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**Monetary Policy Issues in a Low Inflation
Environment**



2 April 2001

MONETARY POLICY ISSUES IN A LOW INFLATION ENVIRONMENT*

by

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* Paper prepared for the Central Banking Conference "Why price stability?" organised by the European Central Bank in Frankfurt, November 2nd -3rd 2000. I want to thank my two discussants, Jeffrey Fuhrer and Lars Heikensten for very helpful comments. The paper has also considerably benefited from discussions with Javier Andrés, Samuel Bentolila, Matt Canzoneri, Stephen Cecchetti, Jordi Gali, Vitor Gaspar, David López Salido, Carlo Monticelli and Javier Vallés. The views expressed here are purely personal.

** Banco de España and CEPR

ABSTRACT

One of the most striking macroeconomic phenomena in recent decades has been the achievement of rather low and more stable rates of inflation in many countries in the nineties. Consequently, the main goal of this paper is to offer an overview of the main policy issues arising in a low inflation environment and their practical relevance so as to identify the main challenges facing central bankers in such an environment. The paper asks the following questions: To what extent are the public's attitudes towards price stability relative to other economic objectives -like unemployment- likely to change over time? How can the effectiveness of monetary policy change as a result of the non-linearities associated with the zero bound on nominal interest rates, the supposedly higher degree of downward real wage rigidity and, in general, the presence of downward nominal wage or price rigidities? What does the low inflation environment imply about the relative importance and effects of supply shocks, "non-monetary" demand shocks and "monetary" demand shocks? What sort of indicators are like to be more useful to the central bank for assessing inflationary pressures and, in particular, should asset prices play a bigger role in the conduct of monetary policy?

JEL Classification: E42, E52, E58

Keywords: Monetary policy, inflation, credibility, prices stability, financial stability

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1. Introduction

A remarkable feature of the economic performance of industrial countries in the post-war period is that there has been persistent inflation, in clear contrast to the XIX century and the period up to World-War I, which saw significant fluctuations in the general price level around a fairly stable mean. However, when one looks at inflation over the past thirty years, it is striking that, in contrast to the relatively high rates of the late sixties, the seventies and -in many European countries- the early eighties, inflation has since attained low rates over the past few years (Figure 1). For instance, while inflation in the OECD was, on average, 10.2% in the seventies and 9.2% in the first half of the eighties, it came down to 5.1% in the second half of the eighties and to 2.8% in the nineties, running in 1999 at 1.4%. In addition, a well-documented but as yet insufficiently explained phenomenon is that lower inflation rates are also more stable. For this reason, the present context can be broadly described as one characterised by lower and more stable rates of inflation.

The fact that in recent years many industrial countries have been enjoying a situation of low inflation rates, which can be characterised as one of price stability, is certainly a most important achievement that entails important economic benefits for society. Moreover, since inflation is, over the medium term, primarily a monetary phenomenon and since central banks are in charge of achieving and maintaining price stability, the present state of affairs is certainly much more comfortable for monetary policymakers than in the past, when they had to fight hard to bring inflation down.

Nevertheless, contrary to those voices which have claimed in recent years that the task of monetary policy is now made less relevant, or even irrelevant, because "inflation is dead" and the "business cycle has disappeared", the problems associated with deflation in Japan, on one hand, and the recent re-emergence of price pressures in the US and in the euro area in 2000, on the other, make it very clear that neither of the above assertions is correct. Indeed, living in an era of low inflation poses important challenges which monetary policy must address. Specifically, it must strive hard to maintain price stability by countering both inflationary and deflationary pressures, doing so in such a way as to ensure the best possible real economic performance.

An issue which has attracted much attention from both academics and policymakers in recent years has been the risk of hitting the zero bound on nominal interest rates in a

context where the economy, starting from a low rate of inflation, is affected by a large deflationary shock or by a succession of smaller deflationary shocks. Insofar as monetary policy would be powerless in such cases to bring nominal interest rates below zero, the risk is that the economy could enter into a deflationary spiral from which, as shown by the recent case of Japan, it is very hard to escape.

Another issue widely discussed in recent years has been the extent to which there may be an increase in the degree of downward real wage stickiness in a zero or low inflation environment in economies exhibiting downward nominal wage rigidity. Here it is claimed that while a higher average rate of inflation allows for the necessary reductions in real wages following an adverse shock, too low an average rate of inflation would prevent this healthy process from taking place, leading to a less efficient working of the labour market and to a higher equilibrium unemployment rate. Thus, for sufficiently low rates of inflation there would be a longer-term trade-off between lower inflation and higher equilibrium unemployment.

Since the literature on how to conduct monetary policy in a low inflation environment has tended primarily to focus on the above two issues, the emphasis has been on deflationary risks. Indeed, the main risk associated with the zero bound and downward real wage rigidity problems is that those central banks which focus "too strongly" on the maintenance of price stability by choosing "too low" a target for inflation will tend to pursue a monetary policy that is "too tight" on average, thus imposing a contractionary bias leading to higher equilibrium unemployment.

Nevertheless, as will be argued in the paper, the sole emphasis on deflationary risks in a context of low inflation is probably not an adequate representation of reality. For one thing, when closely examined, these risks prove to be smaller in practice and more manageable from the standpoint of monetary policy than is sometimes claimed. And, for another, it is important to realise that there are a number of inflationary risks that also need to be taken into account before taking overall stock.

The main goal of this paper is to offer an overview of the main monetary policy issues arising in a low inflation environment and their practical relevance so as to identify the main challenges facing central bankers in such an environment and to assess what is really likely to change -and what is likely to remain the same- in terms of what academics and

central bankers would respectively call "optimal monetary policy" and "best monetary policy practice"¹.

The paper starts by assuming that for the low inflation environment itself to alter the way that monetary policy should be conducted, it must necessarily affect one or more of the following "building blocks" typically shaping the framework that guides the decision-making process of central bankers. In this regard, it is useful to think that the typical monetary policymaker attempts to take the policy decisions which maximise the welfare of society, this being subject to his/her knowledge of the structure of the economy, and in particular of the transmission mechanism of monetary policy, and of the likely sources of macroeconomic fluctuations.

Thus, it is relevant to ask the following questions. To what extent are the public's attitudes towards price stability relative to other economic objectives likely to change over time insofar as, for example, price stability is preserved but, as in Europe, equilibrium unemployment remains relatively high? To what extent is the room for manoeuvre of monetary policy to achieve "secondary or complementary" objectives likely to increase insofar as inflation is kept under control? How can the effectiveness of monetary policy change as a result of the non-linearities associated with the zero bound on nominal interest rates, the supposedly higher degree of downward real wage rigidity and, in general, the presence of downward nominal wage or price rigidities? What does the low inflation environment imply about the relative importance and effects of supply shocks, "non-monetary" demand shocks, and "monetary" demand shocks? What sort of indicators are likely to be most useful to the central bank for assessing inflationary pressures and, in particular, should asset prices play a bigger role in the conduct of monetary policy?

In the process of discussing the above issues -both from a conceptual and empirical viewpoint- implications will be drawn for the practical conduct of monetary policy in a low inflation environment, so as to shed some light on the following questions. Can any modifications to the institutional framework (central bank laws or statutes) governing monetary policy be made so as best address the challenges posed by a low inflation environment? Do any implications follow for the specification of policy objectives, such as, for example, how price stability is defined, over which horizon, and on the basis of which price index? Are there any likely significant changes in the sort of basic principles which, as a guideline, it would be reasonable to follow when taking policy decisions, like

¹ For some recent surveys on the challenges faced by monetary policy in a low inflation context see IMF (1999), Johnson, Small and Tryon (1999), King (2000), and Svensson (2000).

for instance: how gradualist or aggressive should policy responses be to various shocks; how much more/less forward-looking and pre-emptive should policy be; how symmetric should policy responses be to inflationary and deflationary shocks; and how should the information from asset prices be used in arriving at policy decisions?

In order to address the above issues, the paper is organised as follows. Section 2 starts by briefly considering why inflation has been brought down to fairly low levels at present and the role monetary policy has played in this process. The answers given are likely to be important concerning how stable the situation of low inflation is which we are now enjoying. Section 3 looks at the various channels through which the low inflation environment might affect the effectiveness of monetary policy, while Section 4 examines the likely changes in the relative importance and effects of macroeconomic shocks. Section 5 analyses the relationship between price stability and financial stability and explores what role asset prices should play in the conduct of monetary policy. Based on the above discussion, Section 6 draws the practical implications the low inflation environment is likely to have for the conduct of monetary policy. Section 7 concludes.

2. Low inflation: how did we get there and is it sustainable?

As stated in the introduction, a most remarkable economic phenomenon since the eighties has been the very significant reduction in inflation in many industrial countries. It is worth enquiring into the main reasons behind the retreat of inflation, not just because this is of interest in itself but because, depending on the answer provided, it may help in assessing to what extent the present situation of low inflation is a stable economic and political economy equilibrium, and thus to speculate on its sustainability.

2.1 How did we get there? Shocks versus policy

In recent years, explanations have abounded as to why inflation has declined internationally. These have ranged from what can be termed as "popular" explanations to more "academic" ones.

One of the better known popular explanations is that which emphasises the ongoing process of international economic integration or, in the new jargon, globalisation. Namely, stiffer foreign competition arising from growing trade integration would have mitigated inflationary pressures in those sectors and markets more exposed to such competition.

And, at the same time, greater financial integration, amid the increasing globalisation and sophistication of international financial markets, would have considerably quickened and intensified such markets' punishment of those countries pursuing policies not consistent with macroeconomic stability.

Undeniably, in my view, the ongoing process of international economic and financial integration has certainly made national policymakers more aware of the repercussions of their actions and amplified such repercussions. Admittedly, too, stiffer foreign competition has resulted in lower price levels in some tradeable and quasitradeable sectors in a number of countries. Yet it is far from clear why -if this were the main explanation for the reduction in inflation over the past fifteen to twenty years- inflation did not decline but rather increased in previous decades which also saw significant advances in the degree of economic integration.

A second explanation draws on the fact that for most of the eighties and nineties the international economic environment has benefited from the absence of significant adverse energy price shocks, such as those in the mid and late 1970s. Thus, the presence of relative low rates of inflation nowadays in many countries would mainly be a consequence of "good luck"². Yet, while accepting that inflation would, in principle, be temporarily higher (lower) whenever there are adverse (favourable) energy price shocks (as has again become evident at present as OPEC has notably increased oil prices), it ought nevertheless to be clear that since inflation is primarily a monetary phenomenon over the medium term, *average* inflation performance has to do mainly with the conduct of monetary policy³. In this regard, the inflationary episodes of the seventies were not only the result of "bad luck" linked to adverse supply shocks. If inflation persisted it was mainly due to inappropriate demand management policy responses to shocks which allowed them to become embedded in inflationary expectations in a social context where price stability was not sufficiently valued. And likewise, while there were overall favourable supply-side developments during the eighties and nineties in the form of lower energy prices internationally and technological advances -mainly in the US- which contributed to enhancing price performance and to improving the short-term tradeoffs faced by

² For a discussion of different views of how important "good or bad" luck was in driving US inflation over past decades, see Lansing (2000).

³ Going even further, it could be claimed that the adverse energy price increases of the seventies were, at least partly, the consequence of the excessively rapid growth in world demand of the late sixties, itself fueled by expansionary demand policies.

policymakers⁴, the achievement and maintenance of low inflation rates would not have been possible without the resolute pursuit of sounder economic policies and, particularly, of anti-inflationary monetary policies⁵.

2.2 Reasons behind the policy change

Still, even if it could be agreed that monetary policy deserves much of the credit for the international retreat of inflation witnessed over the past ten to fifteen years, there is still the question of why policy became more oriented towards price stability.

2.2.1. The supply of low inflation

Explanations provided in the literature have tended to focus on what could be termed the "supply side of policy"; that is, the behaviour of policymakers. One view -supported by Delong (1997), Taylor (1997, 1998) and Clarida, Galí and Gertler (1998)- is that the shift towards lower inflation policies was due to policymakers learning -through economic principles- that activist demand management policies which seek systematically to exploit Phillips-curve trade-offs are ineffective, on average, for improving output and employment prospects and ultimately have inflationary consequences that are detrimental to economic and social well-being.

An alternative view put forward by Sargent (1999) claims that -at least as far as the US is concerned- it was not so much because policymakers were convinced by theories of the non-exploitability of long-term trade-offs that they started pursuing monetary policies more directed towards price stability⁶. Rather, it was the continuous re-estimation of the Phillips curve under the emergence of new data that led policymakers to pursue lower inflation policies. In particular, discretionary policymakers would have chosen policy during the seventies to select the desirable unemployment-inflation pair along the supposedly exploitable long-run Phillips curve. As new data arrived, they would have re-estimated the curve and chosen a new unemployment-inflation pair. Yet the presence of

⁴ See Orphanides and Wilcox (1996) for how an anti-inflationary monetary policy can benefit from favourable supply-shocks in the transition to lower inflation while later on adopting an appropriate stance to "lock in" the new lower rate of inflation.

⁵ Bernanke, Laubach, Mishkin and Posen (1999) document how the monetary policies aimed at price stability that have been followed in a number of countries in the 1990s have enjoyed higher credibility and successfully contributed to reduce inflation.

⁶ While Sargent has been the main proponent of this view, see also Ireland (1998), Orphanides (1999) and Lansing (2000). According to Chari, Christiano and Eichenbaum (1998), even when policy-makers correctly perceive the trade-off there may be a reason to pursue higher inflation policies insofar as shocks that raise the expectations of inflation make more costly to pursue a lower inflation policy.

random shocks in later years would have made the re-estimated curve appear steeper, leading policymakers to choose less inflationary policies, and so on, until they finally behaved as if they believed that there was no long-term trade-off. Consequently, according to this explanation it would not have been intellectual conviction but rather the focus on the recent data in empirical estimation that led to lower inflation policies. Once again, the presence of "good luck" in the form of a series of favourable supply shocks in the eighties and nineties re-enters the picture, providing the main explanation for the change in policy.

It is far beyond the scope of this section to provide any sort of formal test of which of these two competing views squares better with the actual reasons behind the change towards lower inflation policies. But I would join the camp of those who espouse the first view, based on the intellectual abandonment by policymakers of the old paradigm of a downward-sloping long-run Phillips curve. Acceptance of the second view, on the contrary, would lead to the rather discomfoting explanation that central bankers could become active once again in exploiting long-run inflation/unemployment trade-offs since they were never really convinced of the absence of such a trade-off. This does not seem at all compatible with the behaviour of the Fed since the early eighties nor with the steps taken over the past ten years to reform the institutional framework governing monetary policy in many countries and economic areas in the direction of placing price stability as the main goal of monetary policy and making central banks independent in its pursuit.

A noteworthy example of the above are the steps taken in Europe over the past decade to establish a European Central Bank in the process of moving towards monetary union. Indeed, on reading the Statute of the European Central Bank it becomes quite evident that it is solidly founded on a firm belief in several key principles: that price stability helps to improve output prospects over the medium term; that, for that reason, the best service that monetary policy can deliver to society is to maintain price stability; and that this is much more easily achieved when the central bank is independent and when price stability becomes the primary goal of monetary policy, thus avoiding political pressures and the risk of potential conflicts among competing objectives sharing the same status. Consequently, the drafters of the ECB Statute were quite aware of the economic advantages of price stability-oriented policies and thus sought to ensure that ECB actions would remain consistent with such a primary objective in the future.

