are not explicitly set in a unifying framework, may jeopardize the credibility of monetary policy". More specifically, "reference to a wide range of variables implies the availability of a formal model in which the relationships between real and financial aggregates are shown explicitly and quantified. The Bank of Italy has resolved to meet this need with the help of a quarterly econometric model in which the real and financial sectors are closely integrated." (Ciampi, 1987).

All in all, the use of a common, clearly specified theoretical framework ensured that the multiple objectives pursued by the Bank of Italy could be set in a mutually consistent way and it helped the central bank to present and explain its actions to the general public. More specifically, to ensure consistency, the model, as a forecasting tool, provided the reference path for intermediate variables consistent with the path expected

[3] The announcements were included in the Governor's *Concluding Remarks* to the Annual Report, in May of each year, referring to inflation in the following year, and extensively commented in the press and in the public debate. "The annual average rate of consumer price inflation ... will have to fall below 4 per cent next year, 1996. If price trends over the next few months show a tendency to diverge from the pattern I have just described, we shall not hesitate to tighten credit conditions still further" Bank of Italy (1995), p. 173. "Monetary policy continues to be geared to curbing inflation. In 1997 and subsequent years the rate of increase in prices will have to be close to those in the other leading industrial countries and less than 3 per cent", Bank of Italy (1996), p. 167. "Now that the disinflationary phase has been successfully concluded, we aim in 1998 for a rise in consumer prices of 2 per cent or less and broadly stable producer prices, in line with developments in the leading industrial countries .... If events take an unfavourable turn, we shall not hesitate to halt our policy of reflation, and in extreme circumstances to change course", Bank of Italy (1997), p. 215.

(or desired) for the final targets. In presenting and explaining monetary policy, it served as an analytical device to assess the information content of monetary and credit aggregates and update this assessment when needed. The structural model made it possible to tell a "story" to explain the behavior of the real and monetary indicators, compare it with the initial assumptions and explain the policy conclusions.

In this framework, monetary aggregates, as well as other indicators, play a role as information variables; a role extensively addressed in the literature. According to Friedman (1990), "observations of a variable like the money stock are potentially useful for anticipating future stochastic movements of variables like income and prices that enter the central bank's objective, or for estimating contemporaneous stochastic movements of these variables before the relevant direct data become available". The approach does not involve a choice between models of 'passive' or 'active' money: issues of behavioral causation are of secondary importance. "Whether the money stock does or does not 'cause' future movements of income or prices is not the issue here. All that matters is whether observed values of the money stock provide information that helps predict future movements of these variables." (Friedman, 1990)

The information content of a monetary variable can be gauged through different econometric techniques: large structural macromodels, small structural models and a-theoretical approaches, such as VARs. The reasons for working with large structural models are summarized by Angeloni (1994): "The choice of building a structural model, rather than a simpler time-series structure such as a VAR, is made because forecasting is only one of the purposes that the model is intended to serve. In a policy-oriented institution, the model is a common analytical reference; it provides a framework within which conflicting views can be compared and the data can be organized and interpreted. A formal structure can help the central bank to present and explain its policies, notably to the government and public opinion. Finally, a model is a learning device: it summarizes the 'best available knowledge' about the economy and, in turn, stimulates discussion and improvements. These functions are better performed by a model that combines economic theory with institutional detail and data consistency."

Although large structural models were the main tools used to interpret the information role of monetary aggregates, it should be stressed that other instruments were also used to gain information. For instance, alternative estimates of the effects of monetary policy on inflation were obtained using structural VAR approaches (e.g., Gaiotti-Gavosto-Grande, 1998); statistical methods were used to build leading indicators of economic activity, in which money played an important role (for a recent, systematic application see Altissimo-Marchetti-Oneto, 2001); a large set of indicators was also used to measure market expectations (term structure, survey results, etc.).

3. Monetary variables in the models of the Bank of Italy

The main econometric tools used by the Bank of Italy were the quarterly model of the Italian economy (Bank of Italy, 1986, Galli-Terlizzese-Visco, 1989) and the monthly model of the money market (Bank of Italy, 1988, Angeloni, 1994, Gaiotti, 1992). While the former is a simultaneous model of the real and financial sectors of the Italian economy, the latter is a purely financial model, taking the real sector as exogenous, incorporating greater detail on the monetary sector and providing information at a higher frequency.

In the *quarterly model of the Italian economy*, the effects of a change in the stance of monetary policy are mostly reflected in market interest rates and the exchange rate; these variables in turn affect the components of aggregate demand, employment and inflation (a detailed description of the monetary transmission mechanism in the model is provided in Nicoletti Altimari *et al.*, 1995). Changes in these macroeconomic variables in turn feed back into the financial system, affecting quantities such as money and credit.

Monetary and credit aggregates essentially play a post-recursive role, as in most existing macro-models, although certain changes in the composition of balance sheets do exert some second-round effects on interest rates, thus setting the stage for interactions between the real and financial blocks of the model; but these are of limited importance.[4] The monetary and financial section of the model is composed of more than two hundred equations, some thirty of which are stochastic. It describes the financial position of seven categories of economic agents (central bank, banks, government, households, firms, mutual funds and rest-of-the-world) and how their assets and liabilities are allocated among eight groups of instruments (currency, deposits, compulsory reserves, repos, short-term securities, long-term securities, loans, mutual funds and shares). Each market is described by a demand function and an inverted supply equation, in which the endogenous variable is the relevant interest rate.[5]

Among the financial behavioral equations, money and credit demand have more direct relevance for monetary analysis. The demand for domestic credit by the private sector is influenced by its borrowing requirements, borrowing costs, the return on financial assets and the cost of foreign funds. The demand for credit is modelled separately for households and production units. Borrowing requirements drive the demand for credit by firms, while the nominal value of the stock of durable goods and dwellings determines the size of household debt. Both credit components respond to changes in the spread between interest rates charged on bank lending and returns received on alternative assets.

The demand for M2 (in the definition used by the Bank of Italy until 1998), both in the quarterly and in the monthly version, was based on the results of Angelini-Hendry-Rinaldi (1994). The specification was quite standard: the scale variable was represented by GDP, while the opportunity cost of holding money was measured by the spread between the yield on Treasury bills and the own rate on M2. The role of certain other variables depended on the sample period considered: financial wealth proved to be a significant explanatory variable in the 1980s, while long rates affected money demand in the second half of the 1990s.

The *monthly model of the money market* was designed mainly to support monetary policy decision making. Its purely financial character, taking the real sector of the economy as exogenous, was consistent with the post-recursive role of monetary variables in

[4] In some versions of the model this was obtained through an effect of the composition of bank liabilities (the degree of liquidity) on credit supply, hence on real variables. Also, some feedback could take place informally outside the model: for instance, outside information on the flow of credit could be used to evaluate the plausibility of the behavior of firms' investments or profits in the model, and review some of the assumptions or the underlying equations.

[5] The determination of interest rates is based on banks' behavioral equations and equations for the term structure. Banks have monopolistic power and can set both the lending and the borrowing rate, but take the price of interbank deposits as given. In both cases, the size of the spread depends on the elasticity of demand and the structure of marginal costs.

the quarterly model. For practical applications, it was thus often simulated in conjunction with the Bank's larger quarterly model, taking the profile of real variables from the latter's simulation. Its main advantages were that it allowed analysis of economic conditions at a higher frequency, and made it possible to model a much richer set of variables (several monetary instruments, transmission through the whole interest rate structure) while paying greater attention to institutional details (e. g., tax treatment of financial instruments).[6]

4. The information value of money in theory

As stressed in the literature, money may have information value even when it is determined post-recursively (i.e., in a model of 'passive' money). In the context of such a model, responding to unexpected movements in money or credit growth is appropriate if they signal either contemporaneous, but still unobservable, movements, or anticipate subsequent deviations of real income or prices from what was previously expected (Friedman, 1984). Information lags and, possibly, cross-correlation among structural disturbances are the source of the information value of money in the models.

A standard example of the role of money as an information variable is based on Friedman (1990):

$$\begin{aligned} y &= -\alpha_1 r + u \\ m &= \beta_1 y - \beta_2 r + v \end{aligned} \tag{1}$$

where y is income, m is money, r is the interest rate and u and v are zero mean disturbances with variances $\sigma_u{}^2$ and $\sigma_v{}^2$ and covariance σ_{uv}.

We define y^* as the target level of output and m^*, r^* the corresponding values of m and r under certainty $\left(m^* = \left(\beta_1 + \frac{\beta_2}{\alpha_1}\right) y^* \text{ and } r^* = \left(-\frac{1}{\alpha_1}\right) y^*\right)$. Under the assumption that r, m are observable, while y, u, v are not, the optimal (least-squares) estimate $(\hat{y} - y^*)$ of the output deviation from target can be written as a function of observed deviations of m, r from their benchmark values:[7]

$$\hat{y} - y^* = \delta_1 (m - m^*) + \delta_2 (r - r^*) \tag{2}$$

where

$$\delta_1 = \frac{\beta_1 \sigma_u^2 + \sigma_{uv}}{\beta_1^2 \sigma_u^2 + \sigma_v^2 + 2\beta_1 \sigma_{uv}},$$

$$\delta_2 = \frac{\beta_1 \beta_2 \sigma_u^2 - \alpha_1 \sigma_v^2 - (\alpha_1 \beta_1 - \beta_2)\, \sigma_{uv}}{\beta_1^2 \sigma_u^2 + \sigma_v^2 + 2\beta_1 \sigma_{uv}}.$$

With r exogenous, (2) shows how the unobservable surprise in output may be estimated knowing the surprise in money. The signal extraction problem can be solved in two

[6] The model described in detail the financial behavior of the public (households and firms) and the banking system. The main equations determined the demand for currency, M2, bank loans, banks' excess reserves, refinancing from the central bank, and the determination of interest rates on T-bills of different maturities, and on banks' deposits and loans.

[7] Eq. (2) may be derived as a simple projection of $y + \alpha_1 r = u$ on $m + (\alpha_1 \beta_1 + \beta_2)\, r = \beta_1 u + v$, then rearranging the terms.

ways: explicitly knowing all the parameters in (2); more simply, (2) may be recovered by means of a regression on forecast errors, as suggested by Friedman (1984). The information value of money can be defined as the percentage reduction in the variance of the output forecast obtained in this way.

One may also use (2) to obtain the value of r that stabilizes the expected deviation from target, setting $\hat{y} - y^*$ to zero and getting the standard optimal policy rule as in Friedman (1990):

$$(r - r^*) = \gamma_1 (m - m^*)\,, \qquad \gamma_1 \equiv \frac{\beta_1 \sigma_u^2 + \sigma_{uv}}{-\beta_1 \beta_2 \sigma_u^2 + \alpha_1 \sigma_v^2 + (\alpha_1 \beta_1 - \beta_2)\, \sigma_{uv}}\,. \tag{3}$$

Here, although money is completely demand-determined, the optimal reaction (γ_1) of the interest rate to deviations of money from the benchmark value is not zero, due to information lags (m is observed, while y is not). γ_1 depends also on the values of the covariance of structural disturbances, σ_{uv}.

5. The information value of money: past evidence

As far as *information lags* are concerned, monetary data usually become available before national accounts data are released. In Italy, in the period under consideration the first estimates of M2 (monthly average) were released by the last ten days of the month, while final data were available by the following month, usually with only small revisions. National accounts data was available only after one or two quarters, and would undergo substantial revisions thereafter. More timely information was available on consumer prices, with initial estimates also being available by the end of the same month, as well as consumer sentiment, wholesale prices, survey data on inflation expectations and industrial production.

As regard the existence of some cross-correlation, at various lags, in the surprises of the money demand equation and those in other behavioral equations, this may indicate that unexpected movements in money may help forecast some instability in the other relations in the model. Such a correlation may stem from the information lags; it may also result, *inter alia*, from some of the (unavoidably) simplifying assumptions on which a model is based, e.g., the difficulty of properly modelling the role of forward-looking expectations or the determination of the exchange rate.[8]

For the period until 1989, Angeloni-Cividini (1990) provide empirical evidence supporting the role attributed to monetary aggregates by the Bank of Italy. They measured the amount of information about final policy objectives contained in a number of intermediate variables, including money and credit, taking into account the whole structure of the quarterly model, the empirical cross-correlations between the structural disturbances and the information variables, and the information lags with which the main endogenous variables become known to the Italian policymaker.[9] To solve the equivalent of equation (2) above, they subjected the quarterly model to stochastic shocks, drawn from a normal distribution, whose covariance matrix is derived from the histor-

[8] An analysis of how different ways of modelling expectations and exchange rate determination may affect the properties of the quarterly model is in Gaiotti-Nicoletti Altimari (1996).

[9] The results are also presented and discussed in Angeloni-Passacantando (1991).

ical one and accounts for correlations in monetary surprises in monetary aggregates and real variables, and assessed the decrease in the forecast error variance of the final variables at various horizons; i.e., they measured the reduction of uncertainty on the final variables obtainable by optimal use of the timely available information contained in the intermediate variables.

Their results pointed to the importance of monetary aggregates in providing information on present and future values of nominal GDP. The results showed that M2 alone significantly reduces GDP uncertainty in the same quarter; the "marginal" contribution – obtained once real variables for which timely information is available are also taken into account – is smaller, although not negligible. The information content of monetary aggregates turns out to be somewhat lower for real GDP, while it remains strong for prices. Angeloni-Passacantando (1991) argue that "in relation to the Italian case, the results provide solid grounds for the thesis that money has recently been very informative about the behavior of the real economy and prices, while the information content of credit has substantially weakened". In their results, the information content of money turns out to be greater at shorter horizons.

The role of monetary and financial variables in anticipating cyclical movements in GDP and consumption was recently confirmed, on quite different grounds, by Altissimo-Marchetti-Oneto (2001). They analysed the business cycle properties of about two hundred time series relevant to the Italian economy, including monetary variables. They found that money and financial variables lead the cycle by an average of between 12 to 16 months. Some of their results are shown in Table 1. In particular, M1 and M2 (old national definitions) in real terms were found to lead the aggregate cycle by ten and eleven months, respectively, with a cross-correlation slightly above 0.5. This

Table 1. The Business Cycle properties of Monetary Variables

Series	Characteristics		Cross-correlation (1)						Predictive content		
			Transformed series			Filtered series (2)			12 lags		
	Transf.	Freq.	r_0	r_{max}	t_{max} (3)	r_0	r_{max}	t_{max} (3)	F-value	p-value	cusum
1 M1	d ln	M	0.15	0.27	+ 4	0.20	0.34	+ 7	7.68	0.062	0.711
2 M2	d ln	M	0.05	0.29	+10	−0.13	0.24	+13	7.41	0.037	0.624
3 currency	d ln	M	0.06	0.09	+ 4	−0.15	−0.25	− 8	12.58	0.000	0.625
4 M1 real	d	M	0.08	0.21	+10	0.21	0.52	+10	8.87	0.006	0.810
5 M2 real	d	M	0.01	0.36	+11	0.09	0.56	+11	9.51	0.004	0.668
6 loans	d ln	M	0.10	−0.20	+19	0.08	−0.60	+16	0.89	0.659	0.964
7 Dep., real	d	M	−0.10	0.36	+11	−0.08	0.61	+13	6.80	0.001	0.600
8 Disc. rate	level	M	−0.18	−0.21	+ 5	0.31	−0.70	+14	11.38	0.003	0.986
9 T-bill rate	level	M	−0.22	−0.25	+ 2	0.21	−0.82	+16	3.50	0.058	1.074
10 Loan rate	level	Q	−0.28	−0.29	+ 1	0.05	−0.86	+ 4	5.20	0.011	0.991
11 Loan spread	d	Q	−0.05	−0.34	+ 3	0.00	−0.64	+ 4	2.80	0.086	0.689

(1) Cross-correlation and prediction content of each series are referred to the coincident indicator of the Italian cycle (which includes overtime hours, industrial output, indicators of activity in services, investment in machinery and plant, imports of goods).
(2) Band-pass filter retaining fluctuations between 16 and 92 months.
(3) The + (−) sign corresponds to a lead (lag) with respect to the coincident indicator; t_{max} is the lead (lag) of the maximal correlation.

Source: Altissimo-Marchetti-Oneto (2001)

is roughly consistent with much of the international evidence available, particularly with regard to M2.[10] They also found a clear statistical link between nominal interest rates and the aggregate cycle. Interesting results were also obtained with the spread between the interest rate charged on bank loans and that associated with medium and long-term government bonds, which was found to be strongly countercyclical and to lead the aggregate cycle by four quarters, providing evidence in favour of the credit channel of monetary transmission. In light of these features, they built a composite leading indicator of the Italian cycle, including bank deposits in real terms and the spread between the interest rate on bank loans and the rate on long-term government bonds.

6. The use of the information in monetary aggregates in practice

The studies mentioned above represent the theoretical and empirical underpinning of the role attributed to monetary variables by the Bank of Italy. In practice, the use of monetary aggregates for day-to-day policy evaluation was based on the assessment of their deviations from a benchmark scenario and on the analysis of the factors underlying such deviations.

A main forecasting exercise usually took place each year in the autumn and was updated in the spring. It included the preparation of a 'baseline' forecast with the quarterly model and the selection of a number of alternative scenarios, with different sets of policy and exogenous variables; a selected 'normative' scenario was then used as an input for the monthly model to generate the monthly profiles for the main financial aggregates, interest rates and monetary instruments. Monetary and financial forecasts were then monitored during the year to detect deviations of the financial variables from the projected paths and to interpret their implications for the overall picture.

The first announcement of the monetary growth path was made in October, and stated in the October issue of the Bank of Italy's Economic Bulletin. It was presented consistently with a simulation reproducing the (Government's) macroeconomic planning scenario for the Italian economy and within a flow-of-funds framework, derived using both models. The projected paths for the main financial aggregates (credit to the non-state sector, total credit, total financial assets) complemented the announcement of the monetary growth objective (Table 2).

The entire forecasting process played an important role in shaping the way the monetary growth paths were announced to the public. *Ex-ante*, the caveats or qualifications concerning the underlying macro and financial framework, stemming from the forecasting exercise, were stressed, thus setting the stage for any *ex-post* discussion of possible deviations of money from the announced path and of the appropriate policy response. In those cases where the money-income correlation was considered a reliable guide to policy, and when it was intended to indicate that deviations from the reference path for money would not be tolerated, the path was announced without qualifications. In 1990 it was simply stated that "the target range for growth of the money supply has been set at 5–8 percent";[11] in 1992 it was stated that "the money supply growth target takes on

[10] See for example Kydland-Prescott (1990), Stock-Watson (1990), Cochrane (1994).
[11] See *Economic Bulletin*, October 1990, p. 58.

Table 2. Monetary Targets and Flow-of-Funds

	Gross Domestic Product		Total credit to state sector (a)		Total credit to non-state sector (b)		Total credit (*a*) + (*b*)			Total financial assests			Money (M2)		
	1000 bln. lire	%	1000 bln. lire	%	1000 bln. lire	% of GDP	1000 bln. lire	%	% of GDP	1000 bln. lire	%	% of GDP	1000 bln. lire	%	% of GDP
1989	1193.5	*9.3*	125.5	*20.1*	132.7	*11.1*	258.2	*15.8*	*21.6*	202.7	*13.7*	*141.7*	62.7	*8.6*	*61.6*
1990	1312.1	*9.9*	148.7	*20.0*	139.6	*10.6*	288.3	*15.2*	*22.0*	221.7	*12.8*	*146.1*	79.1	*10.7*	*62.1*
1991	1429.5	*8.9*	138.9	*15.9*	151.2	*10.6*	290.0	*13.4*	*20.3*	244.7	*12.8*	*152.0*	74.3	*8.5*	*62.2*
1992	1504.0	*5.2*	81.1	*8.2*	164.1	*10.9*	245.2	*10.0*	*16.3*	180.0	*8.3*	*157.3*	41.6	*5.9*	*61.8*
1993	1550.2	*3.1*	22.3	*2.0*	161.5	*10.4*	183.8	*6.7*	*11.9*	147.7	*6.2*	*164.9*	75.5	*8.2*	*64.9*
1994	1641.1	*5.9*	7.8	*0.7*	158.8	*9.7*	166.6	*5.6*	*10.2*	182.3	*7.1*	*168.4*	17.4	*1.9*	*62.3*
1995 (1)	1758.6	*7.2*	51.2	*4.3*	133.0	*7.6*	184.2	*5.9*	*10.5*	174.2	*6.3*	*167.1*	16.0	*1.2*	*59.1*
1996 (2)	1872.6	*6.5*	72.0	*5.8*	112.4	*6.0*	184.4	*5.6*	*9.8*	177.1	*6.0*	*166.4*	55.0	*5.0*	*58.4*

Standard table setting growth rates (or ranges) for M2 together with other financial variables. The table was usually published in the October issue of the *Economic Bulletin*. Annual flows, unless otherwise indicated. (1) Estimate (October). (2) Forecast.

greater importance for liquidity management and interest rate policy in the short term"[12]. In other cases, qualifications and uncertainties regarding the behavior of money were stressed, as in 1995: "Assuming that the changes that have occurred in the composition of private financial portfolios this year do not continue, M2 should grow by about 5 percent in 1996. However, the possibility that such shifts may continue ... calls for particular caution in interpreting the behavior of monetary aggregates."[13]

Sometimes, though not always, the implications of the monetary and financial framework for the interest rate policy were also spelled out. In 1996, it was made clear that "the growth in M2 ... must be less than 5 percent in 1997. Assuming that the velocity of circulation ... continues to increase at the rate observed in recent years, the projected expansion in M2 is consistent with a reduction in interest rates".[14] Similarly, in 1993 it was said that the monetary target "leaves room ... for a reduction in the average level of nominal interest rates".[15]

While the macro forecast was usually made twice a year, the monthly analysis of monetary developments was used to put the forecast in perspective, assessing deviations and detecting the sources of shocks hitting the economy.

The monetary analysis transmitted to the Governor centered on, although it was not limited to, the interpretation of the deviations of money growth from the projected path. Monthly deviations of money from the initial profile were monitored, using the monthly money demand equation as a starting point. Decomposition exercises, aimed at singling out the economic determinants of deviations from the benchmark profile were routinely conducted. Econometric analysis, institutional information and anecdotal evidence were used to interpret the discrepancies. A standard decomposition exercise is shown in Table 3; the contribution of the right-hand-side variables in the money demand function to overall money growth are computed. The procedure could be based either on an analytical derivation or on a set of counterfactual simulations.[16]

In the case of instability in the equation, an analysis of institutional factors was conducted in order to distinguish pure financial disturbances from behavior that may reflect some other sources of structural instability in the model. If the behavior of money was accounted for by changes in the explanatory variables, this was analyzed to check whether it was still consistent with the final targets.

The weight assigned to money developments was not constant throughout the 1990s, being influenced by the interpretation of its determinants. A number of examples of how different circumstances dictated different reactions to money growth can be found in the internal briefing material.

At the beginning of the 1990s, money demand showed remarkable stability and was considered a reliable indicator. In the course of that year, in a context of rising infla-

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[12] See *Economic Bulletin*, October 1992, p. 68.
[13] See *Economic Bulletin*, October 1995, p. 64.
[14] See *Economic Bulletin*, October 1996, p. 69.
[15] See *Economic Bulletin*, October 1993, p. 72.
[16] To estimate the contribution of a particular explanatory variable to money growth, a benchmark forecast is produced by keeping all explanatory variables in the money demand equation constant at their value at the beginning of the simulation period (usually December); for each variable, a new forecast is then produced by inserting its actual behavior in the equation, while keeping the others fixed. The difference between the two forecasts gives the contribution of the variable in question.

