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ABSTRACT

This paper is an attempt to provide an updated assessment of what we know and what do not know about the impact of monetary policy on the economy and what implications follow for the conduct of monetary policy in today's world. Firstly, we discuss the conditions under which monetary policy can be expected to affect the economy, both over the medium term and the short term, and review the most policy-relevant empirical results, providing some new evidence. Secondly, we analyze the implications that the empirical regularities have for the practical conduct of monetary policy. We focus on whether the existence of short-run real effects can and should be exploited by central banks and whether the impact of monetary policy on the economy may be affected by the present circumstances of low rates of inflation and low nominal interest rates.

1. INTRODUCTION

The impact of monetary policy on the economy and in particular on output and prices has long been a key issue in macroeconomic theory. It is also of fundamental importance from a policy perspective given how necessary it is for central bankers to have a proper understanding of the consequences of their actions so as to determine at each moment what monetary stance is appropriate for reaching their final goal.

This paper attempts to address the question of what are the real effects of monetary policy. Although one might be tempted at first sight to give a more or less conclusive standard macroeconomics textbook answer drawing on popular perceptions about what monetary policy does, on reflection things are not so simple.

Firstly, when we talk about the impact of monetary policy on the economy a distinction has to be drawn between the shorter term and the medium term: indeed, the effects of monetary actions on nominal and real variables can -and generally will- differ considerably depending on the reference horizon.

Secondly, when we ask "what is the impact of a 1 p.p. change in the official interest rate by the central bank?", it may be important to consider that while monetary policy may affect the economy it also reacts to it. For this reason, it is of interest to differentiate whether such policy action is an unexpected or exogenous shock or is rather part of an explicit or implicit policy rule whereby the central bank systematically responds to evolving economic conditions in the pursuit of its final goals.

Thirdly, while in central bankers' jargon an increase in the official interest rate is always taken to mean a policy "tightening" and a reduction a policy "loosening", measuring the stance of monetary policy is no trivial task. For instance, a rise in official interest rates in response to a prospective worsening in price developments may ultimately be "accommodating" in so far as the nominal interest

rate increase is not as large as the increase in inflationary expectations, thus letting real interest rates drop at a time when they should rather be increasing to counter future inflationary pressures.

Finally, the effects of monetary policy on the economy do not take place in a vacuum. Rather, they critically depend on what the starting conditions are regarding, for example, the credibility of the central bank's policy, the degree of economic slack, the functioning of goods and labour markets, the initial rate of inflation and the initial level of interest rates.

Keeping these considerations in mind, this paper attempts to provide an updated assessment of what we know -and what we still do not- about the impact of monetary policy on the economy, and what implications follow for the conduct of monetary policy in today's world¹. In so doing, our main aim is to bring together economic principles, empirical evidence and central banking experience so as to derive some practical lessons which may be useful to performers of the "art of central banking".

The paper is structured as follows: Section 2 reviews the key conceptual issues that have to be dealt with when studying the conditions under which monetary policy can be expected to affect real economic activity. It presents what we consider to be the most policy-relevant empirical results on the impact of monetary policy on the economy over the short and medium term and provides further results for the euro area using two alternative models. The section concludes with a critical look at the existing evidence and with an assessment of the empirical regularities which seem most robust and thus useful for policymaking.

Section 3 takes stock of the results in the previous section and focuses on the implications that the empirical regularities have for the practical conduct of monetary policy. An initial issue concerns the risks incurred when monetary policy is repeatedly employed as a tool for trying to influence real economic activity without due regard to the maintenance of price stability. A second issue deals with the practical lessons that can be drawn from the evidence regarding the design of

¹ In a recent paper, Friedman (1995) also addresses these issues.

monetary policy frameworks. The last part of the section addresses the issue of whether the impact of monetary policy on the economy may differ under circumstances like the present ones, characterised by very low rates of inflation and nominal and real interest rates. Section 4 completes the paper, summarising its main conclusions.

2. THE IMPACT OF MONETARY POLICY ON THE ECONOMY IN THEORY AND IN PRACTICE

In discussing the impact of monetary policy on the economy, modern macroeconomics draws a distinction between the short and the medium term. This distinction is essential for a proper understanding of what monetary policy does. In the short term, price and output dynamics are likely to be quite complex due to the potential presence of certain frictions and market imperfections. By contrast, in the medium term certain conditions hold which greatly simplify the analysis. For this reason, we start with the medium term and then move to the short term. In both cases the main conceptual elements are presented and the empirical evidence is reviewed².

2.1. The medium term

A most firmly established behavioural relationship in *monetary theory* is that which links in the medium term the inflation rate, the growth of output and the rate of money growth. This relationship states that, on average, the rate of monetary expansion finances the trend growth of output and the sustained increase in the general price level. Thus, the inflation rate equals, on average, the rate of monetary expansion which exceeds that which is needed to finance the potential growth in the economy³.

While the above relationship necessarily holds in any economy, regardless of its economic structure, the concrete monetary policy strategy adopted by the authorities or the specific features of the monetary policy transmission mechanism, something else is needed to turn it into an explanation of the long-run effects of

² This section partially draws on Vinals (1998)

³ To be precise, trend changes in velocity should also enter into the relationship.

monetary policy in the economy. This “something else” is nothing more than the widely shared view that there is no medium-term trade-off that the authorities can exploit for increasing output at the cost of higher inflation. This general result hinges, in turn, on two very reasonable assumptions: that regardless of what the short-run situation is, economic agents eventually learn from their past mistakes and end up having a pretty good idea of how the economy works and, in particular, of the monetary policy being followed; and that prices and wages become fully flexible over time thus making it possible for goods and labour markets to fully clear.

While the above implies that over the medium term inflation is primarily a monetary phenomenon, and that central banks cannot increase output through engineering higher inflation, it must also be acknowledged that inflation may actually be detrimental to economic activity. Indeed, the belief that inflation entails costs to society’s economic well-being is certainly behind the widespread acceptance of the principle that the best contribution that monetary policy can make to society is to maintain an environment of price stability over the medium term.

As concerns the economic costs of inflation, it is generally assumed that such costs arise when the economy deviates over a prolonged time from what is a situation of price stability. Along with the well-known “shoe-leather” and “menu costs”, the most important costs are those that arise as a result of the impact of inflation within a tax, legal and contractual framework which is not fully adapted to it. In addition to these macroeconomic and efficiency costs, when inflation affects the public’s economic entitlements and obligations, a significant redistribution of income and wealth ensues which tends to affect adversely those segments of society with less knowledge and fewer resources to protect themselves against inflation.

Turning now to the *empirical evidence*, we first provide some justification for inflation being primarily a monetary phenomenon over the medium term and then briefly discuss what evidence there is on the costs of inflation.

Most studies confirm that over the medium term there is an extremely high correlation (almost unity) between the growth rate of the money supply and the

inflation rate⁴. Since in the present circumstances of deregulation and continuous financial innovation it is often difficult to identify which specific monetary aggregate corresponds most closely to the relevant concept of "money" or "liquidity", it is comforting that the above results hold for alternative definitions of "money". We have also looked at national macroeconomic trends with a view to evaluating how important monetary developments are in explaining cross-country differences in inflation over extended periods, taking into account that the inflation rate equals, on average, the rate of monetary expansion which exceeds the needs for financing the medium-term growth of the economy. This confirms that the existing differences among national inflation rates are mainly accounted for by different rates of expansion of liquidity in the various countries. This fact comes as no surprise if it is borne in mind that, generally speaking, average output growth rates recorded in highly diverse economies fluctuate within a fairly limited range -particularly in the industrial countries- while, by contrast, rates of monetary expansion vary considerably. To illustrate this point, Figure 1 shows the various inflation rates registered, on average, in the industrial countries over the last thirty years. Figure 2 displays the positive relationship between inflation and the rate of monetary growth in this group of countries during the period under consideration.