2.2.2. The demand for low inflation

In contrast -and as a complement- to these "supply side of policy" theories, there is also a "demand side" which is much less emphasised but which I believe to be very important. Specifically, it can be argued that since the eighties there would also have been a greater social demand for price-stability-oriented policies due to the gradual recognition by society, based on the experiences of the higher inflation periods, that inflation entails economic costs which are far more important than previously considered, and therefore that its successful control is an essential condition to improve output and employment prospects and, ultimately, to enjoy higher economic welfare. Consequently, the public would have repudiated the high-inflation "stop and go" policies of the past, and voted through the political process for policies more oriented towards price stability (Flood and Mussa (1994), and Viñals (1998)).

Although identifying what the social attitudes towards inflation are is not an easy task, the well-known survey study by Shiller (1997) unveils that the public regards inflation as globally harmful inasmuch as it lowers the standard of living. However, the survey results are much less clear with regard to how the public views the specific channels through which inflation entails costs.

The popular perception of the costs of inflation has frequently been criticised on the grounds that the public -on the basis of their experience during stagflationary periods- may wrongly attribute to inflation those costs which actually stem from lower economic growth (Mankiw (1996)). While this is certainly possible, it is not the whole story. Indeed, a growing body of literature over the past few years has provided firmer conceptual and empirical support for the proposition that inflation is in itself a costly process on economic and social grounds even when it does not result from adverse supply shocks. Thus, the public dislike of inflation either because it comes more or less contemporaneously with worse output performance -as with adverse supply shocks- or because it is subsequently associated with a deteriorating output performance -as with overly expansionary demand policies- would have led to the rejection of policies which did not emphasise price stability sufficiently. Policies leading to inflation would have been associated with "bad" economic outcomes in the eyes of the public, thus leading to their social rejection.

Turning to the recent empirical literature on the economic costs of inflation, analyses usually start from the assumption that, regardless of the way in which inflation may

adversely affect the economy, to be costly it should undermine the level or growth rate of per capita income over the medium term. The most recent summary of these studies -provided by Andrés, Hernando and López-Salido (2000) in a recent book of the Banco de España-, together with the new evidence supplied by these authors for industrial countries, seems to suggest that, although results tend to vary considerably due to the diversity of approaches, geographical coverage and time frame of the existing empirical studies, those cross-country studies having a 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 their growth or per capita income prospects and have a high probability of experiencing a deterioration in such prospects (see also Fischer (1994)). In particular, their evidence suggests that lowering inflation by 1 p.p. could bring in an increase in steady-state per capita income of at least 0.5%.

Furthermore, the time-series evidence in Lucas (2000) for the US indicates that a reduction of inflation from 10% to 0% would bring a welfare gain equivalent to a permanent increase in real income slightly below 1%. In turn, the national case studies collected in Feldstein (1999) try to approximate empirically the net welfare gains of going from low inflation to price stability while also taking into account the output costs that may arise when moving along the short-term Phillips curve. The general conclusion emerging from these studies -which assign a primary role to the interactions between inflation and the tax system- is that industrial countries in general tend to experience significant permanent welfare gains in net terms when achieving price stability (ie. inflation rates of 0-2%), even if the starting inflation rates are low or moderate, say 4-5%. The net gains corresponding to reducing inflation by 2 p.p. are estimated to be equivalent (in terms of GDP each year) to 1% in the US, 1.4% in Germany, 1.7% in Spain and 0.2% in the UK.

Consequently, recent empirical evidence seems to be consistent with the widespread public perception that inflation is harmful because it erodes standards of living by reducing steady-state per capita income or its growth rate, and because it lowers economic welfare. It may also explain why, in more recent times, there has been a higher social demand for macroeconomic policies -and monetary policies in particular- more oriented towards the achievement and the maintenance of price stability.

In sum, it appears sensible to conclude from the previous discussion that the change towards monetary policies more geared towards price stability has been driven both by

"policy supply and demand" aspects. Thus, while policymakers would have become progressively convinced of the superiority of policies aimed at providing a framework of nominal stability, the public would also have expressed an increasing preference for such policies through the political process. This political economy equilibrium would ultimately have been responsible for the change in the policy stance that has been so important for achieving and maintaining the low inflation rates witnessed in later years.

2.3 Is the present situation of low inflation a stable economic and political economy equilibrium?

On the basis of the conclusions in the last section, there are several things that can be said concerning the sustainability of the present situation of low inflation.

Firstly, concerning the "policy supply" side, insofar as it is not just "good luck" but rather a conscious change in the orientation of economic policy and, in particular, of monetary policy which is responsible for having made the present state of affairs possible, the latter is likely to be less readily abandoned. Indeed, policymakers are unlikely to forget the basic economic principles underpinning their policies in recent times. This contrasts clearly with what would have been the case were not intellectual conviction in the non-exploitability of a long-run Phillips curve the main reason behind the change towards policies aimed more directly at price stability but rather the fact that incoming data had made the estimated curve appear steeper. In such a situation, the risks to the sustainability of the present low inflation environment would have been very significant since, sooner or later, incoming data might have led policymakers again into thinking that they could exploit the long-term trade-off.

Secondly, from the "policy demand" angle, inasmuch as the public is well aware of the costs of inflation there would seem to be no danger to the sustainability of the present situation. Yet it cannot be ruled out that insofar as the public's preferences may also be influenced by actual economic performance and, in particular, by the joint developments in unemployment and inflation, there may be some risks⁷. In the US, where the natural rate of unemployment seems to be quite low -and even lower in recent years (Gordon (1996)) -, it is quite reasonable to infer that it is unlikely there will be a reduction in the social demand for price-stability-oriented policies, as low inflation comes hand in hand with low(er) unemployment. However, things could, at some point, be different in the

⁷ See, for example, Bernanke (1999) and Mussa (1999).

euro area, where low rates of inflation co-exist with rates of unemployment which are generally perceived as high both relative to the US and to what would be economically and socially desirable. Thus, even if most economists broadly agree that the main reasons behind the high European unemployment rates are structural, it cannot be ruled out that, as low inflation continues but unemployment rates remain high, the public's attitudes may eventually start shifting in favour of lower unemployment and against low inflation (ie. a change in the relative weight that society attaches to both variables in its loss function). And while this would not alter the pre-eminence of price-stability as the primary goal of monetary policy -assuming the ECB Statute is not fundamentally amended, which is quite reasonable given the enormous institutional and political barriers that have to be overcome for this to occur-, there could nevertheless be social pressure for the specific definition of what constitutes price stability (defined by the ECB to be an annual HICP inflation rate below 2%) to be relaxed or for the unspecified medium-term horizon over which this objective is to be reached to become longer in practice.

Needless to say, for those industrial countries whose institutional framework for monetary policy does not explicitly place price stability as the primary goal of monetary policy, or where the operational definition of price stability or of the horizon over which it has to be achieved corresponds to the political authorities rather than to the central bank, the above risks would be exacerbated were they to face -as Europe does- continuing high unemployment while inflation remains low.

This "policy demand" risk is, in my view, the most significant of those considered above and is likely to become more important as time goes by and no solution is found to the European unemployment problem. This is why it is urgent to remind policymakers that the European unemployment problem can only be solved by structural supply-side policies aimed directly at removing its structural roots. Only in this way will it be possible to ensure that social attitudes against inflation remain strong and thus that inflation does not become a problem once again.

3. Low inflation and the effectiveness of monetary policy

Another way through which a low inflation environment may bear on the conduct of monetary policy is by modifying the room for manoeuvre of policymakers and also by altering the way monetary policy decisions impact the economy. The leading example of a change in the room for manoeuvre is the issue of the zero bound on nominal interest rates.

In turn, the possibility of having higher nominal and real-wage rigidities at low inflation rates -which could lead to different output-inflation trade-offs- is a prominent example of how the effectiveness of monetary policy might be affected. In what follows, an attempt is made to review these questions and assess their practical significance for the US and the euro area.

3.1. The zero bound on nominal interest rates

The zero bound problem is certainly not new (it can be traced back to Keynes' "liquidity trap") although it has recently received renewed attention as the depressed state of the Japanese economy has brought to the forefront the problems central bankers can face when they are constrained by the fact that nominal short-term interest rates cannot fall below zero. In particular, as emphasised by Vickrey(1955), Okun(1981), and Summers (1991), the lower the average rate of inflation is, the lower the average nominal interest rate will be and thus the more likely it is that when the economy is hit by a sufficiently large deflationary shock there will be deflation and that the reduction of short-term interest rates needed to stabilise the economy will be limited by the zero bound⁸. Consequently, the economy will be less stable, experiencing higher inflation variability and output variability; and, as argued by Orphanides and Wieland (1998), its long-term output performance could even deteriorate. Thus, by choosing a higher rate of average inflation there will be a lower risk of falling into the "liquidity trap". In this way, the very serious risk of a deflationary spiral will be avoided, whereby a contractionary demand shock would lead to deflation and -given the zero bound constraint on nominal short-term rates- to a higher real interest rate, further contraction and deflation, and so on.

While these are the key aspects behind the zero bound problem, it is nevertheless quite interesting that this issue has stirred considerably greater attention among US academics and central bankers than their European counterparts. This is all the more significant because, while the Fed does not have a specific definition of price stability, the ECB has specified 2% as the upper limit for the annual rate of inflation in the euro area which is consistent with its definition of price stability. This is why, in addition to briefly reviewing

⁸ The "zero bound" problem is surveyed, among others, in Johnson, Small and Tryon (1999) and King (2000). See also Fuhrer and Madigan (1997), Rotemberg and Woodford (1997), Orphanides and Wieland (1998), Wolman (1998), Tetlow and Williams (1999) and Reifschneider and Williams (1999) for empirical analyses of its potential implications, particularly for the US.

the recent literature on the subject, some descriptive evidence is provided for the US and the euro area in what follows to ascertain whether this different emphasis is warranted.

Conceptually, the zero-bound problem will be all the more severe: the lower average inflation is; the lower the equilibrium short-term real interest rate is; the larger and/or more persistent the deflationary shocks hitting the economy are; the more limited the channels through which monetary policy can influence the economy are, apart from the interest-rate channel; and the lower the contribution to short-term stabilization that can be expected from non-monetary policies is. For this reason, the most influential papers written on the subject belong to what has been termed "the new normative macroeconomics", where a model of the economy has been specified and estimated and performance assessed under a portfolio of shocks consistent with those experienced historically in order to see how things would change for different average inflation rates and policy rules.

Although it is not easy to summarise the growing empirical literature on the subject, it is fair to say that the key results obtained so far for the US (see, for example, Fuhrer and Madigan (1997), Orphanides and Wieland (1998), and Reifschneider and Williams (1999)) tend to suggest that, taking as reference the shocks actually experienced in the past, the zero-bound constraint would be hit only very rarely and that, in any case, most of the problems would be avoided for rates of inflation as low as 2%. In contrast, at lower rates of inflation there could be a worsening of the variability of output and inflation, and -in some cases- average output performance could even be below potential.

Whether these papers over or underestimate the extent of the zero-bound problem is, nevertheless, far from clear. On one hand, it can be claimed that things are likely to be rosier in reality once account is taken of the following: that monetary policy may have effects on the economy through channels other than the short-term interest rate (Meltzer (1999) and McCallum (1999)), that policy rules other than the simple ones usually considered could do a better job, or that the degree of inflation persistence is likely to be lower than typically assumed (Wolman (1998))⁹. On the other hand, things could be worse if future adverse shocks turn out to be larger than in the past and if the models' assumptions that policymakers are fully credible and that they have an excellent

⁹ On the "other channels" issue suffice it to say that the various solutions suggested to re-liquify the economy - such as conducting open market operations in foreign exchange, long-term bonds and other assets, and increasing the money holdings of the public through fiscal transfers- are deemed to work by affecting relative asset yields, creating wealth effects and, some cases, by signalling policy intentions.

knowledge of the structure of the economy happen to be far from the truth. For these reasons, it can be accepted as a reasonable tentative result for the US that as long as average inflation does not go below 2%, no significant problems would arise from the zero-bound constraint.

Now, what about Europe? Because no similar papers to those written for the US are yet available in the European case to explore in a relatively precise manner the consequences of hitting the zero bound, some descriptive statistics are provided hereafter in order to help speculate about whether things are likely to be similar in Europe relative to the US.

As a starting point, Figure 2 tracks short-term nominal interest rates and inflation for both the US and the euro area over the past thirty years¹⁰. As can be observed, in this period nominal interest rates have been always above zero in both cases, and -most of the time in the US, and all the time in the euro area- above 4%. Therefore, the zero-bound constraint has not been binding in recent decades in either of these areas, despite they being hit by contractionary shocks which led to negative output gaps at various times.

Since the zero-bound constraint on nominal interest rates (at zero inflation) prevents the economy from having negative short-term real interest rates at times when they may be badly needed, something that is often done is to look at how frequently negative rates have been observed in the past -when inflation was higher- so as to have a very rough idea of how serious this problem is likely to be at low rates of inflation¹¹. As shown by Figure 3, which plots short-term real (ex-post) interest rates over the past thirty years, both the US and the euro area had significantly negative real rates in the seventies. In contrast, during the eighties and nineties, while real rates fluctuated considerably they were always positive -and considerably more so in the euro area-.

Nevertheless, the above evidence concerning how frequently real interest rates were negative in the past must be interpreted carefully since it may otherwise lead to an overly pessimistic conclusion concerning how frequently monetary policy actually needs to resort to negative real interest rates to stabilise the economy. Indeed, the negative real rates observed in the Figure are arguably not directly relevant for judging the likely severity of the constraint that the zero-bound imposes on the freedom of the authorities to bring real

¹⁰ For the euro area, the "virtual" interest rate corresponds to the weighted average of the national interest rates in the various Member States.

¹¹ Nevertheless, it should be taken into account that the past evolution of real interest rates may not have been optimal.

interest rates below zero to stabilise the economy. This is so because these negative real rates had to do with the adverse supply shocks of the seventies which, though leading to severe contractions, had an inflationary -rather than a deflationary- impact. Thus, on impact, real interest rates dropped as inflation increased without the zero bound playing any role. For these reasons, it is fair to say that both the US and the euro area did not have to bring real rates below zero during the last thirty years to offset the deflationary effects of shocks.

Because of the contaminating effects of supply shocks in the seventies, and also to focus attention on the period of relatively lower rates of inflation, it is advisable to concentrate on the twenty-year period starting in 1980. In addition, because it is the ex-ante, and not the ex-post, real rate that really matters for the zero-bound problem, Figure 4 plots the short-term real (ex-ante) interest rates for the US and the euro area in the 1980-1998 period. The ex-ante rate has been constructed on the basis of the first-order equilibrium condition for consumption, assuming an intertemporal elasticity of substitution equal to 1 (higher values did not lead to different conclusions) and taking actual changes in consumption as a proxy for expected changes. As can be seen in the Figure, real ex-ante rates are always positive and relatively stable, particularly in the euro area. Rates are always higher than 3.5% in the US and than 4.3% in the euro area, their average values being 4% and 4.5%, respectively. Thus, this confirms that in no case were negative real interest rates required during this period either in the US or the euro area.