Table 3. A Decomposition of M2 Growth
(percentage change since the beginning of the year, s.a.)

Period	Actual growth	Projected growth	Contribution to projected growth						
			Real GDP	Prices	Own rate on M2	T-bill rate	Medium-term rate	T-bond rate volatility	Lagged endo. at t_0
1993. Dic	7.7	6.2	–0.35	4.13	–2.6	3.04	2.63	1.67	–2.56
1994. Jan	0.02	0.85	0.02	0.14	0.12	0.28	0.07	0.07	0.15
Feb	1.22	1.68	0.15	0.37	0.19	0.31	0.12	0.24	0.30
Mar	2.69	1.97	0.20	0.47	0.03	0.62	–0.05	0.45	0.25
Apr	3.28	2.21	0.33	0.86	–0.14	0.58	–0.06	0.64	–0.01
Mag	3.05	2.55	0.53	1.21	–0.09	0.43	–0.11	0.82	–0.25

In the model: $y_t = \alpha y_{t-1} + \beta' x_t + \varepsilon_t$,
where x_t is a vector of exogenous variables, the contribution of variable j to money growth over n months is:

$$\beta^{(j)}\lfloor \alpha^{n-1} x_{t+1}^{(j)} + \alpha^{n-2} x_{t+2}^{(j)} + \ldots + x_{t+n}^{(j)} \rfloor$$

Source: Unpublished note by G. Grande and R. Rinaldi, 28/6/1994.

tionary pressures and expansionary fiscal policy, concern was expressed about stronger than expected money growth. *"Last September* (1990)*, with M2 still growing at 7.4 percent, but with a higher profile for inflation, we forecasted annual growth of 10 percent* (outside the reference range); *we indicated the cause both in the more sustained pace of prices and in the accumulation of high budget deficits in the following months. Our forecasts did correctly anticipate the deviation of M2 from the target range, at a moment were M2 was still in the centre of the range".*[17] Consequently, monetary conditions were tightened in October 1990, and justified to the public with the explicit aim of "curbing the expansion of monetary aggregates" (*Annual Report for the year 1990*, p. 81).

Later, soon after the exit of the lira from the exchange rate mechanism of the EMS, the need for a clear nominal anchor was felt to be particularly pressing, and the behavior of money was watched carefully. However, in the course of 1993, deviations of money growth from the announced profile were not considered a cause for concern, unlike in the previous example; they were traced to movements in the exogenous variables that were not perceived as a threat to price stability. *"The current trend suggests that, by the end of the year, M2 will be above the upper limit of 7 percent. The question is whether the overshooting should be countered or whether, conversely, it should be announced in advance and with what motivations. The announcement that limited deviations can be tolerated would be appropriate if it is judged that a change in monetary policy took place that is compatible with the inflation objective. This is likely to have happened as an effect of the more pronounced cyclical slowdown, both domestic and international, and of the sharp decrease in interest rates in Europe. (This) ... has created the conditions for a larger decrease in domestic rates, without worsening the risks of*

[17] Research Department note, 24/1/1991, referring to previous analyses in the second half of 1990.

depreciation and imported inflation. Under these conditions, the anti-inflationary target could be compatible with a lower level of domestic rates and, temporarily, with more pronounced growth of the monetary aggregates"[18]. As a result of this analysis, the easing in monetary conditions was not interrupted. The analysis underlying the decision was later presented to the market.[19]

The stability of the estimated money demand equations deteriorated in the last part of the decade, reflecting changes in the fiscal treatment of deposits and reserve requirements, new structural trends in the portfolio choices of households, and possibly currency substitution. As a consequence of these developments, the definition of M2 was changed at the end of 1996, with the exclusion of some categories of CDs. In policy evaluation, greater attention was paid to the composition of money, together with its aggregate behavior.[20]

In 1997 and 1998, in a context of declining interest rates and inflation rates,[21] a strong increase in the growth of M2 was experienced, well above the announced value. In view of the observed instability of money demand, due to the above-mentioned factors, this was not considered a sufficient reason to interrupt the decrease in interest rates. It was also observed that credit aggregates were growing at a very moderate pace, much less than forecast. However, money growth was still considered a sufficient reason to proceed with greater caution, given the highly uncertain outlook for inflationary expectations, the mixed signals coming from other indicators and the sustained increase in the most liquid components of money. "*All in all, it is judged that these factors* (the reform of the tax treatment of bank deposits, the structural changes in households' portfolios, the uncertainty of savers)*, which are to a large extent of a structural character, reduced the value of M2 in the current year as a leading indicator of inflationary pressures. The risks associated with an excessive growth in M2 appear, at present, to be limited. However, these risks will have to be considered again should the growth of the monetary aggregate continue at the same pace observed in the first part of this year".*[22] Again, the analysis was later presented to the public.[23]

All in all, in the 1990s the information value of money was more frequently affected by episodes of money demand instability than in the preceding decade. The analytical

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[18] Research Department note, 16/7/1993.

[19] "Analysis of the factors underlying the growth in M2 indicates that the relationship between the monetary aggregate and its determinants has not been seriously undermined; the overshooting of the target can be explained mainly in terms of interest rate trends. ... In view of the cyclical slowdown in economic activity, which has been more pronounced than expected both in Italy and abroad, a reduction in interest rates and an expansion in M2 by more than forecast are compatible with attainment of inflation objectives" (*Economic Bulletin*, October 1993, p.71).

[20] In the second half of the 1990s monetary analysis was complemented by the use of Divisia monetary indexes, mostly used as a cross-check of the behavior of simple-sum aggregates (Gaiotti, 1994).

[21] Previously, in 1994–95, the currency devaluation, the inflationary pressures and the worsening of inflation expectations had been contrasted with a monetary tightening.

[22] Research Department note, 21/10/1997.

[23] "In 1997 the growth in the M2 money supply was nearly twice the target of 5 percent, owing chiefly to structural changes in the public's portfolio preferences. This suggests that the value of the aggregate as an early indicator of inflationary pressures has been diminished, at least temporarily. Nevertheless, experience demonstrates that in the long run excessive monetary growth tends to be reflected in price and exchange rate pressures. This consideration was one reason for the caution with which monetary conditions were relaxed in the course of the year" (*Annual Report for the Year 1997*, pp. 123–124).

approach to assessing the information content in the context of the model of the Italian economy made it possible to treat money developments in a flexible way. More attention was also paid, on particular occasions, to the liquid components of M2 (using, among other things, Divisia indexes) or to credit behavior. Reference to M2 growth remained an important anchor across the period, but was de-emphasized in some instances, particularly towards the end of the decade.

7. A test of the information value of monetary and credit aggregates in the quarterly model of the Italian economy

Assessing the information value of money in the 1990s is interesting in the light of recent experience. While several factors affected money demand in the past decade, the real sector of the economy was also subject to important structural changes: among other things, the shift to the floating exchange rate regime in 1992–1996 and the reform in the wage bargaining system may have affected macroeconomic behavior and the process of expectations formation in various ways. These changes may have also reduced the information content of real variables, although the evidence on the existence of structural breaks is inconclusive.[24] So, the issue of the marginal information content of money is left open.[25]

To assess the information content of monetary and credit aggregates in the 1990s, we checked whether the most timely information on monetary and financial variables may be used to improve the accuracy of forecasts of those variables of concern to the monetary authorities.

The testing strategy we adopted, conceptually based on equation (2) above, is the following: we computed the k-step-ahead (k = 1, 4, 8 quarters) forecast error of the endogenous variables of the quarterly model and checked whether surprises in monetary and credit variables were correlated with surprises in output and inflation. This approach was suggested by B. Friedman to test for the marginal information value of monetary aggregates within a structural model, based on the consideration that "if observed money growth different from prior expectations also provides information that bears on future income growth", then there is a role for money in guiding policy (Friedman (1984)).[26] Detecting that surprises in monetary and real variables are statistically related justifies the role attributed to nominal aggregates in the conduct of monetary policy.

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[24] A discussion of the possible factors of instability in the quarterly model after 1992 is provided in Siviero-Terlizzese (1997). However, the evidence they present does not confirm the existence of structural breaks.

[25] The information content of money in a structural model has recently been questioned (Svensson-Woodford, 2000; Dotsey-Hornstein, 2000). By contrast, some results for the euro area, obtained with time-series methods, have stressed that money has some forecasting power for future inflation (Nicoletti Altimari, 2000, Trecroci-Vega, 2000).

[26] The proposed approach has the advantage of being simple, but limitations and caveats must clearly be emphasized. Goldfeld (1984) points out that the estimates may suffer from an omitted variable bias, if some relevant information is not included in the equation (which should ideally include the forecast errors for all the endogenous variables). This problem becomes more relevant for longer forecast horizons, as the implicit assumption on the available information becomes more and more questionable. For this reason, our experiment is limited to fixed and not too long forecast horizons, rather than concentrating on a dynamic simulation over the full sample, as Friedman (1984) did. In any case, the results must be considered contingent on the particular information set that is assumed.

To implement this approach, we first ran simulations of the quarterly model over 1989–2000, under the assumption of no uncertainty of exogenous variables, model coefficients and functional form specification.[27]

The quarterly model can be represented by the following set of equations:

$$y_t \equiv \begin{pmatrix} y_t^T \\ y_t^M \\ y_t^O \end{pmatrix} = F(y_t, Y_{t-1}, X_t; \vartheta) + \varepsilon_t \equiv \begin{pmatrix} F^T(y_t^T, y_t^M, y_t^O, Y_{t-1}, X_t; \vartheta) \\ F^M(y_t^T, y_t^M, y_t^O, Y_{t-1}, X_t; \vartheta) \\ F^O(y_t^T, y_t^M, y_t^O, Y_{t-1}, X_t; \vartheta) \end{pmatrix} + \begin{pmatrix} \varepsilon_t^T \\ \varepsilon_t^M \\ \varepsilon_t^O \end{pmatrix} \quad (4)$$

where y_t, the vector of modelled variables, is partitioned into three subsets, y_t^T, y_t^M and y_t^Ocorresponding to policy targets (T), monetary indicators (M) and other endogenous variables (O); ε_t is the vector of structural disturbances; $X_t = \{x_j\}_{j=0}^{t}$ and $Y_{t-1} = \{y_j\}_{j=0}^{t-1}$ represent (present and) past history of the xs and ys and ϑ is the vector of model parameters. The n-period ahead forecast errors (surprises) are defined as:

$$y_t - y_{t|t-n} \equiv u_{t|t-n} = \begin{pmatrix} u_{t|t-n}^T \\ u_{t|t-n}^M \\ u_{t|t-n}^O \end{pmatrix} = F(y_t, Y_{t-1}, X_t; \vartheta) + \varepsilon_t - F(y_{t|t-n}, Y_{t-1|t-n}, X_t; \vartheta) \quad (5)$$

where $Y_{t-1|t-n} = \{y_{j|t-n}\}_{j=0}^{t-1}$, with $y_{t-j|t-n} = y_{t-j}$ when $j \geq n$. We set n to be equal to 1, 4, 8 quarters. Then, for each horizon, we ran several variants of the following regression, choosing the right-hand side variables in a parsimonious way:

$$u_{t|t-n}^T = \alpha + \sum_{j=l}^{p} \beta_j u_{t-j|t-n-j}^T + \sum_{j=k}^{q} \gamma_j u_{t-j|t-n-j}^M + \sum_{j=k}^{q} \delta_j u_{t-j|t-n-j}^O + \eta_t \quad (6)$$

We chose surprises in real GDP and the GDP deflator as the left-hand side variables (T) and M2, currency, credit to households, credit to firms and net domestic financial assets as financial indicators (M). The inclusion of the variable $u_{t|t-n}^O$, which represents a quickly available non-financial variable (in our case the index of consumer prices), allowed us to test whether the information content in monetary and credit aggregates is not replicable by other sources. The values of the l, k, p and q parameters were chosen in such a way as to test whether surprises in financial indicators are related to surprises in policy objectives; whether they contain additional information not contained in lags of the endogenous variable; how this information changes as the information lag shortens or lengthens and, finally, whether their forecasting power survives the introduction of non-financial indicators. We tested the statistical significance of monetary variables in each equation allowing for heteroskedasticity and serial autocorrelation in the error term.

Tables 4–5 report the main results for real GDP and the GDP deflator, respectively. Each row refers to a regression of the n-period ahead forecast error of the final variable (defined as T in the tables) on the same forecast error for a monetary indicator variable, either contemporaneous or lagged (defined as M), as well the forecast error for the consumer price index (defined as O; this variable is included since the informa-

[27] The pre-EMU Italian definition of M2 was used, since most of the sample period lies before the start of Stage Three.

Table 4. Test of the Information value of Monetary Surprises for Real GDP (1989–2000)

1-quarter ahead surprises

Variables in regression (1)	Information variables (M)					Memo: $R2$ without M
	M2	Currency	Credit to firms	Credit to households	Financial assets	
M	0.01 *(R2 = 0.07)*	0.00 *(R2 = 0.23)*	0.02 *(R2 = 0.10)*	0.56	0.69	–
M O	0.00 *(R2 = 0.12)*	0.00 *(R2 = 0.27)*	0.01 *(R2 = 0.12)*	0.84	0.97	– *(R2 = 0.02)*

4-quarters ahead surprises

Variables in regression (1)	Information variables (M)					Memo: $R2$ without M
	M2	Currency	Credit to firms	Credit to households	Financial assets	
M	0.02 *(R2 = 0.06)*	0.00 *(R2 = 0.48)*	0.00 *(R2 = 0.41)*	0.44	0.13	–
M O	0.15	0.00 *(R2 = 0.53)*	0.00 *(R2 = 0.45)*	0.58	0.08	– *(R2 = 0.01)*
$M(-1)$ $O(-1)$	0.20	0.00 *(R2 = 0.46)*	0.00 *(R2 = 0.45)*	0.62	0.18	– *(R2 = 0.02)*
$M(-3$ to $-4)$ $O(-3$ to $-4)$	0.04 *(R2 = 0.02)*	0.00 *(R2 = 0.46)*	0.00 *(R2 = 0.51)*	0.59	0.59	– *(R2 = 0.00)*
$M(-1$ to $-4)$ $T(-3$ to $-4)$ $O(-1$ to $-4)$	0.00 *(R2 = 0.40)*	0.00 *(R2 = 0.55)*	0.00 *(R2 = 0.54)*	0.01 *(R2 = 0.36)*	0.42	– *(R2 = 0.40)*

8-quarters ahead surprises

Variables in regression (1)	Information variables (M)					Memo: $R2$ without M
	M2	Currency	Credit to firms	Credit to households	Financial assets	
M O	0.26	0.00 *(R2 = 0.78)*	0.00 *(R2 = 0.66)*	0.69	0.01 *(R2 = 0.23)*	– *(R2 = 0.01)*
$M(-3$ to $-4)$ $O(-3$ to $-4)$	0.28	0.00 *(R2 = 0.71)*	0.00 *(R2 = 0.76)*	0.02 *(R2 = 0.30)*	0.00 *(R2 = 0.32)*	– *(R2 = 0.02)*
$M(-1$ to $-4)$ $T(-3$ to $-4)$ $O(-1$ to $-4)$	0.08	0.00 *(R2 = 0.75)*	0.00 *(R2 = 0.81)*	0.45	0.00 *(R2 = 0.73)*	– *(R2 = 0.72)*

The table reports the significance level of the Wald test of exclusion of all the lags of the monetary indicator; the test utilizes a heteroskedastic and autocorrelation consistent (HAC) estimate of the variance-covariance matrix of the parameters (Wooldridge, 1994). A value below 0.05 indicates rejection of the hypothesis that the monetary indicator is not informative. (1) The list of regressors includes lags of the dependent variable (T), of the surprise in the monetary variable (M) and of the surprise in consumer prices (O). Each variable is the n-quarter ahead surprise x, $y_{t+n} - \hat{y}_{t+n|t}$, where $\hat{y}_{t+n|t.}$ is the forecast based on the quarterly model of the Italian economy. $T(-1)$ stands for $y_{t+n-1} - y_{t+n-1|t-1.}$.

tion for the CPI is at least as timely as that for the monetary variables). The tables report the probability level of an F-test for the exclusion of all lags of the monetary variable from the regression. In each panel, the first row indicates whether the contemporaneous M is significant in a regression for T; in the following rows, lagged values of M are tested, while we also control for some lagged values of T and O. Whenever the exclusion is rejected, the R square of the regression is reported. This can be compared with the R square of the same regression without the M variables, reported in the last

Table 5. Test of the Information value of Monetary Surprises for the GDP Deflator (1989–2000)

1-quarter ahead surprises

Variables in regression (1)	Information variables (M)					Memo: $R2$ without M
	M2	Currency	Credit to firms	Credit to households	Financial assets	
M	0.70	0.20	0.00 *(R2 = 0.27)*	0.99	0.44	–
M O	0.86	0.23	0.00 *(R2 = 0.34)*	0.63	0.39	– *(R2 = 0.04)*

4-quarters ahead surprises

Variables in regression (1)	Information variables (M)					Memo: $R2$ without M
	M2	Currency	Credit to firms	Credit to households	Financial assets	
M	0.10	0.00 *(R2 = 0.32)*	0.00 *(R2 = 0.53)*	0.50	0.78	–
M O	0.11	0.00 *(R2 = 0.62)*	0.00 *(R2 = 0.80)*	0.58	0.02 *(R2 = 0.30)*	– *(R2 = 0.41)*
$M(-1)$ $O(-1)$	0.29	0.01 *(R2 = 0.47)*	0.00 *(R2 = 0.80)*	0.88	0.02 *(R2 = 0.49)*	– *(R2 = 0.24)*
$M(-3$ to $-4)$ $O(-3$ to $-4)$	0.53	0.00 *(R2 = 0.48)*	0.01 *(R2 = 0.30)*	0.35	0.21	– *(R2 = 0.01)*
$M(-1$ to $-4)$ $T(-3$ to $-4)$ $O(-1$ to $-4)$	0.01 *(R2 = 0.44)*	0.00 *(R2 = 0.76)*	0.00 *(R2 = 0.74)*	0.23	0.07	– *(R2 = 0.41)*

8-quarters ahead surprises

Variables in regression (1)	Information variables (M)					Memo: $R2$ without M
	M2	Currency	Credit to firms	Credit to households	Financial assets	
M O	0.22	0.00 *(R2 = 0.93)*	0.00 *(R2 = 0.95)*	0.92	0.00 *(R2 = 0.90)*	– *(R2 = 0.85)*
$M(-3$ to $-4)$ $O(-3$ to $-4)$	0.81	0.00 *(R2 = 0.67)*	0.00 *(R2 = 0.49)*	0.00 *(R2 = 0.60)*	0.00 *(R2 = 0.34)*	– *(R2 = 0.19)*
$M(-1$ to $-4)$ $T(-3$ to $-4)$ $O(-1$ to $-4)$	0.33	0.00 *(R2 = 0.84)*	0.11	0.00 *(R2 = 0.83)*	0.00 *(R2 = 0.74)*	– *(R2 = 0.71)*

The table reports the significance level of the Wald test of exclusion of all the lags of the monetary indicator; the test utilizes a heteroskedastic and autocorrelation consistent (HAC) estimate of the variance-covariance matrix of the parameters (Wooldridge, 1994). A value below 0.05 indicates rejection of the hypothesis that the monetary indicator is not informative. (1) The list of regressors includes lags of the dependent variable (T), of the surprise in the monetary variable (M) and of the surprise in consumer prices (O). Each variable is the n-quarter ahead surprise x, $y_{t+n} - \hat{y}_{t+n|t}$, where $\hat{y}_{t+n|t.}$ is the forecast based on the quarterly model of the Italian economy. $T(-1)$ stands for $y_{t+n-1} - y_{t+n-1|t-1.}$.

column, to gauge the quantitative importance of the information variable. It should be stressed that the analysis is intended as a check of the explanatory power of monetary surprises for the final variables, and it is not necessarily an accurate representation of the information set available to the policy-maker. In this respect, further analyses would be warranted.

As one would expect, the results are mixed. However, the empirical evidence allows us to draw some general conclusions. First, the monetary indicators have in-

formation content, usually at all horizons. Second, it appears that the information content of monetary aggregates is not limited to nominal magnitudes, but extends to real ones as well. Third, currency and credit to firms outperform other monetary and financial variables as leading indicators of future movements in output and inflation.

A more detailed examination of the empirical evidence suggests that, at short horizons, surprises in M2 are not a significant explanatory variable for the GDP deflator. Contemporaneous surprises in M2 have some information content for real GDP, but the share of explained variance of the surprise (as measured by the corrected R square) is extremely low. Moreover, the exclusion of M2 surprises for GDP is often accepted when lags of the left-hand side variable are included in the regression. These results are consistent with the anecdotal evidence, suggesting that M2 had a limited information content in the 1990s; they are also consistent with the cautious approach adopted by the Bank of Italy in the second half of the decade in responding to movements in M2.

However, other monetary indicators seem to have information content. Surprises in currency significantly enter both the equations of the GDP deflator and real GDP, and they remain significant when lags of the dependent variable are included. In most cases where currency surprises enter the equation significantly, the increase in the R square of the equation is between 0.3 and 0.5. This result, too, is consistent with the approach adopted by the Bank of Italy towards the end of the decade, which paid somewhat greater attention to the behavior of the more liquid components of M2; the latter were probably less affected by the fiscal and regulatory changes that took place in those years. It should be noted that during the period under consideration the growth of currency was also highly correlated with the growth of overnight deposits; this suggests that M1 could be a promising candidate as an information variable in our exercise. Unfortunately, a demand equation for M1 was not readily available for the whole period and the test could not be performed.

The results also suggest that credit to firms may have an informative role. This marks a difference with the evidence and the conventional wisdom in the 1980s. Surprises to credit to firms usually enter significantly the equations for both the GDP deflator and real GDP, over all horizons. Credit to households less frequently enters the regressions in a significant way. The result is not unexpected; the share of households' indebtness in Italy is much lower than all others OECD countries, and recourse to debt financing by households is limited (although it has been increasing in recent years).

8. Conclusions

We draw the following conclusions from both the descriptive and the econometric evidence discussed above.

The Italian experience confirms that money can have information content and be an important guide to policy, even in a model where it is demand-determined. Thus, the foundations for the role of money do not need to involve a choice between models of 'active' vs. 'passive' money.

However, deciding what weight to attach to monetary variables in guiding short- and medium-term policy-making is essentially an empirical matter. The Italian experience suggests that the information content of M2, which was found to be large in the 1980s,

was smaller in the 1990s, when a series of structural changes affected the stability of money demand. Indeed, the weight assigned to M2 in different episodes has changed; however, the whole set of monetary indicators still played an important role. The conceptual framework used to interpret the information contribution of monetary variables, based on the structural model of the Italian economy, was explained in advance to the public. The policy reaction to monetary developments could be justified, depending on the interpretation of the observed instability in money demand, on the behavior of the explanatory variables in the money demand equation and on their consistency with the overall macroeconomic framework.

In this respect, the Italian experience suggests that an essential feature of the policy framework is to grant flexibility to the policy-maker, e.g. to allow the possibility of adjusting the weight assigned to money according to particular circumstances, but to do so without losing consistency and credibility. When facing deviations of some variables from the forecast path, the use of the structural models of the Italian economy made it possible to tell a consistent 'story', in which an interpretation of the observed behavior of various variables was provided and a policy interpretation presented. The reference to a consistent conceptual framework, in which the role of the various indicators could be cross-checked and evaluated, was an essential component of the strategy.