While this body of preliminary evidence is consistent with the traditional interpretation that it is monetary developments which lead to sustained price changes, in practice it may also occur that inflation is initially triggered by non-monetary factors (such as oil price shocks). Still, inflation cannot go on permanently unless it is accommodated by money creation⁵.

As regards the available evidence regarding the size of the economic costs of inflation, most of the existing analyses usually start from the assumption that, regardless of the ways in which inflation may adversely affect an economy, to be costly it should undermine per capita income over the medium term. Given the diversity of approaches, geographical coverage and time frame of the existing empirical studies, it should come as no surprise that their results differ considerably. Admittedly, most of these studies may be criticised owing to the fact that inflation and

⁴ See the recent survey by McCandless and Weber (1995), and also Lucas (1996).

growth are mutually determined variables in a general equilibrium framework. However, the results generated by those cross-country studies having a theoretical framework more firmly anchored in growth theory generally conclude that countries which enter into an inflationary process, even at moderate rates, never see an improvement in per-capita income prospects and have a high probability of experiencing a deterioration in such prospects⁶.

Very recently, the question of whether reducing inflation to go to price stability is also beneficial when starting from relatively low rates of inflation has been the subject of intense research. In particular, it is worth mentioning a recent study under the aegis of the National Bureau of Economic Research (NBER)⁷. The NBER project tries to approximate empirically on a country-by-country basis the net benefits of going from low inflation to price stability. The general conclusion is that industrial countries tend to experience in net terms significant welfare gains when achieving price stability even if the starting inflation rates are moderate, say, 4 to 5%. Consequently, it is our view that the empirical evidence is overall consistent with the widespread public perception that inflation erodes standards of living and economic welfare.

In sum, because, over the medium term, inflation is primarily a monetary phenomenon and because inflation entails significant economic costs, this explains the monetary authorities' concern, even in countries which have adopted highly divergent monetary policy arrangements, with reaching a rate of liquidity creation that is compatible with financing potential economic growth under conditions of price stability in the medium term.

2.2. The short term

It is in the discussion of the short-term effects of monetary policy where the complexities arise. In principle, in a world where prices and wages are fully flexible instantaneously, so that goods and labour markets clear continuously, and where private agents are reasonably well informed about the workings of the economy and

⁶ An alternative view, which postulates a fiscal theory of price level determination, has recently been proposed by Woodford (1996). According to this view, prices are determined by the condition that the intertemporal government budget constraint must be satisfied.

⁸ For recent surveys of the economic costs of inflation, see Fischer (1994). See Andrés and Hernando (1999) for new results.

⁷ See Feldstein (1999)

the nature of the policies implemented by the authorities, the medium term result also applies to the short term: monetary policy influences prices but leaves real economic conditions unaffected⁸.

Nevertheless, central banks know too well that, unfortunately, the reality is far from this idealised world, as revealed, for example, by the interest with which monetary policy decisions are awaited by the public, which would be very hard to justify if money were "just a veil". Moreover, the presumption that monetary policy has, at least under normal conditions, real effects on the economy over short horizons is rooted in the empirical evidence that we will be discussing later in the paper. The attempts theoretically to justify this presumption have been most important in furthering macroeconomics over the years⁹.

For the school of thought that believes that prices and wages are *fully flexible* in the short term, the main reason why monetary policy has temporary real effects is that it leads to misperceptions on the part of the public. Therefore, in so far as agents make appropriate use of all the information available to them to form expectations, monetary policy will have real effects only when it is unanticipated. As originally stated by Milton Friedman, Edmund Phelps and Robert Lucas monetary policy moves which are not anticipated by the public lead agents to misinterpret changes in the price level as changes in relative prices and therefore to modify their economic behaviour¹⁰. While in the short run this would be reflected in an insufficient adjustment of the general price level to the new prevailing monetary conditions and in a change in output, once agents learn and modify their expectations over time prices will eventually adjust fully and output will return to equilibrium in the medium term. By contrast, when monetary policy actions are fully expected by the public, agents will take this information into account when making decisions and monetary actions will lead to a full and instantaneous movement in the price level without any short-run output effects.

⁸ In what follows, it should be understood that monetary policy actions do not affect real variables over the medium term unless they permanently affect the rate of inflation.

⁹ For synthetic but very useful recent explanation of the main conceptual issues behind the existence of short-term monetary non-neutrality see, among others, Blanchard and Fischer (1989), Romer (1996), Mankiw and Romer (1991) and Walsh (1996).

¹⁰ The original contributions are those of Friedman (1968) and Phelps (1968), and they were subsequently theoretically founded by Lucas (1972). In later years, real business cycle models, like those building on the ideas of Kydland and Prescott (1982), attempted to explain the economy as driven by real as opposed to monetary factors, although as of late such models are also integrating monetary developments.

The immediate policy implications from the above are twofold: firstly, only monetary policy actions which are not systematic have a short-run influence on output, with a monetary loosening leading to an output expansion and viceversa; and secondly, systematic policy changes -which by definition are anticipated by the public- influence prices but not output in the short term. Consequently, the choice of the policy rule by the monetary authorities is of no consequence for short-run output developments, thus mattering only for price developments¹¹.

A problem with the practical relevance of the results from the 'flexible price-imperfect information' school is that it is hard to reconcile them with the facts. In particular, it is not easy to explain why monetary policy actions lead to a gradual adjustment of prices which lasts well after agents have become fully informed about the nature of such actions. Moreover, in practice, it turns out that monetary policy decisions lead to adjustments in instruments -like official interest rates- which do not behave erratically but follow smooth paths that are correlated over the business cycle with macroeconomic variables¹². Yet while this would suggest that most policy actions can be interpreted as systematic responses to the state of the economy rather than as exogenous policy shifts, according to the above-mentioned school only the 'non-systematic' part matters for the course of short-run output¹³. It thus becomes very difficult to understand why the public shows so much concern with monetary decisions, which in most cases are a systematic response to economic developments in pursuit of the central bank's final goal.

Properly understanding what happens in the real world becomes very difficult if it is not acknowledged that wages and prices are *not fully instantaneously flexible*, regardless of how well agents are informed about the nature of the policy actions¹⁴. While the microeconomic underpinnings of short-term wage and price stickiness are typically based on the existence of some reason which makes it costly for agents to change prices continuously in an imperfect-competition setting,

¹¹ These policy implications were originally developed by Lucas (1973), Sargent and Wallace (1975) and Barro (1976).

¹² See, for example, the Taylor-type rules estimated by Taylor (1993), and Clarida, Gali and Gertler (1997), which track the evolution of short-term interest rates quite well.

¹³ The empirical dominance of the systematic part is discussed, for example, by Leeper, Sims and Zha (1996) and McCallum (1999).

¹⁴ While some of the short-term effects of monetary policy on the economy can also be generated in a flexible-price environment by the existence of certain restrictions which limit the ability of economic agents to make financial transactions as, for example in Christiano, Eichenbaum and Evans (1996)- these explanations are not so well suited for understanding the dynamics of monetary policy effect on output and prices. This is why we do not deal with such "limited participation" models in the paper.

and while several such reasons may be debatable, we do seem actually to observe that wages and prices are not fully instantaneously flexible, due to the presence of long-term contracts, etc.¹⁵ As Solow once put it, while we do not understand why giraffes have very long necks, for practical purposes it is considerably more reasonable to assume that this is indeed the case rather than to assume that they have short necks.

