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MONETARY POLICY AND INFLATION: FROM THEORY TO PRACTICE

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ABSTRACT

Monetary Policy and Inflation: From Theory to Practice*

This paper addresses a number of questions which are essential to a proper understanding of the causes and effects of the inflationary process and to an assessment of the contribution of monetary policy to the achievement of long-term price stability. These questions are: (1) what are the economic costs of inflation? (2) what part does monetary policy play in the short- and medium-term evolution of inflation? (3) what are the most appropriate monetary policy strategies for fighting inflation?

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NON-TECHNICAL SUMMARY

The experience of recent decades has given rise to the conviction that inflation entails sizeable economic and social costs, and that controlling it is one of the prerequisites for achieving sustained growth. As a result, the authorities in a growing number of countries have recently begun to pay increasing attention to price trends and to tailor the conduct of monetary policies more closely to the achievement of lower inflation rates.

In some countries, this trend has crystallized in legal reforms establishing price stability as the primary goal of monetary policy, while at the same time granting extensive independence to central banks for achieving that end. In other countries, even if there have been no specific legal changes, monetary policy has been pursuing direct inflation targets in order to enhance the visibility of the authorities' commitment to price stability. Finally, even in those countries which have maintained their earlier legal norms and monetary policy arrangements, there has been in many cases a strengthening of the anti-inflationary orientation of economic policy, and particularly of monetary policy.

This paper discusses a number of issues which are relevant to a proper understanding of the causes and effects of the inflationary process, and to an assessment of the contribution that monetary policy may make to achieving price stability. It begins by identifying the various channels through which inflation generates economic costs, and provides evidence of the actual empirical magnitude of these costs. It then goes on to examine the various factors that influence inflation in the short and the medium term, focusing particularly on the role played by monetary policy. Finally, it reviews the recent experience of central banks in their efforts to develop successful anti-inflationary monetary policy strategies.

Section two of this paper concludes that the popular belief that inflation is costly for society is supported both by economic principles and by the experience of many countries. It also concludes that the most significant costs of inflation are those resulting from its interaction with a legal and contractual framework which is not fully adapted to coping with it, and those linked to the uncertainty and volatility of the inflationary process itself. The international empirical evidence tends to confirm that countries entering into an even moderate inflationary situation never see an improvement in their growth prospects and, in contrast, have a high probability of experiencing a deterioration in economic growth during prolonged periods of time. It may therefore be said that the evidence is broadly consistent with the popular

perception that inflation erodes standards of living, although it must be acknowledged that we are still far from fully understanding the complexity of the inflationary process in modern economies, to say nothing about providing precise estimates of the magnitude of its costs. This should not, however, obscure the main conclusion: price stability is a highly desirable economic policy goal.

The analysis in section three of the factors affecting price trends makes it clear that as inflation in the medium term is fundamentally a monetary phenomenon, it is monetary policy that is best able to ensure price stability, and it should accordingly assume responsibility for doing so. It is also found, however, that as monetary policy is a highly complex process in which a whole series of economic, political, and social factors converge, it is often the case that the rate of monetary expansion diverges from that which would be compatible with maintaining price stability. It is also concluded that the main difficulties in implementing an anti-inflationary monetary policy can be traced to unsustainable budgetary policies, to the relatively low priority that may be assigned by the authorities to price stability relative to other economic policy goals, to the short-sightedness of monetary policy decisions, and to the distortions and rigidities prevailing in goods and factor markets.

The paper also examines the factors that influence inflation in the short term in order to gauge the actual capacity of monetary policy to guide price trends in this time frame. At the same time, it tries to clarify why policies aimed at price stability are often postponed or phased in gradually, even when it is generally recognized that achieving such a goal will have a favourable medium-term impact on the economy. Our examination shows that since various and very different factors influence inflation in the short term, the temporary output or employment costs of a monetary policy aimed at reducing inflation become smaller, the greater the anti-inflationary credibility of macroeconomic policy as a whole and the greater the degree of downward price and wage flexibility. It may thus be concluded that strengthening budgetary discipline, implementing structural reforms to improve the functioning of goods and labour markets, and adopting mechanisms to enhance the anti-inflationary orientation of monetary policy are of fundamental importance for achieving price stability as rapidly as possible and at the lowest cost.