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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

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"In its coverage of economic conditions in the Federal Republic of Germany the Bundesbank has always given special attention to the money supply. In its 'Monetary Analyses' it has regularly investigated how the stock of money has changed and what factors have brought about the changes." (Deutsche Bundesbank, Monthly Report July 1971, p. 11)

1. Introduction

The insight that inflation is, in the long run, a monetary phenomenon was already deeply anchored in the perception of the general public in Germany long before the policy of monetary targeting was introduced. This conviction was visibly reflected in the Bundesbank Act of 1957, which expressly committed the Bundesbank to regulating the currency in circulation and the supply of credit to the economy in order to safeguard the currency. Accordingly, the observation and analysis of developments in the monetary aggregates as well as their components and counterparts has a similarly long tradition in Germany. Bearing that in mind, it is also understandable that the Bundesbank turned to this natural stability anchor when it first announced a monetary target in December 1974 following the final collapse of the Bretton Woods system and the attainment of far-reaching freedoms in taking monetary policy action. Up to the time of foregoing autonomy in monetary policy with the start of European Monetary Union, the money stock continued to occupy the top position in the hierarchy of indicators within the Bundesbank's monetary policy (König, 1996, p. 125). Analysing and commenting on monetary developments on the basis of the consolidated balance sheet of the banking system was of prominent importance both in preparing decisions internally and for explaining monetary policy decisions that had been taken.

This paper has the following structure: Chapter 2 gives a brief account of the essential elements of the Bundesbank's monetary targeting strategy. Chapter 3 is concerned with the basic elements and general principles of the Bundesbank's analysis of the consolidated balance sheet of the banking sector. Following this, in the Chapters 4 to 9 periods in which the analysis of the consolidated balance sheet was of particular importance for the interpretation of monetary developments are discussed. Finally, Chapter 10 summarises the most important findings.

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2. Basic features of the Bundesbank's monetary targeting strategy

The Bundesbank had always attributed a special role to the money stock within its intermediate-target-oriented strategy.[1] For that reason, the Bundesbank announced a monetary target for the first time in 1975 (see the annex for a table of the Bundesbank's monetary targets). Proceeding from a medium-term orientation, the Bundesbank derived the stability-oriented rate of monetary expansion from the aggregate key variables for potential growth, the unavoidable rate of price increases (later, "normative inflation rate" or the "medium-term price assumption") and the trend rate of change in the velocity of circulation. Starting with the target formulated for 1979, the Bundesbank switched from a single-figure target for average annual monetary growth to setting a target path with a target corridor for monetary expansion during the year (between the fourth quarter of the previous year and the fourth quarter of the current year). Announcing a target for the money growth in the course of the year had the major advantage of showing the importance of controlling the monetary expansion continuously. The formulation of a target corridor not only helped to take account of the sometimes quite sharp short-term random fluctuations in the money stock – in the first half of the eighties it was also used deliberately by the Bundesbank as an instrument for making monetary targeting more flexible. The – in some cases – clear failures to meet the target in the first four years of its monetary policy strategy had taught the Bundesbank that single-figure targets were too ambitious precisely in the light of "unforeseeable external disturbances ... – such as oil price shocks or sharp monetary policy changes, affecting interest rates, in other countries with which Germany has close ties – ..." (Deutsche Bundesbank, 1980, p. 30). By contrast, a corridor with a specification of the conditions for an orientation more to the top or bottom edge of the corridor or with a regular review of the monetary target at mid-year enabled the Bundesbank to counter unexpected risks to price stability more easily.[2] The use of four-quarter targets rather than target averages had the additional advantage that the Bundesbank was able to make adjustments for failure to meet the previous year's target or for very sharp or weak monetary expansion at the end of the previous year (a monetary overhang) despite the comparatively invariant key macroeconomic variables in the derivation of the target.

Initially, the Bundesbank formulated its monetary target for the "central bank money stock" as defined by the Deutsche Bundesbank. In addition to currency in circulation – less cash balances of the domestic credit institutions –, this definition contained the banks' required minimum reserves on domestic liabilities at constant reserve ratios as at January 1974. Minimum reserves were to be held on sight deposits as well as the holding of time and savings deposits with a maturity or period of notice of less than

[1] On the Bundesbank's monetary policy strategy, see, for example, Issing (1992), Deutsche Bundesbank (1995a), König (1996), Neumann (1997), Schmid (1998).

[2] In each of the years from 1979 to 1983, the Bundesbank announced which edge of the corridor monetary expansion should incline to. Accordingly, in the years of monetary policy tightening (1979 to 1981) the bottom half of the corridor was targeted and, in the years of economic downturn (1982 and 1983) the top half. Thereafter, no such specifications were made. Instead, greater attention was devoted to reviewing the corridor regularly in mid-year. However, only once (1991) did such a review result in an adjustment being made. This consisted in a lowering of the whole corridor by 1 percentage point.

four years.[3] Precisely the weighting of the various bank deposits, which was intended to reflect their varying liquidity, was highlighted as a crucial advantage compared with unweighted, broadly defined aggregates. Even so, the central bank money stock was closely related to these aggregates, since it represented "the reflection of non-banks' (weighted) money balances in the Bundesbank's Weekly Return" (Deutsche Bundesbank, 1985, p. 14/15). Not least, however, the central bank money stock was, at the same time, also supposed to express the Bundesbank's responsibility for the rise in money balances. After all, without any action by the Bundesbank the banks' balances at the central bank were unable to rise (Deutsche Bundesbank, 1985, p. 15).

With its monetary target for 1988 the Bundesbank switched to basing its monetary target directly on the broadly defined aggregate M3 – consisting of currency in circulation excluding the credit institutions' cash balances and the sight deposits, time deposits for less than four years and savings deposits at three months' notice held by domestic non-banks at domestic banks. Even though the deposits that were subject to minimum reserve requirements were very largely the same ones that also formed part of the money stock M3, and both aggregates had therefore developed over time mostly in parallel, the different weighting of the components did result in marked differences in the recorded pace of growth in individual periods (see Figure 1).[4] The divergent developments had invariably been due to a perceptible reaction of currency in circulation to extreme fluctuations in interest and exchange rates. Owing to the higher weighting of currency in the central bank money stock, these fluctuations had a much greater impact on this aggregate than on M3. Owing to the fear at the end of 1987 that disturbing factors would lead to a persistent distortion in the demand for currency, a decision was made to change the key operational variable.[5]

Despite its intermediate-target-oriented monetary policy strategy, at no time did the Bundesbank use the money stock as a "monetary autopilot"; shorter-term deviations of monetary expansion from the target path, viewed in isolation, never led to a purely mechanistic response on the part of the central bank. What was crucial for the role of the money stock in taking interest-rate decisions was always its informative value for future price developments; after all, the monetary target was merely an intermediate objective on the road to safeguarding price stability. The comparatively narrow gearing of monetary policy to a monetary aggregate over the years was thus only made possible

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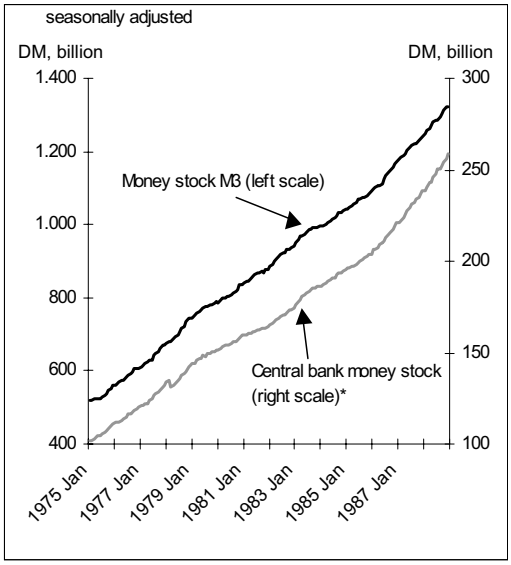
[3] Specifically, this was 16.6% for sight deposits, 12.4% for time deposits and 8.1% for savings deposits. From March 1978, the credit institutions had been allowed to deduct their monthly average cash holdings at least up to an amount equal to 50% of their required reserves (Section 7.3 of the Bundesbank's Minimum Reserves Order as amended on March 1, 1978). Since the incentive to restrict cash balances to an absolutely necessary minimum now no longer appeared to apply, the Bundesbank feared that such cash balances would increase sharply overall and also become more volatile. With a view to the potential negative implications for the monetary intermediate target variable, from March 1978 the deductible cash balances were no longer included when determining the central bank money stock (Deutsche Bundesbank, Monthly Report, June 1978, p. 18/19).

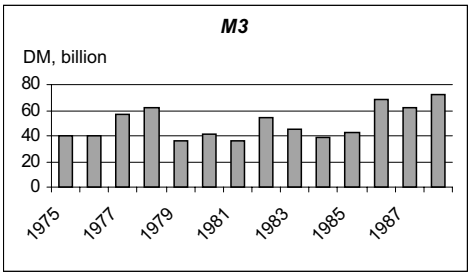
[4] One difference between the two aggregates was that the central bank money stock included the minimum reserves on savings deposits of over three months' notice but less than four years and savings bonds with a maturity of less than four years – all of which were not part of the money stock M3.

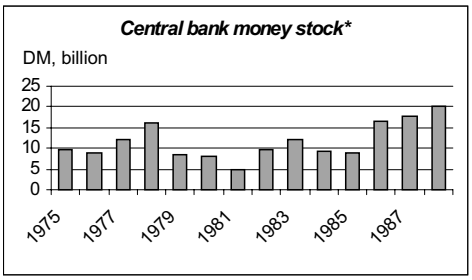
[5] Given the large number of financial innovations in many industrial countries, the Bundesbank perceived an additional advantage of M3 in its unweighted construction allowing new forms of investment to be incorporated more easily than by the central bank money stock (Deutsche Bundesbank, 1988b, p. 20).

Figure 1. Development of the money stock M3 and the Central bank money stock – stocks and changes during the year



* Statistical break in March 1978 due to the chargeability of banks' cash holdings





* Statistical break excluded.

by an extensive analysis and assessment of monetary growth in Germany. This was precisely the key contribution of monetary analysis to monetary policy; it ensured the stabilising role of the money stock trend in forming the economic agents' inflation expectations. Monetary analysis was intended not only to supply an explanation for the current development of the monetary aggregates as well as their components and counterparts on the basis of the consolidated balance sheet of the banking sector, but also to reveal potential changes in their longer-term trends. In this connection, econometric methods were used, primarily to test for the stability of the money demand function. This holds especially for the nineties, as the short-run volatility of the money stock increased significantly as a result of increasing incidence of special factors.[6]

3. Basic elements of the Bundesbank's analysis of the consolidated balance sheet of the banking sector

The consolidated balance sheet of the banking system formed the basis for the analysis of monetary developments in Germany. It was prepared on the basis of the monthly balance sheet statistics and the position of the Bundesbank and was published in the Statistical Section of the Monthly Report. The consolidated balance sheet excluded purely interbank operations and showed the amount of the various assets and liabilities of the German banking system (including the Deutsche Bundesbank) vis-à-vis domestic non-banks and other countries broken down by debtor, creditor, type and originally

[6] Examples for an econometric-oriented analysis are Deutsche Bundesbank (1992) and (1995b), König (1996) as well as Scharnagl (1996) and (1998).

agreed maturity. Principally, reports by the banks were used for this purpose. These reports had to be prepared by the banks in accordance with the provisions of the Banking Act on prudential grounds.[7] Although general reporting requirements had already been introduced for all banks when the Bank deutscher Länder had been established in 1948, a reporting obligation was not enforced initially for all credit institutions, mainly for technical reasons. In particular, smaller credit cooperatives were not recorded in the monthly balance sheet statistics to begin with. From December 1985, however, the Bundesbank did switch to a complete survey. A wave of mergers in the cooperative banking sector had meant in any case that a large number of exempted institutions had since been incorporated into credit cooperatives that formed part of the reporting population.[8]

For the purposes of monetary analysis, the consolidated balance sheet of the banking system was prepared as a table (text table in the Monthly Report "Money stock and its determinants" and, later, "The money stock and its counterparts"). This overview table showed the monthly changes – adjusted for purely statistical effects – that had taken place in bank lending to domestic non-banks, the net external assets of the banking system, domestic non-banks' monetary capital formation at domestic banks, other factors and the Federal Government's deposits in the domestic banking system.[9] The bottom line showed the monthly increase or decrease in the money stock.

In the sixties and even in the early seventies, the Bundesbank initially derived the balance of the change in bank lending to domestic non-banks and monetary capital formation. This balance was interpreted as an "internal money creation balance". Deducting the change in the (longer-term) liabilities of German credit institutions to domestic non-banks not counted towards the money stock, the balance was intended to indicate the contribution made by the domestic source of money creation – in other words, bank lending – to the creation of the money stock. With the Bretton Woods crises it became apparent, however, that monetary capital formation was being fed not only by the domestic expansion of credit but also – and mainly – by heavy inflows of funds from abroad. The internal money creation balance lost its value as an information variable for monetary policy and balancing was no longer appropriate.

It later proved to be more appropriate, in fact, to combine lending to domestic non-banks and the change in the net external position in one variable for the "overall available domestic capital and credit sources" (Deutsche Bundesbank, 1987, p. 42) or the "banks' assets-side business" (Deutsche Bundesbank, 1996, p. 62). This took account of the observation that, from the point of view of domestic borrowers, borrowing from domestic or foreign banks was generally closely substitutable for each other. Looking

[7] Linking the balance sheet statistics to the banks' prudential reports to the Bundesbank is likely to have enhanced the correctness of the reports submitted (Schlesinger, 1984, p. 5).

[8] The reporting requirement was initially geared to the balance sheet total of the credit cooperatives. Starting from Reichsmark 2 million (balance sheet date March 31, 1948) or DM 500,000 (from January 1955; relevant balance sheet date 31 Dec. 1953) this limit was raised in several stages to DM 10 million. Until the overall survey was instituted in December 1985 all credit cooperatives were required to report, whose balance sheet total on 31 Dec. 1972 amounted to DM 10 million or more or which were already subject to reporting requirements on 30 Nov. 1973.

[9] Until the balances of the central and regional authorities were freed from the deposit requirement at the Bundesbank as of January 1, 1994 owing to the entry into force of the second stage of European Economic and Monetary Union, this item corresponded to the central bank deposits of the domestic public sector.

solely at credit expansion, as a guiding principle for the trend of monetary expansion, would have produced a false picture of the underlying driving force for monetary expansion. It was decided not to combine them in this way in the table, however, in order not to devalue the importance of lending and external transactions for monetary capital formation.

The definition of the money stock – the level of which was shown in the consolidated balance sheet and the development of which was primarily intended to provide information on the monetary situation in Germany – did not remain unchanged over the years. Generally, there was a tendency on the part of the Bundesbank to extend the originally very narrow definition of the money stock more and more as time went on. As early as the mid-sixties, besides the "classical" monetary aggregate M1 – consisting of currency in circulation (excluding the cash balances of the credit institutions) and the sight deposits of domestic non-banks – a money stock aggregate was being calculated which additionally included time deposits – initially with a period of notice of six months and, from 1968, for three months.[10] This aggregate, which was now named M1a, was replaced at the start of the seventies by a more broadly defined money stock concept: the money stock M2. Besides M1, this included "quasi-money", in other words, time deposits for less than four years.[11] The money stock M1 was now (only) one part of the "money stock in the broader sense" (M2). Savings deposits at three months' notice had initially been deliberately excluded from being considered for defining the money stock, since their low transactions velocity had meant that they had been ascribed more the character of a "long-term accumulation of capital" (Deutsche Bundesbank, 1971, p. 13). From the middle of 1975 onwards, however, they were indeed used for calculating the money stock M3 – the "money stock in the broadest sense". To begin with, there were only verbal references to the trends in this broadly defined aggregate and a mention as a memorandum item in the Monthly Report table "The money stock and its counterparts", but in mid-1976 M3 finally attained the prominent importance in the analysis of the consolidated balance sheet of the banking sector that it retained up to the end.[12] This was in no way changed by the money stock "M3 extended", which was introduced to the general public for the first time in the 1986 Annual Report and which was commented on regularly from the start of 1990. In addition to the components of M3, M3 extended comprised the bank deposits of domestic non-banks with the foreign subsidiaries and foreign branches of German banks (Euro-deposits), and the short-term bank bonds issued by German banks (with a maturity of up to two years) and – from August 1994 onwards – the certificates of money market funds held by domestic non-banks (less the bank deposits and short-term bank bonds held by domestic money market funds).

The Bundesbank's preference for more broadly defined monetary aggregates – in which it included the central bank money stock as defined by the Bundesbank in addi-

[10] This slight narrowing in the time deposits had become possible as a result of a new maturity breakdown which had been introduced in the balance sheet statistics at the end of 1968. This made it possible to focus even more strongly on "cash holdings affecting payments" without totally neglecting the frictions in the synchronisation of the payment flows.

[11] The first reference to this aggregate was in the Monthly Report of July 1971, pp. 11–13.

[12] The first systematic listing of the three aggregates M1, M2 and M3 was in the Monthly Report of June 1976, p. 11. From July 1976, M3 appeared "below the line" in the table showing monetary growth.

tion to M3 – was explained by the high interest-rate sensitivity of the narrow aggregates (for example, in Deutsche Bundesbank, 1985, p. 18–21.). The money stock M1, in particular, reacted strongly to the cyclical movements of the short-term interest rates. Interest-rate increases, for instance, quite quickly triggered shifts into higher-yielding forms of investment, especially into shorter-term time deposits. Even though the M1 holdings had fallen, the investors had not become perceptibly less liquid; there had been scarcely any change in the liquidity situation in the economy. For the Bundesbank, M1 therefore represented more of a measure for the monetary policy stimulus than for the stock of money influencing demand in the economy. As a consequence of extensive portfolio shifts, M1 understated monetary expansion. Similarly, albeit in the opposite direction, the aggregate M2 was also affected by interest-rate-induced shifts. In periods of sharply rising short-term interest rates, it were mainly time deposits for up to four years which benefited since both sight deposits and shorter-term savings deposits were shifted into them. M2 thus tended to develop in the opposite direction to the interest rate policy. It was therefore not least owing to its comparatively steady development that the Bundesbank selected the money stock M3 as its key point of reference for the monetary analysis and later as its intermediate target aggregate. The observation of more narrowly defined aggregates (such as M1 or M2), components and counterparts was only undertaken in order to better assess the development of M3. The comparatively low statistical explanation power argued against M3 extended.

An additional disadvantage of the money stock M3 extended – but also of the central bank money stock – was the fact that one could not see the reason behind its expansion. In contrast, M3 had the advantage of being an integral element of the consolidated balance sheet. Although one has to be careful when making statements about causal relationships on the basis of the consolidated balance sheet, it gave some hints about possible reasons. By including the Euro-market deposits and, later, the money market fund shares, the money stock M3 extended obviously went beyond the consolidated balance sheet, since additional statistical information was needed to form it. In addition to the monthly reports of the foreign subsidiaries and branches of German banks, which made it possible to determine the amount of Euro-market deposits, the capital market statistics had to be used to calculate the money market fund shares in circulation. Even the key monetary policy reference variable from 1975 to 1987, the central bank money stock as defined by the Deutsche Bundesbank, could not be taken directly from the consolidated balance sheet, but had to be derived instead from the return of the central bank and the minimum reserve statistics. The data of the monthly balance sheet statistics were also supplemented by various additional surveys. In this context, besides quite detailed quarterly borrowers statistics and lending commitments statistics, mention should be made, above all, of the external position of the credit institutions, which broke down the bank's external assets and liabilities by country and currency. Furthermore, yet other statistics were used for interpreting monetary trends, interest-rate statistics and balance of payments statistics being only two examples.

4. Periods of particular challenges for the analysis of the consolidated balance sheet of the banking sector – an overview

Given the sometimes considerable short-term random fluctuations in monetary growth, ultimately only the analysis of the *consolidated balance sheet of the banking sector* was able to impart a certain degree of sureness to the assessment of current monetary de-

velopments. Especially in periods when the money stock deviated from its target path, there had to be an answer to the question of whether this divergence was merely random in nature or whether it was perhaps indicative of a longer-term trend. Putting monetary developments in the context of the prevailing interest-rate and income situation – as the essential factors influencing private sector money holdings – a search was made for (other) reasons for the short-term growth of the money stock both in the components and their counterparts. It can, in actual fact, be observed that in the periods when either various monetary indicators were showing a mixed picture or when the monetary aggregates were revealing particularly striking behaviour, there was either a very flat or even an inverse yield curve or that serious institutional changes (tax law, minimum reserve regulations, change in the provisions governing savings, authorisation of new forms of investment) and external changes (exchange rate) had occurred.[13] A few periods are cited below as examples of times in which the analysis of the consolidated balance sheet was of particular importance for assessing monetary growth. Even though periods are assigned to particular "special developments", this does not imply that the identified factor was the sole cause of the monetary expansion in question. Given the large number of individual money holders and a continuously changing monetary policy setting, monetary growth invariably reflects a whole range of different factors.[14]

5. Monetary policy in times of a sharp appreciation in the D-Mark – 1986 and 1987

Although monetary expansion in 1985 had been consistent with the target, the pace of money stock growth had started to pick up as early as the start of 1986, and accelerated even more sharply in the middle of the year and persisted throughout 1987. The originally envisaged growth of the central bank money stock between the fourth quarter of the previous year and the fourth quarter of the current year of 3 ½% to 5% for 1986 and 3% to 6% for 1987 was clearly exceeded at 8% in both 1986 and 1987 (see Figure 2). The impression of an excessively sharp rise in money holdings was also confirmed by the expansion of the other aggregates, especially the money stock M3. Above all, in 1986 the quite similar growth rates in the various money stock definitions suggested that the increase in the central bank money stock was being underpinned both by an excessive increase in currency in circulation and by the minimum reserve component – and thus by all its underlying bank deposits. By contrast, the distorting indicator property of the central bank money stock known to the Bundesbank again become apparent in 1987, which was caused by the high weighting of currency.[15] The low opportunity costs of liquidity holdings due to low short-term interest rates as well as quite a sharp rise in the amounts of currency held abroad had bloated currency in circulation

[13] For similar breakdowns of such factors, see, for example, König (1996, p. 118–121), who, however, ascribes the effects on the term structure to disruptions in the capital market (see also Schmid, 1998, p. 14).

[14] For a more chronological analysis of monetary developments in Germany between 1975 and 1995, see for example Kole and Meade (1995, p. 922–927).

[15] During 1986, the monetary aggregate M3 increased, at 7 ¼%, approximately as sharply as the central bank money stock (7 %). In 1987, however, the increase was significantly lower (6 ½%) than in the case of the central bank money stock (8%). The assessment that there was a sharp monetary expansion was nevertheless confirmed both times in principle.