Once the introduction of short-term wage and price nominal rigidities is allowed, then it follows that both systematic and unsystematic monetary policy actions will have a temporary effect on output. Yet, it will still be the case that as wages and prices fully adjust over time, output will come back to its starting level. According to Blanchard and Wolfers (1999), "hysteresis" effects may be present and thus, under certain circumstances, there may be a permanent effect on output. Nevertheless, we consider as much more plausible that monetary policy affects output in a prolonged fashion but not permanently unless the rate of inflation is permanently increased, in which case there will be permanent economic costs. Thus, the policy implications from the 'imperfect price flexibility' school are twofold: monetary policy actions temporarily impact output regardless of whether they are systematic or not; and the choice of policy rule by the monetary authority is relevant for the short-run course of both prices and output.

Moreover, it should be recognised that not only nominal price and wage rigidities but also *real or, in general, structural rigidities* are important for assessing how monetary policy impacts the economy. Indeed, if we lived in a world where only real or structural rigidities were present, this would imply that monetary policy were totally powerless to have any transitory effect on real output, merely affecting wages and prices instantaneously without modifying real wages or any other relative price in the economy. Interestingly, in such an extreme setting, the policy implications would be rather similar to those of the "flexible price-imperfect information" school. However, if it were the case, as seems much more likely, that nominal and real rigidities do coexist, then the policy implications turn out to be

¹⁵ The traditional references are Fischer (1977), Phelps and Taylor (1977) and Taylor (1979). "Menu costs" were originally put forward by Akerlof and Yellen (1985) and Mankiw (1985). See also Caplin and Spulber (1987), Blanchard and Kiyotaki (1987), and Ball and Romer (1991).

qualitatively similar to those of the "imperfect price flexibility" school¹⁶. For this reason, in the rest of the paper we group all rigidities under this school.

Because things may not really be either black or white, as implied by the schools of thought reviewed above, it may be useful to come up with an integrated view more closely tailored to the actual needs of monetary policymakers. From this angle, the main implication of what was discussed in this section is that the more rapidly agents adjust their inflationary expectations and the more flexibility there is in the setting of prices and wages, the greater the impact of systematic monetary policy actions on prices with lower or no temporary output effects. This is so because the better agents understand the policy pursued and the more confident they are that the authorities will stick to it, the more intense and rapid will be the adjustment of expectations. And because, when goods markets are highly competitive and the labour market is flexible enough to permit the rapid adjustment of wages, prices will also respond faster and there will be lower output effects in the short term. In these circumstances, it will also be the case that the capacity of monetary policy to influence real economic conditions will be increasingly limited to unexpected or unpredictable policy shifts.

Finally, it could be argued that there are also a number of factors that have to be properly taken into account when studying the transmission mechanism of monetary policy and which are associated with the complexities of modern financial systems. Still, in our view, the stylised description provided so far in this section concerning the reasons why monetary policy may temporarily affect output captures the key issues to be borne in mind when analysing the empirical evidence and discussing its policy implications. For this reason, we now turn to discussing the empirical evidence on the short-term effects of monetary policy.

¹⁶ See Goodfriend and King (1997) for a discussion of this issue.

2.3. Empirical evidence on the short-term effects of monetary policy

2.3.1 Existing Evidence

The *existing empirical literature* that attempts to characterise the effects of monetary policy on the economy uses either structural or reduced-form models. In the first case it is sought to isolate the various channels of monetary policy transmission by specifying the agents' behavioural equations -like, for example, the consumption, investment or wage equations-. In the second case, an attempt is made properly to distinguish the unexpected component of monetary policy from other sources of uncertainty in the economy¹⁷.

Central bank analysts usually rely on large macroeconomic models to study monetary policy effects. The multi-country model from the US-Federal Reserve Board (called FRB/MCM) is an example of this type of structural model¹⁸. The model ensures its long-run stability by imposing convergence to a balanced growth path and makes explicit the treatment of expectations for each of the G7 countries considered. The monetary policy simulations carried out with the model suggest that output effects take place within the first two years and are thus transitory. Although there are not large disparities among countries in the magnitude of these effects, it is true that the maximum occurs earlier in time in continental Europe than in the US and the UK: the peak effect on output is within the 4th-6th quarter in continental Europe and within the 6th-8th quarter in the US and UK. The maximum effects on inflation appear with a lag of a few quarters with respect to the maximum output effect and become insignificant after three years.

The 'hump-shaped' pattern for output and the slower responses of prices obtained with the above model are also found by other models that incorporate some form of rational behaviour in the financial sector. In this vein, Taylor (1993) also considers the existence of staggered wage setting which implies that the expected excess demand in the economy affects the current course of wages. The relevant role played by forward looking behaviour in the model generates an output

¹⁷ See Friedman (1995) and Walsh (1998) for other reviews of the existing evidence.

¹⁸ The BIS (1995) conducted a study to analyse the transmission of monetary policy that includes some simulation results under that FRB/MCM model and under other central bank models.

peak effect within the first year for most countries. Consistent with the FRB/MCM simulations, he also reports some cross country differences in the impact and in the peak effect on output.

While structural macroeconometric models usually have a very detailed description of the transmission mechanism, the way monetary policy is conducted may also influence how it impacts the economy. Clarida, Gali and Gertler (1997) estimated policy reaction functions for the G3 countries after 1979. They found that the data was consistent with a forward looking behaviour of policy where interest rates mainly respond to expected moves in inflation with some weight being also given to output changes. Moreover, this systematic behaviour tracks quite well the observed movements in actual short-term interest rates. This evidence is consistent with that discussed in Sims, Leeper and Zha (1996) and in McCallum (1999), overall suggesting that the systematic part of policy accounts for most of the changes observed in monetary policy instruments, the role of policy shocks being rather minor.

In a recent contribution, Dornbusch, Favero and Giavazzi (1998) estimated monetary policy rules for six large European economies and measured their effect on output. Although they do not specify a complete model, since their goal is to ascertain whether monetary policy has different effects across the euro area, they control for two important effects: changes in intra-European exchange rates and simultaneity in the determination of monetary policy and output. Their results point to the existence of significant short-run output effects of the systematic part rather than the unanticipated part of the monetary policy. Contrary to the structural model results, they also find relevant cross-country differences over a two-year horizon in the output effects of systematic changes in interest rates.

Vector Autoregressions (VARs) are reduced-form models that explicitly recognise the importance of the endogeneity of economic variables for studying the effects of monetary policy. The main analyses in this area have attempted to properly identify the unanticipated disturbances that may be due to monetary policy from others sources of disturbance in the economy (i.e. supply shocks or real demand shocks).

The work by Sims (1992) presents evidence on the effects of monetary policy for the five largest OECD countries. The identification of the shocks needs to assume some informational restrictions among the contemporaneous actions of private agents and the central bank¹⁹. He finds that in all countries there are significant negative responses of output to positive innovations in interest rates. The size of those responses varies across countries but the sign and the form does not. Although the output response has a "hump-shaped" pattern, similar to that found with the structural models, it is more persistent. The paper also reports some responses that do not fit well with the usual textbook interpretation of the impact of money shocks. For instance, the responses of prices are initially positive or insignificant and only take negative values after a year or so (the so-called "price puzzle")²⁰.

An alternative way of identifying monetary policy shocks is to impose long-run restrictions consistently with a vertical Phillips Curve. Gerlach and Smets (1995) considered this type of identification in a VAR with output, prices and short-term nominal interest rates to isolate monetary shocks from aggregate demand and supply shocks for each of the G7 countries. Nevertheless, this alternative identification does not change the general message in terms of the effects of monetary policy actions on output and prices.