After examining, in preceeding sections, the problems facing monetary policy in achieving price stability and concluding that reinforcement of the anti-inflationary stance of monetary policy is essential for establishing the framework of nominal stability required for sustained economic growth, section four reviews recent changes in national monetary policy strategies, discusses

their underlying rationale, and analyses their effectiveness. In accordance with the analysis in this section, the inflationary risks of an excessively discretionary monetary policy and the problems linked to rigid or fixed policy rules help to explain why, in recent years, the idea has gained ground that a convenient way to prevent an inflationary bias from emerging without unduly constraining monetary policy is to assign to the central bank the basic objective of achieving and maintaining price stability, and to endow it with the necessary means for doing so. Indeed, as corroborated by experience, this constitutes a useful blend of rules and discretion which, by strengthening the anti-inflationary credibility of monetary policy, allows greater flexibility in adapting monetary conditions to a changing economic and financial environment. It is also stressed, however, that regardless of the chosen institutional framework, anti-inflationary monetary policies will be all the more effective, the greater the support that price stability receives from other economic policies and ultimately, from society as a whole.

Outline

1. Introduction

Inflation may be defined as a continuing increase in the general price level. As a deeply rooted characteristic of many economies, it receives considerable attention from the public, and is assiduously studied by economists. The experience of recent decades has given rise to the conviction that inflation entails sizable economic and social costs, and that controlling it is one of the prerequisites for achieving sustained growth. As a result, the authorities in a growing number of countries have recently begun to pay increasing attention to price trends and to tailor the conduct of monetary polices more closely to the achievement of lower inflation rates.

In some countries, this trend has crystallized in legal reforms establishing price stability as the primary goal of monetary policy, while at the same time granting extensive independence to central banks for achieving that end. In other countries, even if there have been no specific legal changes, monetary policy has been pursuing direct inflation targets in order to enhance the visibility of the authorities' commitment to price stability. Finally, even in those countries which have maintained their earlier legal norms and monetary policy arrangements, there has been in many cases a strengthening of the anti-inflationary orientation of economic policy, and particularly of monetary policy.

Public awareness of inflation, and the increasingly widespread gearing of national monetary polices to bring inflation rates down to acceptable levels, requires an in-depth analysis of the factors that comprise the inflationary process, and especially of the links between monetary policy and inflation in various time horizons. This paper examines a number of questions which are essential both for a proper understanding of the causes and effects of the inflationary process and for assessing the contribution of monetary policy to price stability. These questions are: (1) what are the economic costs of inflation?; (2) how does monetary policy affect the course of inflation?; and (3) what are the most appropriate monetary policy strategies for combatting inflation?

In an attempt to answer these questions, the remainder of the paper has been organized as follows: it first looks at how the public perceives the costs of inflation. Then it examines the various channels through which inflation may generate economic costs, and provides a summary of the available empirical evidence as to

their extent. Once it has been confirmed that inflation is economically costly, it analyzes the determining factors of inflation, distinguishing between the short and long-term. It then examines the recent experience of central banks in the search for alternative anti-inflationary monetary policy strategies and explains why an increasing number of countries have in recent years adopted inflation targets, and why in many cases there have been legal reforms that enshrine price stability as the primary objective of monetary policy, while conferring considerable independence on central banks. Finally, the paper summarizes the main conclusions and policy implications.

2. The costs of inflation

In the introduction, inflation was defined as a continuing increase in the price level. "Price stability" was also mentioned on several occasions, although not specifically defined. As price stability is an economic policy goal in most countries -and the primary goal of monetary policy in many- it may be well to begin this section by explaining what is generally meant by this term. It is, after all, precisely in the absence of such stability that an inflationary process begins, bringing economic costs in its wake.

In economic policy discussions, price stability is usually defined in a pragmatic manner. Indeed, far from being regarded as a situation of constancy in the price level, it is rather identified with an inflation rate that is low enough not to distort the decision-making processes of economic agents, either in the areas of production, saving, or investment[1]. In numerical terms, an annual inflation rate of between 1 and 2 or 3% is considered as a reasonably approximate figure for what, in practice, is to be considered price stability (see Fischer, 1994), although most central bankers would rather put the upper limit at 2%.