Figure 2. Development of the Central bank money stock 1985–1987

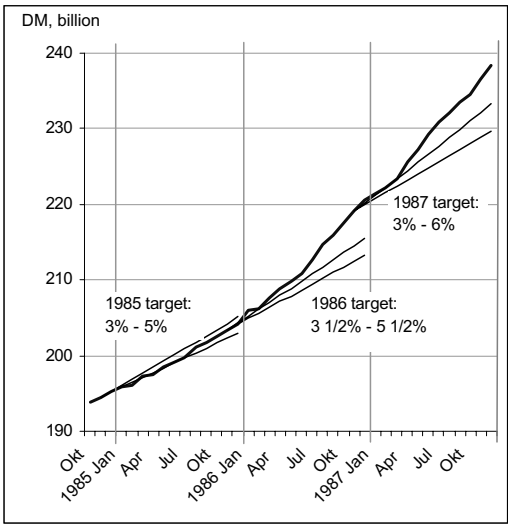
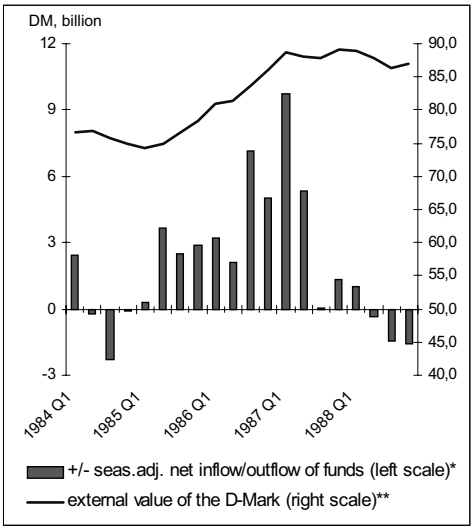


Figure 3. Net inflow of external funds and development of the external value of the D-Mark



* increase/decrease of the net-foreign position of the consolidated banking sector in Germany
** index (1995=100), based on D-Mark exchange rates against 18 industrial countries

exceptionally in 1987. The expansion of the money stock M3 during the year, at 6 ½%, was therefore also less sharp in that year.[16]

To a considerable extent, the sharp appreciation in the D-Mark in those two years had contributed to a sharp increase in cash holdings – presumably mostly outside Germany. Despite an increase in the surplus on current account, appreciation expectations for the D-Mark as well as marked speculation on interest rates had resulted in a high net import of capital (see Figure 3).[17] There were extensive inflows of funds from abroad to domestic non-banks, leading to a rise in the net external asset position of the banking system.[18]

As is usual in such periods, the large inflows of funds from abroad in 1986 and 1987 had not only led to a sharp rise in money holdings but had simultaneously curbed banks' lending to domestic non-banks. Obviously, there was a close substitutional link between borrowing from domestic credit institutions and borrowing abroad. Precisely in such a situation, it proved to be helpful for assessing monetary developments to combine domestic lending and the change in the net external position. A "domestic financing potential" determined in this way expanded comparatively sharply in both 1986

[16] Average of the fourth quarter of 1987 compared with the average of the fourth quarter of 1986.

[17] Short-term, low-interest funds taken up in the Euro-market were used for financing German bonds (Deutsche Bundesbank, 1986, p. 38).

[18] Rohde (1996, p. 62ff.) identifies a clear connection between D-Mark appreciation and monetary growth for other periods as well. Masuch (1994) likewise provides an analysis of the external influences on German monetary policy.

and 1987; the banks' entire asset-side business had thus perceptibly fostered monetary growth. Another factor was a low propensity on the part of investors to invest over the medium term; given the low interest rate of such investments and in the expectation of interest rates rising again, domestic non-banks adopted a "wait-and-see" attitude.

For 1986 and 1987, therefore, the analysis of the consolidated balance sheet of the banking sector discerned a high rate of monetary growth. Additionally incorporating the deposits of domestic non-banks at the foreign subsidiaries and branches of German banks – the Euro-market deposits – in the analysis of the monetary aggregates showed an expansion in 1986 that was even higher than already indicated by M3.[19] The fact that the Bundesbank nevertheless lowered central bank interest rates in 1986 and 1987, rather than raising them, was mainly justified by the sharp appreciation in the D-Mark against the US dollar (Deutsche Bundesbank, 1986, p. 34–36 and Deutsche Bundesbank, 1987, pp. 38–40). An interest-rate increase would probably have given further encouragement to the appreciation tendencies of the D-Mark and thus additionally intensified the economic impact of the trend in the exchange rate. Given the fact that appreciation had made imports cheaper and the dramatic fall in oil prices, the risks to price stability were, if anything, rated as slight. The overshootings of the monetary targets therefore appeared to be acceptable on the whole. After all, the monetary targets were not an end in themselves but were intended solely to help safeguard price stability. The overshootings of the target in 1978 and 1979 were justified in a similar manner. These likewise occurred in times of a sharp D-Mark appreciation, although exchange-rate developments were not their primary cause.

6. Monetary policy in the wake of the ERM crisis 1992/93

A growth of the money stock that was very sharp to begin with in the summer months of 1992 – in August 1992, M3 already exceeded its average of the fourth quarter of 1991 at a seasonally adjusted annual rate of some 8 ½% – was joined in autumn 1992 by disruptions in the wake of the turbulence within the ERM. This turbulence initially led to a further acceleration of monetary expansion because the inflows largely benefited domestic non-banks. This was reflected by a rise in the banks' net external asset position. The Bundesbank's foreign exchange inflows amounting to DM 82 ½ billion was accompanied by an increase in the banking system's net external position of as much as DM 42 ½ billion. This meant that the inflow of funds to domestic non-banks was more than twice as high as in the months particularly affected by the D-Mark appreciation speculation in the mid-eighties taken together.[20] Besides non-residents' acquisition of German bonds, this was probably due to German enterprises high debt in foreign currency abroad. Added to this might have been an increased holding of D-Mark balances by multinational companies. In this period of expectations of a sharp appreciation in the D-Mark, an early redemption of liabilities denominated in D-Mark

[19] The money stock "M3 extended" which, in addition to M3, also comprised the (in 1986 sharply risen) Euro-deposits and the (perceptibly falling) bank bonds with a maturity up to one year (from 1990 with a maturity of up to two years) in the hands of domestic non-banks rose just as sharply, at 7%, as the central bank money stock.

[20] Specifically, this had mainly been the months December 1985 to March 1986 and January to February 1987. In the months April and Mai 1986 as well as March 1987, high external outflows occurred in each case as a counter-reaction (Deutsche Bundesbank, 1993b, p. 28).

by foreign debtors as well as German importers delaying foreign-currency payments for as long as possible might have also been factors contributing to the sizeable inflows of funds to the domestic non-banks.

Even though the heavy inflows of funds to non-banks had perceptibly dampened both short-term borrowing by private non-banks and lending to the public sector in September 1992, the money stock M3 rose in that month at a seasonally adjusted annual rate of 27%. This increase particularly affected sight and time deposits. These were evidently being used to "park" short-term inflows of funds. After the wave of speculation had receded and the reversal of external payments flows, there followed a corrective movement in the money stock, but the rate of monetary expansion nevertheless remained quite high for some time. This confirmed the earlier empirical finding that in periods of high appreciation expectations, a bloating of liquidity occurs more quickly than a subsequent return to normal.

During the tensions in the ERM in summer 1993 the formula "speculation on D-Mark appreciation equals a sharp increase in the rate of monetary expansion" did not hold. Despite an intervention volume of DM 60 billion in July 1993, there was, in fact, a fall in the net external position of the banking system in that month. The funds thus flowed predominantly to German banks and not to domestic non-banks; the interventions thus remained more or less neutral in terms of their impact on the money stock. Similarly, the expectation of a D-Mark appreciation at the end of the seventies played only a minor role in the excessive monetary expansion of that period. It was precisely the *per se* unclear role played by external influences in the increase in the money stock which taught the Bundesbank that it had to identify the causes of monetary growth at all times with the aid of the analysis of the consolidated balance sheet of the banking sector.

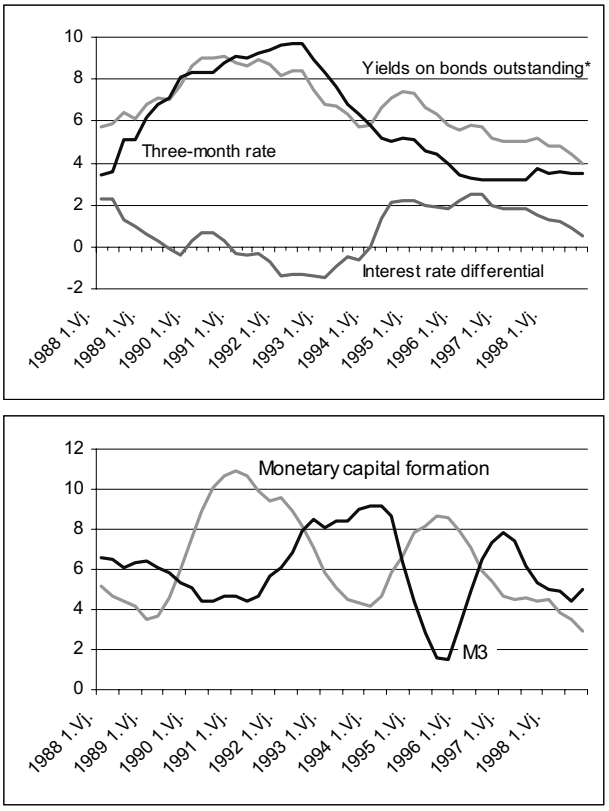
7. Monetary policy in periods when there was an inverse term structure – the "liquidity jam" in 1992 to 1994 and in 1996

Besides externally induced distortions, shifts between money stock components and monetary capital have always exerted a strong influence on the rate of monetary expansion. Such shifts were mostly a reaction to existing interest-rate differentials between short and long-term investments of funds, with tax motives being an added factor (see Figure 4). Probably mainly on account of an inverse term structure – in other words, short-term assets being remunerated at a higher rate than long-term ones – as well as uncertainty about future interest-rate movements, a pronounced "wait-and-see" attitude concerning monetary capital formation set in from 1992 up to early 1994. Funds which had previously been invested over the longer term became free and were "parked" in liquid accounts. Although the Bundesbank had been steadily lowering short-term interest rates since autumn 1992, by the end of 1993 it had not managed to effect a crucial reduction in the interest-rate advantage of shorter-term investments. This was due to the fact that, not least owing to external influences, German capital market rates, too, were following the downward trend they had been on since the end of 1990. Since the money stock M3 had increased sharply in 1992 and 1993 owing to other "special factors" in any case, the existing interest-rate advantage of shorter-term assets and the unclear direction in which longer-term interest rates were heading led to a further bloating of M3. Overall, the Bundesbank was forced to recognise that the "surge in liquidity" had run into a considerable "liquidity jam" (Deutsche Bundesbank, 1994b, p. 21).

Notwithstanding the failures to meet the monetary targets in 1992 and 1993, as well as the still-accelerating monetary expansion at the beginning of 1994, the Bundesbank responded in spring 1994 by a lowering of interest rates by a cumulative total of 1 ¼ percentage points. The aim of this was "to encourage the acquisition of longer-term financial assets by increasing the interest rate gap between short and long-term assets, and thus to contribute to dampening monetary growth and the associated fears of inflation" (Deutsche Bundesbank, 1994a, p. 68). In addition to this interest-rate-policy measure, the interest-rate rise in the capital market was probably the main factor that also played a crucial part in freeing up the liquidity jam in the financial markets from mid-1994 onwards (Issing, 1996, p. 121).

This interest-rate policy of the Bundesbank, which runs exactly counter to the traditional concept of the reaction of the money stock to changes in the short-term interest rate, could ultimately only be justified by the special factors prevailing at the end of 1993 and at the start of 1994. The indispensable role of analysis of the consolidated balance sheet of the banking sector in this lay in determining the underlying causes of

Figure 4. Interest-rate development and shifts between the money stock M3 and the monetary capital formation (12-month growth rates, in %)



* Bonds issued by residents; interest rates are weighted with the amounts outstandig of the debt securities included in calculation.

monetary expansion and thus in identifying the prevailing special factors.[21] The transmission mechanisms of monetary policy to the money stock are just not always time-invariant, as is frequently assumed. This insight and the interest-rate decisions derived from it did not imply any departure by the Bundesbank from its monetary targeting strategy. The Bundesbank found support for its adherence to the monetary targeting strategy in the internal and external econometric studies which were largely unable to find empirical evidence of an unstable long-run money demand equation in Germany (see for example Deutsche Bundesbank 1995b, p. 31–37).

In spring 1996, the Bundesbank found itself facing a similar situation. At that time, too, monetary capital formation was very weak owing to special factors. Instead, M3 was clearly above the target corridor, since savings deposits with a period of notice of three months, in particular, were rising sharply. The additionally formed savings deposits were mainly special savings facilities, however, which did formally have a three-month period of notice, but which yielded much higher rates of interest than the traditional savings deposits at three months' notice if there was a contractual agreement to forgo notice.[22] To that extent, they were a substitute for the long-term forms of savings traditionally counted towards monetary capital (savings deposits with an agreed period of notice of over three months or time deposits with an agreed maturity of four years or more). The fact that, in 1996, long-term savings deposits were greatly reduced, while the holding of savings bonds remained unchanged, indicates that a part of monetary capital formation was recorded de facto in M3 and that M3 was therefore overstated.[23] In turn, an added factor was uncertainty about interest-rate developments in the capital market, which resulted in a "wait-and-see" attitude in the case of monetary capital formation. Uncertainty played an important role in the following years, too. Especially in 1998 "the historically low capital market rates, the flattened yield curve, and the occasionally quite pronounced uncertainties in financial markets" (Deutsche Bundesbank, 1998, p. 82) dampened the propensity to accumulate longer-term financial assets with the banking sector. On the basis of a more medium-term orientation to the average expansion of M3 as well as comparatively low growth in the money stock M3 extended and the banks' largely unchanged assets-side business, the Bundesbank arrived at an overall assessment that the provision with liquidity was generous but by no means excessive. In this case, too, the Bundesbank – superficially counter the signals given by the money stock – decided to lower interest rates.

8. Monetary policy in times of institutional change – the authorisation of money market funds in mid-1994

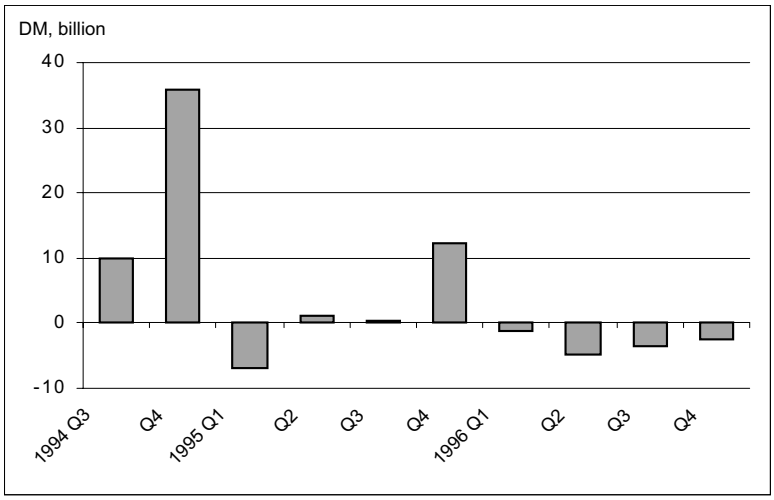
Following the extremely sharp growth in the money stock M3 at the end of 1993, which persisted in the first quarter of 1994 – M3 had risen in seasonally adjusted terms by 16% on the quarter – a corrective movement in the monetary trend set in towards the

[21] The unconventional interest-rate measure did, of course, encounter objections; this also concerned the credibility of the monetary targeting strategy (for critical appraisals, see, for example, Goldman and Sachs, 1994, p. 5ff. or Rohde, 1996, p. 231ff.).

[22] With the entry into force of a new provision governing savings in mid-1993, the credit institutions increasingly switched to offering more attractive forms of savings. Throughout the nineties, the higher-yielding special forms of savings were the cause of the renaissance in Germany of savings deposits at three months' notice.

[23] In principle, this portfolio-shifts continued until summer 1999. It is only since autumn 1999 that not only the traditional savings deposits at three months' notice but also the higher-yielding special forms of savings have been run down.

Figure 5. Purchases/sales of domestic and foreign money market funds shares by German non-banks



middle of the year. This movement became even stronger towards the end of 1994 and even led to an absolute seasonally adjusted decline in the money stock M3 at the turn of 1994/95. One important factor that contributed to this development was domestic non-banks' large-scale acquisition of money market fund certificates that do not count towards the money stock M3 (see Figure 5). In July 1994, the Central Bank Council of the Deutsche Bundesbank had set aside its previous reservations against D-Mark money market funds, which now made it possible for units in such funds to be issued in Germany, too. Domestic and foreign funds made very active use of this opportunity; up to the end of the year, domestic non-banks acquired certificates to the amount of DM 46 billion, of which just under DM 27 billion was accounted for by the month of December alone. This "enthusiasm" for what was a new form of investment in Germany was encouraged not only by their attractive remuneration combined with comparatively high liquidity, but also by their preferential wealth-tax treatment.[24] The latter factor explains their great popularity at the end of the year.

Among the counterparts of the money stock M3, the acquisition of money market fund certificates was reflected, above all, by quite high outflows in foreign payments - which had a dampening impact. To the acquisition of foreign money market fund certificates was added a fairly pronounced involvement by domestic funds in the Euro-market (Deutsche Bundesbank, 1994a, p. 82). The large-scale withdrawal of non-residents from the DM bond market had also been no less of a cause for the sharp drop in the net external asset position in 1994, however.

However, the analysis of the consolidated balance sheet of the banking sector showed that it would be too simplistic to explain the collapse in the development of M3 in the second half of 1994 exclusively in terms of the acquisition of money market fund certificates by domestic non-banks and the outflows of funds to non-residents which

[24] In contrast to other (directly held) financial assets, only half the rate had to be paid for fund certificates in connection with capital taxation (Deutsche Bundesbank, 1994a, p. 78).

this generated. It was rather the case that monetary growth was also curbed by the perceptible surge in monetary capital formation in mid-1994. Above all, funds "parked" in short-term time deposit accounts were shifted into monetary capital on a large scale. Besides longer-term bank bonds, time deposits with a maturity of four years or more benefited from this shift. The overall quite sharp expansion of lending to domestic non-banks was thus faced with an additional dampening influence in addition to outflows in foreign payments.

Another reason for not overemphasising the influence of money market fund certificates on German monetary growth is that, while the money stock M3 initially continued to grow only very weakly in 1995, domestic and foreign money market fund certificates were purchased only to the equivalent of just under DM 7 billion. The dampening impact in 1995 was thus very slight. Since, in the two following years, money market fund certificates of just under DM 20 billion were resold, their introduction had not on the whole led to a permanent distortion of the pace of monetary growth. Even though the abrupt increase in this form of investment had clearly disturbed monetary growth at the turn of 1994/95, the Bundesbank saw no reason for departing from its monetary targeting strategy.

9. Monetary policy in times of institutional change – the influence of tax legislation on monetary developments

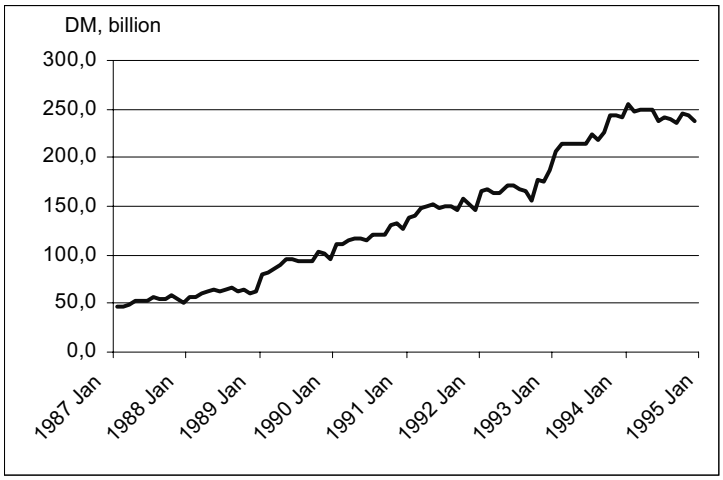
It is unlikely that there are any influencing factors which impaired of M3's function as an indicator of underlying monetary trends as often as tax legislation. Besides variations in the taxation of interest income on forms of monetary investment, the introduction and expiration of tax incentives for investment also deserve mention here – they have impacted on monetary growth by either inflating or deflating lending by banks. The following list must therefore be limited to important changes.

9.1. Changes in taxes on interest income

- Even in the run-up to the introduction of the 10% tax on all domestic interest income which was introduced on January 1, 1989, massive evasive reactions occurred. At the end of 1988 "an increase in currency in circulation which was completely out of line" (Deutsche Bundesbank, 1988a, p. 39) took place, with domestic investors virtually fleeing to cash.[25] Instead of long-term investment of funds with domestic banks (monetary capital formation), not only was cash squirreled away, but there were also shifts in sight deposits and Euro-market deposits. However, the strongest increase was in holdings of foreign securities. Even the mere announcement of the introduction of taxation on interest income starting at the beginning of 1989 was enough to cause major shifts of monetary asset formation from Germany abroad in 1988. In the face of public pressure, the Federal Government felt compelled, as early as in May 1989, to abolish capital gains taxes on interest income effective July 1. For monetary developments, this "tax policy experiment" had the inglorious effect of causing the money stock, having already missed the target in 1986 and 1987, to

[25] In December 1988 currency in circulation rose at a seasonally adjusted rate of 46 ½%. By contrast, the increase in December 1999, as the millennium was coming to a close, was, at 23%, only half as high.

Figure 6. Short-run deposits of German non-banks at foreign branches and foreign subsidiaries of German banks



clearly overshoot the upper limit of the target corridor in the fourth quarter of 1988 as well. Outflows in cross-border payments were not a real counterweight to the meagre formation of monetary capital and the rather large growth of lending in the light of low interest rates. Moreover, it caused investors to rediscover the virtues of the Euro-market; Euro-deposits were replenished very strongly in the years that followed thanks to their attractive interest rates (see Figure 6). At least part of those funds probably represented "a... shifting of domestic cash balances to the reserve-exempt 'offshore centres' of the Euro-market" (Deutsche Bundesbank, 1989, p. 39), meaning that their rise went along with an impairment of M3's indicator function – even if it was only temporary in nature. The consequence was a closer observation of M3 extended in monetary analysis, however, without doing away with M3 as the prominent indicator.

- At the beginning of 1993 a new attempt was made to tax domestic interest income. Effective January 1, 1993, a tax on interest income of 30% was introduced. Now, too, the end of the previous year saw extensive hoarding of cash and major shifts of funds abroad. Cash stockpiling even turned out to be greater than at the end of 1988.[26] Yet as before, the impact on the willingness of domestic investors to deposit long-term funds with German banks is likely to have been a more important factor in the development of M3. As a consequence of the inverse yield structure, monetary capital formation was exceptionally weak both in the second half of 1992 and in the first few months of 1993. In addition to shifts in shorter-term bank deposits with domestic credit institutions, a share of the funds envisaged for deposit was placed with foreign banks – especially in Luxembourg. Also, the purchase of foreign investment fund shares by domestic non-banks was particularly high. Via foreign investment companies, a large share of the funds shifted abroad returned to the German capital mar-

[26] In December 1992 alone, cash in circulation rose at a seasonally adjusted annual rate of 61 ½%.

ket, however. Bank debt securities also benefited, meaning that the dampening impact on monetary capital formation, both in 1992 and 1993, was in actual fact likely to have been less pronounced than indicated by the statistics. Therefore, monetary capital formation tended to be understated.[27]

- As a reaction to the shift of monetary capital formation to Luxembourg, starting on January 1, 1994 the tax on interest income was extended to include foreign growth investment funds. At the end of 1993, therefore, there was a repatriation of funds held abroad which distinctly exceeded the window-dressing which German investors always did at the end of the year. As a consequence of the unclear direction of long-term interest rates, the funds were first parked on the already very healthy short-term time deposit accounts. Additionally, sight deposits and shorter-term savings deposits benefited as well – the latter also due to an institutional change. Also, in view of the growth rates of the money stocks M1, M2 and M3, which all shot past the reference corridor for M3 growth, the Bundesbank gained the impression that the domestic non-banks' liquidity situation at the end of 1993/beginning of 1994 was rather abundant. Looking back at the preceding months, the Bank noted that "money holdings ... shifted temporarily between Germany and abroad ... constitute a considerable potential source of disruption of domestic monetary growth" (Deutsche Bundesbank, 1993a, p. 69).