More recent papers identifying monetary policy shocks have gone further in examining the implications of policy endogeneity. Sims (1992) originally suggested that "price puzzles" could be explained by systematic pre-emptive responses of the monetary authority to inflationary pressures that were not considered in his VAR model. Grilli and Roubini (1996) and Kim (1996) considered innovations of interest rates as money supply shocks and identified them separately from money demand shocks. They also considered explicitly the possible contemporaneous responses of monetary policy to inflation expectations arising from exchange rates or foreign commodity prices. Their results show that with such a structural identification the

¹⁹ See Christiano, Eichenbaum and Evans (1998) for a recent overview of the identification of exogenous monetary shocks and Cochrane (1998).

²⁰ Furthermore, on impact the domestic currency in some European countries depreciates instead of appreciating to be followed by a persistent depreciation. These results are referred to as the 'exchange rate puzzle' and the 'forward discount bias puzzle'.

price puzzle disappears for most of the G-6 countries considered: after a monetary tightening, prices decline smoothly and significantly²¹.

Monetary policy operates in the structural models through a liquidity effect on the interest rates. That means, for example, that in the FRB/MCM model the cost-of-capital channel on investment is the most important channel of monetary policy transmission (along with the exchange rate that operates also via interest rate differentials). Moreover the size of this effect in the MCM model is comparable across the European countries and the US. The theoretical literature has also defended a special role for credit as an additional channel of monetary transmission because of the existence of asymmetric information in the financial markets. The VAR results (see Bermanke and Blinder (1992)) show that after a positive innovation of interest rates, bank deposits initially decline more than bank loans but over time the decline in loans is larger. More importantly, as shown by Bacchetta and Ballabriga (1999) this behaviour seems to be very similar across all the European countries and the US but the size of the decline differs from country to country.

All the VAR studies mentioned above found that monetary policy shocks, although they have significant short-term real effects, account for only a small fraction of output variability. A variance decomposition of the forecast error at different horizons shows that, independently of the identification criteria or the selected information set, policy shocks do not account for more than 10% of the variations in output. Of course, this is an average across the selected sample period and thus it is possible to find certain periods in which such a percentage is larger. Moreover, the studies across countries do not find significant differences in the importance of monetary policy shocks in explaining output.

To summarise, the empirical evidence on the short-run effects of monetary policy is broadly the following: (a) there is a 'hump-shaped' pattern for output that reaches a maximum between the 4th and 8th quarters; (b) prices show a sluggish response with a maximum effect that appears later than the output effect; (c) the unanticipated component of monetary policy does not explain more than 10% of output variability; and (d) the diversity of institutional arrangements across countries

²¹ In addition, exchange rates appreciate on impact followed by a continuous depreciation.

may induce differences in the size of the effects but those seem more readily identifiable with the systematic part than with the non-systematic part of monetary policy.

2.3.2 Some new evidence

Besides providing a compact summary of what we consider to be the more relevant existing evidence on the impact of monetary policy, in what follows we supply some *further results* using two alternative models: a widely-used European structural macroeconomic model, the National Institute Global Econometric Model (NIGEM) and a reduced-form model (VAR). The NIGEM model applies to an area made up of the EU11, so as to match the euro zone. The VAR models are estimated both for the euro area and the US. Although the exercise is based, in the case of the euro area, on historical estimations under a common monetary policy that did not exist before 1999 and are thus subject to the Lucas critique, the results may nevertheless be illustrative of what the average responses were. Moreover, while the structural model can be useful for addressing the consequences of both anticipated and non-anticipated monetary policy changes, the reduced-form VAR model can mainly shed some light on the latter.

The simulations presented in Figure 3 use the NIGEM macroeconomic model. This model is characterised by forward looking financial markets and the existence of imperfectly flexible wages and prices in the short term. An important advantage of NIGEM is that although it separately models the national economies of the 11 countries in the euro zone, it can nevertheless be used to simulate the effects of a common monetary policy.

The left hand side of Figure 3 shows the impact of a non-systematic monetary policy change on output and prices: from a baseline of fixed interest rates we assume an unexpected 1% rise in short-term nominal interest rates that last for one year. Output and price responses in the euro area are a weighted average of the responses for each EU-11 country. As can be seen, output starts falling from the first quarter and reaches a maximum value between the 4th and 5th quarter; this effect becomes negligible after three years. In contrast, prices do not start falling

significantly until the second year and the maximum effects occur after the third year.

The right hand side of Figure 3 shows the effects of a systematic monetary policy change: according to NIGEM, the policy rule of the ECB could be characterised as maintaining nominal stability through movements in its short-term nominal interest rate to the observed deviations from the objective. In this case, we assume that monetary policy responds to the inflationary pressures resulting from an autonomous consumption increase of 1% during one year in all the euro countries. What we present in the figure are the differences in the economic impact of the shock depending on whether the policy rule is activated (thus making short-term interest rates respond to the state of the economy) or not (whereby short-term interest rates remain constant). As observed in Figure 3, although the size effects are smaller than with an unanticipated interest rate change, the important observation is that the real output effects directly attributable to the monetary policy response occur later in time than in the non-anticipated case. Nevertheless, under both types of monetary policy actions, the output effect starts to disappear after the second year.

We also provide alternative evidence from the estimation of a VAR model for the euro area as well as for the US. The purpose is to characterise the effects of an unanticipated monetary policy shock in both areas. The continuing lack of a sufficiently ample historical data base for the euro area as a whole limited us to including only the following aggregate variables in the model: output, prices, short-term nominal interest rates, and M3 as the monetary aggregate²². We also considered a world commodity price index as an additional variable to control for inflationary pressures from outside the area. For the US, we considered the same variables but using M1 as the relevant monetary aggregate. The sample period is 1980:1-1998:4.

We followed a 'classical' identification of the monetary shocks. The recursive structure assumes that the central bank observes current prices, both domestic and from abroad, as well as the current level of activity within the quarter before

²² The euro area data for output, prices and nominal interest rates has been taken from the BBV data base, and for M3 from the ECB.

deciding the tone of monetary policy. Figure 4 shows the responses of interest rates, output and prices to an identified money supply shock in the US and in the EU-11. The shock is normalised to be equivalent to a percentage point interest rate change.

As shown in Figure 4, an unexpected monetary tightening in the US leads to reductions in both output and prices. In particular, output starts falling after the second quarter and its maximum effect is in the 4th quarter, the effect vanishing after two years. Prices start falling smoothly after the 3rd quarter and the maximum drop appears in the second year. These results are consistent with those found in the literature, with alternative identifications and sample periods, and which are summarised above.

The responses for the aggregated European variables to a common monetary policy shock appear in the right-hand column of Figure 4. While the magnitude of the responses differs from those observed in the US, the direction of the responses is nevertheless the same: both output and prices fall, with output responding in advance to prices. From this last piece of evidence it can be concluded that, based on the historical estimates presented, as far as the euro zone is concerned, monetary policy actions seems to have their maximum effect on output after the 6th to 10th quarters, this effect not lasting more than three years. As for prices, they adjust in a gradual manner, starting after the first year of the monetary policy impulses. Therefore, these tentative empirical results are broadly similar to those found in the literature by other studies for individual European countries. Compared to the US, the output impact of monetary policy in the euro zone seems to be quite smaller and to happen later, thus suggesting that the real effects of monetary policy actions are more limited in the European case²³. The reasons why this is so are certainly worth exploring.

²³ Recently, Monticelli and Tristani (1999) have also noticed that European inflation responds more persistently than in the US to monetary shocks.