To complement the descriptive statistics already provided and explore more formally the differential impact of the zero bound problem in the US and the euro area, a simple simulation exercise is carried out whose details are provided in the Appendix. Basically, the exercise consists of using a very stylised macro-model whose parameter values are chosen in the light of the estimates already available in the literature for both the US and the euro area to carry out simulations of the impact of demand and supply shocks under different assumptions about the values of the equilibrium long-run real interest rate (from 1.5 to 4.5%) and the inflation objectives (from 0 to 2%)¹².

¹² Using the average real interest rate as a proxy for the equilibrium rate has several problems. If the period is relatively long (covering also the 40s, 50s and 60s) there may be a downward bias since, in many cases, monetary policies tried at that time to hold down the costs of financing governments deficits. If the period is shorter (covering just the 80s and 90s) there may be an upward bias since the disinflationary policies pursued at that time led to rather high interest rates in many cases. This is why a wide range of real interest rates is used in the simulations performed.

The results obtained from the simulation exercises suggest that the probability of hitting the zero bound is smaller in the euro area than in the US, and that this probability falls below 5% for the US and below 1% for the euro area for real rates as low as 1.5% and inflation rates as low as 1%. In the specific case where the values given to the long-run real interest rate correspond to the averages for the period 1980-1998 (4% in the US and 4.5% in the euro area), the probability of hitting the zero bound even at zero inflation rates is 1% in the US and even lower in the euro area. In view of these results, and taking into account the uncertainty that unavoidably surrounds this sort of exercise (given the imperfect knowledge of the behavioural parameters of the economy, and the possibility that the future may bring with it much larger shocks than in the past), it can be concluded that establishing an objective for the inflation rate as low as 1% -or to be even safer, 2%- would avoid most complications stemming from the zero bound issue.

In practice, of course, it is not enough to chose and appropriate value for the price stability objective. The problems associated with hitting the zero bound can only be effectively prevented if the central bank is successful in building up considerable credibility around such objective. This means that the central bank must earn a solid reputation not just as a tough inflation fighter but also as a tough deflation fighter during "normal" times. Only then will the public expect -whenever a severe deflationary shock finally arrives- that inflation will subsequently rise towards the price stability objective. This will, in turn, allow real interest rates -short and long- to come down, helping to restabilise the economy even if nominal interest rates cannot fall below zero¹³.

Moreover, as an additional safety measure it might be desirable for policymakers to respond somewhat more promptly and aggressively than what their implicit reaction function or policy guideline might normally advise whenever they are faced with shocks that threaten to place the economy "too" near the liquidity trap so as to avoid falling into it¹⁴. In addition, as will be further discussed in Section 6, when the economy is subject to deflationary pressures a credible price level objective will engineer a stronger rebound of

¹³ For the different views which have been put forward concerning policies to either prevent or escape from the liquidity trap, see Krugman (1998), Johnson, Small and Tryon (1999), Reifschneider and Williams (1999), McCallum (1999), Goodfriend (1999), Buiter and Panigirtzoglou (1999), and Svensson (2000) and the papers presented at the Federal Reserve Board Conference on "Monetary Policy in a low inflation environment", held in Vermont in October 1999.

¹⁴ This suggestion is also discussed in Johnson, Small and Tryon (1999), Blinder (1999), and Freedman (1999). Empirical evidence in its favour is provided in Reifschneider and Williams (1999).

inflationary expectations and a correspondingly larger reduction in real interest rates than a credible inflation objective¹⁵.

Finally, it is important to point out that the zero-bound problem becomes particularly severe when it occurs in circumstances where the financial system is in a delicate situation¹⁶. As it will be explained in Section 5, a low inflation environment does not guarantee that financial stability problems will not arise, insofar as there are phenomena of excessive risk-taking, overlending and asset price inflation which may compromise the integrity of the balance sheets of financial intermediaries. If so, it is of paramount importance that the authorities take the appropriate regulatory and supervisory measures to preserve the health of the financial system. Otherwise, the risk will be that systemic problems within the financial system will greatly contribute to magnifying the adverse macroeconomic repercussions from hitting the zero bound in a deflationary situation.

In sum, zero-bound problems are very rare events and most of their negative consequences should and can be avoided by preventive measures. Nevertheless, it is of paramount importance that such measures, which are designed to address occasional but severe deflationary risks, should not entail any undesirable side effects in the form of higher inflation on average (since, as discussed earlier in the paper, this implies permanent costs) or an excessive volatility of real variables. For this reason, the best contribution that monetary policy can make is to prevent the economy from falling into the liquidity trap by setting the objective of keeping the rate of price increases below 2%, and by making this objective credible by fighting both inflationary and deflationary risks. In this regard, it may be advisable for policymakers to respond more promptly and aggressively to perceived deflationary shocks than they would normally do whenever such shocks are deemed to bring the economy too close to the liquidity trap. Furthermore, application of the appropriate supervisory and regulatory measures by the financial authorities would ensure that if the economy were nonetheless to fall into the trap, its deflationary effects would not be magnified.

3.2. Output-inflation tradeoffs: the role of wage and price rigidities

The interplay between wage and price rigidities and the low inflation environment has potentially relevant implications for the conduct of monetary policy. In this respect, two

¹⁵ See, for example, Rotemberg and Woodford (1999), which shows that a credible objective of very small increases in the price level -close to zero- solves most of the zero bound problem.

¹⁶ See Johnson, Small and Tryon (1999) and Crockett (2000).

key issues have been extensively discussed. Firstly, that the degree of temporary nominal stickiness may change as inflation settles around a lower mean as a result of the different incentives faced by wage and price-setters. And secondly, that even if the degree of nominal wage stickiness were not to increase, this would still be associated with a higher degree of real wage rigidity if the inflation rate were sufficiently low (Akerlof, Dickens and Perry (1996)). An attempt follows to review these two key issues from both a conceptual and empirical viewpoint in order to explore to what extent the short and longer-run trade-offs faced by monetary policy makers are likely to be any different in a context of low inflation.

3.2.1. Changes in the degree of nominal stickiness

There has been considerable literature on whether the degree of short-term nominal wage and price rigidity might change in a low inflation environment. If this were the case, the *short-term Phillips curve* would be non-linear, the short-term trade-off between inflation and unemployment being different in a low inflation context.

As the Taylor (1999b) survey of wage and price rigidities makes clear, there are two basic explanations why there may be temporary nominal wage and price rigidities: imperfect information, and staggered or costly wage and price-setting.

The first explanation, associated with the "new classical macroeconomy", postulates that wages and prices are, in principle, fully flexible but that they become sticky as a result of the inability of the public to distinguish between aggregate and relative price shocks (Lucas (1972 and 1973)). Thus, insofar as the relative variabilities of nominal and real shocks remain unchanged, the slope of the short-term Phillips curve would not be expected to change with the rate of inflation.

In addition, if the low inflation regime comes with a more stable and predictable monetary policy, agents might be more able to distinguish between nominal and relative price changes, which would enhance the responsiveness of wages and prices to systematic monetary policy changes, the latter now becoming even more prevalent than before as monetary policy becomes more predictable. Consequently, the slope of the short-term Phillips curve might even steepen in a lower inflation regime if observed price rigidities reflect, to some extent, imperfect information problems.

The second explanation has rather different policy implications since it is based not so much on misperceptions on the part of the public but rather on the belief that agents find it costly to continuously adjust money wages and prices. Under these circumstances, there are a number of reasons that can be provided, based on alternative "New Keynesian" models, to explain why the slope of the short-term Phillips curve may change in a low inflation environment. In particular, as posited by Ball, Mankiw and Romer (1988), imperfectly competitive firms have an incentive to adjust prices faster when inflation is higher, thus making the overall price level more responsive to nominal shocks. Consequently, when inflation is, on average, lower, it is expected that the short-term Phillips curve will be flatter. These basic results are consistent with those derived from a variety of "New Keynesian" models which conclude that there would be incentives for agents to adjust their prices faster at higher rates of inflation.

In contrast, to the above, there are also reasons to posit that there could even be more flexibility in wage and price setting in a low inflation environment. For example, agents may become more used to falls in nominal wages and prices which would thus no longer be regarded as unfair (Gordon (1996) and Mankiw (1996)). Moreover, when inflation is higher, accepting a cut in nominal wages will amount to a very significant fall in real wages, and would therefore likely be resisted by workers. In contrast, in a low inflation context, nominal wage cuts will lead to much less dramatic falls in real wages and thus be much more readily acceptable to workers (IMF (1999)). Furthermore, in such an environment there would be an incentive for firms to resort increasingly to other more flexible forms of compensating their employees (like benefits and bonuses) as witnessed in recent years.

Now, what does the empirical evidence on the shape of the short-run Phillips curve tell us? Overall, it is fair to say that it is quite inconclusive, as stated in the extensive review conducted by Yates (1998). Some research tends to conclude that the international evidence is consistent with a non-linear model although it is not always clear what the source of the non-linearity is¹⁷. In contrast, other international evidence is either more mixed, or conclusively against significant non-linearities being present¹⁸. In turn, some evidence for the US is broadly consistent with the presence of non-linearities, although there is disagreement over their source and thus no clear policy implications can be drawn

¹⁷ See Ball, Mankiw and Romer (1988), Yates and Chapple (1996), Debelle and Laxton (1996), Kiley (1996), and Laxton, Meredith and Rose (1995).

¹⁸ See Turner (1995) and Yates (1998).

concerning the sensitivity of the short-term trade-off to inflation¹⁹. On the contrary, other US evidence finds either no trace of significant non-linearities²⁰, or that, although such non-linearities exist, they are the opposite of what is expected, the Phillips curve becoming steeper as inflation gets lower²¹. Finally, for European countries, there are contradictory results concerning non-linearities in the UK²². In addition, recent research finds little support for non-linearities when using pooled data for EU countries and, when the estimation is made on a country-by-country basis, only in Germany and Italy is there any evidence of non-linearities²³.

Although the period of low inflation may not yet be long enough to allow reaching more definitive conclusions and although there are significant empirical problems when trying to test the hypothesis of non-linearities in the Phillips curve, on the basis of the evidence reviewed it can be tentatively concluded that there is no reason to expect that policymakers would face a flatter or steeper short-term Phillips-curve in a low inflation environment. Thus, it does not seem that the job of monetary policy in maintaining price stability becomes more difficult in such an environment as, for example, would have been the case had the degree of responsiveness of money wages and prices to aggregate demand and, in particular, to monetary policy become lower, as originally posited by Ball, Mankiw and Romer (1988)²⁴.

3.2.2. Unchanged nominal wage rigidity but higher real wage rigidity

Even if the degree of nominal wage rigidity were to remain invariant, Akerlof, Dickens and Perry (1996) have argued in their very influential paper -along the lines of Keynes and of the further elaboration by Tobin- that this is nevertheless associated with a higher degree of real wage rigidity when the inflation rate is zero or sufficiently low. The reasoning is as follows: while due to money illusion workers are more likely to accept

¹⁹ See Evans (1992), Clark, Laxton and Rose (1996), Laxton, Rose and Tambakis (1997), and Dupasquier and Ricketts (1997).

²⁰ See Gordon (1996).

²¹ See Eisner (1997) and Stiglitz (1997).

²² While Coulton (1993) and Bean (1993) find some support in the UK for the Phillips curve becoming flatter as inflation gets lower, Yates (1998) finds no evidence of a significant non-linearity.

²³ See Pyyhtiä (2000)

²⁴ It should be emphasised that the absence of an empirically robust positive relationship between the slope of the short-term Phillips curve and the rate of inflation does not necessarily mean that "New Keynesian" theories are wrong and that "new classical" theories are right. Indeed, there are a number of well-documented stylised facts -such as anticipated monetary policy having temporary effects on output- which are clearly at odds with the "new classical" theories as being most appropriate for explaining economic fluctuations. As emphasised by a number of authors (Roberts (1997) and Taylor (1999b)), the short-term impact of monetary policy on the economy is likely to reflect both elements of the limited information theory and of the existence of temporary stickiness in wage and price formation.

reductions in real wages as a result of inflation, they would be much more reluctant to do so through nominal wage cuts. Thus, while in a higher inflation environment the unfavourable consequences for unemployment resulting from adverse shocks could be softened or avoided by a reduction in real wages even when nominal wages are downwardly rigid, in an environment where the inflation rate is zero (or "too" low) such a fall in real wages will not occur (or not do so to the required extent), therefore leading to higher unemployment. As a result, there will be a downward sloping *long-run trade-off* between inflation and equilibrium unemployment rates below a certain average rate of inflation. This led Akerlof et al. to postulate that "some" positive rate of inflation in the US - of the order of 3%- would "grease the wheels" of the labour market by increasing real wage flexibility, thus leading to a lower equilibrium unemployment rate²⁵.

How relevant is this suggestion likely to be for the conduct of monetary policy in a low inflation environment? My judgement is that its relevance is likely to be limited, due to the following reasons:

Firstly, as concerns the money illusion assumption behind the alleged downward rigidity of nominal wages, while it is not very easy to rationalise on purely economic grounds, it is nevertheless true that survey studies generally tend to corroborate that workers do not see perfectly through the "money-wage veil" and thus that it is not just real but also nominal wages that matter for them (Kahneman, Knetsch and Thaler (1986), and Shiller (1997)). Yet even if money-illusion could be accepted as a short-term phenomenon, it is rather more difficult to believe that it will persist in the longer run once workers "go shopping" and realise that the purchasing power of, for example, a sustained 4% wage increase and a 5% price increase is not different from that of a constant wage and a 1% price increase. Furthermore, insofar as a low inflation regime comes with a more stable and predictable monetary policy, it is to be expected that agents will be more able to distinguish nominal changes in the price level and the average money wage from changes in relative prices and real wages. Consequently, inasmuch as the prevalence of money illusion in the shorter run

²⁵ In a most recent paper, Akerlof, Dickens and Perry (2000) make use of "near rationality" to argue that inflation is likely to be ignored in wage and price setting when it is low, and to be less than fully taken into account when it is not too high. In contrast, for inflation rates which are sufficiently high, wage and price setting will respond fully to expected inflation. In their empirical testing they conclude that insofar as US inflation is held, on average, between 1.6-3.4% ,the lowest sustainable unemployment rate will be 1.5 to 3.1 p.p. below the natural rate of unemployment. Nevertheless, they acknowledge that it is not possible to robustly distinguish between the relative importance of the effects of "near rationality" and "nominal wage rigidity", both of which rest on the existence of money illusion.

is linked to the confusion that agents may have in distinguishing between aggregate and relative price and wage changes, the better information that comes with a lower and more stable inflation environment could even help reduce money illusion in the shorter run.

Secondly, as stated by King (2000), insofar as trend productivity growth remains sufficiently high, it is possible to reduce unit labour costs and relative wages when appropriate without nominal wages having to be cut. As a result, targeting a positive rate of inflation so as to achieve a reduction in labour costs, even in the face of substantial downward nominal wage rigidity, would be unnecessary. Only when the size of shocks warrants real wage cuts which exceed trend productivity growth would it be appropriate to target a positive inflation rate.