There are a number of reasons why price stability should be interpreted in relative, rather than absolute, terms. On the one hand, it is statistically difficult to measure adequately the true evolution of cost of living standards through traditional consumer price indices. The consumer's ability to substitute cheaper goods for those which have become more expensive, the improvements in the quality of many goods, the continuous emergence of new products, and the opportunities to purchase similar goods at lower prices in hypermarkets and department stores tend to cause CPI changes to overstate statistically the increase in the cost of living by a magnitude that

has been estimated in various countries at between 0.5% and 1.5% per annum[2]. On the other hand, in economies characterized by the downward rigidity of prices and wages, a positive inflation rate permits the necessary regular changes in relative prices to take place fluidly, resulting in an improvement in the overall efficiency of the economy[3].

2.1 Popular perception

Once it has been agreed that in practice price stability corresponds to a rate of inflation of between 1 and 2-3% per annum, the next step is to ask how the public perceives the costs of inflation. A detailed survey has recently been carried out in a number of countries (see Schiller, 1996) with a view to answering this question. The survey shows 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 economically costly nature of inflation has frequently been criticized on the grounds that economic agents -on the basis of their experience in stagflationary periods- may wrongly ascribe to inflation those costs which actually come from lower economic growth. If this were true, it would not be inflation as such which is in fact costly but rather the sluggish pace of economic activity. Nevertheless, the validity of this criticism may be disputed. Since the stagflationary periods that occurred in the mid 1970s and early 1980s are now -fortunately- relatively remote in time, it does not seem reasonable to assume that memories of such periods are behind present popular perceptions that inflation undermines standards of living.

From a different standpoint, it has also been argued (Katona, 1976) that the popular view of inflation as deleterious to the standard of living has its roots in the existence of money illusion, which would cause people to regard the increases in nominal wages accompanying the inflationary process not as a result thereof, but rather as an acknowledgement of their professional merits. In contrast, the steady increase in the general level of prices would be ascribed to the inflationary process which, in this way, would end up by undermining purchasing power. While this logic could be a plausible explanation of the popular perception of the costs of inflation in

the short term, it does not appear to offer an adequate explanation of such costs in the medium term, a time frame in which money illusion is seriously weakened.

To summarize, although it seems to be true that the perceived costliness of inflation is quite widespread, the surveys conducted to date do not adequately explain what are the actual reasons behind this perception. From a strictly economic standpoint, it is thus essential to provide a theoretically convincing and empirically meaningful explanation of the various ways in which inflation erodes the public's standards of living.

2.2 Diversity of costs and their actual importance

In recent decades, particularly as a result of the generalised increase in inflation rates in many countries following the oil shocks of the mid-1970s and early 1980s, a considerable number of theoretical models have been constructed that are able to establish the adverse effect of inflation on people's standard of living and welfare[4]. However, it is only recently that these conceptual advances have been coupled with empirical evidence corroborating that the costs of inflation are indeed significant. Consequently, we shall now describe briefly the main costs associated with inflation, and then summarize the available empirical evidence concerning their magnitude.

In examining the costs of inflation, a distinction should be made between those costs of inflation that are anticipated and those that are not. Anticipated costs of inflation usually arise in the following ways:

Firstly, since in efficient financial markets inflationary expectations are incorporated into interest rates, inflation raises the opportunity costs of maintaining liquid balances and reduces the demand for money. This effect (shoe leather costs), with which the names of Bailey (1956) and Friedman (1969) are associated, makes inflation costly because the demand for money is reduced below what is socially optimal, thus entailing a welfare loss. Nevertheless, the empirical evidence on the magnitude of this cost suggests that, although it may be considerable in economies with high or soaring inflation rates, it is relatively small in economies with moderate or low inflation rates[5].