9.2. Changes in tax incentives for borrowing

In the wake of German unification, many tax incentives for investing in eastern Germany were introduced. This bloated the demand for credit and distorted the role of the interest rate as an operating variable. Scaling back those programmes or already existing programmes or allowing them to expire, especially programmes granting tax credits for private homebuilding, in some cases caused grave anticipatory effects in domestic lending: the distortion of lending to domestic non-banks mostly seeped through all the way to monetary growth. In addition, the role of credit aggregates as an indicator of the long-run effects of monetary policy was distorted. Credit aggregates have never been particularly important as an indicator for price developments in Germany, anyway. In nearly all years following 1993, tax-related reasons can be found for the continuously high rise in medium to long-term loans and advances of domestic non-banks. The tax measures introduced at the beginning of 1993/94 and 1997 had a particularly distinct impact.

- The measures to limit write-off possibilities for the purchase of owner-occupied old buildings adopted in May 1993 as part of a "Federal consolidation programme", part of which were to take effect on January 1, 1994, led to a wave of premature housing purchases and a sharp rise in homebuilding loans. In December 1993 alone, medium to long-term loans and advances to private non-banks rose by a seasonally adjusted 19%, with roughly half of those loans being attributable to homebuilding purposes.

[27] In its overview of monetary developments in terms of the balance sheet (based on adjusted changes), in the past the Bundesbank adjusted the German bank debt bonds in issue for those sold to non-residents or purchased from non-residents. Since the statistical inaccuracies of the underlying balance-of-payment data were well-known, these corrections were not explicitly taken into account in the levels listed in the consolidated balance sheet.

Over all of 1993 the rise in medium to long-term lending was 11%; this made it distinctly higher than could be reconciled with the weak growth of the German economy. The expansionary impact on the money stock linked to the heavy lending, together with the above-mentioned return flows of foreign funds and the low propensity to deposit funds over the longer term, led to a strong bloating of M3, which persisted beyond the end of 1993, held firm until mid-1994 and then was adjusted into 1995. Since the "Federal consolidation programme" also envisaged a further reduction in tax promotion of owner-occupied old buildings starting on January 1, 1995, borrowing throughout 1994, too, was marked by anticipatory effects in the purchasing of residential property. Two-thirds of all new medium to long-term loans taken up by domestic non-banks were attributable to homebuilding purposes. Private-sector borrowing, motivated not least out of tax considerations, was, in an overall view, the most important source of the high monetary growth in 1994. Along with comprehensive outflows of funds in payments to non-residents, only the monetary capital formation which kicked in in mid-year posed a true counterweight and made it possible for the money stock M3 to swerve into the target corridor at the end of the year.

- In 1996, too, housing loans expanded particularly strongly compared with other lending to the domestic private sector. Besides a change in tax promotion of owner-occupied housing which took effect at the beginning of that year, the reduction in special depreciation facilities for new rental housing in eastern Germany starting on January 1, 1997 probably had a major impact. The simultaneous raising of the tax on the acquisition of land and buildings probably unleashed additional anticipatory effects. Besides medium- to long-term housing loans, as the end of the year 1996 approached, short-term lending was likewise perceptibly replenished before being turned into longer-term loans over the course of the following year. Since in 1996 the propensity to form (domestic and foreign) monetary capital was relatively low due to low long-term interest rates, the tax-policy-related distortions in lending for housing purposes led, on the whole, to monetary growth that overshot the target corridor.

10. Conclusions

In summary, it may be noted that the analysis of the consolidated balance sheet of the banking sector has been an indispensable element in assessing the monetary dynamics in Germany. Only this was able to give the Bundesbank's M3-oriented monetary policy the necessary security, for only with its help could disturbances in the indicator quality of the money stock be identified in a relatively short time. Especially in the nineties, the M3 monetary aggregate was repeatedly exposed to disturbances. Although this was reflected in a stronger short-term volatility of the money stock M3, it did not disrupt the underlying long-term relationship between M3 and price movements in Germany. Thus, monetary analysis – and therefore the analysis of the consolidated balance sheet – has formed the basis for a policy of "pragmatic monetarism" (Schmid 1998, p. 20) and "rule-based discretion" (Neumann 1997, p. 196). Looking back on the years between 1975 and 1998, the following conclusions may be drawn:

- The consolidated balance sheet of the banking system formed the basis for this analysis. The money stock M3 ascertained on that basis has, over large stretches of time, been the key orientation variable for judging monetary developments. Even when

the central bank money stock as defined by the Deutsche Bundesbank represented the intermediate target, M3 growth was analysed and commented upon in an ongoing manner. It often served to ensure the accuracy of signals being emanated by the central bank money stock. Wherever extreme reactions in cash holding exercised a dominant influence on the central bank money stock, changes in the central bank money stock were mostly put into perspective with a reference to M3 growth.

- Even after the transition to the M3 intermediate aggregate, the Bundesbank did not stop at observing and commenting upon M3 growth. Much as the dynamics of the central bank money stock were often juxtaposed with the growth of M3, M3 growth was later compared especially with growth of M3 extended. Such an approach made it possible to assess monetary growth more reliably. However, M3 stayed in the midpoint of the analysis and at the top of the indicator hierarchy. However, if the aggregates under observation sent different signals, the reasons were always explained in depth if the M3 aggregate was not followed.
- This was mostly achieved by analysing the components and counterparts of M3. This analysis always took place in view of the components' and counterparts' significance to M3 growth. The Bundesbank has never left any doubt that lending aggregates have, in its view, never been indicator variables equivalent to the money stock M3. True, lending growth has had an impact on monetary growth; however, lending aggregates, because they develop broadly in parallel to price rises, have no inherent informative value in respect of the future rise in prices.
- Although the long-term connection between the money stock and prices in Germany has been rather stable over the years, the shorter-term volatility of M3 rose sharply in the nineties. One particular reason for this was the existence of numerous disruptive factors which either had an unusually dampening impact on monetary capital formation or distorted lending. Strong changes in exchange rates also played a role, as did changes in tax law or the authorisation of money market funds.
- For interest rate decisions, short-term developments of the monetary aggregate were never relevant. Rather, its trend was important. If the monetary expansion was due to strong growth of bank lending, which tends to reflect the long-run effects of monetary policy, interest rate hikes were appropriate. However, if the cause was a pronounced "wait-and-see" attitude in monetary capital formation, a reduction in the interest rate could help increase the propensity to invest over the longer term. In the event of a strong monetary expansion thanks to appreciation-related capital inflows, it was generally advisable to first wait and see so as not to provoke further capital shifts by raising interest rates. Here, one could hope that domestic price movements would not pick up due to the cheapening of imports despite a sharp rise in the money stock.[28]
- On the whole, monetary targeting is likely to have helped in the establishment of a solid monetary policy reputation. Particularly the certain degree of "hands-tying" and the associated obligation to explain and justify deviations of the money stock from the target path have been helpful here.

[28] This variety of reactions by monetary policy to the development of the money stock is likely to have contributed to the money stock not having any significant impact in most estimates of the Bundesbank's reaction function (e.g. in Bernanke and Mihov (1997), Clarida and Gertler (1996) or Berger and Woitek (1996)); Schächter provides an overview of such studies and her own results (1999, pp. 257–311.).

Appendix

Monetary targets and their implementation

in %

Year	*Target*: growth of the central bank money stock or the money stock M3 **1**			Actual growth (rounded figures)		Target achieved
	in the course of the year **2**	as an annual average	more precise definition during the year	in the course of the year **2**	as an annual average	
1975	8	–	–	10	–	no
1976	–	8	–	–	9	no
1977	–	8	–	–	9	no
1978	–	8	–	–	11	no
1979	6–9	–	Lower limit	6	–	yes
1980	5–8	–	Lower limit	5	–	yes
1981	4–7	–	Lower half	4	–	yes
1982	4–7	–	Upper half	6	–	yes
1983	4–7	–	Upper half	7	–	yes
1984	4–6	–	–	5	–	yes
1985	3–5	–	–	5	–	yes
1986	3 1/2–5 1/2	–	–	8	–	no
1987	3–6	–	–	8	–	no
1988	3–6	–	–	7	–	no
1989	about 5	–	–	5	–	yes
1990	4–6	–	–	6	–	yes
1991 **3**	3–5	–	–	5	–	yes
1992	3 1/2–5 1/2	–	–	9	–	no
1993	4 1/2–6 1/2	–	–	7	–	no
1994	4–6	–	–	6	–	yes
1995	4–6	–	–	2	–	no
1996	4–7	–	–	8	–	no
1997 **4**	3 1/2–6 1/2	–	–	5	–	yes
1998 **4**	3–6	–	–	6	–	yes

1 From 1988: money stock M3. – 2 Between the fourth quarter of the previous year and the fourth quarter of the current year; 1975: December 1974 to December 1975. – 3 In accordance with the adjustment of the monetary target in July 1991 – 4 Embedded in a two–year orientation for 1997/98 of about 5% per year. Deutsche Bundesbank

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The integration of analysis of extended monetary and credit aggregates in the experience of the Banque de France*

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Banque de France

1. Introduction

To achieve the ultimate goal of price stability prior to Stage III of EMU, the Banque de France has for many years pursued two intermediate objectives, namely the stability of the franc within the EMS exchange-rate mechanism and a growth norm for a monetary aggregate.

The announcement of a growth target range for a monetary aggregate has been a key component of French monetary policy since 1977. This strategy, designed as an intermediate target policy, has traditionally relied on the assumption of a stable and predictable relationship between, on the one hand, the instruments of monetary policy and the intermediate objective and, on the other hand, between the intermediate objective and the ultimate goal of price stability.

However, as in many countries, these two relationships became looser in France in the 1980s:

- with the removal of quantitative credit controls since 1987, and the adoption of a comprehensive set of instruments in the form of interest rate changes, the effects of monetary policy were no longer transmitted *via* financial intermediaries alone; they have been also propagated throughout financial markets and have affected the behaviour of economic agents via their portfolio choices;
- financial innovation, together with the expansion and liberalization of financial markets, and their opening-up to the outside world, have broadened the range of financing and investment instruments available, and the scope for substitution of both assets and liabilities, for financial and non-financial agents alike.

The mid-eighties saw many momentous changes in the environment and in the organisation of the French financial markets as well as a development of financial innovation. All capital controls were removed as part of the move towards the creation of the Single European Market. A regulated derivative market –MATIF– was created in 1985. The French Government securities market was overhauled, with issues covering the full range of maturities, new issuing procedures and the selection of primary dealers. The money market was also fully reorganised into two compartments, one for interbank transactions, reserved for credit institutions, on which the Banque de France intervenes to implement the interest-rate policy, and the other open to all borrowers and

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investors, on which instruments such as certificates of deposits, medium-term notes, commercial paper and treasury bills are traded. Moreover, the development of money market funds (MMFs) gave non-financial agents easy access to money market-related remuneration for their liquid assets.

Therefore, the concept of money has become less readily definable. The distinctions between money and securities are now blurred. Some financial products earning interest at market rates offer all-but-perfect liquidity with moderate capital risk. This is the case for some money market instruments, mostly for MMF units. Thus, financial innovation has resulted in some confusion between transaction balances and non-financial agents' portfolio investment. This means that reallocations within portfolios can have an impact on monetary aggregates without necessarily being a sign of impending changes in spending.

Similarly, it is no longer possible to limit monetary analysis to the "creation of money" solely through the counterparts recorded in banks' balance sheets.

It has therefore been necessary to redefine the monetary aggregates, and simultaneously to broaden our analysis to the flow of funds and to track through a Total Domestic Debt aggregate the complete spectrum of domestic and external financing. The development of the Table of Financing and Investment (TFI) also provides for the need for a comprehensive monetary analysis.

Nonetheless, these considerations did not alter the need to announce a target based on a monetary aggregate. Even if the short-term relationship between growth of monetary aggregates and inflation became less rigid, the fundamental relationship that exists in the long term between the quantity of money and the price level remains. As a consequence, the Banque de France modified its original strategy in certain respects, but did not change its main features.

M3 replaced M2 as the target aggregate in 1991. A broad aggregate was chosen to avoid the instability that financial liberalization causes in narrow aggregates. M3 displayed stability, but interest rates had little influence on it, at least within the one-year time frame used for defining the monetary target, because of the wide range of assets earning interest at market rates that it covered. Moreover, switching between M3 assets and investment assets seemed to be motivated partly less by interest rate developments than by changes in the tax treatment and other specific features of competing products. For these reasons, a medium-term growth trend was set for M3 in 1994, stressing the fact that the announcement of a monetary target serves as an "*anchor*" shaping medium-term nominal expectations. At the same time, the Banque de France adopted a comprehensive approach, monitoring a range of indicators, particularly the total domestic debt, in order to underpin and, if need be, modulate its assessment of the monetary situation.

The remainder of the paper is organised as follows. The extended money and credit aggregates developed by the Banque de France are detailed in Section 2. Section 3 presents three "*case studies*" showing how these extended aggregates were integrated in practice in the analysis of the Banque de France. Section 4 concludes in an European perspective and draws from the French experience some lessons for monetary analysis in the euro area. Suggestions for further reading are referenced at the end of the paper.

2. The extended money and credit aggregates developed by the Banque de France

The globalisation of capital markets and the wave of financial innovation over the eighties brought new challenges for the definition and the conduct of monetary policy. In

response, the Banque de France developed a broad set of money and credit aggregates, which aimed at providing meaningful and complete information on the financial investment and borrowing behaviour of French residents while encompassing the increasing complexity of financial investment strategies and capital market interactions. This set of indicators comprised, on the one hand, money and investment aggregates up to December 1998 and, on the other hand, the total domestic debt and the table of financing and investment (TFI) which are still part of the national indicators used in the context of the single monetary policy.

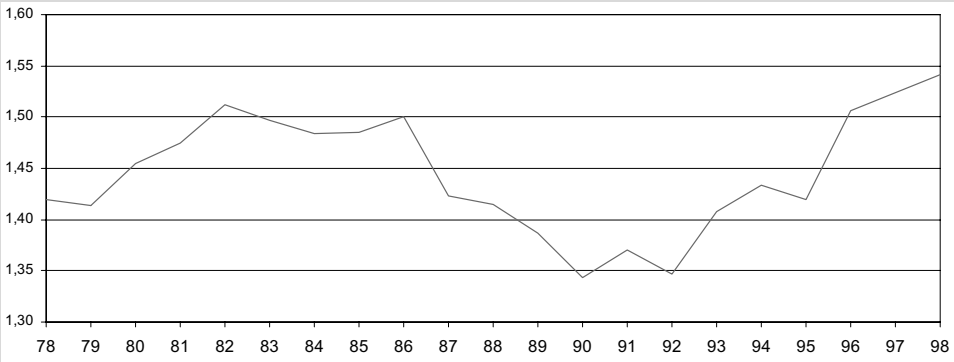
2.1. The money aggregates

In 1986, the monetary aggregates were modified to take into account the behavioural changes resulting from the launching of money market negotiable instruments and the rise of money market funds (MMFs). In particular, MMFs were included in the national money-holding sector. Therefore, MMFs' holdings of monetary liabilities were included in the different national money aggregates (overnight deposits in M1, foreign-currency-denominated assets, repos, term deposits and short term securities issued by credit institutions in M3-M2, treasury bills and commercial paper in M4-M3).

From an econometric point of view, the introduction of MMFs in the money-holding sector brought a greater stability to the income elasticity of money demand. Yet, on the basis of the same data, the unit income elasticity hypothesis for M1 was rejected as well as cointegration between broad money, output and interest rates. Furthermore, such a treatment was likely to bring additional instability in the monetary aggregates as any shift in the portfolio behaviour of the fund managers could lead to large changes in the monetary aggregates irrespectively of the liquidity of the MMF units. In addition, this treatment could not account for the specific role of MMFs in the money creation process.

Actually, MMFs do create money, although in a different way than credit institutions. They do not grant loans to non-financial agents but they purchase securities issued or held by them as a counterpart of the issuance of units, which are in practice convertible at any time with no capital loss, the risk being borne in practice by a custodian entity (a credit institution or an insurance company).

Velocity of M3 (ratio GDP/M3)



Source: Banque de France

Hence, as from 1991, along with a clarification and a strengthening of their definition together with an improvement of their statistical coverage, MMFs have been considered as part of the French money-creating sector.

The related definition of broad money, used over Stage II of EMU and which included the MMF units, provided a better account of the deterministic component of velocity. With the former definition (e.g. MMFs included in the money-holding sector), the velocity of M3 exhibited a trend break in the late seventies relating to no clear economic event. Conversely, using the new definition, it has been found:

- a trend break affecting the velocity of M3 (as well as the velocities of M1 and M2) in the mid-eighties, in connection with the diffusion process of MMF units;
- a unit elasticity to output for M1, taking into account the breaking trend;
- evidence of a cointegration relation between GDP and either M1, M2 or M3, although only the velocity of M1 appears unambiguously stationary (with a breaking trend).

Under the definition adopted in 1991, monetary aggregates consisted of means of payment held by non-financial residents and of their holdings of those financial assets which can be converted easily and readily into means of payment, without substantial risk of capital loss (see table hereafter for the instrument breakdown of the Stage II French money aggregates).

Money Aggregates

M1	**M2**	**M3**	**M4**
Coins Banknotes Overnight deposits in FRF			
M2 – M1 "A" and "Blue" passbooks Housing savings accounts Industrial development accounts People's savings passbooks Youth passbook accounts Taxable savings passbooks			
M3 – M2 Foreign currency-denominated holdings Term savings Certificates of deposits, medium-term notes issued by credit institutions Money market fund units Securitized debt fund units ≤ 5 years			
M4 – M3 Treasury bills, commercial paper and medium-term notes issued by non financial corporations			

Box 1: Specific arrangements regarding interest rates and taxes paid on financial investments

1. Regulatory arrangements on deposit interest rates

In France, accounts bearing regulated interest rates account for almost one quarter of the credit institutions liabilities excluding interbank operations. They can be broken down in three groups.

- non-taxable savings passbooks: they comprise "A" and "blue" savings passbooks, housing saving accounts, industrial development accounts and people's savings passbooks and are fully convertible;
- housing saving schemes: funds cannot be withdrawn before four years unless the interest rate is reduced to the same level as housing saving accounts. The remuneration may be maintained at the initial contractual rate up to ten years.
- Overnight deposits: remuneration is prohibited on French franc-denominated overnight deposits.

The interest rates paid on these instruments are set by the government. Therefore, they do not automatically follow changes in market interest rates and intervention rates.

In 1998, the government announced new rules for setting the rate of interest paid on "A" and "blue" passbook savings accounts: the interest rate should henceforth move within a corridor formed by a lower limit equal to the rate of inflation plus one point and an upper limit determined by the average of the short-term market rates minus 0.5 point. An advisory committee on regulated rates comprising members of the banking profession was created in order to ensure "a balance between fair remuneration of popular savings and efficient financing of social housing and small and medium-sized firms". However, the government retains the decision-making power.

Furthermore, the government put an end to the administrative setting of rates on taxable "B" savings passbooks and non-taxable youth savings passbooks, but the rate paid on the latter product cannot be less than the one paid on "A" passbooks.

Regulated rates paid on deposits as of August 2000

Instruments	**Rates in annual %**
Overnight deposits	0
"A" savings passbooks	3.00
"Blue" savings passbooks	3.00
Housing savings accounts	2.00 (excluding bonus)
People's savings passbooks	4.25
Housing saving schemes	4.50
Memorandum items:	
Youth savings passbooks	*4.03 (sample average as at end-August 2000)*
Taxable savings passbooks	*2.78 (sample average as at end-August 2000)*

2. Interest revenue and capital gains taxation

In principle, interest incomes are subject either to a withholding tax (current rate: 25%) or to a personal rate of income taxation. However, savings passbooks are exempted from taxation (except housing saving accounts). Interest income on housing saving accounts and schemes, and also on life insurance contracts with special conditions are only subject to a social tax (current rate: 10%). Income taxation of dividends allows for a tax credit (current rate: 50%).

Capital gains are subject to a tax rate (26% currently) to the extent that they are greater than a given threshold which has been lowered progressively over the past years. A specific threshold used to apply to capital gains on units of MMFs and bond capitalization funds: up to 1993, this threshold was higher than for other securities, then it became lower and was eventually suppressed in 1996. To a certain extent, these changes explain the impressive development of the MMF market in France since the mid-eighties together with the large shifts which affected the flows of MMF units thereafter. As from 1 January 2000, the same threshold of EUR 7622 (FRF 50,000) applies to all types of securities.

Besides the means of payments utilised in France (M1) and savings passbooks bearing a regulated interest rate (M2 – M1) see Box 1 for a presentation of specific arrangements regarding interest rates and taxes paid on financial investments in France, the broad money aggregate M3 included non-marketable and marketable instruments on a all currency basis, including MMF units and money market instruments issued by financial institutions.

In practice, the investments made by non-financial residents on the French money market mainly depend on the risk of signature and the expected yield and only marginally on the sector of issuance. Therefore, an aggregate named M4, slightly broader than M3 as it also included money market instruments issued by non-financial agents (treasury bills, commercial paper, medium term notes), was finally defined to monitor substitution effects between the various types of money market instruments held by non-financial agents. However, it was less commonly used than the other monetary aggregates for monetary policy purposes.

2.2 The investment aggregates

The frontier between monetary assets defined as a means of payments reserve and non-monetary holdings which reflect a longer term saving behaviour having become less clear and precise, a close monitoring of monetary developments on the basis of money aggregates would also require to obtain specific information on the other financial instrument categories.

Henceforth, the Banque de France established in 1991 a set of investment aggregates (P1, P2, P3), which covered non monetary financial assets within homogenous subgroups ranked by decreasing substitutability with monetary holdings. P1 included contractual savings, P2 bond-type instruments and P3 equity-type instruments. Unlike the money aggregates, the investment aggregates did not fit together given the very large scope of assets covered.

Investment Aggregates

P1
Housing savings plans People's savings plans Cash deposits on personal equity plans Capital accumulation certificates Corporate savings accounts Savings contracts with savings and lending institutions Guaranteed mutual fund units
P2
Bonds Bond mutual fund units Life insurance contracts
P3
Shares Equity mutual fund units Composite mutual fund units Other mutual fund units

2.3. The total domestic debt

Financial globalisation and innovation have also made substitutions between various types of financing easier, especially bank lending and security issues. The role of financial intermediaries such as credit institutions has indeed become less predominant over the past ten years, making necessary to complement loan indicators with aggregates which could cover a larger spectrum of financing means.

Along these lines, the Banque de France has developed a broad debt aggregate named total domestic debt. It covers all facilities obtained by non-financial residents, regardless of form (loans or security issues) or origin (resident or non-resident financial intermediaries or capital markets). Total domestic debt excludes financing raised *via* equity issues since this type of financing does not generate debt vis-à-vis third parties:

Total domestic debt
= Loans obtained from resident financial institutions
+ Loans obtained from non-residents
+ Market financing (*via* the issuance of bonds or commercial paper)
+ Private sector deposits with the central government

The range of beneficiaries is equally exhaustive, since it covers all non-financial residents, including the general government, non-financial corporations, households and

non-profit institutions serving households:

Total domestic debt
= Household debt
+ Non financial corporation debt
+ General government debt

The monitoring of total domestic debt provides French monetary authorities with valuable information on the borrowing behaviour of non-financial residents and substitution phenoma across sectors and between various forms of indebtedness. Moreover, by providing a synthetic framework for analysing financing granted to the economy, total domestic debt can be used as a **pedagogical device** to explain monetary analysis and financing trends to the public (see Box 3). It may also be an indicator of the risk of excess demand and of its potential adverse effects on price stability.