Thirdly, as concluded in the extensive review of existing empirical studies conducted by Yates (1998) -which enlarges upon and updates that performed by Akerlof et al. in their article- the evidence concerning the actual importance of downward wage rigidities based both on the frequency of wage cuts and on the observed distribution of wages both in the US and -mainly- in European countries is much more controversial than the findings of Akerlof et al., and Taylor (1999b) in their respective reviews.

Finally, even if the assumptions on which the Akerlof et al. story is based were correct and their policy implications accepted, targeting a positive but still low rate of inflation to "grease the wheels" of the labour market would not be at odds with what most central banks already do nowadays, and it would thus imply no additional restrictions on the conduct of monetary policy, which would continue to aim at maintaining price stability. For instance, most central banks specify their price objective, implicitly or explicitly, as an inflation rate between 0 and 2-3%. In this light, it is worth remembering that while the direct evidence supporting the Akerlof et al. conclusions refers to the US, at the time of writing this paper there is yet no similar European study to shed some light on whether the direct micro and macro evidence is more or less supportive than in the US and, in particular, on whether the "optimal positive rate of inflation" is higher or lower than in the US.

Still, it is worth recalling that the available evidence on wage behaviour tends to suggest that, overall, the degree of nominal wage rigidity is considerably less prevalent in European countries than in the US; in contrast, there is abundant evidence showing that the degree of real wage rigidity is significantly higher in the European case. For instance,

according to estimations by Viñals and Jimeno (1998), the average degree of real wage rigidity in the European Union is almost twice that of the US. In this regard, it is important to point out that while in the US the phenomenon of real wage rigidity comes from the combination of nominal rigidities on both wage and price setting, in Europe real wage rigidity is apparently not so much the result of such a combination of different nominal rigidities but a genuine real rigidity stemming directly from the institutional and structural features shaping European labour markets and which are also largely behind the relatively high rates of European unemployment. For example, in their well-known study, Layard, Nickell and Jackman (1991) report that nominal inertia in wage and price setting is considerably lower in European countries than in the US. As a result, it is reasonable to expect that even if in the US the degree of real wage rigidity could be lessened and thus equilibrium unemployment improved by accepting some positive rate of inflation, this would be much less feasible in European countries since the reasons for both real wage rigidity and high unemployment are different.

Consequently, pending the availability of direct evidence concerning the relevance of the Akerlof et al. results for the European case, the foregoing indirect evidence would tentatively suggest that the existence of an exploitable long-term inflation/unemployment trade-off at low inflation rates is considerably more doubtful in the European context than in the US. Therefore, the case for targeting a positive rate of inflation to deal with the unemployment problems associated with downward nominal wage rigidities is even weaker in Europe than in the US, and correspondingly it is likely that such a "positive rate" would be smaller than that found for the US. Thus, it would not be the workings of monetary policy which, by pursuing elusive long-term trade-offs, would help to permanently lower unemployment in Europe, but rather the resolute specific action of national governments in removing the structural rigidities that lie behind the highly rigid real wages and the high European unemployment rates.

3.3.Higher credibility of monetary policy

In economies which succeed in maintaining low rates of inflation, there are additional changes in the effectiveness of monetary policy that ought to be considered. In this regard, it is relevant to recall that, while the maintenance of low inflation reflects success in dealing with the well-known "inflation bias" problem, it need not be accompanied by a successful solution to the so-called "stabilisation bias" problem (Goodfriend (1991) and Woodford (2000b)). According to the latter, even if monetary policy ensures the

maintenance of an inflation rate in line with the objective, this could be accompanied by an excessive volatility of inflation, output and/or the policy instrument (i.e. short-term interest rate) relative to what would be optimal.

The clearest way to see this issue is in terms of the now-familiar short-term volatility trade-off originally postulated by Taylor (1979). According to this, monetary policy should rapidly react to offset demand shocks, thus avoiding both inflation and output volatility at the cost of higher interest rate volatility. In contrast, in the face of cost-push shocks, the only way for monetary policy to reduce inflation in the short term is to lessen aggregate demand by increasing interest rates. Thus, there will be a trade-off between inflation volatility, on the one hand, and output and interest rate volatility on the other. Since lower volatility of inflation and output and -under some circumstances, like the zero bound problem, concern with financial fragility or tax-smoothing considerations- lower interest-rate volatility are deemed to be welfare-enhancing, it is in society's interest to achieve the best possible combination: the lower the volatility of each of the three variables, the better.

Clearly, the nature of the trade-off depends on the sources of shocks and on all the parameters governing the functioning of the economy. The important question is whether the trade-off is likely to be any different in a low inflation regime.

As emphasised by a number of authors, the trade-off is improved and thus the "stabilisation bias" problem addressed whenever the central bank enjoys greater credibility in pursuing its optimal state-contingent plans (even if the latter may become time-inconsistent) aimed at the objective of price stability, and as long as the public's current behaviour (i.e. in price setting) depends on expectations about the future²⁶. In this way, central bank policy will affect people's expectations in a favourable manner which, in turn, will improve the short-term volatility trade-off faced by the central bank, leading to an overall increase in welfare.

A specific example of how the above could be relevant in a low inflation environment has been provided by Svensson (2000) and Woodford (2000a). The basic conjecture is that as long as a regime of low and stable rates of inflation is accompanied by low and stable expectations of inflation, this would be a reflection of the greater credibility enjoyed by

²⁶ See Goodfriend (1991), Clarida, Gali and Gertler (1999), and Woodford (2000a)

policymakers concerning the maintenance of price stability²⁷. In these circumstances, inflationary expectations will foreseeably remain closely in line with -or be mean reverting to- the price objective when the economy is hit by shocks that imply a departure from low inflation. If so, the economy will be less subject to the "stabilisation bias" that results from a less than optimal short-term performance even if "inflation-bias" problems do not reappear.

The firm anchoring of inflationary expectations around the price stability objective entails several things. On the one hand, there will not be any "inflationary scares" (Goodfriend, 1995), thus removing one potentially important source of macroeconomic disturbances to the economy. And, on the other, the favourable behaviour of expectations will reduce the adverse impact of inflationary shocks on inflation and output volatility and will furthermore require a lower than otherwise volatility of interest rates to stabilise the economy around the established objectives. Specifically, in a highly credible policy regime, an inflationary shock will not lead to as large an increase in inflationary expectations as it otherwise would, thus lowering its impact on current inflation. This, in turn, will require a lower output contraction relative to potential, thus requiring a lower increase in real interest rates to counter the shock. And finally, the increase in nominal interest rates needed to bring about the desired increase in real rates will be also smaller since there will now be no -or a much smaller- increase in inflationary expectations. For these reasons, it is to be expected that in a consolidated low inflation environment with high credibility there will be a more favourable trade-off between the volatility of inflation, output and nominal interest rates.

It should also be recognised, however, as stated by Goodfriend and King (1997), that when the central bank is very credible in maintaining low inflation, this very credibility makes some of the indicators which are traditionally looked at to assess the risk of price pressures less useful. For instance, higher long-term interest rates would signal higher future expected short-term real rates rather than higher inflationary expectations; and firms could be less likely to accumulate inventories when the economy nears full employment as agents will trust the ability of the central bank not to push demand beyond capacity. Consequently, while it is essential that the central bank remains firmly in control to ensure the maintenance of price stability, there is the question of which indicators of price pressures should the central bank look at in the practical conduct of monetary policy.

²⁷ See Bernanke, Laubach, Mishkin and Posen (1999) for a description of how price stability oriented monetary policies in a number of countries have earned credibility.

To this issue I will turn in Section 5 when discussing the role of asset prices in the conduct of monetary policy.

4. Changes in the relative importance of different sources of macroeconomic fluctuations

A potential consequence of a low inflation regime is that, insofar as it is accompanied by stable, less noisy monetary policies, it will *ceteris paribus* contribute both towards reducing overall macroeconomic uncertainty and reducing monetary uncertainty relative to the other sources of uncertainty impinging on the economy. If so, it is important to ask the following questions: Firstly, does the reduction in overall uncertainty contribute towards a better understanding of the monetary transmission mechanism and thus render policymaking easier? And secondly, does the change in the relative importance of different sources of uncertainty make monetary policymaking any easier?

Regarding the first question, once monetary policy becomes more stable and less noisy, this ought to improve the quality of the information available to the private sector, helping it to better distinguish between nominal-aggregate shocks and real-idiosyncratic shocks. Therefore, the policymaker trying to estimate the relevant parameters which describe the set of behavioural equations constituting the monetary transmission mechanism could benefit from less frequent structural breaks and more predictable private-sector responses, thus gaining a better understanding of the monetary transmission mechanism²⁸. Consequently, policymakers living in a low and more stable inflation environment could benefit from an improved knowledge of the monetary transmission mechanism in the form of reduced parameter uncertainty (Issing (1997)). This is certainly an issue worth of being researched further.

As concerns the second question, a visible development in recent years has been that in many countries there have not only been more stable and predictable monetary policies set in place to help achieve and maintain price stability, but also various mechanisms have been introduced to achieve and maintain fiscal discipline, both in the US and in European countries. Since historically both monetary and fiscal policies have been among the main

²⁸ It could nevertheless be argued that for better estimating the behavioural parameters it helps to have a higher -rather than a lower- degree of variability of the relevant economic variables, and consequently, that a low and stable inflation regime may be "too flat" to allow a sufficiently precise estimation of the relevant parameters.

driving forces of disturbances in aggregate demand, what seems to be observed in the present context of low inflation is that the uncertainty from aggregate demand is being reduced relative to that from aggregate supply -which is associated with cost-push shocks, technological shocks, etc...-.

Evidently, a monetary policy which strives to maintain price stability has an easier task if, to begin with, it does not "shoot itself in the foot" by introducing monetary noise which has to be later counteracted and, in addition, if it does not have to react to fiscal policy shocks. In terms of the Taylor volatilities trade-off, in such an environment there will be a lower volatility of the policy instrument and also of inflation and output, insofar as, in practice, monetary policy cannot in general fully and instantaneously offset demand shocks due, for example, to the presence of imperfect information or lags in the monetary transmission mechanism.

While monetary policymaking is indisputably rendered easier and the economy enjoys a more favourable volatilities trade-off, it is also nevertheless true that the shocks that remain undiminished -supply side shocks- are those which the monetary authorities find more difficult to tackle. As is well-known from the theory of optimal monetary policy, while it is appropriate to try to fully and immediately offset demand shocks to preserve price stability, it is in general appropriate to converge towards price stability more gradually following cost-push shocks, thus allowing for temporary departures from price stability. This is so because, under the latter shocks, policymakers face a trade-off between inflation and output variability which makes it socially undesirable to try to fully offset the price consequences of the shock on account of the associated output costs.

In particular, while the policy responses following demand shocks are quite clear (tighten policy after an expansionary shock regardless of its duration or specific origin, and vice versa), such responses are likely to be considerably more complex when supply-side shocks prevail. For instance, it matters whether the shock is a cost-push shock or a technology shock since, in the latter case, potential output is affected. Furthermore, in the case of technology shocks it matters greatly whether the growth rate of output is transitorily or permanently affected. And finally, as revealed by the recent performance of economies -like the US- which have experienced technology shocks, these have repercussions for both aggregate supply and demand whose relative timing and intensity need to be considered before taking policy decisions (Buiter (2000), Galí, López-Salido and Vallés (2000)).

The easiest way to illustrate the above is to consider the example of a policymaker following a simple Taylor rule of the sort:

$$i = r^* + p^* + a(p - p^*) + b(y - y^*) \quad ; \quad a > 1, \quad b \geq 0$$

where r^* is the neutral equilibrium real interest rate, p^* the inflation objective, y^* potential output, p inflation, y output and i the short-term nominal interest rate.

Let us assume that the economy is hit by an expansionary demand shock. Clearly, following the shock there will be an increase in inflation relative to the objective and a positive output gap which -according to the policy rule- will both lead to an interest rate increase in the short run. In the longer run, the nominal interest rate will revert back to its initial position once inflation goes back to the objective and the output gap is closed ($i = r^* + p^*$). So, the policy response is clear: raise nominal rates by enough to raise real rates so as to counter the expansionary shock as fully and quickly as possible, and then revert to the initial interest rate once equilibrium is restored.

In contrast, consider the case of a favourable technology shock. If the shock only temporarily affects the growth rate of output, in the long run the equilibrium real interest rate will remain unchanged and, for the same inflation objective, so will the equilibrium nominal interest rate ($i = r^* + p^*$). But does this mean that there should be no policy response in the short run? Not really, since depending on the strength and timing of the favourable effects of the shock on supply and demand (for example, through the wealth effects coming from the higher asset prices resulting from better profit prospects if the shock is temporary but persists for sometime) there would be deviations by inflation relative to the objective and changes in the output gap which -according to the policy rule- would require a reaction by the authorities. Yet whether this should take the form of an interest increase or decrease will depend on whether demand expands by more or less than supply in the short term. Or more specifically, in terms of the Taylor rule, it can happen that either both the output gap and inflation fall, thus requiring a fall in interest rates; or that both the output gap and inflation rise, thus requiring an increase in interest rates. Yet, the shorter lived is the shock (or the more it is perceived as such) the more likely it is that interest rates will have to drop as the demand effect will be very small relative to the supply effect.

Things are somewhat different when the shock permanently affects the growth rate of output. In the long run, contrary to above, the equilibrium real interest rate will generally need to be higher and thus the equilibrium nominal interest rate will also be higher. In the short term, while it is likely that the favourable effects on supply and demand will both be larger, their relative strength and timing could lead to either lower or higher interest rates, depending on what the overall effects are through the policy rule resulting from changes in the equilibrium real interest rate, in the deviation of inflation from the objective and in the output gap. Still, there is the formidable complication of deciding which is the appropriate path that interest rates should follow over time to reach the higher long-run equilibrium value.

It follows from the above that, in contrast to demand shocks, where the direction of policy responses is fairly clear quite independently of the source and nature of the shock, policy responses to supply-side shocks are more complex and dependent on the specific source and nature of the shock. This makes it crucial for policymakers to strive to clearly explain to the public the nature of their responses and the elements incorporating them in order to prevent the unavoidable complexities from leading to unnecessary and potentially damaging confusion. Therefore, while monetary policymaking naturally becomes easier in an environment where important sources of uncertainty on the demand side have greatly diminished, dealing with the more difficult shocks -supply shocks- is no easier.

A final point to be made is that, in addition to the policy response to supply shocks being more complex than to demand shocks, identifying the former is sometimes likely to be more difficult than identifying the latter. Specifically, while there are traditional indicators of the monetary and the fiscal stance that, though imperfect, help identify shocks to aggregate demand from either the monetary or fiscal policy sides, things are often significantly more cumbersome in the case of supply shocks and, in particular, of shocks to technology. As the recent experience of the US has shown, statistical measurement of productivity shocks is rather intricate and entails a considerable delay, thus leaving policymakers guessing -until firmer evidence is available- whether there really has been a technology shock, how big it is and the horizon over which it is likely to affect the growth rate of output²⁹.