2.3.3 What we know and what do not know about short term effects

Although the empirical evidence reviewed does not claim to be exhaustive, it yields several results which are useful for central bankers when assessing the consequences of their policy decisions.

Firstly, the international evidence both from structural and reduced-form models suggests that while monetary policy actions only influence nominal variables in the medium term, they nevertheless impact real variables in the short term, albeit with differing degrees of intensity across countries and economic areas.

Secondly, following a monetary policy tightening output displays a “hump-shaped” pattern²⁴. In particular, there seems to be a gradual decline in output which reaches its peak typically after 4 to 8 quarters, before it starts progressively to return to its original situation as prices adjust and/or the policy change is reversed. In general, a large part of the initial output effects disappear after 8 to 12 quarters. As far as prices are concerned, they respond with longer lags than output, the fullest effect on prices occurring with a lag of two years or longer.

Thirdly, it seems that monetary policy actions have transitory output effects both when they reflect the systematic response of the authorities to the economy and when they correspond to exogenous policy shocks which depart from this pattern. Yet, at least for continental Europe, it is found that the output effects of systematic or anticipated monetary actions take longer to be felt than those resulting from policy shocks.

Fourthly, in practice it turns out that movements in monetary policy instruments typically correspond to responses by central banks to the state of the economy, exogenous policy shocks playing only a relatively small part. This feature -which reflects the prevalence of systematic or expected policy changes relative to unexpected changes- should not come as a surprise once it is recognised that policy decisions are normally guided by the specific monetary policy strategy with which the central bank tries to fulfil its final goal.

²⁴ In this section we take the example of a policy tightening. Clearly, the same results apply to a policy easing, although the directions in which variables move will be opposite.

Finally, in general, it seems reasonable to expect that the short-term effects of monetary policy on output will be smaller, the higher the credibility of the monetary authority and the degree with which private-sector expectations adjust, and the faster the adaptation of wages and prices to the changing monetary conditions.

In principle, these results appear to be quite reasonable and in fact may not be that far from what central bankers of many countries consider, based on their actual experience, to be a plausible description of reality. Still, beyond this it would be much harder to find any agreement concerning what the precise timing and magnitudes of the output and price effects of monetary policy are. As is well known, monetary actions are transmitted with relatively long and variable lags which differ not only across countries but also across time. In particular, the 'typical' responses estimated by econometric models correspond to the normal conditions prevailing in the economy over relatively long periods of time. Consequently, they may not be applicable under specific or new circumstances which depart, in one way or another, from what is considered to be normal from a historical perspective.

Furthermore, even the more widely acceptable empirical regularities which were listed earlier have to be used cautiously in a policy environment since they come from econometric models with certain limitations. As is well known, structural models generally rely on a priori assumptions on how the transmission mechanism of monetary policy works which may artificially bias the estimated responses of output and prices to official interest rate changes. Furthermore, such models are subject to the Lucas critique and are in general not prepared to handle issues related to the credibility of monetary policy which, in practice, are of fundamental importance for how private agents respond to the policy change. As concerns reduced-form models, while they are well suited for giving information mainly on the impact of the non-systematic part of monetary policy, the economic interpretation of the policy simulations performed with such models frequently relies on a priori assumptions on 'what precedes what' that are debatable and which, if changed, may modify the simulated responses in significant ways. Finally, policy exercises performed with these models may be quite sensitive to the specific set of economic

variables considered, the addition of an extra variable often having important effects on the results²⁵.

3. IMPLICATIONS FOR THE CONDUCT OF MONETARY POLICY

After having reviewed the evidence on the impact of monetary policy on the economy we now turn to discussing the implications which follow from the less controversial aspects of such evidence for the conduct of monetary policy in today's world. The focus is on whether the existence of short-run real effects can and should be exploited by central banks, and on what adaptations should be made to take into account how differently monetary policy may operate in a low inflation, low interest rate environment.

3.1. Can and should the existence of short-run real effects be exploited by monetary policymakers?

Although our summary of the international evidence concluded that monetary policy generally influences the short-run behaviour of real variables -albeit with an intensity which varies significantly across countries and, presumably, also depending on circumstances-, caution should be exercised when extracting policy implications.

On the one hand, knowledge about the existence of transitory real effects from monetary policy actions can and should be used by central banks -albeit prudently- for steering monetary conditions, so that price stability over the business cycle is maintained and, without prejudice to it, economic activity is promoted whenever necessary. Yet policymakers have to take into account the uncertainties surrounding the transmission mechanism of monetary policy to the economy, so as to avoid any sort of fine-tuning nor the well-known problems of instrument instability. If the central bank succeeds in prudently conducting monetary policy, the outcome will be an environment of price stability which is conducive to growth.

²⁵ See Friedman (1995) and Walsh (1998), among others, for a critique of structural and reduced-form models.

An entirely different matter, however, is whether the evidence on the short-run effects of monetary policy on output can be used to achieve, through an expansionary policy, a consistently higher output level or growth rate, on average, than warranted by potential. Here, the answer is certainly “no”²⁶. Indeed, even if the continuous pursuit of a more expansionary monetary policy stance than would be required to maintain price stability can at best stimulate output temporarily, it leads for sure to higher inflation which -as discussed in Section 2.1- entails significant permanent economic costs.

In principle, recognition of this outcome should be enough to deter any central bank from conducting monetary policy in an activist manner. Still, to make sure that the risks of engaging in such inappropriate policy are minimised, in recent years it has been deemed advisable to do something to counter the other factors which also contribute to exacerbate temptations in this domain. In this connection, in addition to the pleas by central banks to the economic authorities for them to remove the structural rigidities and distortions hindering an appropriate working of goods and labour markets -something which applies particularly in the European context-, recent changes in central banking legislation in many countries –and particularly in Europe- have placed price stability as the primary goal of monetary policy and have given the central bank full independence to effectively pursue this goal²⁷. These principles - which are enshrined, for example, in the Statute of the European Central Bank- seek to avoid the risks of short-term subordination of price stability to other policy goals, and allow monetary policy decisions to be adopted with a sufficiently long horizon and independently of the political cycle.

To conclude, a sensible reading by central bankers of the evidence on the short and medium-term impact of monetary policy would be that while the medium-term monetary stance must be set consistently with the maintenance of price stability, this does not preclude exercising a certain margin of flexibility to respond to macroeconomic disturbances in the short run, provided this does not jeopardise the primary goal of price stability. An important practical question is which strategic policy framework best accomplishes these aims.

²⁶ The seminal contributions in this literature are Kydland and Prescott (1977), and Barro and Gordon (1983).

²⁷ See, for example, Goodhart and Vinals (1994).

3.2. Implications for monetary policy practice

At the risk of oversimplifying what has proven to be an arduous and complex process in many countries, recent developments in monetary policy strategies may be said to have been marked by the endeavour to find a framework capable of blending rigour and discipline in the medium-term monetary policy stance with certain margins of flexibility to respond to macroeconomic disturbances in the short run.

This endeavour of monetary authorities reflects the desire to avoid two sorts of difficulties. On the one hand, the dynamic inconsistency problems arising from an excessively discretionary management of monetary policy, which -as explained- make it virtually impossible to achieve and maintain price stability. And, on the other, the drawbacks associated with fixed or rigid rules which, by predetermining the course of monetary variables, leave no scope for monetary policy to play the welfare-improving role of reacting to certain macroeconomic disturbances.