Secondly, it is argued that even fully anticipated inflation is socially costly because it obliges firms to revise the prices of their products, and thus incur the corresponding administrative costs (menu costs). Although these costs may be sizable in economies with high or soaring inflation rates, in which firms must frequently revise prices, it is hardly likely that such costs are very important in economies with moderate or low rates of inflation, where most price changes occur only once a year (see Blinder, 1993).

It is clear from the above that if inflation costs were limited solely to those mentioned, it would be extremely difficult to explain the widespread perception that inflation is harmful in countries with low or moderate rates of inflation. Hence it is necessary to consider those costs that arise as a result of the impact of inflation within a legal and contractual framework which is not fully adapted to it, and also the costs linked to the uncertainty which generally is associated with the inflationary process.

One of the most important economic costs entailed by inflation, even if it is fully anticipated, consists of the disincentives and inefficiencies that its interaction with the tax system introduces into the functioning of the economy (Feldstein, 1983). Indeed, the fact that tax systems in most countries are not adapted to offsetting the effects of inflation on effective tax rates has major consequences. As is well known, in progressive systems, the lack of full indexation of personal income taxation causes inflation to push taxpayers steadily toward higher tax brackets, thus raising the tax rate effectively applied to real income. As regards corporate taxation, inflation reduces real after-tax profitability since the tax falls not only on real profits, but also on the additional profits which in principle serve to compensate investors for expected inflation. Lower real after-tax profitability, in turn, discourages investment. As distinct from what happens in the case of other costs, those arising from the interaction between the tax system and inflation have a strong economic impact. Studies which have attempted to approximate such costs in various countries[6] tend to confirm their significance even in economies with moderate or low inflation, as magnitudes are reached which tend to exceed 1% of GDP per year (see Feldstein, 1996, Dolado, González-Páramo and Viñals, 1997, Tödter and Ziebarth, 1997 and Bakhshi, Haldane and Hatch, 1997).

So far, the costs identified have been those associated with anticipated inflation. In practice, however, inflationary processes are usually accompanied by a

notable degree of volatility and uncertainty, both as regards changes in the inflation rate and in the structure of relative prices[7]. The most immediate effect of such uncertainty is the inclusion of an inflation risk premium in interest rates which has a negative influence on investment decisions. The impact of uncertainty on the economy's relative price structure, both at home and abroad, then generates distortions in the functioning of the price system which reduce the efficiency of resource allocation. The reason for these efficiency losses -first shown by Phelps (1970) and Lucas (1973)- stems from the fact that economic agents' uncertainty as to whether the price changes they observe correspond to actual changes in relative prices, or whether they are the result of changes in the general price level, is a factor in these agents' decisions. Taken together, these problems ultimately induce economic agents to earmark more resources for protection against inflation -to the detriment of productive activities. It should also be mentioned that it is difficult to approximate empirically the magnitude of the costs linked to the uncertainty of the inflationary process, even if such costs are assumed to be considerable.

Finally, it should be noted that when inflation is not anticipated or when, if anticipated, it affects the public's economic entitlements and obligations, it entails a significant redistribution of income and wealth which tends to affect adversely those segments of society having fewer resources with which to protect themselves against inflation. Although it is very difficult to obtain estimates of the magnitude of this cost, they are likely to be very significant.

Having identified some of the main theoretical ways in which the economic costs of inflation manifest themselves, we now need to determine the actual size of such costs. As already mentioned, given the considerable difficulty of empirically approximating the magnitude of each of these costs individually and the desirability of conducting a comprehensive analysis, there have recently been attempts to evaluate the overall economic impact of inflation in the medium term. These analyses start from the assumption that regardless of the ways in which inflation adversely affects an economy, it ultimately undermines the growth of per capita income -either temporarily or permanently- by reducing the rate of factor accumulation and/or the efficiency with which these factors are applied in productive processes. Thus, for instance, to the extent that inflation reduces the after-tax rate of return on productive capital, there will be a slower capital formation. Moreover, insofar as inflation distorts the functioning of the price system, a less efficient allocation of resources is also to

be expected. For these reasons, it seems appropriate to proxy the costs of inflation by their medium term impact on the growth of per capita income.