5. Price stability, financial stability and the role of asset prices and quantities

²⁹ See Orphanides (1999) for the policy consequences of mismeasuring the output gap in earlier periods in the US.

While some central bank statutes include financial stability -alongside price stability- among the objectives of monetary policy, even in those cases where legal mandates focus primarily or exclusively on price stability central banks are still concerned about financial stability. Therefore, it is important to discuss a number of questions concerning the relationship between price stability and financial stability. For instance, does the maintenance of price stability limit the risk of financial stability and, if so, to what an extent? And can the central bank afford to pay more attention to financial stability issues once price stability is ensured?

Another issue that has in recent years attracted considerable attention from both academics and policymakers is the role asset prices should play in the conduct of monetary policy in a low inflation environment, where traditional indicators of price pressures run the risk of being less revealing. In particular, does it make sense to include asset prices (e.g. equities, housing, the exchange rate) in the price index that serves to define the price stability objective? Should central banks react to asset prices directly or only insofar as they contain information which helps to forecast future price developments? And how does the appropriate role of asset prices in monetary policymaking vary with whether financial stability is included or not in the central bank mandate?

This section discusses the above issues by considering, firstly, the relationship between price stability and financial stability and, secondly, the role of asset prices and quantities in the conduct of monetary policy in a low inflation environment.

5.1. Price stability and financial stability

Although price and financial stability are two potentially different policy objectives, the experiences of industrial countries in the seventies and early eighties revealed that both objectives are largely complementary and thus that problems of financial instability are likely to be considerably less severe, in general, when the macroeconomic environment is characterised by a significant degree of price stability (IMF (1999), Crockett (2000)).

Specifically, in a context of greater monetary stability there is likely to be less noise in the trend of nominal magnitudes, thus contributing to a better functioning of all markets, including financial markets, as agents are more able to distinguish between aggregate-nominal shocks and idiosyncratic-real shocks. In addition, the lower uncertainty which both borrowers and lenders face when evaluating potential real returns contributes

towards greater financial stability, as does the fact that it becomes less difficult to assess the quality of potential borrowers. Finally, financial speculation is likely to recede in a context where agents cannot bet on asset prices going up all the time, fueled by relaxed monetary conditions.

Nevertheless, while it is largely true that the risks of financial instability are likely to be exacerbated in circumstances where inflation gets out of hand, the experience of the late eighties and the nineties shows that maintaining price stability is certainly no guarantee that financial risks will be eliminated. Furthermore, it has also been observed (Crockett, (2000)) that even if price stability is maintained there may still be problems for financial stability. In particular, in addition to the well-known financial crises in Japan and South-East Asia, in recent years a number of industrial countries which have been so far quite successful in ensuring price stability have been experiencing phenomena of asset price inflation in property and equity values and asset price gyrations which are sometimes very difficult to relate to the underlying fundamentals. Furthermore, these developments in financial prices have often been accompanied by a rapid expansion of credit which has led to increasing concern about the integrity of the financial positions of the private sector and of financial intermediaries in the event of a collapse in asset prices (BIS (2000)).

But what are the main reasons why a low inflation environment should still pose risks to financial stability?

It has been widely acknowledged that, insofar as periods of sustained low inflation are often accompanied by long periods of economic expansion (Taylor (1998)), this may result in excessive optimism on the part of private agents. Under such circumstances, there is a tendency for an overextension of credit and also of foreign credit. This occurs as borrowers demand credit to finance excessive consumption and investment based on overly "exuberant" assessments of future income prospects, and as lenders accommodate the expansion in credit demand without sufficient guarantees that the economy-wide non-diversifiable risk is appropriately priced in the loans granted or that credit standards are not lax. Such trends may be intensified by the pressures arising from a very competitive and deregulated financial environment and by the moral hazard related to existing safety nets. Moreover, even if the nominal debt in the economy keeps rising, the detection by the authorities of potential financial vulnerabilities is rendered considerably difficult by the increasing value of the underlying collateral.

This piling up of nominal debt tends to be accompanied by increases in asset prices which, to a large extent, are also based on excessively optimistic assessments of future dividends and capital gains. Indeed, asset price inflation and credit expansion do tend to reinforce each other; the higher collateral helps to obtain additional credit, and a portion of such credit is directed towards asset purchases in the expectation that their prices will continue to rise.

For all the above reasons, and as it has been witnessed in a number of economies in recent years, financial imbalances may develop as a result of asset price inflation and overextension of credit even if no departures from price stability are apparent for a prolonged period of time.

Still, it is very unlikely that price stability can be maintained in the medium term in a financially fragile environment. Specifically, during the upswing, in addition to the sectoral structural bottlenecks arising from the excessive amount of resources being devoted to those sectors whose prices rise by more in detriment of the other sectors, there will sooner or later be aggregate demand pressures as private agents take up an excessive amount of credit with which to finance consumption and investment plans based on excessively optimistic forecasts of future earnings, and as rising asset prices further expand private spending. All this will eventually show up as a higher inflation rate if the upswing lasts long enough. In turn, when the financial risk finally materialises and asset prices fall, there will be deflationary pressures in a context where the integrity of the financial positions of the public and of banks' balance sheets could be jeopardised³⁰.

The above description of financial cycles suggests that even in an environment of low inflation there can be significant strains on financial stability, which are partly related to an excessively sanguine assessment of future income prospects on the part of both borrowers and lenders. Over time, such strains could even lead to upward departures from price stability during the phase where there is an accumulation of financial imbalances, while later on they can cause downward departures from price stability as the financial cycle turns down, asset prices fall and credit contracts. Consequently, while the symptoms of financial instability may be apparent at a time where price stability seems to be maintained, sooner or later price stability will inevitably be compromised.

³⁰ See, for example, Bernanke, Gertler and Gilchrist (1999).

Clearly, many of the above problems need to be addressed directly by the authorities legally responsible for the preservation of financial stability, through the adoption of the appropriate regulatory and supervisory framework. But the key question remaining for central banks whose mandate attaches primary importance to the maintenance of price stability is how they should make use of the information embedded on financial variables and, in particular, on asset prices and quantities when taking monetary policy decisions. To this question I now turn.

5.2. Asset prices and quantities

In principle, it is quite reasonable to think that, at the source of the rapid growth of credit and asset prices, there must be relatively relaxed monetary and financial conditions which are capable of accommodating and even fuelling such phenomena, even if no departure from price stability is observed for quite some time. But if this is really the case, it is important to ask how central banks can make the best possible use of the information contained in asset prices and/or quantities so as to ensure macroeconomic stability and, in particular, price stability over the medium term. In what follows, several possibilities are considered which are often the subject of academic and policymaking discussions: (a) modifying the price index which the monetary authorities seek to stabilise by including asset prices alongside consumption prices; (b) establishing intermediate targets on certain asset quantities -such as money-; and (c) making policy respond directly to asset prices over and above their value in helping forecast future price developments.

(a) Regarding the re-definition of the price index, the well-known paper by Alchian and Klein (1973) proposes that asset prices should be included together with current consumption goods and services prices in the overall price index that the monetary authorities seek to stabilise. The logic underlying the Alchian and Klein proposal is that, rather than defining price stability in terms of the money prices of current consumption as is usually done, it would be better to define it in terms of the money price of lifetime consumption, measured in current prices. The reason for this is that, under certain conditions, the price of future consumption can be satisfactorily approximated by current asset prices.

However, there are substantial problems with implementing such a proposal. Firstly, as pointed out by Vickers (1999), price stability should be conceptually understood as the stability over time of the money price of current consumption, and not as the stability of

the money price of current and future consumption. Secondly, there are formidable empirical problems in measuring the price of future consumption. Thirdly, as explained by Cecchetti, Genberg, Lipsky and Wadhvani (2000), targeting asset prices would lead to rather erratic policymaking, as asset prices tend to move quite substantially and in a noisy manner. Therefore, this could cause significant departures from price stability as it is now understood. Fourthly, targeting asset prices requires correctly identifying what price path corresponds to the course of the underlying fundamentals, something which is extremely hard to do. And finally, central banks should not be seen as directly taking responsibility for asset prices since they cannot control them.

Once the conclusion is accepted that current consumption price indices should not be "augmented" to include asset prices, the question remaining is how to make use of financial quantities and asset prices in the conduct of monetary policy in a low inflation environment, where traditional indicators of price pressures are a lot more muted.

(b) As concerns the possibility of directly targeting monetary or financial asset quantities -such as some measure of money or credit-, there is a well-known and extensive literature that advises in general against doing so³¹. In practice, it is rather unlikely that in a deregulated, competitive financial environment, which is subject to continuous processes of financial innovation, there will be a sufficient degree of controllability of the relevant monetary or financial aggregate and a sufficient degree of stability of the behavioural relationships linking monetary or credit growth and nominal spending to ensure that such a strategy will be successful in achieving and maintaining price stability. Hence the growing popularity of strategies which hinge on a global assessment of prospective price developments, to which monetary and credit aggregates contribute as relevant indicators, and sometimes as privileged indicators. This is the case, for example, with the so-called "two pillar" monetary policy strategy of the European Central Bank.

(c) Finally, concerning the role to be played by asset prices in the conduct of monetary policy, insofar as asset prices contain useful information that helps predict future price developments, they should clearly be part of the relevant set of indicators at which the central bank looks to take monetary policy decisions aimed at maintaining price stability, their relative importance being directly proportional to their predictive power. Nevertheless, account should be taken of several things: that the integration of asset prices into current macroeconomic models is often not as rich and successful as is deserved;

³¹ See Rudebusch and Svensson (2000), and Svensson (1999b)

that the information provided by asset prices is not structurally invariant, being quite sensitive to the policy regime (Lucas (1976), Estrella (1997)); and that the available international empirical evidence on the value of asset price changes in predicting future price and output developments is far from conclusive³².

Yet provided that overall there is informational value in financial prices that can be used to assess prospective price developments, there are different views concerning whether monetary policy should directly react to asset prices over and above the role played by the latter in helping forecast future price prospects.

On the one hand, Bernanke and Gertler (1999) have shown that a monetary policy which reacts directly to asset prices may be detrimental to macroeconomic stability and -in particular- to price stability. For these authors, even when asset prices depart from what the fundamentals would justify, the best contribution that monetary policy can make is to take into account asset price movements only insofar as they are indicative of changes in expected future inflation. That way, policy decisions will foster both price stability and financial stability. On the other hand, Cecchetti, Genberg, Lipsky and Wadhvani (2000) have recently argued that, in general, there is a well-founded case for monetary policy to react directly to asset price movements when they reflect -or are perceived by the monetary authority as reflecting- bubbles. This is so because disinflating an asset price bubble at a sufficiently early stage contributes to macroeconomic stability -and also to financial stability- by reducing the likelihood of a "boom-bust" financial cycle. According to the authors, while this strategy could lead to missing the inflation objective over a certain horizon (eg. two years) it would nevertheless help maintain price stability over a longer horizon (see also Kent and Lowe (1997)).

In my view, there are a number of reasons which would advise against augmenting the reaction function of the central bank to directly include asset prices as arguments, over and above the indirect attention they receive through their role in helping forecast price developments. Firstly, as is well known, it is very difficult in practice to identify asset price bubbles and even more so at an early stage, with the subsequent risk that policy would be countering asset price developments which are genuinely supported by the fundamentals. Secondly, it is highly uncertain how asset market bubbles would respond to policy changes. In particular, while it is true that bubbles may be less difficult to detect once they become big enough, it must be taken into account that any attempt to gradually

³² See, for example, BIS (1998), Goodhart and Hofmann (2000), and Stock and Watson (2000).

disinflate a bubble which is big enough to be detected may well lead to its explosion, thus potentially destabilising the economy. Thirdly, since there is a wide array of asset market prices -equities, housing, exchange rates, etc...- problems may be encountered if some but not all are included in the policy reaction function. Specifically, trying to counter a bubble in one specific asset market may throw other asset markets out of equilibrium. And last, but certainly not least, there would be significant communication problems in explaining to the public, for instance, why official interest rates are being increased at a time when the assessment by the central bank is that price stability is being maintained over the relevant medium term policy horizon.

In view of the above discussion there are no good reasons for believing that central banks should directly react to asset prices over and above the indirect reaction which is implicit insofar as such variables help predict future price developments over the medium term. Perhaps one way of reconciling to a certain extent the contrasting views of Bernanke-Gertler and Cecchetti et al. concerning the role of asset prices in the conduct of monetary policy is to depart from the simplified environment on which their conclusions are based. Such an environment is one of certainty equivalence resulting from the absence of non-linearities and multiplicative uncertainty. Under such circumstances, as is well known, policymakers only care about mean expected inflation but not its overall distribution.

In a more complex but more realistic context, like the one faced by central banks, monetary policymakers do not only care about future inflation developments in terms of the expected mean -as in the baseline or central scenario-, but also in terms of its entire distribution in a more or less explicit manner, as is typically done in the assessment of the various risks to price stability. From this viewpoint, it could be argued that asset prices (and quantities) should be taken into account not just insofar as they help to forecast mean future inflation but also as they help forecast the distribution of future inflation over the medium term. This procedure, which bears a close resemblance to what Svensson (1999b) has termed "distribution inflation forecast targeting", would still not allow asset prices (or quantities) to play any direct role in monetary policy decisions in addition to that which they would indirectly play by helping to forecast the price distribution.

Notwithstanding the foregoing, a final note of caution is required. In practice, current structural and reduced-form models incorporating asset prices and quantities may not yet be rich enough to fully capture the channels through which these variables affect the economy, and thus policymakers may still be far from being able to make the best possible

use of such variables in forecasting future price developments over different time horizons. If this were the case, monetary policy might sometimes fail to react as swiftly as required to avoid macroeconomic instability. Consequently, it is highly desirable from the standpoint of improving the conduct of monetary policy that further research be undertaken to improve the understanding of how financial and real variables interact in increasingly realistic macroeconomic settings.

6. Implications for the practical conduct of monetary policy

The main challenge confronting the monetary authorities in a context of low inflation is to ensure that price stability is maintained by effectively countering both deflationary and inflationary risks. At the same time, however, it is important that the chosen policy framework should lead to decisions ensuring the best possible macroeconomic performance as reflected, for example, in a low volatility of inflation around the objective and of output around potential (ie. avoiding stabilisation bias).

The endeavour over the years to find a monetary policy framework capable of fulfilling the above aims has crystallised nowadays in a rather broad consensus about the key features that should characterise such a framework, both at the institutional and the strategic levels³³. At the institutional level, it is widely accepted that the maintenance of price stability should be the primary goal of monetary policy and that central banks should enjoy considerable independence in the pursuit of this goal. At the strategic level, while at present there are different policy strategies in various countries and economic areas, there is nevertheless a core of agreement on certain *desirable features* that the appropriate strategy should have. Firstly, constrained discretion should be exercised, in the sense of blending rigour and discipline in the medium-term policy stance with some room for manoeuvre to respond to macroeconomic disturbances in the short term. Secondly, it should be forward-looking to take properly into account the lags with which monetary policy affects price developments. Thirdly, it should not be run mechanically, but rather make efficient use of the available information, both model-based and extra-model. Fourthly, it should ensure that the decision-making process performs reasonably well across different models of the economy, given how imperfect policymakers' knowledge is about the monetary transmission mechanism. And finally, both the strategy and the decisions made on the basis thereof should be clearly and transparently communicated to the public, so as to favourably influence the expectations of the private sector.