While this "search for the lost nominal anchor" has already crystallised out into the widespread acceptance that price stability should be the primary goal of monetary policy and that the central bank should be granted independence to effectively pursue this goal, this commonly accepted institutional framework is nevertheless complemented by alternative strategic frameworks in different countries and monetary areas. This is reflected, for example, in the 'implicit' strategy chosen by the Fed, the direct inflation targeting strategy of the UK, Canada and Sweden, the monetary targeting strategy which prevailed until recently in Germany, and the stability-oriented strategy adopted by the European Central Bank. Still, while formally different, in practice the central banks which follow these alternative strategies look at broadly similar sets of information variables and make interest rate decisions that are rather similar when faced with similar economic circumstances²⁸. Lastly, some features which are common to all these strategies can be rationalised in terms of the empirical evidence which was provided earlier in the paper.

A first such feature is that all of these strategies are forward looking, in the sense that policy reacts in anticipation of prospective economic developments. This is

²⁸ On this issue, see EMI (1997), Clarida, Gali and Gertler (1997) and Laubach and Posen (1997)

only natural once it is recalled that monetary policy affects prices gradually, so that it becomes important to react with enough lead-time, for example, to changes in the price outlook so as to avoid a future departure from price stability in whichever direction. Furthermore, since in practice recessions are very often preceded by significant increases in inflation, keeping inflation from rising through an appropriate forward-looking use of monetary policy is of paramount importance so as to have, on average, more stable output and employment conditions. Indeed, it is the view in most central banks that interest rates should be adjusted in a timely manner whenever there are signs of persistent inflationary pressures, so as to avoid having to increase such rates by larger amounts later on, with the correspondingly higher output costs. Yet, a well-known practical problem is that what may be clear to the central bank may not be so apparent to the public if inflation has not yet risen. Consequently, to avoid the risk of delaying taking the appropriate policy measures for fear of them not being socially understood nor accepted it is most important that central banks explain in a clear and transparent manner the reasons why the measures are being taken.

A second feature is that central banks typically tend to adjust monetary instruments gradually, so as to avoid sudden reversals, for example, in the path of interest rates. This is consistent with the by now generally accepted empirical finding that most monetary policy actions consist of smooth responses to the state of the economy rather than exogenous policy shifts²⁹. Were the latter to prevail instead, it would be frequent to encounter sudden increases in interest rates followed by sudden decreases, rather than the gradualistic interest rate movements which are observed in reality, and which are furthermore consistent with the relatively smooth course of prices and output over the business cycle.

A final feature is that while all these strategies are firmly oriented in the medium term to the maintenance of price stability, in the short term they also adapt somewhat flexibly to respond to macroeconomic disturbances which affect output. This would be warranted, for instance, insofar as central banks' objectives included the promotion of output on an equal footing with, or subordinated to, price stability. Moreover, even for those central banks which have price stability as their only goal, it will always be appropriate to take into account the behaviour of real variables -like

²⁹ On the variety of reasons which may behind the interest rate smoothing observed in practice see Brainard (1967), Goodfriend (1991), Goodhart (1996), Blinder (1998), and Woodford (1999)

output- when deciding whether official interest rates ought to be adjusted, since such behaviour is generally informative about the price outlook³⁰. Indeed, since the empirical evidence suggests that, in general, output adjusts somewhat faster than prices in the presence of demand shocks -and, in particular, of monetary shocks-, the course of output may signal to policymakers with some anticipation how prices may move later on. This would help in assessing whether further official interest moves are likely to be needed to reach the intended price objective.

While it is of interest to note that there are key features common to the various monetary policy strategies employed in different countries and that -as earlier mentioned- central banks tend to look at broadly comparable sets of information and make interest rate decisions that are broadly similar when faced with similar circumstances, it would be mistaken to conclude that the alternative monetary policy strategies are equally effective. Indeed, given the imperfect knowledge that we have on how the economy works, the most suitable strategy will be that which, while adopting a medium-term perspective, tends to work well across different models of the economy, can cope with shocks from different sources, and can be clearly and transparently communicated to the public, thus effectively anchoring price expectations.

3.3. Some uncertainties regarding the impact of monetary policy in a low inflation, low interest rate environment

The policy issues discussed so far in the paper have been addressed bearing in mind the empirical regularities characterising the workings of the economy in the past. Yet central banks of industrial countries are faced at present with the challenge of having to conduct policy in an environment of low or very low inflation and interest rates. While in the case of the US this challenge must be met in the context of a very dynamic economy, in the euro area growth is envisaged to be rather more subdued. In Japan, in contrast, not only are interest rates extremely low but the economy remains depressed and prices are actually falling. Consequently, it becomes very important for central bankers to ascertain to what extent monetary policy actions can be trusted to have similar effects in the short

³⁰ On this issue, see Vickers (1998), King (1998) and Svensson (1999).

term to those observed in normal times in the present environment of low inflation and interest rates.

Certainly, the concept of a "liquidity trap" is an old one. Still, it may be worthwhile to revisiting it in a context such as that faced today by central bankers, characterised by the existence of considerably sophisticated financial markets and globalisation. For this reason, and without wishing to engage in a full discussion of what is certainly a complex issue, in what follows we try to speculate on how such an environment may influence what are typically regarded as the main blocks of the monetary transmission mechanism. In doing so, we discuss the transmission of movements in official interest rates to market interest rates, the effect of changes in market interest rates on private spending, and the impact of spending on prices and output.

Starting with the impact of official interest rates on market rates, it is widely recognized that movements in official rates impact the economy all the more the fuller their repercussion on the various maturities of the term structure of interest rates and, ultimately, on long-term rates. Thus, insofar as both short-term nominal and real interest rates and inflation are considered by markets to be at historical lows in a context, for example, of sluggish economic growth, a further interest rate cut may not trigger as significant a reduction in long-term yields -and could in some cases even generate increase- if markets perceive this cut to be the last one or likely to be reversed in the future. On the other hand, the impact of, say, an interest rate cut on the term structure will generally also depend on how credible the monetary policy is in the eyes of market participants. Thus, if price stability were sufficiently well established so as to make markets confident that central bank actions were always in line with the maintenance of price stability, they would regard the interest rate change as sustainable and would not raise their inflationary expectations. Consequently, one would expect the downward movement in the term structure of nominal and real interest rates to be larger compared to a situation where price stability were absent to begin with or not yet sufficiently consolidated. Which of these two opposing forces may prevail remains an open question worthy of further study.

As concerns the banking system, lending interest rates might respond less to a cut in official rates in an environment where initial rates are already very low and there is no room for deposit rates to fall much further (in fact, many forms of deposit are remunerated at zero or close to zero rates). The reason is that, in such a case, an interest rate cut could make banks much more reluctant to decrease lending rates for fear of excessively squeezing net interest margins and eroding profitability.

There may also be specific environments characterised by very low nominal and real interest rates and depressed -rather than sluggish- economic conditions where further cuts in interest rates, even if still possible without turning negative, might be quite ineffective in stimulating the economy through the interest rate channel. This would be the case, in particular, if there were severe problems in the banking system making banks extraordinarily reluctant to lend to the public given the considerable credit risks involved. While this does not refute the fact that a monetary easing may still stimulate spending by inducing, for example, an exchange rate depreciation which boosts exports, the total size of such stimulus will likely be smaller since the traditional interest rate effects will not directly help demand due to the existence of a "credit crunch".

In a low interest rate environment there is also the question of whether -for a given impact of the official interest rate change on market rates- the repercussions on private spending may differ from what would happen under other circumstances. Specifically, whenever the starting cost of capital is already sufficiently low, it may be hard to find investment projects that are not undertaken to begin with but which would be were the cost of capital to fall further. Therefore, a given size reduction in official interest rates, starting from a very low level, might stimulate private spending by less than if the starting situation had been characterised by the prevalence of a higher cost of capital.