In recent years, numerous empirical studies have been conducted with a view to determining whether inflation is associated with a reduction in either the level or the rate of growth of per capita income. These studies are generally based on econometric estimates of equations in which the level of per capita income or its medium-term growth rate depends on the average inflation rate and other macroeconomic variables. However, studies differ notably on their degree of consistency with the basic postulates of growth theory and on the type of macroeconomic variables included[8].

Given the diversity of approaches, geographical coverage, and time frame of the above mentioned empirical studies, it should come as no surprise that their results differ considerably. Many authors find a negative medium-term relationship between economic growth and inflation for various countries and periods (e.g., Fischer, 1991; De Gregorio, 1996; and Barro, 1995) which leads them to conclude that inflation is harmful for the economy in the medium term. By contrast, other authors (Levine and Renelt, 1992; and Levine and Zervos, 1993) find that the relationship between growth and inflation is not robust to changes in econometric specification. Recently, however, it appears that the available evidence increasingly tends to support the view that, in general, inflationary processes entail significant economic costs in industrial countries (cf. De Gregorio, 1996). Still, differences remain as to the size of such costs and their significance in countries that have achieved moderate rates of inflation (Barro, 1995).

With a view to supplementing and updating the existing empirical evidence on the medium-term relationship between inflation and growth (cf. Figure 1), Andrés and Hernando (1997) recently conducted a study which is solidly anchored in growth theory and which covers OECD countries in the period 1960-1993. They found that inflation entails significant costs and that these costs exist both in countries with below- and above-average inflation. Specifically, the authors conclude that an average increase in inflation of 10 percentage points would have reduced the growth of real per capita income in the average OECD country by 0.6 percentage points per annum in the period 1961-1993. Furthermore, such annual costs, as explained in Andrés, Hernando, and Krüger (1996), may reach between 0.8 and 1.6 percentage points once the bias resulting from not taking into account the influence of the exchange rate regime is corrected[9].

[Figure 1 here]

To sum up, a sensible reading of the available empirical evidence for industrial countries would seem to be that inflation is in no case beneficial, that it is generally associated with lower economic growth rates over prolonged periods, and that such costs exist in countries with both moderate and low rates of inflation.

Admittedly, most of the existing empirical studies may be criticized owing to the fact that inflation and growth are mutually determined variables in a general equilibrium framework, with the relationship between them finally depending on the macroeconomic policies applied in the countries involved. However, the results generated both by studies having a theoretical framework firmly anchored in growth theory and by those using statistical procedures to take into account the endogeneity of inflation[10] generally validate the assumption that countries which enter into an inflationary process never see an improvement in their growth perspectives and have a high probability of experiencing a deterioration in their economic growth rates over long periods of time. Consequently, it may be argued that the empirical evidence is consistent with the widespread public perception that inflation erodes standards of living. Nevertheless, it must be conceded that we are still far from adequately understanding the complex processes by which inflation manifests itself in modern economies, and from being able to provide precise assessments of the true magnitude of the relevant costs.

3. The main determinants of inflation

After examining some of the main economic costs of inflation, and reaching the conclusion that the pursuit of price stability is a highly desirable monetary policy objective, it is necessary to identify those factors that play a key role in determining the path of inflation. This section therefore focuses on the study of the determinants of inflation, with a distinction being made between the short and the medium term. This distinction is essential for a proper understanding of the complexity of the inflationary process since in the short term price developments are influenced by a variety of supply and demand factors, whereas in the medium term certain conditions are verified which greatly simplify the analysis of the inflationary process.

3.1 Inflation in the medium term

3.1.1 Determinants of inflation

A most firmly established behavioral relationship in monetary theory is that which links, in the medium term, the inflation rate, the growth of output, and the rate of money expansion. This relationship, which emerges necessarily from any well-constructed macroeconomic model, is based on the simultaneous equilibrium of money, goods, and factors markets, and serves to reaffirm that, on average, the rate of monetary expansion finances the trend growth of output and the sustained increase in the general price level.

Viewed from a medium-term general equilibrium perspective, this relationship also shows that the inflation rate equals, on average, the rate of monetary expansion which exceeds the needs for financing the potential growth of the economy. This occurs in any economy, regardless of its economic structure, its degree of openness to the outside world, the concrete strategy of monetary or exchange policy followed by the authorities, and the specific features of the monetary policy transmission mechanism.