2.4. Flow-of-funds tools

2.4.1. Econometric modelling

In analysing the borrowing and investment behaviour of non-financial agents, the financial intermediation process and the setting of interest rates, the Banque de France started to use in 1992 a quarterly macroeconometric model of financial relations in the French economy named MEFISTO (**M**odelling the **E**volution of **FI**nancial **STO**cks).

Box 2: The financial model MEFISTO

Constructed both in flow and stock terms on the basis of flow-of-funds tables, MEFISTO consisted of about 440 equations including 31 econometric equations.

It aimed at explaining portfolio choices made by 8 sectors including non financial corporations, households, general government, non-residents, mutual funds, insurance companies, credit institutions and the Banque de France. Financial instruments were broken down in 11 categories: overnight deposits, deposits bearing interest at regulated rates, interbank instruments, money market instruments, franc-denominated bonds, shares and other equity, insurance technical reserves, housing loans, other franc-denominated loans, other franc-denominated advances and foreign currency balances.

MEFISTO also provided specific information on the development of monetary aggregates and on the main international capital flows through the balance of payments. The model was used both in the framework of internal macroeconomic forecasts and for policy evaluation, in particular to identify and assess the monetary transmission mechanism and the impact of financial innovation.

However, in the light of the institutional and expected behavioural changes brought by the changeoever to the monetary union and also because of increasing difficulties in maintaining a timely and detailed quarterly flow-of-funds database, MEFISTO was discontinued in 1998.

2.4.2. The table of financing and investment (TFI)

In the meantime, the Banque de France has also developed a table of financing and investment (TFI) at the national level. The French TFI – *Tableau des financements et des placements* – contains consistent information on the instrument and sectoral breakdowns of financing and on the financial portfolio choices of economic

Table of Financing and Investment

FINANCIAL INVESTMENT BY NON-FINANCIAL RESIDENTS	
SHORT-TERM DEPOSITS AND SECURITIES VIS-À-VIS RESIDENT MFIs	(A)
Currency in circulation and short-term deposits	
Debt securities ≤ 2 years, MMF units and repos	
OTHER SHORT-TERM DEPOSITS AND SECURITIES	(B)
Other deposits (cross border deposits, etc.)	
Other short-term securities (commercial paper, etc.)	
MEDIUM- AND LONG-TERM INVESTMENTS	(C)
Deposits with agreed maturity > 2 years	
Bond-type investments	
Equity-type investments	
TOTAL INVESTMENT	(D = A + B + C)
FINANCING GRANTED TO NON-FINANCIAL RESIDENTS	
Loans	(E)
≤1 year	
>1 year	
Loans granted by non-residents	
Private sector deposits with the central government	(F)
Market financing	(G)
≤1 year	
>1 year	
TOTAL DOMESTIC DEBT (monetary statistics definition)	(H = E + F + G)
Change to financial statistics	(I)
TOTAL DOMESTIC DEBT (national accounts definition)	(J = H + I)
SHARES AND OTHER EQUITY	(K)
TOTAL FINANCING	(L = J + K)

agents. It thus provides a synthetic view of the investments and net asset statement of non-financial agents which is quite useful in the evaluation of monetary policy effects.

Up to the start of Stage III of EMU, the TFI was considered as an intermediate analytical tool between national financial accounts and monetary aggregates. Available on a quarterly basis, it provided a comprehensive picture of the financial behaviour of non-financial residents, allowing a simultaneous analysis of money and investment aggregates, total domestic debt and equity financing developments.

Compared to the MEFISTO experience, the TFI approach seemed more promising in terms of maintenance costs, data availability and timeliness. Accordingly, the TFI presentation was reviewed to take into account the Stage III statistical requirements and the full implementation of ESA 95. It now covers the non-financial resident population (general government, non-financial corporations, households and non-profit institutions serving households), which differs from the money-holding sector to the extent that the former includes the central government but not the non-monetary financial institutions. Henceforth, the French contribution to M3 cannot be directly derived from the TFI [1].

Furthermore, the TFI covers a larger spectrum of financial instruments than the monetary statistics. Regarding the liability side, only a few changes have been made to the former presentation, as the consistency with other financing indicators is ensured by the inclusion of the total domestic debt components and an item reflecting the change from nominal to market value. On the assets side, the reference to both national accounting standards and the definition of monetary instruments has led to a breakdown in three categories: short term deposits and securities vis-à-vis resident MFIs (monetary assets), other short term deposits and securities (non monetary liquid assets) and medium and long term investments. The French TFI is shown hereafter with a detailed instrument breakdown.

3. The integration of extended money and credit aggregates in the analysis of the Banque de France: three "*case studies*"

3.1. Monetary developments in 1993

In 1993, the main aggregates used as monetary policy indicators showed contrasting trends. Lending and, to an even greater extent, the money supply aggregate M3, which was the target aggregate for monetary policy, started to contract from the middle of 1993. On the other hand, there was a sustained increase of about 4% in total domestic debt throughout the year. Meanwhile, the investment aggregates showed exceptionally rapid growth.

These contrasting developments reflected massive switching between different types of financial investments and different forms in financing. Several clearly identified factors were behind these changes (see Box 3).

[1] Branthomme, Marchal and Odonnat (2000)

Box 3: What happened in 1993?

1. While the 1993 target range for growth in M3 had been set at 4%–6.5%, **the aggregate actually shrank by 2.2%**.

Broad money aggregate M3

Source: Banque de France

This break in the M3 trend in 1993 can be explained by:

- **the effect of the economic slowdown**, as the target range was set with reference to 1993 GDP growth forecasts that were not achieved (nominal GDP growth for 1993 stood at 1.5% whereas 5.5% growth had been expected); this resulted in less demand for transaction balances and for credit;
- **the flattening of the inverted yield curve through the decrease of short-term rates**, which made short-term maturities less attractive; short-term investments carrying money market interest rates accounted for about 45% of M3;
- **discretionary factors** which encouraged the household and corporate sectors to consolidate their monetary holdings by **enlarging the supply of savings vehicles available** (launch of the "Balladur" loan; greater reliance on bond issues, instead of Treasury notes and bills, to finance Government debt; privatisation programme); moreover, **tax changes** diminished the attraction of MMF units that made up 30% of M3.

Adjusted for the discretionary factors mentioned above, the 1993 change in M3 stood at approximately 1.8%, still far below the target range of 4%-6.5%, but comparable to the growth of nominal GDP.

2. The flattening of the yield curve and the discretionary factors led to **a massive transfer of monetary assets into financial investment assets** covered by the P1 (contractual savings), P2 (bonds) and P3 (equities) aggregates which showed very rapid growth in 1993 (20.8%, 29.3% and 31.1% respectively). Given the outstanding liquidity of French capital markets, and especially the liquidity of mutual funds in bonds and equities, **this transfer of assets** into longer-term savings vehicles **was not seen by monetary authorities as the outright destruction of money in favour of long-term savings**.

3. The annual growth rate of total domestic debt was 4% or more throughout 1993, which was significantly higher than the nominal GDP growth. Here again, massive substitution had occurred but, because of the specific features of this aggregate, its evolution had not been affected. As regard the pattern of financing raised and the type of borrowers, while loans granted to the private sector contracted slightly by 0.4%, financing through domestic debt issues grew strongly (+15%), particularly government borrowing on the bond market (+29%); **the government borrowing requirement – including the "Balladur" bond – was, therefore, substituted for the requirements of other economic agents,** reflecting the effect of automatic stabilisers during a cyclical slowdown and the structural deterioration of the government's finances.

The monetary policy strategy set by the Monetary Policy Council of the Banque de France for 1994 took into account these developments and the uncertainty surrounding the evolution of M3 in 1994:

- the Council considered that the abrupt deviation of M3 from its medium-term growth trend was due to exogenous causes and did not invalidate the targeting of this aggregate as the medium-term reference for France's monetary policy; however, owing to the fact that the discretionary factors which explained the deviation of M3 from its medium-term trend in 1993 might also come into play in 1994, no annual target range was set for M3 growth: instead, the Council set a medium-term growth trend of 5% for M3, in keeping with the potential for 2.5% to 3% medium-term real non-inflationary GDP growth and price rises of less than 2%;
- total domestic debt was singled out as a prominent indicator for monetary policy, particularly in times of major structural changes in monetary and capital markets, savings patterns and government financing. As evidenced in 1993, shifts between borrowing from credit institutions and market financing, portfolio shifts induced by non-monetary measures such as changes in tax or government funding policies, or shifts between the borrowing requirements of economic agents can impinge directly upon growth in monetary aggregates while having no impact on total domestic debt.

The definition of a medium-term growth trend for a monetary aggregate and the monitoring of total domestic debt remained major features of the French monetary policy strategy until 1999.

3.2. Monetary developments in 1996

Monetary developments in 1996 underlined once again the need to have recourse to broader concepts.

Box 4: What happened in 1996?

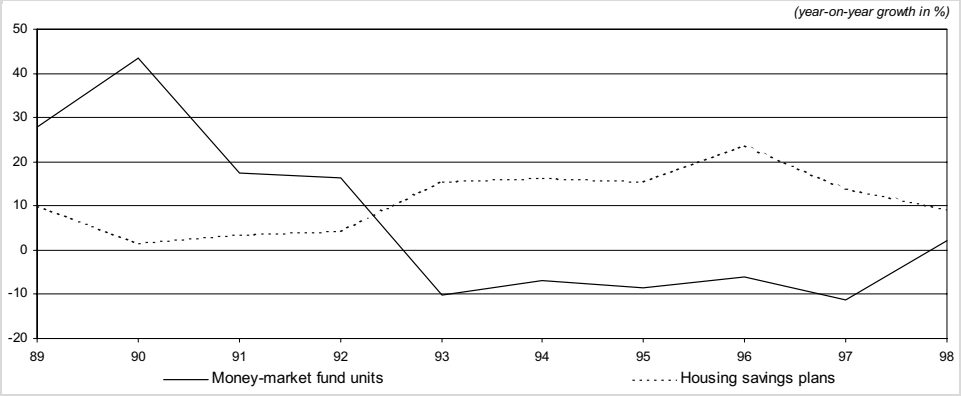
1. M3 experienced a trend reversal in 1996. The annual 4.6% growth of M3 in 1995 gave way to a 3.3% contraction in 1996.

Motivated by **monetary policy** as well as **regulatory considerations, portfolio decisions made by non-financial economic agents had a strong influence on the M3 aggregate**. Massive shifts in investment flows were sparked off by the unprecedented amplitude and speed of the fall in short-term market interest rates since the autumn

of 1995 and by the cancellation of the tax advantage granted on capital gains on sales of MMF units which had already been reduced in previous years.

2. This change in investment flows was amplified by new developments regarding housing saving plans, a component of the P1 investment aggregate. These instruments exhibit specific features: they offer a loan option; their interest rate is fixed and set by the government; they can be held up to ten years although the initial maturity is four years. However, over the past years, housing saving plans proved to be more and more liquid. As it is possible to renew the contract at maturity for short-term periods up to a maximum of six additional years and because housing saving plans were paying a relatively high interest in the mid-nineties**,** households started to use them as a substitute for monetary assets. Indeed, P1 showed a very strong twelve-month increase of almost 18% at the end of 1996. Therefore, **the M3+P1 aggregate expanded by 1.5% in 1996.** P2 and P3 also posted strong growth figures (16% and 25% respectively).

Non-financial resident holdings of MMF units and housing saving plans



Source: Banque de France

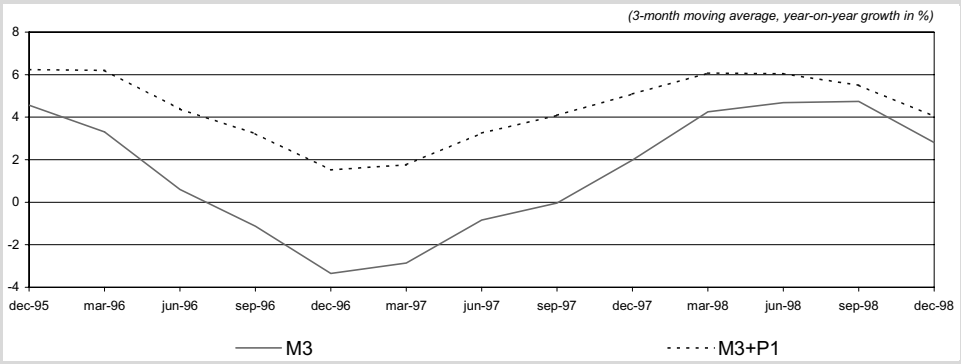
3. Annual growth in **total domestic debt** fell from 5.9% in 1995 to 3.1% in 1996. This overall slowdown mainly reflected a **deceleration in growth of government debt** to 6.7% at end – 1996 from 15.1% a year earlier, in line with the gradual consolidation of public finances. Loans granted by all resident financial institutions to non-financial residents contracted by 1.8% at the end of 1996. This evolution reflected in part a move towards greater **disintermediation**, companies taking advantage of low market interest rates: a third of their debt reduction vis-à-vis credit institutions was compensated for by increased securities issuance. Moreover, the corporate sector posted a very substantial self-financing rate.

These developments had some implications for the definition of the monetary policy strategy of the Banque de France for 1997 and 1998.

The Council announced that given the disruptions which had recently affected M3, he would keep a very close eye on the M1, M2, M3 and M3+P1 aggregates as expressions of the underlying growth of the money supply, in order to establish a synthetic estimate of overall monetary developments. Particular attention would be paid to the growth of the

M3+P1 aggregate, since this type of investment, particularly housing savings plans with a residual maturity of one year or less, constituted a very close substitute for monetary assets.

M3 and M3+P1



Source: Banque de France

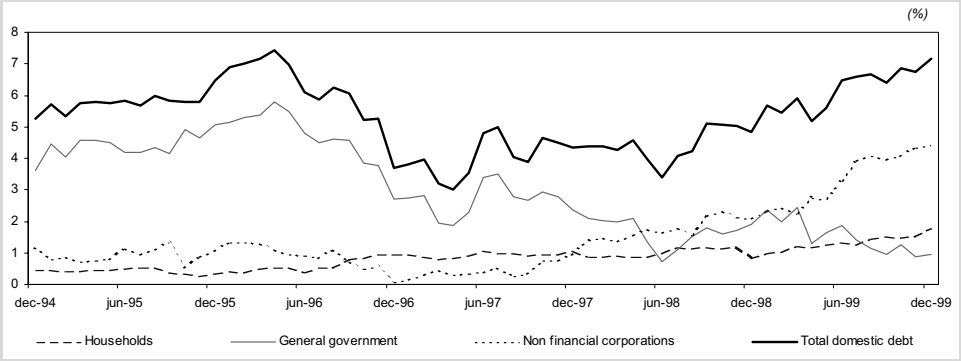
3.3. Financing developments in 1999

The rise in the overall indebtedness of resident non-financial agents has accelerated since mid-1998, notably via faster credit growth. Thus, the trend towards disintermediation observed since the mid-1990s – resulting from the more rapid expansion of market financing – was slightly less accentuated in 1999.

Box 5: Recent trends of financing flows in France

1. The annual growth rate of total domestic debt has increased since the mid-1998.
The annual growth rate of total domestic debt accelerated from 3.4% in June 1998 to 7.2% at the end of 1999, the highest rate ever reached since the mid-1990s. The rise was driven by the private sector, while in the previous period of acceleration (December 1994-April 1996), the main force was the general government.

Contribution of economic sectors to the annual growth of total domestic debt

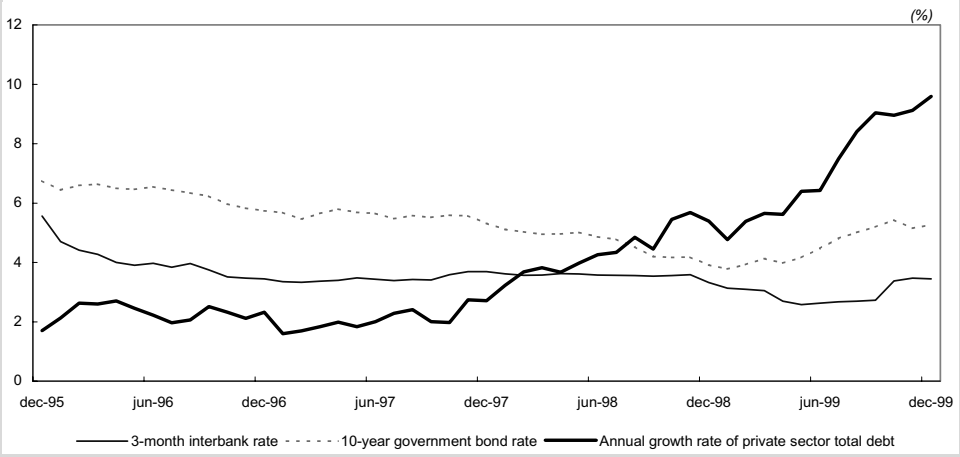


Source: Banque de France

Indeed, the annual growth of the general government debt slowed down with a net flow decreasing from EUR 83.3 billion in 1996 to EUR 14 billion in 1999, in connection with the reduction of the general government deficit.
Conversely, the private sector indebtedness rose significantly. Several factors may explain this trend reversal:

- First, the lagged positive effect of the reduction in interest rates. Between 1995 and 1999, the three-month interbank interest rate decreased from 5.6% to 3.4% and the 10-year government bond interest rate declined from 6.7% to 5.3%. However, most of the decrease in short-term interest rates was effective by the beginning of 1996. In addition, the rise recorded in long-term interest rates over 1999 (from 3.9% to 5.3%) did not prevent a further acceleration in the private sector debt growth:

Growth of the private sector debt and interest rates



Source: Banque de France

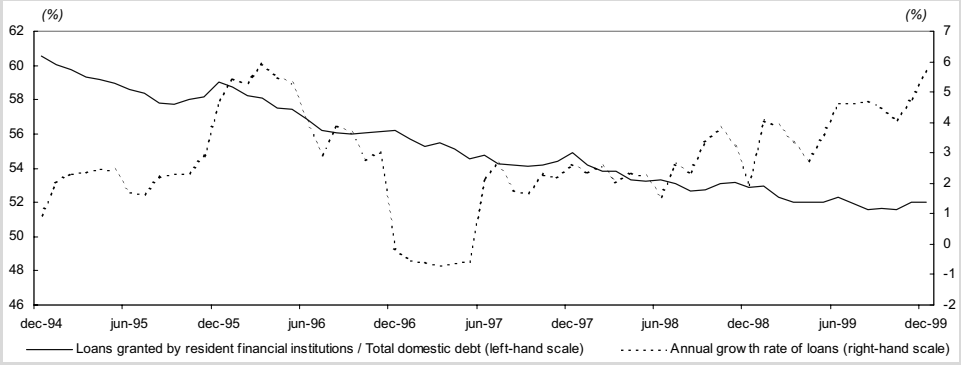
- Second, the non-financial corporations' financing strategy also played an important role. Their self-financing ratio went back to 87.6% and 80.6% in 1998 and 1999 respectively, after having reached historical highs in the mid-1990s (close to 100%), following a rise in productive investment. At the same time, their debt ratio started to increase again after a continued decline between 1993 and 1998. Namely, companies seem to have replaced equity financing by debt financing in the recent years, as a counterpart of their equipment purchases.
- Third, in the case of households, the strengthening of indebtedness trends also relates to sustained demand for consumption goods and real estate since 1996. On average, the annual growth rate of individual housing purchases reached 4.2% in nominal terms over the period 1996–1999, compared to 1.2% between 1993 and 1995. At the same time, the annual growth rate of household consumption increased from 1.6% to 2.5%. These additional expenses were partially covered by debt financing. Thus, the household debt ratio increased significantly from 52% in 1996 to 54.2% in 1999.

2. The financial disintermediation process initiated in the eighties slowed down in 1999

Such developments can be measured by analysing the share of loans in the non-financial residents total debt. Accordingly, the share of loans in total domestic debt remained stable in 1999 after a continued decrease since the mid-1990s:

- over the period 1994–1999, loans granted by resident financial institutions to non-financial residents grew at a lower pace than other indebtedness forms. On average, the annual growth rate of the former stood at 1.9% compared to 10.2% for market financing and 10.7% for loans granted by non-residents. Henceforth, the share of domestic loans in total domestic debt continuously declined, from 63.5% at the end of 1993 to 52% in 1999, while the share of market financing increased from 29.7% to 38.5% and that of foreign loans rose from 4.8% to 6.8%. These trends relate, in particular, to the behaviour of non-financial corporations. The latter tend to favour either market financing because in the recent past it has appeared less costly than bank financing given the inertia of retail bank interest rates compared to market interest rates, or foreign financing in the form of loans granted through direct investments in a context of increasing internationalisation of the French economy;
- however, the share of loans in total domestic debt remained stable in 1999, as the growth of loans granted by monetary financial institutions got momentum. The demand for credit addressed by small and medium size enterprises was indeed stronger because of the economic activity recovery as well as because of lower lending bank interest rates. Meanwhile, large firms most likely continued to favour market financing for mergers and acquisitions or, to a lesser extent, for the constitution of precautionary holdings before the Y2K changeover.

Disintermediation and growth of domestic loans



Source: Banque de France

4. Lessons for monetary analysis in the euro area

4.1. Monetary analysis under the first pillar

The first pillar of the strategy of the Eurosystem confers a prominent role to money, signalled by the announcement of a reference value for broad monetary growth, and

reflecting the monetary origins of inflation over the medium term. The Council of Governors has emphasized that "the reference value does not entail a commitment on the part of the Eurosystem to correct mechanistically deviations of money growth from the reference value. Rather, monetary developments are thoroughly analysed in relation to the reference value in order to ascertain their implications for the outlook for price stability over the medium term" [2].

Therefore, the announcement of the reference value represents a commitment on the part of the Eurosystem to thoroughly analyse and explain monetary developments and their role in policy decisions. Thus, the first pillar encompasses a broader range of analyses of monetary and credit aggregates and of analytical tools (e.g. a money demand function), even if not all of the underlying monetary analysis is published.

4.2. Proposals for additional indicators and analytical tools

In the context of a deregulated market economy that is largely open to financial innovation, it may also be important to analyse interactions between money, other forms of investment and financing, and to interpret diverging trends in these variables.

In this regard, one should mention first the work already accomplished by the ESCB within the framework of financial accounts, which aims at building a euro area quarterly table of the financing and investment flows of non-financial agents. The euro area TFI, which is close to the French one in concept but differs from it in that it makes an explicit reference to the monetary aggregates, is to be released in the next few months.

The creation of a total domestic debt indicator for the euro area could also provide a solution to these needs, like the indicator used by the Banque de France to track financial developments in France. Such an indicator would make it possible, for internal purposes, to track developments in every form of debt financing in the euro area simultaneously, within a single conceptual framework, as a supplement to the indicators based on the MFI sector balance sheet. This addition would thus make it easier to understand the monetary and financial developments in the euro area.

The construction of such an indicator at the euro area level would also be consistent with the definition and the implementation of a euro area TFI. Although narrower in scope than the table of financing and investment flows, since it would be limited to debt financing, a euro area total debt would nevertheless have a crucial advantage for monetary policy in that it can be produced on a monthly basis. In fact, this indicator would be based on data taken from the MFI sector balance sheet and security issues statistics, which are also available at short notice in most member states of the monetary union.