³³ See Fischer (1994), McCallum (1988 and 1997), Taylor (1999a) and Svensson (1999b).

In principle, the policy framework described should be able to contribute towards resolving two sorts of difficulties. On the one hand, the dynamic inconsistency problems arising from an excessively discretionary management of monetary policy, which make it difficult to maintain price stability or, at least, to do so efficiently by successfully influencing expectations. And, on the other, the drawbacks associated with rigid rules which, by predetermining the course of monetary variables or instruments, may unduly constrain in actual practice policymakers' scope to react to useful information.

Beyond these basic elements of the desirable monetary policy framework, there are different views concerning the specification of policy objectives such as, for example, whether price stability should be explicitly defined, over which horizon and on the basis of which price index; and whether it is better to pursue objectives defined on the basis of the price level or the inflation rate (ie. the base drift issue). Moreover, and linked partly to the above, there is also room for discussion regarding the sort of basic principles that could orient policy decisions. For example, to what extent should policy be purely forward-looking or should also incorporate some "history dependence" (Woodford (2000a,b))? How gradualist or aggressive should policy responses be to various shocks? How symmetric should policy responses be to inflationary and deflationary shocks? And how should the information from various indicators be combined when arriving at policy decisions?

In what follows, an attempt is made to explore -in the light of the analysis provided in previous sections- to what extent the enshrinement of a low inflation environment is likely to influence the views concerning the specification of what constitutes a desirable monetary policy framework.

6.1. Statutory policy objectives and central bank independence

As explained in Section 2 of the paper, while the achievement and consolidation of the low inflation environment has been made possible by the increased orientation of monetary policy towards price stability in a social context where such a goal has been increasingly valued, risks exist which could threaten the sustainability of the present situation. In particular, it should be recalled that insofar as the public's preferences may be influenced by the joint evolution of unemployment and inflation, there is a risk that, in those areas where inflation remains low while structural unemployment continues to be high (in the absence of the implementation of the necessary structural reforms), the

public's attitudes may eventually start shifting in favour of expansionary demand policies so as "to do something" about unemployment.

In this regard, in those countries where disinflation was previously achieved but whose institutional framework did not explicitly place price stability as the primary goal of monetary policy or did not formally establish the independence of the central bank, there could eventually be higher inflationary risks and significant challenges for monetary policy. The implication would thus be that, even when low inflation was achieved and maintained in a social context favourable to low inflation in the absence of a clear legal mandate to do so, *there are very good reasons at present to establish or to improve such legal mandate in the direction of both granting pre-eminence to price stability among other monetary policy objectives, and of safeguarding the independence of the central bank in order to fend off the political pressures that could otherwise arise.* Doing so would contribute to preserving the anti-inflationary credibility of the central bank.

6.2. Defining price stability: who and how

Even when the institutional framework is clearly supportive of price stability, there is still a risk that in a social context pushing for expansionary policies there may be outside pressures to operationally re-define "price stability" in terms of a higher inflation rate. Evidently, such inflationary risks would be greater in those cases where it is the government rather than the central bank which explicitly defines what constitutes price stability, or when this prerogative is in the hands of the central bank but no explicit definition is provided. For these reasons, it might be advisable in the above cases *to take the necessary steps to bestow upon the central bank the responsibility of defining operationally what is meant by price stability (in terms of actual numbers) and for such definition to be clear and explicit.*

There is also the issue of whether in a low inflation environment there are economic reasons to increase the rate of inflation, explicitly or implicitly targeted by the central bank. As concluded in Sections 3.1 and 3.2, neither the zero-bound problem nor the real-wage rigidity problem seem to warrant increasing the upper range of targeted inflation rates relative to what central banks committed to maintaining price stability already do. In this regard, *continuing to have inflation rates of about 2% as the upper bound for the range of what constitutes price stability would seem reasonable, on the understanding that price stability is to be maintained over the medium term.*

Concerning the length of the "medium-term" horizon over which price stability has to be maintained, should the optimal policy horizon become any different in a low inflation environment? In addition to the reasons that will be discussed later in the debate over whether it is the price level or the inflation rate that should be stabilised, there are two motives why *the horizon could now become somewhat longer*. First, if the central bank enjoys higher credibility, it can allow itself to have a longer horizon as the public will not be so eager to promptly check the ability of the central bank to deliver on its promises (as it would be in the case of a central bank which enjoys lower credibility or which is still in the process of earning its credibility). And further, if the lower monetary noise that presumably comes with a low inflation environment allows a better knowledge of the monetary transmission mechanism, it would also make it possible for the central bank to have better quality forecasts at longer-term horizons. Insofar as a longer policy horizon had not been chosen before because of the significant lack of knowledge of the impact of policy on such a time frame, this constraint may now be relaxed.

6.3. Price level versus inflation objectives

An issue that has recently become the subject of increasing attention among academics and policymakers -and which is surveyed in Gaspar and Smets (2000)- is whether price stability should involve targeting inflation or the price level³⁴. Clearly, while in the former case there is *base-drift* in the price level as "bygones are bygones", in the latter the *absence* of base-drift means that shocks to the price level (or the price level path) have to be fully reversed³⁵.

The reasons why this debate makes sense are threefold. Firstly, while it was natural to consider that achieving low inflation was an ambitious enough objective in those years where central banks were trying to disinflate their economies from relative high inflation rates, once this objective has been realised the more ambitious goal of stabilising the price level is now understandably being considered. Secondly, there are grounds to think that society may not only care about having stable low inflation but also about having a stable price level so as to guarantee certainty in long-term economic and financial planning (Hall (1994)). And finally, there has recently been research showing that, even if society does not value stability of the price level per se but only having low inflation, the adoption of a credible price level target may, under certain conditions, have desirable repercussions on

³⁴ See, for example, Blinder (1999), King (2000), Svensson (1999a), Woodford (2000 a,b) and Parkin (2000).

³⁵ In principle, price level targeting implies defining a pre-specified price level path, which could grow by 0% or by X%. In what follows, for the sake of clarity the discussion refers to keeping the price level constant -the 0% case.

nominal and real macroeconomic stability, preventing both the inflation bias and stabilisation bias problems which arise in an unconstrained discretionary policy framework.

The traditional view on the pros and cons of price level versus inflation targets is that price level targeting helps to reduce the long-term variability of the price level but at the cost of inducing higher short-term variability of inflation, as inflationary periods would have to be followed by deflationary periods to keep the price level constant. In the presence of nominal rigidities this would entail higher output variability³⁶. As a result, the relative desirability of price-level targeting would depend on how society does value long-term benefits relative to short-term costs.

Nevertheless, as Gaspar and Smets (2000) note, the trade-off between a lower variability of the price level in the long-term and a higher variability of inflation and output in the short term is present whenever the expectations of the private sector are sufficiently backward-looking³⁷. In contrast, when the private sector is forward-looking, it is generally the case that adoption of a credible price-level target need not lead to higher inflation and output variability, possibly even reducing it³⁸.

Overall, the available literature tends to conclude that adopting a credible price level target is likely to be preferable when society cares about having a stable price level *per se*³⁹. But even if society does not care or does not care enough, it remains the case that a price-level target will be the more preferable the more forward-looking agents are in forming their expectations, the longer the policy horizon is, and the stronger the short-term response of prices to changes in the output gap is (Smets (2000)). The basic intuition behind the role of forward-looking behaviour is that, as agents are confident that the price level will be restored, they will expect an inflationary shock to be followed by a return to the pre-determined price level path, thus leading to a smaller increase in inflationary expectations and to a smaller inflationary impact of the shock. This will reduce the size of the official interest rate increase needed to counter the shock and, as a result, the variability of output in the short term. Concerning the horizon, a longer policy horizon lessens the need to proceed to engineer abrupt reversals of the price level, thus leading to lower short-term inflation variability. Finally, when prices are very responsive to excess demand in the

³⁶ See, for example, Fischer (1994) and Goodhart and Viñals (1994).

³⁷ See Lebow, Robert and Stockton (1992), and Haldane and Salmon (1995).

³⁸ See Vestin (1999), Svensson (2000), Woodford (2000a), Clarida, Galí and Gertler (1999) and Smets (2000).

³⁹ See Batini and Yates (2000).

short-term, the inflation variability which is necessary to stabilize the price level can be generated with little variability of the output gap.

As emphasised by a number of authors, the attractiveness of a credible price level target is further enhanced when account is taken of the zero-bound problem⁴⁰. Specifically, the confidence of the public in the restoration of the price level in the future means that, following a deflationary shock, there will be a higher expected inflation than with an inflation target, thus further lowering short and long real interest rates and self-equilibrating the economy without short-term nominal interest rates having to drop by as much as otherwise and thus running the risk of hitting the zero bound. As is evident, this self-equilibrating effect will be the more intense the more forward-looking agents are and the higher the confidence of the public is about the ability of monetary policy to actually re-inflate the economy, which is crucial for the credibility of the price level target.

The main interest of the above results is that they cast more than a shadow of a doubt on the inevitability of the trade-off associated with the adoption of a price-level target, thus making it nowadays a much more palatable alternative to targeting the rate of inflation or, at least, making it a desirable complement to targeting inflation. From this light, it can be said that as the credibility of central banks has become firmer in the present low inflation environment, there are reasons to think that a policy of -at least- partially reversing changes in the price level -as emphasised by Goodfriend and King (1998) and King (1999)- may be a desirable course to take, the fraction of the reversal being correspondingly higher the more confident the policymaker is about the forward-looking behaviour of private agents and on the short-term responsiveness of prices to the output gap, and the longer the horizon is over which the price stability objective has to be reached.

Nevertheless, these potential advantages should be compared to the -much less noted- potential disadvantages that such a "mixed" policy of partial base drift could have in terms of complexity, transparency and external communication, as the fulfilment of the policy objective is likely to become more difficult to monitor by the public and the explanation of policy responses more cumbersome than if the objective were solely defined in terms of the inflation rate. Consequently, more research is therefore necessary to incorporate those more qualitative but nonetheless very important considerations into a global assessment

⁴⁰ See, among others, Coulombe (1997), Wolman (1998), Reifschneider and Williams (1999), and Gaspar and Smets (2000).

before deriving definitive policy recommendations on the price level versus inflation targeting issue.

6.4 Gradualism, pre-emptiveness and symmetry in policy responses

One of the reasons behind the attractiveness of price-level targeting is that by adopting such an objective the central bank can credibly pre-commit to take a course of action which is not purely discretionary, in the sense of re-optimising every period as if the past did not matter. By incorporating this sort of history dependence in the policy framework, the central bank can thus favourably influence private-sector expectations and succeed in maintaining price stability with low inflation and output variability.

More generally, as emphasised by Woodford (2000a and 2000b) and Svensson and Woodford (1999), any sort of policy framework which is not purely forward-looking (as occurs with discretionary inflation targeting) but which also incorporates some degree of history dependence can have favourable effects on macroeconomic stability insofar as the central bank is credible and the private sector is sufficiently forward-looking. In this regard if, as discussed in Section 3.3, the low inflation environment comes together with higher credibility of monetary policy, there is a presumption that, while *monetary policy should continue to be forward-looking and pre-emptive, central banks will enjoy somewhat more flexibility in responding with somewhat less anticipation and with smaller changes in the policy instrument to inflationary shocks* without the risk of this being misinterpreted by markets. More precisely, higher credibility is what makes private-sector expectations adjust in a self-stabilising fashion, thus making it less necessary for policy to respond as pre-emptively and strongly as otherwise.

On the other hand, as long as the more stable low inflation environment allows for a better knowledge of the structure of the economy -and, in particular, of the impact of monetary policy-, this could make desirable responding more strongly to shocks (Brainard (1967) and Söderström (1999)). If that were the case, then the combined effect of enjoying higher policy credibility and having a better knowledge of the economic structure would still make desirable to respond somewhat less pre-emptively to disturbances but not necessarily less strongly than otherwise. This is certainly a question worthy of further investigation.

Moreover, to the extent that zero-bound problems remain a concern, *it might be appropriate to have somewhat asymmetric policy responses*. Specifically, as discussed in Section 3.1, it might be advisable for policymakers to respond relatively more promptly and aggressively than they would normally do whenever they are faced with deflationary shocks that threaten to place the economy dangerously close the liquidity trap.

Another relevant policy issue is that, as the discussion in Section 4 made clear, the *environment under which monetary policy operates is significantly improved* in a context of low and stable inflation insofar as it comes with more stable demand policies and thus with less frequent and smaller demand shocks that need to be countered. Yet policy will continue to face supply shocks, the policy responses to which are more complex and dependent on their specific nature (e.g. a cost-push shock, a technology shock which temporarily affects growth, a technology shock which permanently affects growth). In addition, the identification and measurement of supply shocks is often quite difficult (as in the case of technology shocks, which tend to show up with a considerable delay in productivity statistics). *Thus, the risk of making policy errors continues to be very present in a low inflation context.*

Finally, as concluded in Section 5, while in an environment of price stability significant strains to financial stability can still develop in the form of excess credit expansion and asset price inflation, *a central bank whose primary aim is to maintain price stability should not directly react to changes in asset prices or quantities* over and above the indirect reaction which is implied insofar as these variables help forecast the distribution of future price developments.

7. Conclusions

The fact that in recent years many industrial countries have been enjoying a situation of low inflation is certainly a most important achievement, entailing considerable economic benefits for society. In addition, since inflation is over the medium term primarily a monetary phenomenon, the present state of affairs is certainly much more comfortable for central bankers than in the past, when they had to fight hard to bring inflation down.

As this paper has tried to argue, although the recent literature has tended to emphasise the deflationary risks arising in a low inflation environment -linked to the zero bound and higher real wage rigidity problems- those risks do not seem as serious as often claimed,

although the likelihood of deflationary shock is admittedly higher when inflation is very low. In this regard, having inflation rates of about 2% as the upper bound for the range of what constitutes price stability would seem appropriate. Furthermore, sight should not be lost of the inflationary risks which can still threaten the present environment. Specifically, in addition to the occurrence of adverse supply shocks like those currently being witnessed, which can place the authorities before policy dilemmas in the short-run, there is the danger that in those cases where high unemployment rates persist -amidst a lack of appropriate structural reforms to reduce them- there may eventually be social and political pressures for more expansionary demand policies.

In the present context, the main challenge faced by monetary policymakers is to maintain price stability -by countering both inflationary and deflationary pressures- and to do so in an efficient way that ensures the best possible macroeconomic performance as reflected, for example, in the stability of inflation around the objective and of output around potential. In this light, the review made in the paper of how the low inflation environment is likely to impinge on the effectiveness of monetary policy has led to the conclusion that central banks should not depart from the core of basic principles that over the years have come to be regarded as desirable for monetary policymaking. Yet, there are some grounds to believe that while policy should continue to be forward-looking and pre-emptive, insofar as monetary policy now enjoys more credibility central banks could afford more flexibility, in the sense of gathering more information before acting, of responding to shocks with less aggressive movements in official interest rates, and of extending somewhat the medium-term horizon over which price stability is to be maintained. Also, there may now be good reasons to consider moving from targeting inflation towards targeting the price level (or the trend price level) in those cases where the policy horizon is long enough and the private sector is sufficiently forward-looking, provided this does not entail significant costs from the viewpoint of external communication to the public.