Having identified the determinants of the inflationary process in the medium term, it is of interest to look at national macroeconomic trends with a view to evaluating how important each of these determinants is in explaining cross-country differences in inflation over extended periods. Doing so definitely confirms that the existing differences among national inflation rates are mainly the result of different rates of expansion of liquidity in the various countries. This fact comes as no surprise if it is borne in mind that, generally speaking, average output growth rates recorded in highly diverse economies fluctuate within a fairly limited range -particularly in the industrial countries- while, by contrast, rates of monetary expansion vary considerably. To illustrate this point, Figure 2 shows the various inflation rates which, on average, have been registered in the industrial countries during the last 30 years. Figure 3 displays the positive relationship between inflation and the rate of monetary growth in this group of countries during the period under consideration.

[Figures 2 and 3 here]

It may be inferred from the above that, in practice, the rate of expansion of liquidity is the main determinant of medium-term inflation, and that regardless of the speed with which monetary impulses are transmitted to inflation, those countries which on average have higher rates of monetary expansion will also be those which on average experience higher inflation[11]. This in turn explains the monetary authorities' concern, even in countries which have adopted highly divergent monetary policy arrangements (e.g., intermediate monetary targets and direct inflation targets), with reaching a rate of liquidity creation that on average is compatible with financing potential economic growth under conditions of price stability.

The conclusions reached in the above paragraphs inevitably lead to the following question: if inflation entails significant economic costs for society as a whole in the medium term, and if monetary policy is the main determining factor of the path followed by inflation in the medium term, what prevents a rate of monetary expansion from being adopted that is compatible with achieving and maintaining price stability? This question cannot be answered, however, in simple and direct terms. Indeed, far from being a mechanical phenomenon, monetary policy is a highly complex process in which a whole array of factors -economic, political, and social- converge and ultimately determine its course. Moreover, even if it is granted that going to a situation of price stability has a favourable impact on standards of living in the medium term, the fact remains that certain short-term costs are likely to arise in the course of the disinflation process. The existence of such costs -even when they are smaller in magnitude than the above-mentioned benefits- may influence the authorities' decision to postpone or soften (e.g., for electoral reasons) the policy measures aimed to achieving price stability. These issues are discussed in what follows.

3.1.2 Monetary policy: conditioning factors

Having concluded that monetary policy is the main determinant of inflation in the medium term, the next step is to attempt to identify the factors that influence the medium-term stance of monetary policy. To do this, we draw on both economic theory and experience.

Combining some of the main results of monetary theory and the lessons learned from the experience of a number of countries in conducting monetary policy over the years indicates that there are two main reasons which explain why monetary

polices may diverge from a path compatible with the achievement of price stability: the difficulties arising from a structurally unbalanced budgetary policy, and the problems of dynamic inconsistency which result from the authorities' temptation to exploit the trade-off between unemployment and inflation in order to step up the pace of economic activity.

In the medium term, an unbalanced budgetary policy may force monetary policy to expand liquidity at a rate in excess of what is needed to finance the sustained growth of the economy under conditions of price stability. The most direct way in which an excessively loose budgetary policy brings about the creation of excessive liquidity occurs when the fiscal deficit is monetized by the central bank. This situation, which is characteristic of nonindustrial countries with high budget deficits and poorly developed capital markets, reveals that keeping the fiscal deficit under control is essential for maintaining moderate rates of monetary expansion and inflation.

However, industrial countries may also experience the adverse effects exerted in the medium term by structurally imbalanced budgetary policy on the anti-inflationary stance of monetary policy (see Rojo, 1985). A fiscal deficit financed in an orthodox manner by the issue of debt may have inflationary consequences if the debt has a high degree of liquidity, since it becomes a near substitute for money[12]. In such a case, the shorter the maturity of the debt, the higher its degree of liquidity is likely to be. It may also occur that financial intermediation activities in the private sector lead to the creation of more liquid financial assets based on the debt issued. In both cases, the issue of debt would be inflationary, either directly or indirectly.