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[2] "Review of the Quantitative Reference Value for Monetary Growth", ECB Press Release, 2 December 1999.

Annexes

Money and investment aggregates

	Outstanding amounts FRF billion	Outstanding amounts EUR billion	Year-on year % changes (a)	
	1998	1998	1997	1998
Banknotes and coins	*265.0*	*40.4*	*1.1*	*1.6*
Franc-denominated overnight deposit	*1735.7*	*264.6*	*7.4*	*3.8*
M1	**2000.7**	**305.0**	**6.5**	**3.5**
M2 – M1	1784.2	272.0	9.2	5.5
"A" passbooks	*709.1*	*108.1*	*3.0*	*1.4*
"Blue" passbooks	*99.7*	*15.2*	*4.2*	*3.7*
Housing savings accounts	*168.6*	*25.7*	*5.6*	*4.5*
Industrial development accounts	*229.6*	*35.0*	*8.1*	*5.4*
People's passbooks	*237.5*	*36.2*	*20.1*	*16.0*
Youth passbooks	*31.5*	*4.8*	*17.9*	*4.3*
Taxable passbooks	*308.3*	*47.0*	*24.3*	*9.3*
M2	**3784.9**	**577.0**	**7.8**	**4.4**
M3 – M2	1744.9	266.0	– 8.2	– 0.9
Foreign currency deposits and negotiable debt securities	*124.0*	*18.9*	*4.2*	*12.2*
Time deposits (b)	*317.5*	*48.4*	*–12.8*	*– 1.6*
Loan notes and savings certificates	*135.1*	*20.6*	*– 3.8*	*–13.4*
CDs and negotiable medium-term notes issued by banks	*264.4*	*40.3*	*5.6*	*– 6.5*
Bills and negotiable medium-term notes issued by financial societies and specialised financial institutions	*11.2*	*1.7*	*–39.0*	*2.1*
MMF units	*885.5*	*135.0*	*–11.3*	*2.1*
Securitised vehicle units ≤ 5 years	*7.2*	*1.1*		
M3	**5529.8**	**843.0**	**2.0**	**2.7**
M4 – M3	93.8	14.3	51.9	–25.8
Negotiable treasury bills	*78.1*	*11.9*	*80.6*	*–27.2*
Commercial paper and negotiable medium-term notes	*15.7*	*2.4*	*–20.3*	*–16.9*
M4	**5623.5**	**857.3**	**2.8**	**2.0**
Housing savings schemes	*1146.6*	*174.8*	*13.8*	*8.6*
Other savings accounts (c)	*22.3*	*3.4*		
People's savings plans	*679.2*	*103.5*	*12.6*	*3.4*
– of which: insurance companies	*177.4*	*27.0*		
Guaranteed mutual fund units	*167.3*	*25.5*	*39.3*	*19.1*
Capital accumulation certificates	*311.1*	*47.4*	*3.6*	*– 0.6*
P1	**2326.5**	**354.7**	**13.6**	**6.4**
Bonds	*811.5*	*123.7*	*–16.6*	*– 2.3*
Life insurance investments	*2908.0*	*443.3*	*17.8*	*12.0*
Bond mutual fund units	*563.3*	*85.9*	*– 5.4*	*5.8*
P2 (base 80)	**4282.8**	**652.9**	**5.3**	**8.2**
Shares	*23384.0*	*4479.6*	*27.4*	*28.2*
Equity mutual fund units	*332.9*	*50.8*	*36.5*	*34.9*
Composite mutual fund units	*330.8*	*50.4*	*32.1*	*29.4*
Other mutual fund units (d)	*245.9*	*37.5*	*28.5*	*23.0*
P3 (base 80)	**30293.5**	**4618.2**	**27.6**	**28.3**

(a) At end-December
(b) Time accounts, unavailable factoring accounts and forward securities transactions
(c) Cash deposits on personal equity plans, savings contracts with savings and lending institutions and other regulated savings accounts
(d) Employee mutual funds, venture capital mutual funds, future mutual funds and investment trusts
Source: Banque de France

Total domestic debt
Breakdown by instruments

(end-of-period outstanding amount in EUR billions and percentage change)

	Amount	Twelve-month rate of growth			
	Aug. 00	Dec. 98	Dec. 99	July 00	Aug. 00
Total domestic debt	**2176.8**	**4.8**	**7.2**	**5.6**	**5.8**
Households (a)	487.7	3.7	8.0	7.5	7.1
≤1 year	23.8	6.4	8.9	9.6	11.7
>1 year	463.9	3.5	8.0	7.4	6.8
Non-financial corporations	900.3	5.4	11.4	8.0	8.8
≤1 year	330.8	5.4	11.5	12.5	14.0
>1 year	569.4	5.4	11.3	5.5	5.9
General government	788.8	5.0	2.5	1.7	1.8
≤1 year	93.1	2.7	–12.9	2.0	1.5
>1 year	695.7	5.3	4.8	1.7	1.8
Loans obtained from resident FI (b)	**1116.8**	**1.4**	**5.2**	**5.6**	**5.8**
Households (a)	487.7	3.7	8.0	7.5	7.1
≤1 year	23.8	6.4	8.9	9.6	11.7
>1 year	463.9	3.5	8.0	7.4	6.8
Non-financial corporations	518.9	2.3	5.9	6.9	8.0
≤1 year	138.3	–3.1	0.1	8.9	10.4
>1 year	380.5	4.3	7.9	6.2	7.2
General government	110.3	–7.9	– 6.0	–7.1	–8.1
≤1 year	10.7	–1.9	– 9.8	8.8	3.0
>1 year	99.6	–8.5	– 5.5	–8.5	–9.1
Loans obtained from non residents (c)	**159.8**	**10.3**	**14.0**	**9.9**	**10.7**
Market financing	**862.7**	**9.1**	**8.6**	**4.8**	**5.0**
Non-financial corporations	221.6	11.1	25.0	9.4	9.2
≤1 year	51.2	27.9	32.5	26.8	29.6
>1 year	170.4	7.8	23.3	5.0	4.2
General government	641.1	8.6	4.1	3.3	3.6
≤1 year	45.1	4.9	–28.5	–2.6	–0.4
>1 year	596.0	9.0	7.1	3.7	3.9
Private sector deposits with the central government	**37.4**	**1.6**	**7.7**	**5.2**	**3.2**

(a) Households + non-profit-making institutions in the service of households
(b) FI (Financial institutions) = Monetary financial institutions + other financial intermediaries
(c) Loans between units of different companies + loans obtained through direct investments + commercial loans

Source: Banque de France Produced 28 September 2000

Table of Financing and Investment

(in EUR billions)

		Outstanding amount 1999Q4	Flow 2000Q1	Outstanding amount 2000Q1
FINANCIAL INVESTMENT BY NON-FINANCIAL RESIDENTS				
SHORT-TERM DEPOSITS AND SECURITIES VIS-À-VIS RESIDENT MFIs	(A)	841.1	– 0.5	846.6
Currency in circulation and short-term deposits		**650.4**	**–11.2**	**639.7**
Currency in circulation		*39.9*	*0.0*	*39.9*
Overnight deposits		*292.2*	*– 7.2*	*285.3*
Savings passbooks		*274.0*	*– 1.4*	*272.6*
Deposits with agreed maturity ≤2 years		*33.4*	*1.3*	*34.9*
Deposits of the central government		*10.9*	*– 3.9*	*7.0*

(Table continued)

(in EUR billions)

		Outstanding amount 1999Q4	Flow 2000Q1	Outstanding amount 2000Q1
Debt securities ≤2 years. MMF units and repos		**190.7**	**10.7**	**206.9**
Debt securities ≤2 years		*50.6*	*3.9*	*54.5*
MMF units		*131.4*	*3.9*	*140.5*
Repurchase agreements		*8.7*	*2.9*	*11.9*
OTHER SHORT-TERM DEPOSITS AND SECURITIES	(B)	*73.9*	*0.3*	*74.2*
Other deposits (cross border deposits, etc.)		**53.3**	**0.0**	**53.3**
Other short-term securities (commercial paper, etc.)		**20.6**	**0.3**	**20.9**
MEDIUM- AND LONG-TERM INVESTMENTS (C)		4743.0	23.0	4937.7
Deposits with agreed maturity > 2 years		**292.9**	**– 7.3**	**285.6**
Bond-type investments		**853.5**	**14.3**	**866.2**
Bonds		*114.7*	*– 0.3*	*110.1*
Other debt securities > 2 years		*19.4*	*0.1*	*19.4*
Bond mutual funds		*73.0*	*0.4*	*69.2*
Guaranteed mutual funds		*35.4*	*0.8*	*33.9*
Insurance technical reserves		*611.0*	*13.3*	*633.6*
Insurance people's savings plans		29.3	1.5	33.8
Other life insurance investments		581.7	11.8	599.8
Equity-type investments		**3596.6**	**16.0**	**3785.9**
Quoted shares		*667.0*	*3.5*	*710.3*
Other equity		*2712.6*	*8.7*	*2845.8*
Equity mutual funds		*87.2*	*1.0*	*91.0*
Composite investment mutual funds		*49.3*	*2.9*	*55.3*
Other mutual funds		*80.5*	*– 0.1*	*83.5*
TOTAL INVESTMENT	(D = A + B + C)	5658.0	22.8	5858.5
FINANCING GRANTED TO NON-FINANCIAL RESIDENTS				
Loans	(E)	**1235.3**	**23.3**	**1257.6**
≤1 year		*157.8*	*11.1*	*169.5*
>1 year		*928.3*	*7.0*	*933.7*
Loans granted by non-residents		*149.2*	*5.2*	*154.4*
Private sector deposits with the central government	(F)	**38.0**	**– 2.1**	**35.9**
Market financing	(G)	**815.6**	**5.2**	**822.3**
≤1 year		*76.1*	*2.6*	*78.8*
>1 year		*739.5*	*2.6*	*743.5*
TOTAL DOMESTIC DEBT (monetary statistics definition)	(H = E + F + G)	2088.8	26.4	2115.8
Change to financial statistics	(I)	38.3	ns	38.8
TOTAL DOMESTIC DEBT (national accounts definition)	(J = H + I)	2127.2	26.4	2154.6
SHARES AND OTHER EQUITY	(K)	4079.0	14.5	4256.2
Quoted shares		**1295.1**	**8.8**	**1314.6**
Other equity		**2783.9**	**5.7**	**2941.6**
TOTAL FINANCING	(L = J + K)	6206.2	40.9	6410.8

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Flow of funds analysis in the experience of the Banco de España

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1. Reasons for focusing on flow of funds analysis[1]

Monetary and financial analysis as conducted by central banks has evolved over the last century in order to remain in touch with an increasingly complex economic and financial world. In a sense, flow of funds analysis might be seen as the final stage of a long haul during which the most relevant pieces of information for central banks' assessment have been pursued. Although the events described in this section are overly rough and simplistic, they may help place flow of funds analysis in an appropriate perspective.

When monetary policy began to be implemented in a modern sense, central banks did not need to go too far to collect information about the financial world. Indeed, their balance sheets contained fundamental data for analysing liquidity and credit conditions in the economy and the external sustainability of the economic situation. Moreover, in some countries central banks played a key role in providing finance to the government, thus influencing most significantly the economic cycle and inflationary prospects. Even if data had to be properly interpreted, they were immediately available, with no delay and no estimated components or errors.

Afterwards the financial system developed much further and the population's economic welfare increased substantially, with both factors promoting household saving. Financial markets, especially those for public debt, also expanded and monetary policy took a more stabilising role. As a result of these factors, the central bank's balance sheet lost some of its past importance to the benefit of credit institutions' balance sheets. Households and firms depended crucially on those entities to obtain finance and most of their saving was also invested in them. Moreover, currency and bank deposits (money) were the key variables to monitor if monetary policy aimed to ensure price stability. A very sound theoretical and practical framework was duly established, supported by the collection of data from credit institutions through which almost all relevant financial information was obtained.

Finally, in the last two decades, other financial intermediaries emerged and expanded and the size of financial markets -not only for trading with public debt – increased

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[1] In this paper the terms "flow of funds" and "financial accounts" are used indistinctively, both referring to the data on financial flows and outstanding amounts classified by financial instrument and economic sector.

forcefully. Disintermediation, financial deregulation and liberalisation, and internationalisation were the major forces behind the outstanding changes in finance. These factors reinforced each other making the whole process unstoppable. Whereas the authorities might be seen to have ignited the initial stages of the process, they have been somewhat overpowered subsequently by the speed and strength of the ensuing changes.

As concerns traditional monetary and financial analysis, centred on money and loans, these changes advised taking a wider perspective of the financial variables. The main consequences of these factors for monetary and financial analysis can be summarised as follows:

- A growing share of saving is not reflected in the MFIs' balance sheets. Direct equity purchases on the market (also encouraged recently by Internet access), insurance products and, in particular, mutual funds have partly replaced traditional banking deposits. Table 1 shows that in 2000 only one-third of the financial assets held by Spanish households was invested in currency and bank deposits as compared with two-thirds at the beginning of the decade.
- Capital markets and financial intermediaries other than credit institutions are playing an increasingly important role in channelling financial resources from savers to investors. In the Spanish case, loans from credit institutions only accounted for 26% of non-financial corporations' total increase in liabilities in 1999, as compared with 36% ten years earlier. In this case, disintermediation is not observed in the issuance of bonds, which is still very scarce, but in the resort to the issuance of equities.
- Financial innovation and the development of financial markets has made it possible for banks to offer new and more attractive combinations of liquidity and risk in their products. In this respect, it is very difficult to disentangle where to place the borderline between monetary (liquid) and non-monetary assets. The distinction between assets mainly used for a transactions motive or for investment, or between low-risk very liquid assets and riskier and less-liquid ones, has become blurred and complicates to define what money really is.

All these major changes do not recommend abandoning all previous indicators and the preceding framework. It merely advises scaling down their significance and not

Table 1

Outstanding Financial Assets of Households and Non-Profit Institutions Serving Households (NPISH)					Memorandum item
	Breakdown as percentage of total (a)				As % GDP (b)
	1990	1995	1999	2000 IIIQ	
Total	100,0	100,0	100,0	100,0	191,0
Currency, deposits and securities	68,0	55,4	34,6	36,7	70,1
Shares and other equity	14,5	28,6	51,6	48,1	91,9
Insurance technical reserves	7,6	10,1	10,7	11,9	22,8
Other accounts	9,9	5,9	3,1	3,3	6,2

(a) The 1990 data were compiled following the methodological guidelines of ESA 79, and the 1995 and 1999 data, following ESA 95.
(b) Referred to 2000 IIIQ.

neglecting other sources of financial information. The financial system is changing rapidly and central banks need to adapt their way of dealing with financial information. Bank assets and liabilities will continue to play a central role in monetary and financial analysis, but it should be recognised that other relevant intermediaries cannot be sidelined. A wider framework of analysis thus seems to be better suited to cope with this increasingly complex world.

This paper examines how information contained in financial accounts may contribute to improving our knowledge of the monetary and financial conditions faced by economic agents, making a special reference to the work conducted at the Banco de España in this respect. Section 2 outlines the main advantages and drawbacks of placing financial accounts at the forefront of a central bank's financial analysis. In Section 3 the Banco de España's first steps in this direction are presented, while Section 4 shows the potential improvements which are being considered. Finally, Section 5 draws the conclusions.

2. Cons and pros of flow of funds analysis

2.1. Cons

The main disadvantages of flow of funds analysis are related to its complexity as a tool for analysing monetary and financial developments. In fact, the great efforts made to build up domestic financial accounts have not run in parallel to the use of these accounts for policymaking. The lack of high-frequency data up until very recently may be one of the main reasons for this. In any case, once quarterly data are available it is to be expected that more and better answers will be found to the relevant questions policymakers ask.

Difficulties in the analysis of financial accounts may be classified into two large groups: the first includes all problems relating to the collection and processing of information; the second one is related to the informational content of flow of funds for financial analysis.

Flow of funds data provide for an exhaustive collection of information of all economic sectors' financial balance sheets, their financing and investment The first problem is therefore how to obtain such a huge amount of data promptly and accurately. In contrast to the central bank's balance sheet, whose information can be obtained daily or even instantaneously, or to the MFIs' balance sheets, whose monthly reports offer a detailed picture of their operations, the financial accounts of the economy can only be produced quarterly and with a significant delay. This implies that they do not provide yesterday's or last month's data but at most those of the last-but-one quarter.

Moreover, financial accounts offer a fully closed and coherent picture in which, ultimately, several economic constraints are verified (e.g. for each instrument, net acquisitions by all sectors must equal net change in liabilities of all sectors). This allows the information from one sector to be used to complete that of a different sector, but it also entails the need to obtain or estimate the whole set of data in order to close the system coherently.

It must also be assumed that flow of funds analysis is not fully based on observed data. Actually, there are no primary data for a number of agents and transactions,

and, in particular, for the most relevant sectors for spending decisions: households and non-financial corporations. Therefore, financial accounts contain several elements which are to some extent estimated. This introduces a certain degree of ambiguity into the construction of financial accounts: whereas once money is defined, the uncertainty on how to measure it is reduced considerably, calculations of household saving are more the result of an intellectual process combining primary information and expert judgement.

This brings the discussion to another important issue. Are flow of funds data neutral? Namely, can we trust statisticians – when preparing the financial accounts – not to prejudge the subsequent monetary and financial analysis by juggling figures? Even if experts cannot be asked to ensure that the financial accounts are a pure reflection of reality, analysts may demand that at least no bias be included in the way some financial transactions are estimated or the whole system is closed. This is particularly relevant in the household and non-financial business sector where the quality of information is fairly mixed: on one hand, there is very reliable and prompt information on their financial transactions vis-à-vis MFIs; on the other, for transactions with securities the private sector is considered the residual sector – as no primary information exists for it – and therefore it is the one which has to adjust the likely differences between the instruments issued and the amount held by other sectors.

As to the collection and availability of information, it should also be recalled that there are certain transactions and instruments whose measurement is particularly complex. This is the case of real assets, whose changes are very important when explaining the economic and financial decisions of households. Although not a financial variable, the lack of an adequate measurement of housing wealth limits the assessment of households' financing and investment decisions stemming from financial accounts.

Finally, an important element to be considered is that financial accounts follow a set of statistical principles (at present based on ESA 95) which sometimes may not provide the best basis for assessing certain monetary and financial developments. Faced with these problems, users must choose between accepting the criteria of the accounts or adjusting specific items in order to obtain a more appropriate picture of the financial situation. In the latter case, the fact we are dealing with a closed system of accounts makes any adjustment in the original data a fairly complex task.

The second group of problems relates to the way such a large amount of data can be managed to allow economic analysts to make sense of it. The underlying theoretical rationale for this analysis is still weakly integrated with the assessment of financial conditions provided by financial accounts. This may be partly due to the fact that theoretical relations embodied in this information have only been partially exploited when modelling relationships among financial and non-financial variables.

Much research has been conducted in the past to explain the performance of money and credit. And despite significant obstacles, it has been notably successful. However, modelling different categories of financial assets and liabilities or broader aggregates appears to be a much more difficult task. Many questions remain unanswered. What are the factors behind the demand for financial assets? Does the latter depend on the demand for liabilities? Is it possible to identify the forces shaping portfolio shifts? And what role do financial decisions play in spending? Therefore, the full exploitation of flow of funds possibilities requires strong research and a clear theoretical framework to organise the huge amount of information available.

2.2. Pros

The advantages of focusing on flows of funds to conduct financial analysis stem both from the difficulties of making an assessment based on narrower and specific variables and from the genuine pros of such an analysis.

As commented above, money is a key variable in monetary and financial analysis, but confidence about its informational content has been gradually declining for the past two decades. Money is almost impossible to define as financial innovations continuously change the features of liquid financial assets, obliging central banks to re-assess money demand on an ongoing basis. Although money is still important, increasing attention has to be paid to other financial variables in order to substantiate that information and enrich the analysis. Likewise, credit from the MFIs to the private sector is still relevant but a full account of how non-financial corporations fund their activity also requires considering the issuance of bonds and equity. Even data on lending to households may be distorted by the growing importance of mortgage loan securitisation.

Among the difficulties of dealing with the financial accounts, the large amount of data involved was mentioned earlier. At the same time, such information may provide for a deeper assessment of the economic and financial situation of the country. It provides for the potential to recognise the interdependence between expenditure and portfolio allocation decisions and the interrelationships between different sectors' behaviour in the various asset markets. Thus, ex-ante sectoral budget constraints of the type:

$$\text{Gross Savings} + \text{Change in liabilities} = \text{Investment} + \text{Financial asset acquisition}$$

induce several relationships among financial and non-financial variables within each sector. Furthermore, there may still be some interdependence between spending and portfolio composition decisions. For instance, the fact that a good deal of wealth revaluation has come from increases in the value of mutual funds, which can be easily liquidated, might have had an important influence on spending decisions in Spain. Furthermore, the fact that some financial markets are not always cleared through interest rates (credit rationing is relatively common in bank lending) implies a binding constraint on the non-financial decisions of economic sectors. This allows for financial variables not to be considered as endogenous, as is often assumed, permitting feed-back relations between real and financial variables to be taken into account.

At a minimum, financial data provide for an additional source of information to assess recent developments in real variables as it allows to conduct a cross-check of real-sector information. Actually, financial accounts provide us with some idea of net financial saving by sector, which can be compared with net borrowing/lending obtained from the non-financial transactions accounts. This type of contrast is interesting since financial and non-financial variables are to some extent independent sets of information of a process in which agents take both real and financial decisions at the same time.

Flow of funds analysis is also advantageous as it enables sector-by-sector assessment of monetary and financial conditions. Such a sectoral perspective is difficult to obtain from the traditional variables, relating to money, credit and interest rates. Changes in the monetary policy stance and the different channels of monetary transmission affect financial prices and quantities, but its impact on each economic sector may be quite different. For example, the net financial position of a particular economic sector and its portfolio composition affects its sensitivity to changes in interest rates. This sectoral

approach, of a more microeconomic nature, is essential to fully understand the effects of monetary policy on the economy[2]. Flow of funds analysis thus enables us to examine both the financial performance by sector and the links between sectors following any policy decision or change in the institutional framework. This approach is therefore much more ambitious and far-reaching than that focused on specific monetary and financial variables.

The importance of financial flows other than money and credit was explained before by the growing relevance of the disintermediation, deregulation and internationalisation of modern financial systems. Also, in the last two decades there has been an ongoing process of increasing investment by households in variable-yield instruments, such as equities and shares in mutual funds. These assets introduce new financial considerations, as fluctuations in their prices may have important repercussions for household behaviour. The so-called *wealth effect* is increasingly significant in a number of countries whose economic developments are sometimes difficult to explain without some reference to that effect. By showing the proportion and performance of those assets, the financial accounts allow for an assessment of the potential implications of a change in asset prices. For example, in the Spanish case, almost one-half of financial assets held by households -equivalent to slightly less than 100% of GDP- is invested in equities and other variable-yield securities (see Table 1).

Flow of funds analysis also enables us to address an important source of concern for central banks: financial stability. Irrespective of their responsibility for banking supervision, central banks and, in general, economic authorities are becoming increasingly worried about the stability of the financial system. The traditional risks stemming from systemic considerations are now compounded by the much larger and more complex financial system in which economic agents conduct their activities and by the tighter links between different financial markets. Financial accounts show very relevant information about the health of sectoral balances, risks, vulnerabilities, potential effects from changes in exogenous variables, and so on.