In turn, the way that a given change in spending is split into price and output changes may also depend on the initial inflation rate. In this regard, it has been pointed out that, as inflation reaches progressively lower values it becomes harder and harder to reduce it further, implying that the short-term Phillips Curve becomes

flatter at low rates of inflation³¹. While this assumption is broadly supported by the experience of those countries which underwent disinflationary processes starting from high or very high inflation rates, it nevertheless remains very controversial as concerns the experience of industrial countries, which started their disinflation processes from significantly lower inflation rates. Certainly, the experience of various European countries -like Spain, Italy, Portugal and Greece- in recent years shows that reducing inflation even from moderate rates has not been costlier than in previous disinflation episodes; quite the contrary, although it has to be recognised that favourable supply shocks may have helped. Still, it is worth studying further whether the existence of low inflation rates -likes those prevailing today- may affect in other ways the short-term impact of monetary policy on the economy, and also the extent to which things may differ depending on whether the low inflation environment is more or less consolidated.

Finally, it should be acknowledged that the actual effects of monetary policy on the economy may also differ depending on whether the policy move involves an easing or a tightening of monetary conditions; something which Milton Friedman referred to a long time ago when saying that "You can pull a string but cannot push it". In this regard, it is worth noting that the reasons put forward in this section concerning why an easier monetary policy may not be as effective in stimulating demand in a context of low interest rates and a sluggish or depressed economy, also suggest that a policy tightening -were it to be required to preserve price stability in a more dynamic economic setting- may still be quite effective in slowing down the pace of demand. In particular, an official interest rate increase will more readily be reflected in higher lending rates -which reduce the demand for loans-, it will lead to a contraction in the actual supply of loans, and the higher cost of capital will dent private spending. As concerns the split of the resulting changes in spending into prices and output, insofar as wages and prices tend to show a higher degree of flexibility in an upward than in a downward direction due, for example, to the desire of economic agents to avoid losses in their real incomes, the demand

³¹ See Akerlof, Dickens and Pery (1997).

stimulus from a monetary easing may be reflected less in output increases, and the demand contraction from a tightening may be reflected more in output decreases³².

To summarise, this section has sought to explain how the short-term impact of monetary policy on the economy may differ in specific circumstances like those prevailing today, which depart from those observed, on average, during the period over which such impact was observed or estimated with the help of more or less sophisticated econometric models. Since this may influence significantly the absolute and relative sizes of the short-run effects on output and prices, it shows how important it is that when making policy decisions central banks take fully into account not just what the current state of the economy is and what forces are shaping it but also the envisaged direction of the policy move. This notwithstanding, on the basis of the reasoning put forward it may be concluded that, in the present environment of low inflation and interest rates, a monetary policy easing may actually be less effective in promoting economic activity than under different circumstances, even when such a move does not jeopardise price stability. However, this is a highly speculative conclusion that needs to be further scrutinised.

4. CONCLUSIONS

This paper has tried to deal with an old issue which nevertheless continues to be of great relevant for central bankers: the impact of monetary policy on the economy. The empirical evidence discussed in the paper suggests that since, over the medium term, inflation is primarily a monetary phenomenon and entails significant economic costs, the best contribution that monetary policy can make to society's welfare is to maintain price stability. Still, over the short-term, monetary policy seems to affect real economic variables regardless of whether policy moves are systematic responses to the state of the economy or exogenous shocks, presumably as a result of the coexistence of nominal and real rigidities.

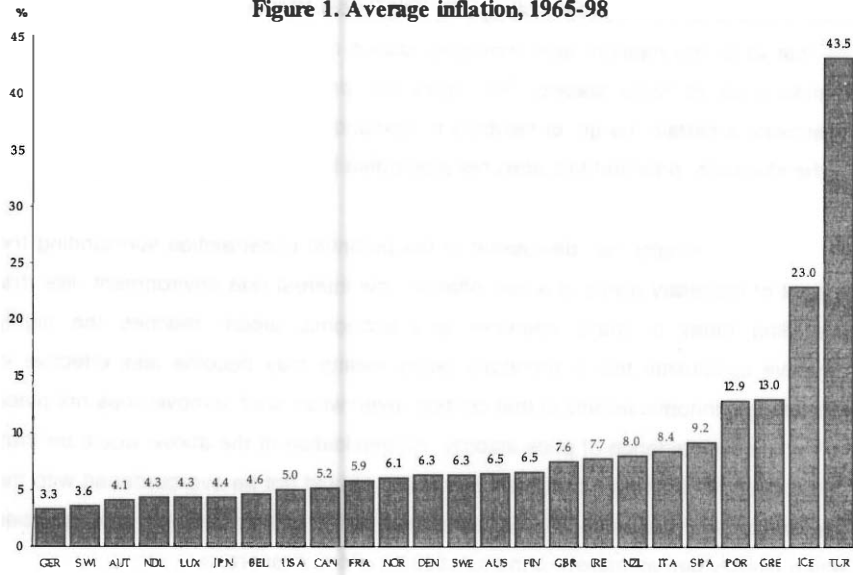
While these general results appear quite reasonable, beyond this it would be much harder to find any agreement concerning what the precise timing and magnitudes of the output and price effects of monetary policy are over the short-

³² Cover (1992) and Garcia and Schaller (1995) provide evidence in favour of the hypothesis that monetary policy impacts output more when it tightens than when it eases.

term. From a central banker's viewpoint, a sensible reading of the evidence would be that while the medium-term monetary stance must be set consistently with the maintenance of price stability, this does not preclude central banks prudently exercising a certain margin of flexibility to respond to macroeconomic disturbances in the short-run, provided this does not jeopardise the primary goal of price stability.

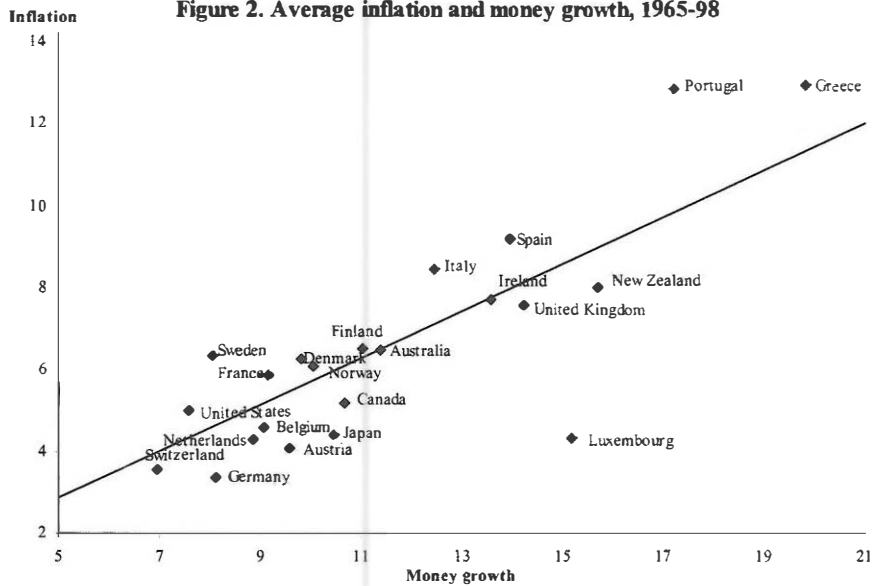
Finally, our discussion of the potential uncertainties surrounding the impact of monetary policy in a low inflation, low interest rate environment -like that prevailing today in many countries and economic areas- reaches the highly tentative conclusion that a monetary policy easing may become less effective in promoting economic activity in that context, even when such a move does not place at risk the maintenance of price stability. An implication of the above would be that, in the present circumstances, monetary policy should not be overburdened with the responsibility of solving problems which are better tackled through other policies which directly aim at improving the functioning of the economy.