Furthermore, as stated by Sargent and Wallace (1981), fiscal deficits which lead to an unsustainable growth of public debt lead to monetary expansions and to higher inflation rates. And although it may be argued that there are fortunately few industrial countries currently facing the problems of financially unsustainable debt, the above reasoning is still relevant if it is borne in mind that in countries with relatively high deficits and levels of debt, pressure may be exerted on the central bank to keep interest rates comparatively low in order to ease and lower the cost of financing the deficit through debt[13]. In such a case, even if the deficit is not directly monetized it is nevertheless monetized indirectly, which also has an adverse effect on inflation[14].

It may be concluded from the above that, apart from the problems which an excessively loose budgetary policy entails for short-term price developments, persistent budgetary imbalances may undermine the anti-inflationary credibility of monetary policy and, in the medium term, cause the money supply to expand at a rate incompatible with achieving and maintaining price stability.

The growing consensus as to the importance of the macroeconomic problems arising from a structurally imbalanced budgetary policy, both with regard to the impact on monetary policy and inflation and to the adverse effect on potential economic growth, has in recent years led the authorities in many countries to adopt measures to improve their public finances. For example, the introduction by the European Union of fiscal discipline rules to regulate access to the Monetary Union and, after accession, to prevent the emergence of excessive deficits, together with the recent entry into force of legal provisions prohibiting any central bank financing of the public sector, is a significant step toward solving the inflationary problems which, in the medium term, arise from imbalanced budgetary polices.

In addition to the difficulties posed by fiscal policy, monetary policy may find that the pursuit of price stability is also rendered more difficult by dynamic inconsistency problems, stemming from the inclination of the authorities to exploit the short-term trade-off between unemployment and inflation in order to boost economic activity[15]. Most of the theoretical models setting forth this problem reach the conclusion that the proclivity of the authorities to systematically run an expansionary monetary policy to stimulate their economies simply leads to higher inflation without bringing any benefit in terms of higher output or employment. The main reason for this result is that once economic agents become aware of the authorities' policy, they adapt price and wages accordingly. This prevents the authorities from achieving their real targets, and induces them to accept a higher inflation rate.

One of the basic contributions that the literature on dynamic inconsistency has made to monetary theory is to permit identification of a series of factors that influence the size of the inflationary bias (see Appendix). These factors, which will be examined below, are the following: the existence of more policy targets than instruments; the extent to which the authorities value price stability relative to other policy goals; structural distortions that limit potential output; and the authorities'

ability to engineer short-term movements in economic activity through monetary surprises[16].

One of the main problems traditionally faced by the authorities is that of having to achieve a variety of monetary policy targets with an insufficient number of instruments. As originally stated by Tinbergen (1952) and as later qualified by Brainard (1967), economic policy dilemmas arise when there are not at least as many instruments as there are policy targets. Thus, when the authorities' goal is to reach a high rate of economic activity under conditions of price stability, and only monetary policy is available for this purpose there is an overburdening of monetary policy. Under such circumstances, the lower the priority given to price stability relative to other goals, and the more pressure there is on the authorities to shorten the horizon of monetary policy decisions (owing, for example, to elections at regular intervals), the greater will be the inflationary bias. The request that monetary policy should satisfy several independent goals is thus a necessary condition for it to adopt a stance which is not compatible with the pursuit of price stability.

In a context of multiple monetary policy targets, the second factor which -in accordance with the models of dynamic inconsistency- influences the medium-term stance of monetary policy is the difference between the level of the economy's potential output and the level of output targeted by the authorities. For instance, if the authorities' target is to achieve the level of potential output that would prevail in a more efficient and competitive framework, while the level of potential output actually attainable is lower, owing to the rigidities and distortions that disturb the smooth functioning of goods and labour markets, this introduces an expansionary and inflationary bias to monetary policy. In less formal terms, the more constrained are the levels of output and employment due to the presence of market rigidities and distortions, the greater are the pressures for monetary policy to stimulate economic activity.