All this, however does not mean that monetary policy will not be subject to important challenges. On the one hand, while the present context makes it less likely that monetary policymakers will have to deal with large demand shocks, they will continue to face supply shocks whose policy responses are more complex. Therefore, the risk of making policy errors remains. On the other hand, although price stability and financial stability are largely complementary policy objectives, financial imbalances may develop even if no departures are apparent from price stability for a prolonged period of time. Care should be taken, however, not to overburden monetary policy with the task of solving problems

which are better dealt with by the authorities legally responsible for the preservation of financial stability, so as not to endanger the maintenance of price stability.

Appendix

A simple simulation exercise to analyse the probability of hitting the interest rate zero bound

In what follows a simple simulation exercise is carried out to analyse the importance of the zero-bound problem with the help of the following highly stylised macro model:

$$\tilde{y}_t = \mathbf{r}_y \tilde{y}_{t-1} + (1 - \mathbf{r}_y) E_t \tilde{y}_{t+1} - \mathbf{s} [i_t - E_t \mathbf{p}_{t+1}] + \mathbf{e}_{y_t} \quad (1)$$

$$\mathbf{p}_t = w \mathbf{p}_{t-1} + (1 - w) E_t \mathbf{p}_{t+1} + \lambda \tilde{y}_t + \mathbf{e}_{p_t} \quad (2)$$

$$i_t = \mathbf{r}_r i_{t-1} + \mathbf{b}_p \mathbf{p}_t + \mathbf{b}_y \tilde{y}_t + \mathbf{e}_{r_t} \quad (3)$$

Equation (1) represents the demand side of the economy, where \tilde{y}_t corresponds to detrended output as a proxy of the output gap, i_t is the nominal interest rate and \mathbf{p}_t the (quarterly), inflation rate. Equation (2) represents a Phillips curve including both backward and forward looking components. As recently stated in the literature these two equations capture the inflation dynamics observed in the late decades in industrial economies. Finally, equation (3) is a simple Taylor rule representing the behaviour of monetary policy with a smoothing component.

Table 1 shows the parameter values used in the simulation exercises. For the demand equation (1), a value of $\rho_y=0.5$ is chosen. That value is consistent with the evidence on the importance of a backward as well as a forward looking component (see Campbell and Mankiw (1989), and recently Fuhrer (2000)). For the relationship between aggregate demand and real short-term interest rates the calibrated value in McCallum and Nelson (1999) of $\sigma=0.16$ is taken for the US and $\sigma=0.06$ for the euro area (see Smets (2000)), For the supply equation (2) it is also assumed that the backward looking component is as important as the forward looking component ($\omega=0.5$). The effect of output gap on inflation (i.e. the slope of the Phillips curve) is fixed at a value $\lambda=0.25$ for the US (Roberts, (1997)) and at 0.18 for the euro area (Smets (2000)). The interest rate reaction function (3) uses the standard Taylor coefficients and a smoothing coefficient of $\rho_r = 0.8$, in accordance with recent empirical evidence (see, for instance, Clarida, Galí and Gertler (1998)).

Table 1. Calibrated Parameters		
	US	Euro area
Demand equation (1):	$\rho_y = 0.5$; $s = 0.16$; $s_{ey} = 0.8\%$	$\rho_y = 0.5$; $s = 0.06$; $s_{ey} = 0.45\%$
Supply equation (2):	$\gamma = 0.5$ $\gamma = 0.25$ $\sigma_{\epsilon_p} = 0.20\%$	$\gamma = 0.5$ $\gamma = 0.18$ $\sigma_{\epsilon_p} = 0.20\%$
Reaction function (3):	$\rho_r = 0.8$; $\beta_p = 1.5$; $\beta_y = 0.5$	

Given those parameter values, the variance of the demand (σ_{ϵ_y}) disturbance was calibrated to reproduce the observed volatility of US output (0.80%) and euro-area output (0.45%) when the data for the sample period 1980-98 is filtered with the Hodrick-Prescott method⁴¹. Similarly, the variance of the supply (σ_{ϵ_p}) disturbance was set at 0.2%, to reproduce the observed volatility of both the US and euro-area HP filtered inflation over the same sample period (0.2%).⁴²

Table 2 presents, for different scenarios of the equilibrium real interest rate and the average or targeted inflation rate, the probability that deflationary shocks will lead to the zero interest bound being hit. The different values taken for the real interest rate range from 1.5 to 4.5%, thus containing most estimates of the equilibrium real interest rate for the US and the euro area for periods covering the past twenty to forty years⁴³. The targeted inflation rate takes values ranging from 0 to 2%.

⁴¹ The data for the euro area and the US were respectively obtained from Fagan, Henry and Mestre (2000) and Citibank.

⁴² Notice that to calibrate the volatility of the shocks we are using detrended series, so avoiding the possibility that those shocks can have a permanent or long-run effects on the evolution of the variables. In this sense, our volatility measures underestimate the true volatility of the shocks.

⁴³ As reported, for example, by Fuhrer and Madigan (1997) -2.1%-, and Reifschneider and Williams (1999) -2.5% - for the US. In the the euro area, German short-term real interest rates are around 3%, on average, since 1960. In the period 1980-98, the average rates are approximately 4% in the US, and 4.5% in the euro area.

Part(a) shows the probability of hitting the zero bound when a negative demand shock occurs in the US and the euro area. As can be seen, the probability decreases as the real interest rate or the inflation rate increase and, given the parameter values for each area, such probability tends to be higher in the US than in the euro area. In any case, except for the zero-inflation case, and the lowest real interest rate, the probabilities are very small for inflation rates as low as 1%,and drop to zero in all cases when the targeted inflation rate is 2%.

Part (b) repeats the same exercise for deflationary supply shocks in the US and the euro area and finds even lower probabilities -in fact, zero or very close to zero- in all cases.

Table 2**(a): Probability (%) of hitting the zero bound (Demand Shock)**

	Real interest rate = 1.5%			Real interest rate = 3.0%		
	$\pi=0\%$	$\pi=1\%$	$\pi=2\%$	$\pi=0\%$	$\pi=1\%$	$\pi=2\%$
	US	16.0	5.0	0.0	2.0	1.0
Euro area	6.1	1.0	0.0	0.0	0.0	0.0

	Real interest rate = 4.0%			Real interest rate = 4.5%		
	$\pi=0\%$	$\pi=1\%$	$\pi=2\%$	$\pi=0\%$	$\pi=1\%$	$\pi=2\%$
	US	1.0	0.0	0.0	0.0	0.0
Euro-area	0.0	0.0	0.0	0.0	0.0	0.0

Note: Given the parameter values and the distribution of the demand shock $N(0, s_{ey})$, the figure in each cell gives the probability to generate an interest rate equal or lower than zero.

(b): Probability (%) of hitting the zero bound (Supply Shock)

	Real interest rate = 1.5%			Real interest rate = 3.0%		
	$\pi=0\%$	$\pi=1\%$	$\pi=2\%$	$\pi=0\%$	$\pi=1\%$	$\pi=2\%$
	US	0.0	0.0	0.0	0.1	0.0
Euro area	0.1	0.0	0.0	0.0	0.0	0.0

	Real interest rate = 4.0%			Real interest rate = 4.5%		
	$\pi=0\%$	$\pi=1\%$	$\pi=2\%$	$\pi=0\%$	$\pi=1\%$	$\pi=2\%$
	US	0.0	0.0	0.0	0.0	0.0
Euro-area	0.0	0.0	0.0	0.0	0.0	0.0

Note: Given the parameter values and the distribution of the supply shock $N(0, s_{et})$, the figure in each cell gives the probability to generate an interest rate equal or lower than zero.

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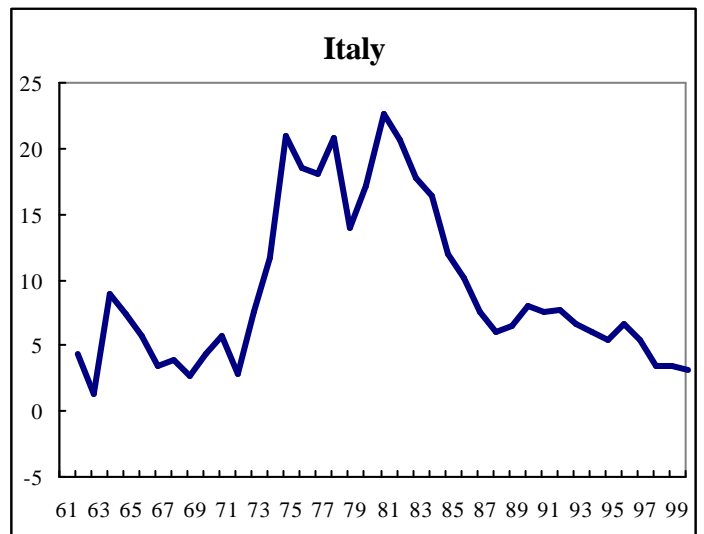
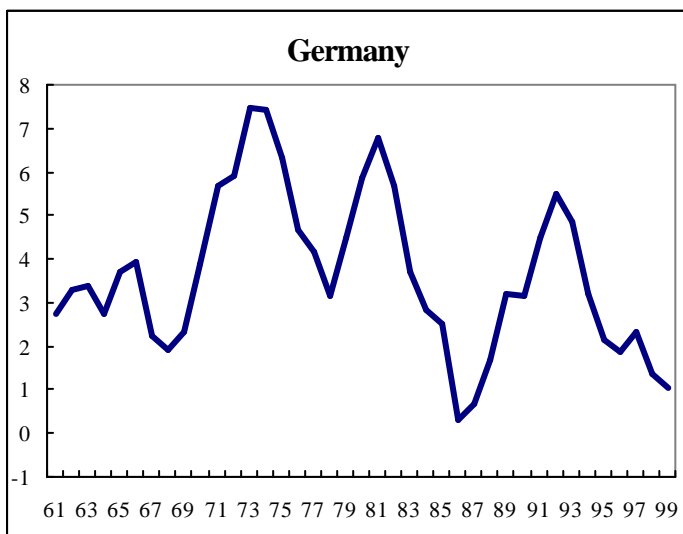
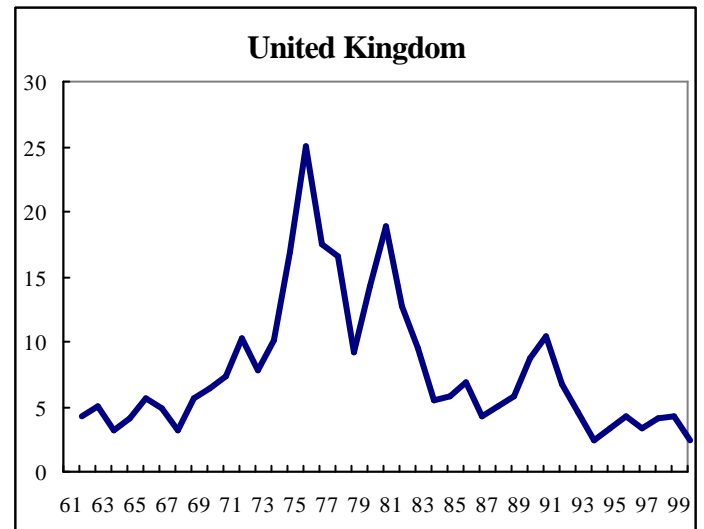
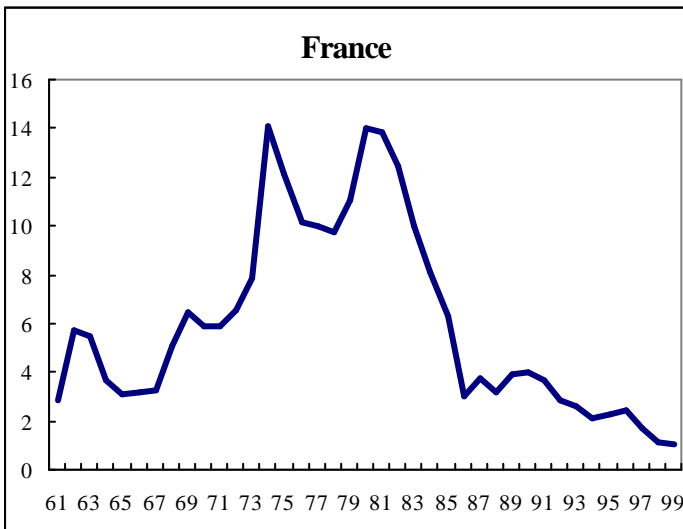
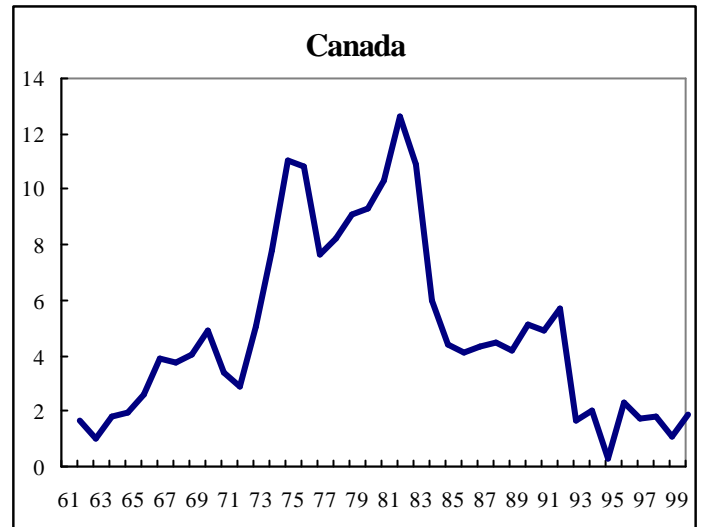
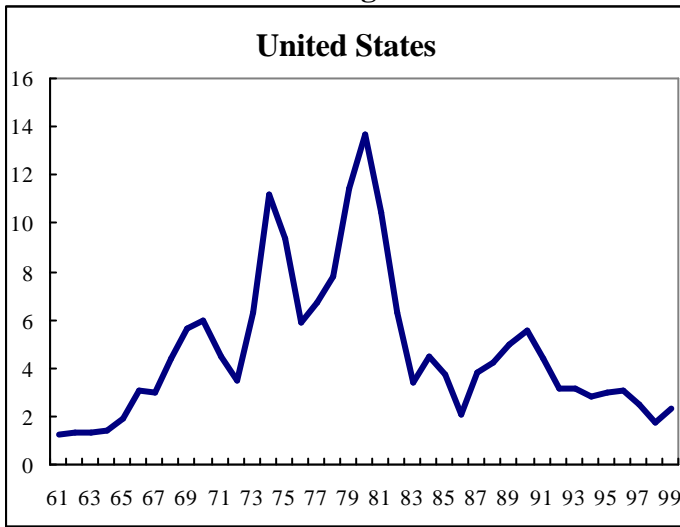
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Figure 1. Inflation in selected industrial countries