Figure 1. Average inflation, 1965-98



Source: OECD.

Figure 2. Average inflation and money growth, 1965-98

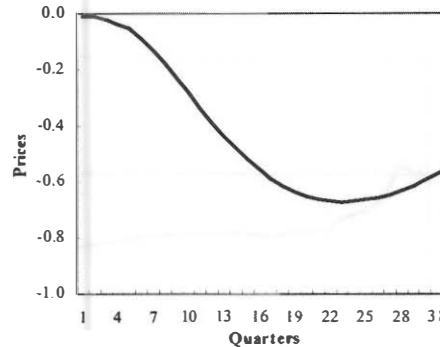
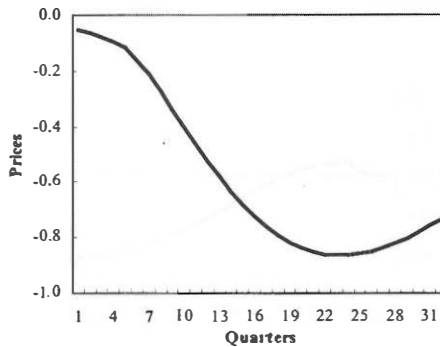
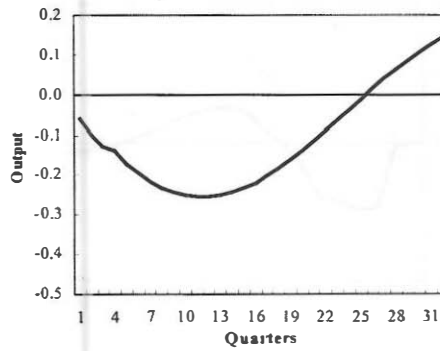
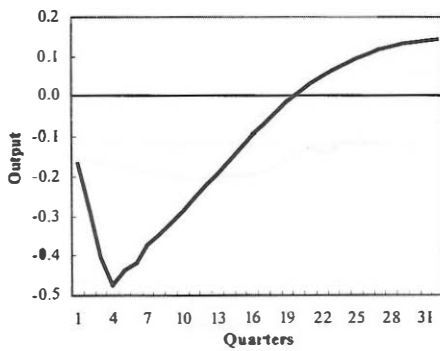
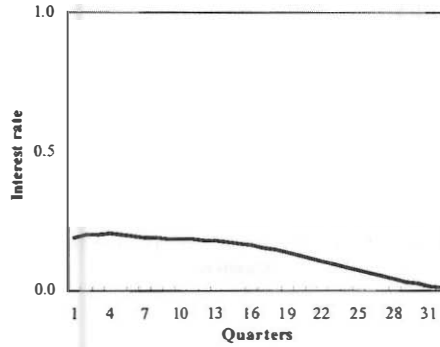
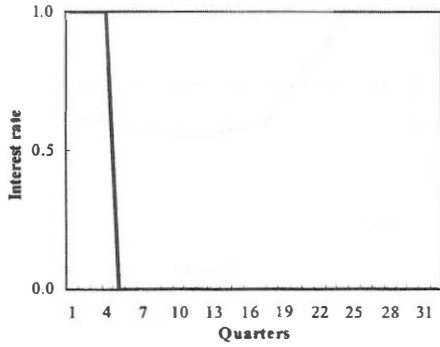


Source: OECD and IMF.

Figure 3
The non-systematic and systematic effects of monetary policy in the EU-11
(NIGEM model)

The non-systematic effect: 100 basis point exogenous increase in the short-term nominal interest rate maintained for one year

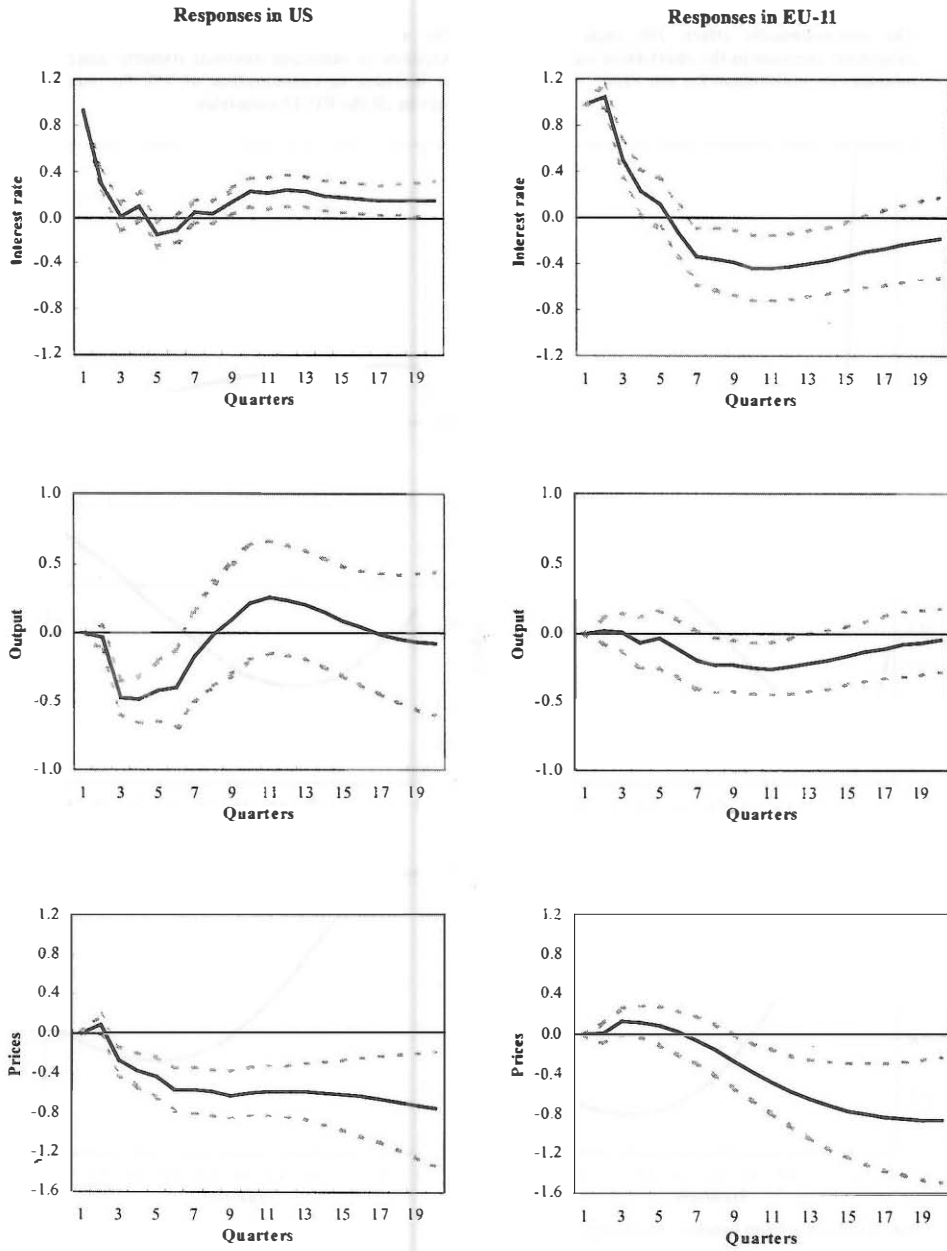
The systematic effect: The interest rate responds to maintain nominal stability after an increase in consumption of 1% for one year in all the EU-11 countries



Note: Difference from baseline, percentage points.

Figure 4

The unanticipated effect of a monetary policy interest rate shock (VAR model)



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