All the aforementioned reasons warrant implementing a thorough analysis of the information provided by the financial accounts, aiming at fully characterising financial conditions which affect the main economic sectors, assessing how monetary policy decisions are transmitted and examining the interrelationships between expenditure and portfolio asset allocation decisions[3]. Moreover, from the standpoint of a national central bank, there is also a timely reason to devote more resources to this task. The start of Monetary Union has led to the conduct of a single monetary policy which focuses on developments across the whole euro area. Evidently, therefore, the performance of monetary and financial conditions in one single country cannot influence the monetary policy of the whole area. However, analysis of domestic conditions is useful from different points of view (see Banco de España (1999a)). For one thing, from the domestic viewpoint the assessment of the financial situation of the domestic sectors may help to understand economic developments thus allowing for the design of a proper policy mix at the national level as well as to assess financial stability issues. For another, such an

[2] Peñalosa (1998) examined the effect of agents' financial position in the transmission of monetary impulses. More recently, Cuenca and Sáez (2000) analysed the sectoral income effect on the basis of the data provided by the financial accounts.

[3] There is a fairly wide agreement among several authors that these are the main uses of the flow-of-funds approach (see, for instance, Owen (1986) and Alho (1991)).

analysis could also be fruitful from the Eurosystem's standpoint, as it complements monetary and financial analysis for the whole euro area, raising points of potential interest to other countries. Moreover, the domestic assessment may also be useful for checking the consistency of the future European financial accounts, which are currently under preparation.

3. First steps in the flow of funds analysis

Economic analysis requires promptness: though explaining the past is important, central banks need to know what is going on at present in order to provide an adequate judgement of the situation. Analysis should thus be based on promptly available data. However, the more ambitious and numerous the variables to be measured, the more difficult it is to comply with this requirement.

Financial accounts represent a compilation of all financial flows of the economy classified by sector and instrument. As these accounts are a closed and coherent system, a huge amount of data is needed before the system can be fully closed. In the Spanish case, regular publication of quarterly financial accounts started in 1999. Data are available for the period 1987.I–1999.IV based on ESA 79 methodology and as from 1995.I according to ESA 95 criteria. The quarterly financial accounts are published regularly with a 100-day delay (slightly longer than three months), which is around 2–3 weeks after the national accounts are available. This delay is not fully satisfactory but due account should be taken of the fact that there are some sectors, such as insurance entities or the external sector, whose information is only obtained with a significant lag.

To cope with such a delay, two main measures have been taken. First, monthly indicators of liquidity – in a broad sense – and financing have been constructed. These indicators are largely drawn from the monthly MFIs' balance sheets and are therefore available with only a three-week delay. Second, an effort is made to estimate and extrapolate the performance of some assets and sectors for the most recent quarter, taking into account the information which is readily available.

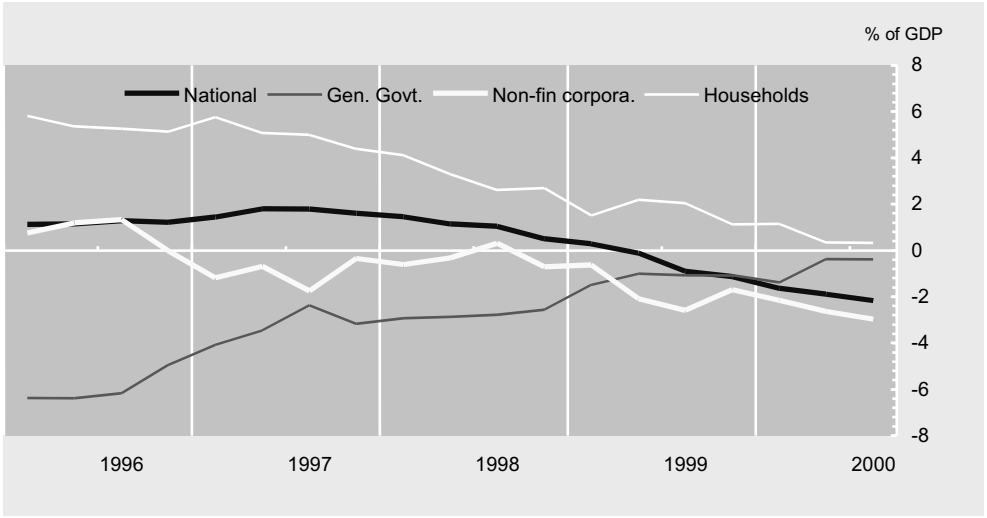
In order to make a sensible assessment of the information, data have to be properly arranged: relevant indicators must be selected and the methodology to calculate rates of growth or change in flows needs to be examined. The recent introduction of ESA 95 criteria has also made us reconsider some of their implications. Among other questions are the extent to which liabilities should be valued at market prices, or the treatment that should be given to interest accruals.

Initially, the information contained in quarterly financial accounts was monitored on the basis of original data, paying a lot of attention to stocks rather than to flows. This was a clear extension of the monitoring scheme followed in previous years when monetary and credit aggregates played a crucial role. In order to prevent seasonal changes from interfering in the assessment of the situation, year-on-year rates of growth were used and four-quarter results were accumulated. This allowed for consideration of one-year moving data with no major seasonal distortion, but it also hampered analysis of the latest quarterly data per se. As will be discussed below, some efforts have been made recently to seasonally adjust financial flows.

The main output based on financial accounts information is a quarterly report published in the Banco de España's Economic Bulletin (see Banco de España (1999b)). In its last section, this report analyses the financial situation of the economy as a whole,

Chart 1.

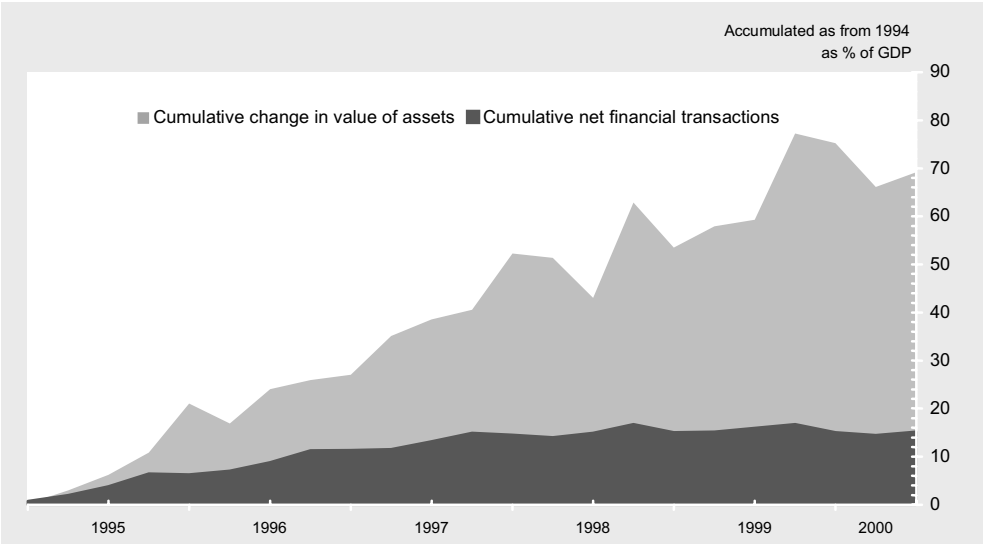
Net financial saving (1)



Notes
(1) Cumulative four-quarter data.

Chart 2.

Households: net financial wealth.



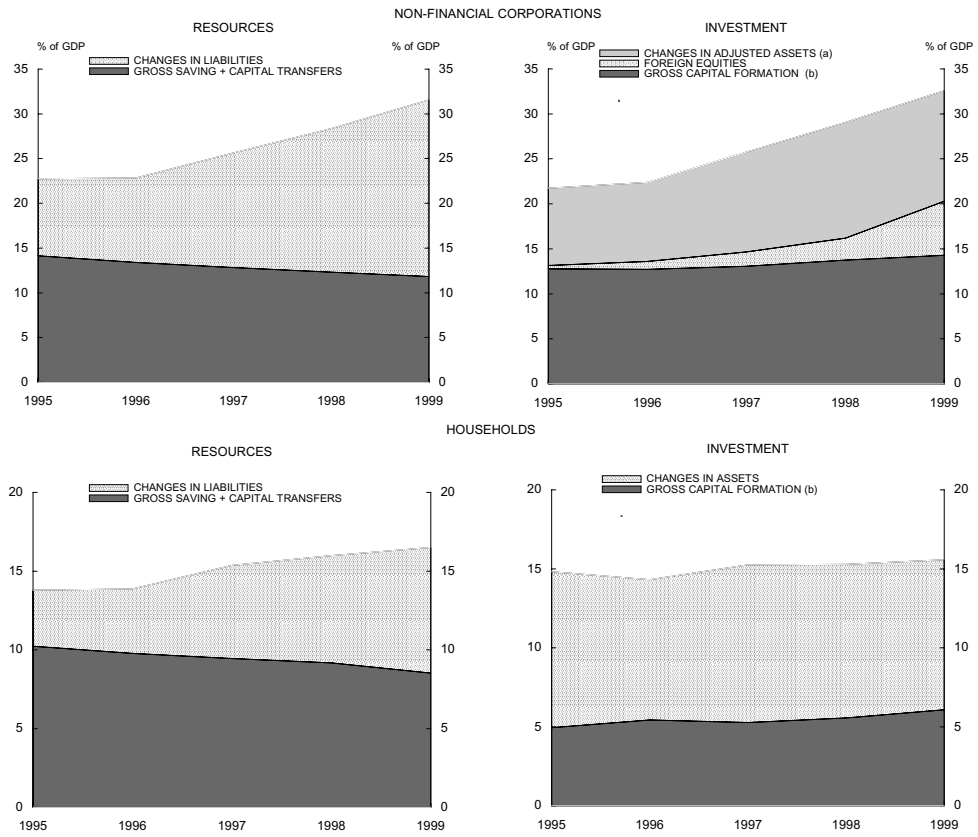
the performance of households, firms and the general government, and, finally, external financial flows based on balance of payments information. The focus of the assessment is on the private sector since households and non-financial corporations are the sectors taking spending decisions which are the main point of interest to a central bank.

Charts 1 to 4 offer some basic evidence which is regularly analysed in the quarterly report on the Spanish economy. Chart 1 shows developments in net financial saving by sector: in the last few years, the net financial saving of the nation has been falling due to the lower ratios recorded by non-financial corporations and, particularly, by households, and despite the significant improvement in public finances. In Chart 2, the rapid decline in household net financial saving is reconciled with the increase in their net financial wealth: most of the strong increase in wealth is due not to the accumulation of saving, but to the revaluation of previously existing financial wealth.

In Charts 3 and 4 some of the links between financial and real flows are shown. In Chart 3, real and financial resources are examined together with their uses. Given the

Chart 3.

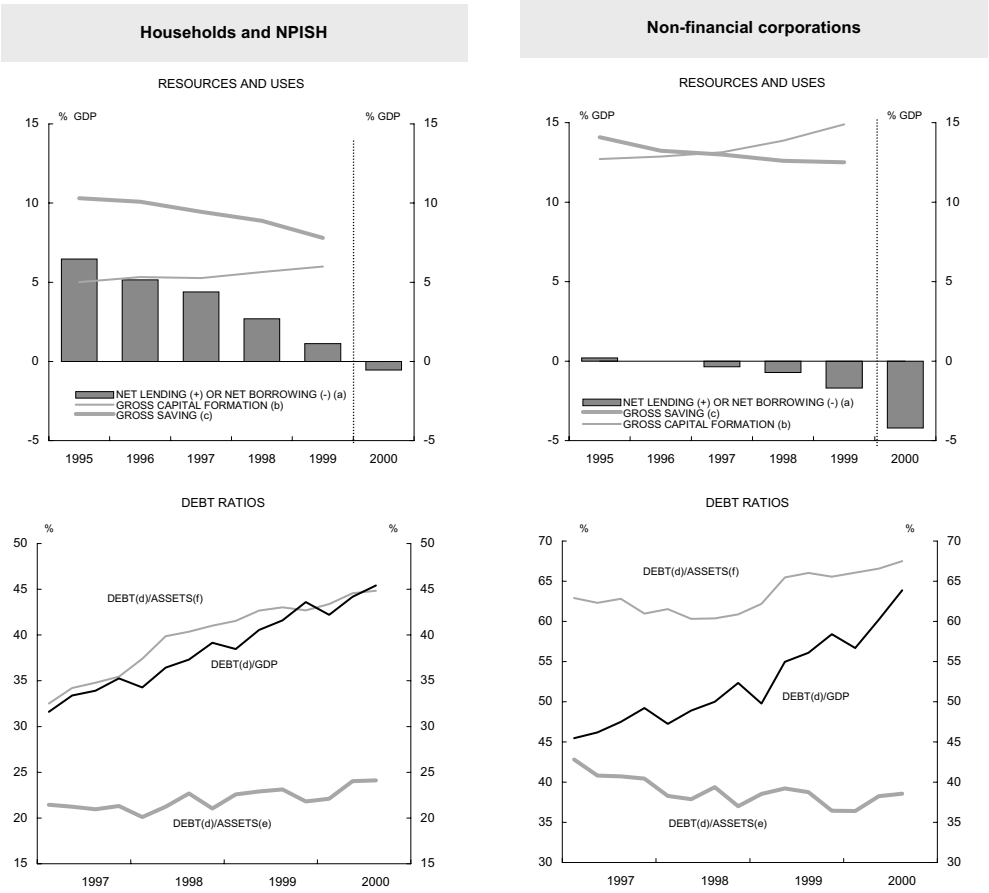
Saving, investment and financing of households and non-financial corporations



Source: Banco de España.
(a) Calculated by subtracting foreign equities from the change in assets.
(b) Gross capital formation includes changes in stocks and purchases of valuables and of non-financial assets.

decline in gross saving in both non-financial corporations and households, only growing financing to these sectors has allowed them to increase investment in real and financial assets. In the case of non-financial corporations, the very sizeable acquisitions of foreign equities, which are a proxy for direct investment by Spanish companies abroad, have absorbed a good deal of resources. Chart 4 adds some prospective elements to this analysis: according to the data for the first three quarters of 2000 – which are used to estimate a figure for the whole year –, the gap between gross saving and investment for non-financial corporations will probably widen very significantly during 2000. Moreover, the indebtedness ratios in the bottom panel of Chart 4 show that the strong increase in lending in the last few years has been reflected in an upsurge in debt in terms of GDP. Although debt is not growing in relation to financial assets held by each sec-

Chart 4.



Source: Banco de España.
(a) The figure for the year 2000 has been annualised.
(b) Includes change in stocks.
(c) Includes capital transfers.
(d) Includes loans extended by resident and non-resident credit institutions, securities and securitisation bonds.
(e) Total assets except other accounts.
(f) Total assets except shares and others equities (excluding money market funds) and other accounts.

tor, due regard should be given to the fact that, as earlier mentioned, the expansion of assets is largely explained by the substantial revaluation of equities. If these assets with a more uncertain realisation value are excluded from the calculation, the ratios have recently started to rise.

Not only the explanation of the past – however recent it may be – is of interest in this flow of funds analysis. The possibility of making forecasts is also attractive from the standpoint of a central bank. Currently, only very basic extrapolations – mainly based on univariate models – can be made and only for specific variables. More resources and time should be assigned to investigate the potential ability to forecast financial variables. In any case, financial forecasting seems to be rather complex since shifts between financial instruments are very common and the motives for investing in a particular set of assets change very often, due also to regulatory and tax reform. In this respect, very accurate forecasting of financial variables cannot be expected; however, conditioned forecasts based on specific assumptions for some financial aggregates may help outline a reasonable picture of the economic situation, describe the main trends for monetary and financial conditions, contrast the evidence from the real sector and draw important conclusions for the development of sectoral balance sheets.

As we have seen, there are still many ways to improve our incipient approach to flow of funds analysis. The most important areas for improving it are described in the next section.

4. Further stages under way

After having gained some experience from using flow of funds data for monetary and financial analysis, some further steps are warranted so as to obtain a more fruitful use of this information in financial analysis. In this connection, several projects have been initiated, some of which are currently being developed.

Firstly, indicators obtained from the flow of funds for quarterly financial analysis have been reviewed. This revision has aimed more at focusing on information provided by flows. Data on stocks are intended to be used to provide information on changes in the market value of some assets and as a link to monthly indicators of liquidity and financing which usually update quarterly analyses. This change in the focus of analysis will allow shifts in the demand or supply of financial instruments to be better disentangled from changes due to the exchange rate or other asset price variations. Furthermore, the way rates of growth are computed has also been reviewed in the case of financing instruments so as to strip out these influences. As seen, some indicators on sectors' indebtedness have also been added to assess financial stability issues.

Secondly, seasonal adjustment of flow data has been undertaken. On some occasions several difficulties have been found in clearly conveying the most relevant developments in a quarter when using year-on-year rates of growth or four-quarter moving variables. This approach allows most seasonal variation to be stripped out but at the cost of incorporating into figures the entire pattern of variables over the last four quarters. So as to pay more attention to latest-quarter developments, seasonal adjustment of the flows of some items (mainly credit and deposits) has been carried out.

Third, a computer utility is being designed so as to build alternative integrated systems of financial and economic variables with the capacity to include the accounting identities implicit in financial and national accounts. Once this tool is readily available,

analysis of the transmission of monetary policy across financial markets will be more thoroughly carried out. Moreover, this will allow to cross-check financial and non-financial information and make the consistent forecasting of relevant items of financial accounts easier. This utility is expected to put together medium- and short-run model-based projections of financial flows as well as advances to complete the financial accounts if some information is not yet available. A key feature of this utility is to perform these functions in a fast, user-friendly way. Initially, the link between real and financial variables will be very modest as no sector-by-sector quarterly national accounts are available yet. Only annual figures up to 1999 are available.

Fourth, there is a need to enhance linkages with non-financial variables. The key feature of this approach – pioneered by J. Tobin and other members of the Yale school – is the recognition of the interdependence between expenditure and portfolio allocation decisions and the interrelationships between different sectors' behaviour in the various asset markets (see Brainard and Tobin (1968) and Tobin (1980)). Each period households, businesses, government and the foreign sector decide about flow variables such as consumption, saving and investment. Simultaneously, these sectors and financial institutions as well adjust their balance-sheet positions while current period flows (saving and investment) have an influence on asset and liabilities stocks (financial wealth, stock of real assets, stock of debt). Also, expenditure is financed by running down asset holdings or by increasing liabilities. These are just a few examples of the interdependence between financial and non-financial variables characterising economic decisions. There is a need to enhance our understanding of these mechanisms and their use in explaining economic and financial developments.

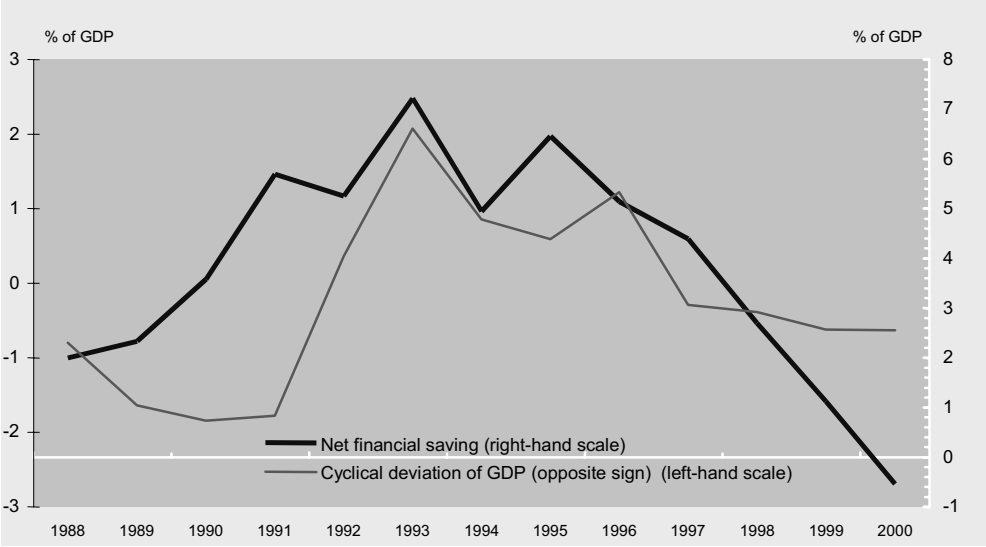
Lastly, forecasts of certain relevant financial variables are needed in order to assess future monetary and financial conditions and to forecast real variables. Even if financial markets' influence on non-financial variables may not have been taken into account in the models used to forecast the latter, projections of the former may also be used as a coherence test for real-economy forecasts.

So far, short-run projections have been based on univariate statistical models (ARIMA-type or naive extrapolation rules) which have worked fairly satisfactorily. However, medium-run projections – one or two years ahead – ought to be model-based and obtained from a framework with the capacity to inform on the interrelationships described above. To attain this goal a gradual approach has been taken, starting with simple models of a few variables with a view to trying more complex strategies later. The idea is to learn about the underlying economic and financial relationships while the very process of modelling is carried out.

In a first stage, some models are being developed to explain the financial saving of households and businesses from two perspectives: a) univariate ARIMA models which take into account leading information from certain assets and liabilities; b) equations which capture the relationship between the economic cycle and saving. Chart 5 shows one example of the latter: the significant negative correlation between household net financial saving and the cyclical deviation of GDP can be exploited to assess the consistency of current financial developments with the macroeconomic scenario. Likewise, this relationship can be used to estimate what financial saving is implicit in the macroeconomic projections for the next few years. The next stage will be to select a set of relevant financial variables to be modelled through econometric models (credit and deposits are clear candidates). The remaining assets and liabilities can be forecast by

Chart 5.

Households: net financial saving



using univariate statistical models and the consistency rules implied both by the adding-up restrictions on financial flows and sectors' balance sheets. For this approach to be feasible a high degree of aggregation is needed.

In the final stage, the knowledge acquired in previous steps will allow areas to be identified where simultaneous systems of equations might be required in order to inform on the interrelationships among the most relevant variables (financial and non-financial). Full modelling of the cells in financial accounts is not intended. Rather, the aim is to model those variables playing a significant role in the various sectors' expenditure and asset accumulation decisions.

5. Conclusions

Financial deregulation and liberalisation have increased the relevance of financial flows in the performance of economic activity. However, at the same time, the proliferation of financial instruments, the flexibility to invest and borrow, and the wide spectrum of interest rates and financial useful prices have also made it very complex to build up a financial analysis capable of giving useful direction for the assessment of macroeconomic situation. Likewise, the traditional sources of financial information – money and credit – are becoming less informative due to the very intense development of the financial system, new intermediaries and instruments.

Flow of funds analysis may be an answer to these concerns. First, it coherently takes into account all financial information about flows. Second, it enables financial variables to be interpreted in connection with real indicators. Third, it allows consistent financial forecasts to be produced, which may be used to contrast other evidence and estimates.

And finally, this approach helps assess certain features of financial stability by focusing on the sectoral financial situation.

Summing up, progress in flow of funds analysis will, in our view, allow financial variables to play a more relevant role in any assessment of the economic situation. Before this can be attained, a more thorough understanding of financial flows and their relationship to spending decisions is needed.

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Luxembourg:	Patrick Lünnemann Sandrine Scheller
Netherlands:	Maarten van Rooij Cees Ullersma
Portugal:	Pedro Duarte Neves Ana Cristina Leal
Spain:	Juan Peñalosa Teresa Sastre
Sweden:	Hans Dillén Kerstin Mitlid

Switzerland:	Thomas Jordan Michel Peytrignet
United Kingdom:	Peter Andrews Andrew Hauser
United States:	Richard D. Porter
European Central Bank:	José Luis Escrivá Hans-Joachim Klöckers (Chairman) Klaus Masuch Huw Pill Caroline Willeke