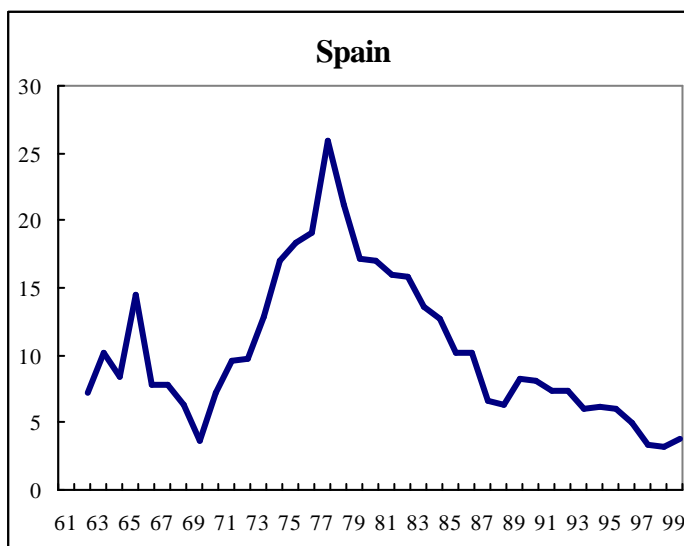
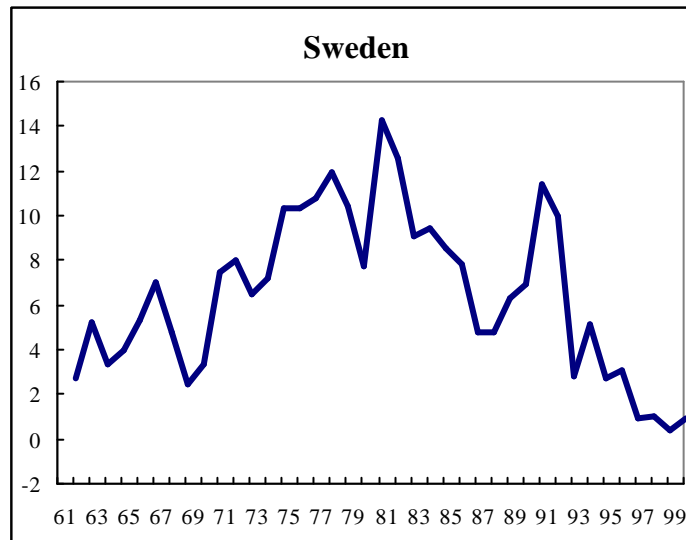
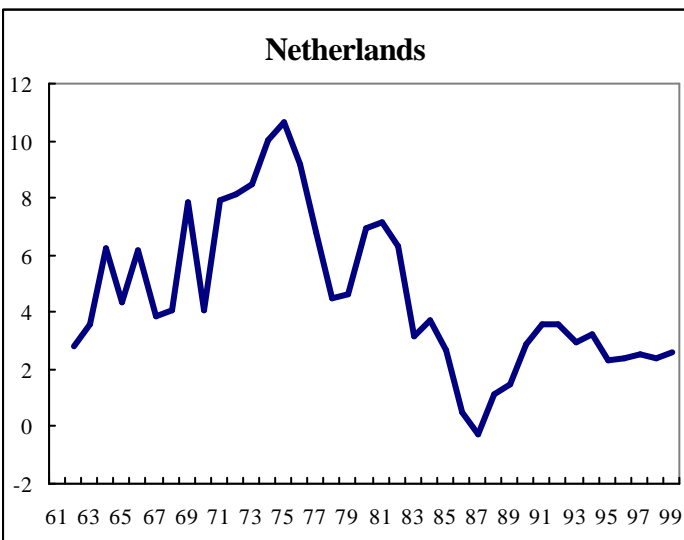
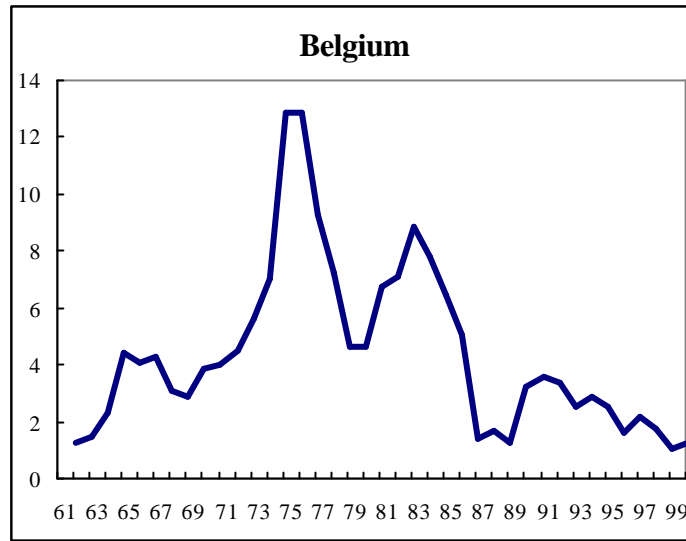
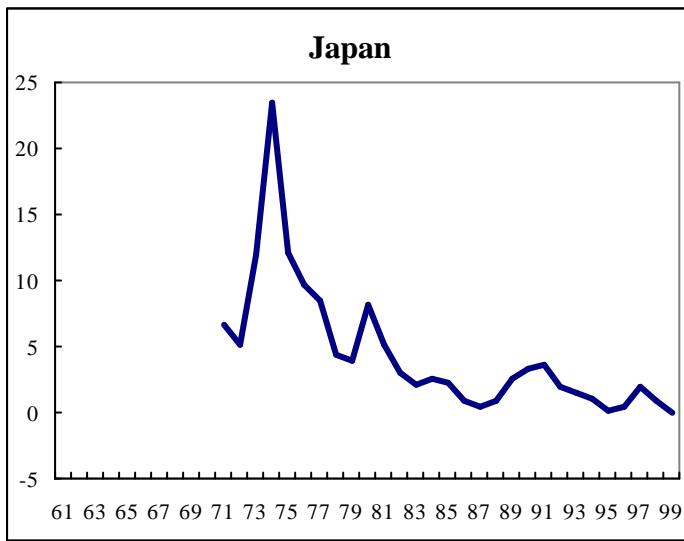


Figure 2. Short Term Nominal Interest Rate and Inflation

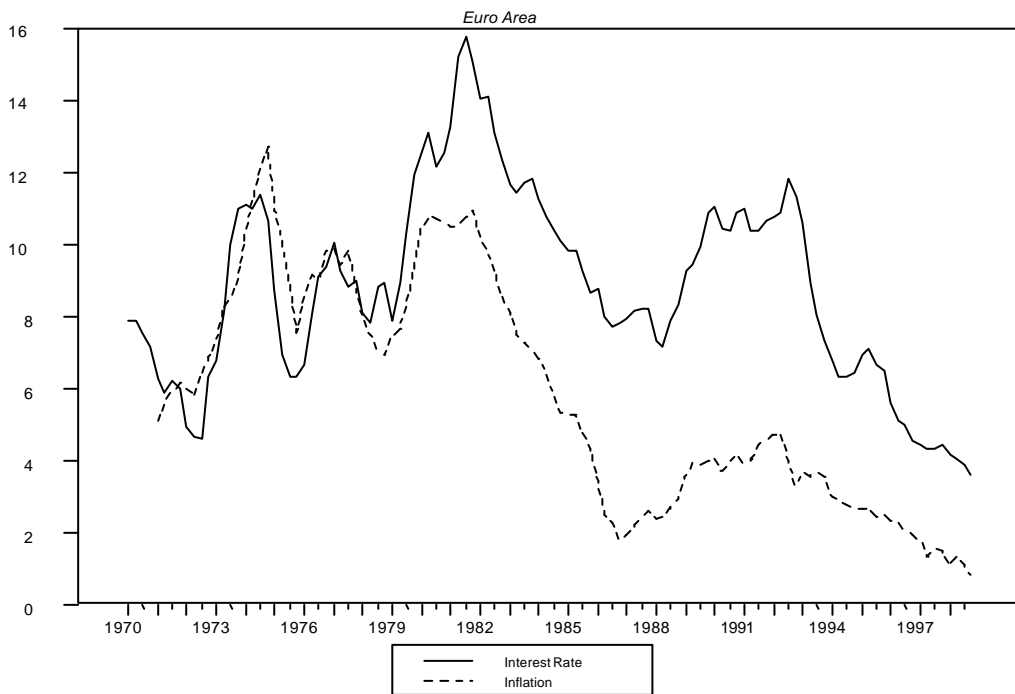
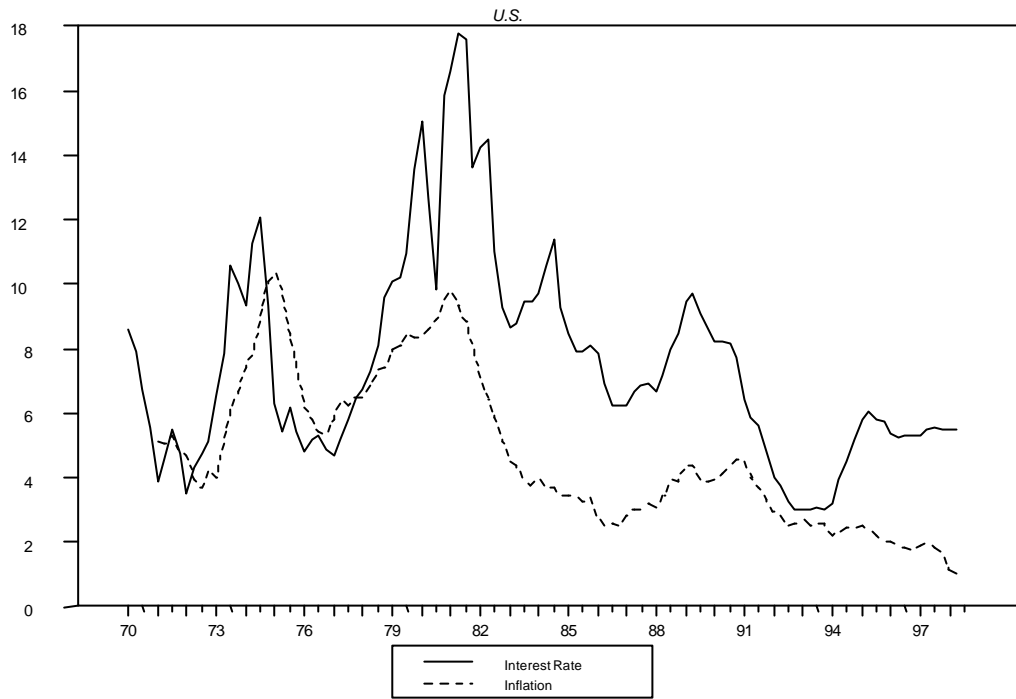


Figure 3. Short Term Real ex-post Interest Rates

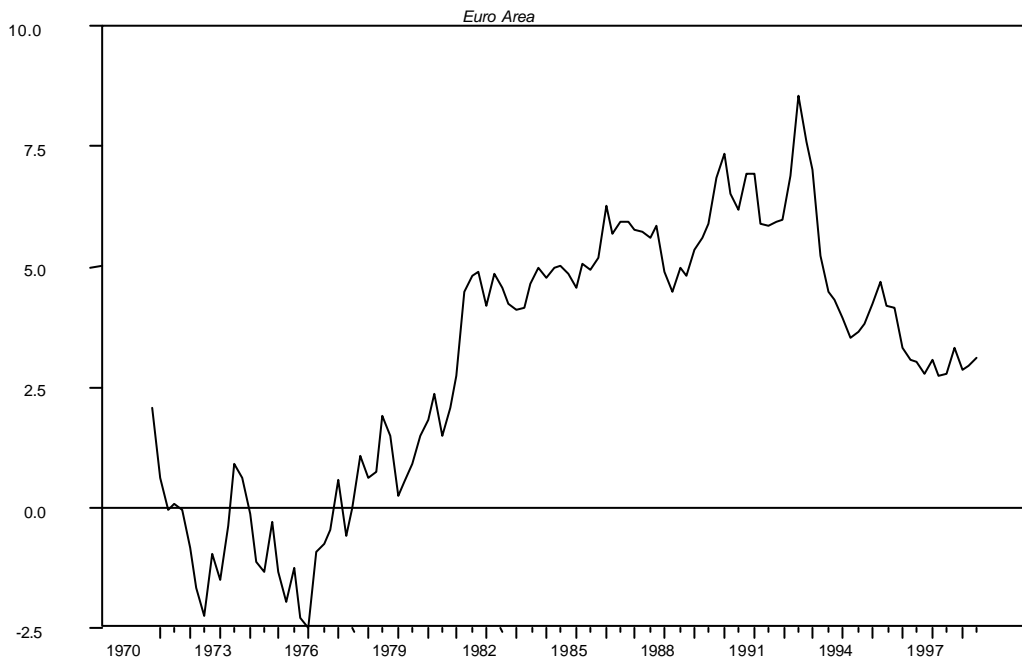
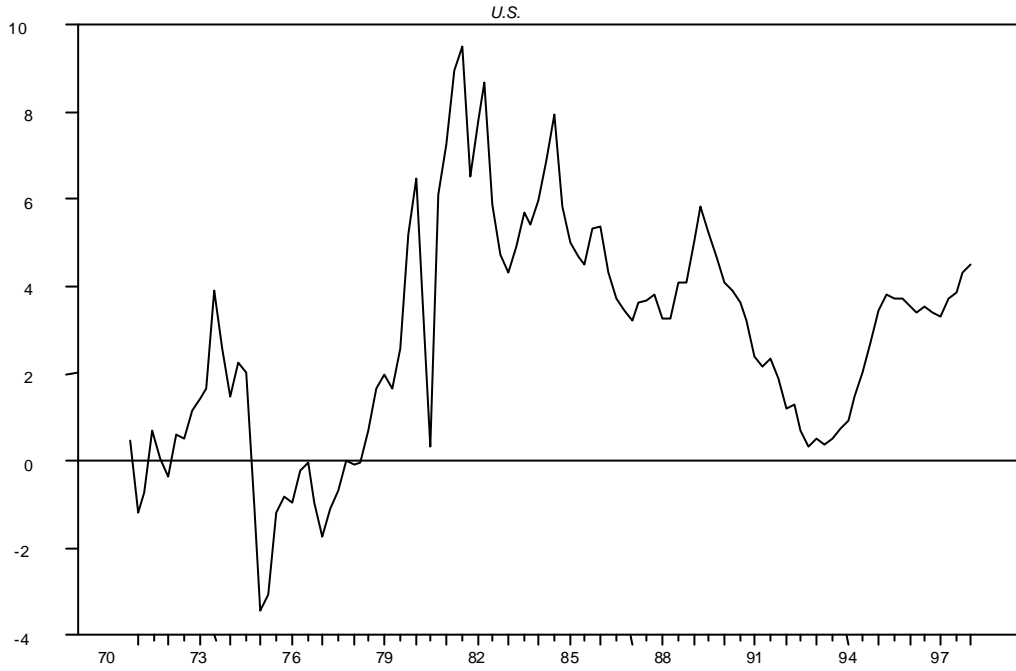


Figure 4. Short Term Real ex-ante Interest Rates