The third factor which according to the theory of dynamic inconsistency causes an inflationary bias in monetary policy is the extent to which the authorities are able to boost the rate of economic activity in the short term through monetary surprises. Hence the stronger the authorities' conviction, right or wrong, that monetary policy can stimulate the economy in the short term, the greater will be the temptation to expand liquidity systematically and thus the greater the departure from price stability.

To sum up, the analysis in this section has shown that monetary policy, far from being exogenous, is a complex process affected by a number of conditioning factors. Indeed, the difficulties in implementing an anti-inflationary monetary policy may result from the persistence of imbalanced budgetary polices, from the relatively low priority attached by the authorities to price stability compared to other policy goals, from the lack of cooperation from non-monetary policies in achieving these goals, from an excessively short horizon of monetary policy decisions, and from the presence of market distortions and rigidities. All this also explains why it is so difficult to reduce inflation on a lasting basis unless: an adequate degree of budgetary discipline and a balanced macroeconomic policy mix are restored; structural reforms are implemented that improve the functioning of goods and labour markets; the economic authorities become convinced that price stability is a highly desirable goal for society as a whole; and there is widespread agreement that the sole task that monetary policy can perform efficiently in the medium term is precisely the achievement of this goal.

3.2 The short term

An analysis of the factors influencing price developments in the short term is essential for gauging the actual ability of monetary policy to control inflation over limited periods of time, and also for understanding why policies designed to achieve price stability are often postponed or phased in only gradually, even when it is generally recognized that achieving such a target will have a favourable impact on the economy in the medium term.

In practice, there are several factors, in addition to those of a strictly monetary nature, which have a direct impact on the price level in the short-term. Any factor influencing aggregate demand or supply in an economy may in principle induce a change in the inflation rate within that time frame, for example: fiscal policy, the behaviour of economic and social agents in price and wage formation processes, international economic trends, and import prices. Furthermore, experience confirms that, in many cases and for relatively short periods, the above variables frequently exert a stronger influence on prices than does monetary policy, owing to the fact that the effects of monetary policy on nominal magnitudes tend to become fully visible only with the passage of time.

The short-term impact of monetary policy on prices and output has long been one of the most widely discussed issues in macroeconomic theory. It is also of considerable practical importance for the topic in hand. In particular, even where there is a firm belief that price stability is good for a country's economic health, the authorities must also assess what is the magnitude of the short-term output costs of disinflation in order to determine the pace at which inflation should be reduced to reach the established goals[17].

Although there is abundant theoretical literature and empirical evidence concerning these matters, the differences among the assumptions underlying the various theoretical models and the diversity of national experiences in periods of disinflation make it very difficult to reach definitive conclusions on the short-term impact of monetary policy on inflation. The most we can hope to do is to set out some of the more generally accepted points, while identifying those important issues still open to discussion.

A point on which there is broad consensus is that the more rapidly agents adjust their inflationary expectations, and the more flexibility there is in the setting of prices and wages, the greater the ability of monetary policy to reduce inflation without entailing temporary output or employment costs (sacrifice ratio). On the one hand, the more confident agents are that the authorities will stick to a less inflationary monetary policy, the more intense and rapid will be the adjustment of expectations. On the other hand, when goods markets are highly competitive and the labour market is flexible enough to permit the rapid adjustment of wages to lower expected inflation, disinflation will be faster and entail lower output costs.

Along with this core of agreement, which is fairly well established in the thinking of most central banks, there are a number of factors that may influence the ability of monetary policy to achieve disinflation with low output costs but whose practical significance remains controversial. Among those which have received the most attention are: the initial level of inflation, the economy's degree of openness, and the speed with which the disinflation process takes place[18].

As regards the first issue, it is often assumed that the lower the initial inflation rate the costlier it is to reduce it further, implying that the short-run Phillips curve becomes flatter at low rates of inflation. While this assumption is broadly supported by the experience of those countries which registered disinflationary processes starting

from high or very high inflation rates, it nevertheless remains very controversial as concerns the experience of industrial countries, which started their disinflation processes from significantly lower inflation rates.

Considerable attention has also been given to whether the success of disinflationary policies -as measured by the sacrifice ratio- depends on an economy's degree of openness. As the logic goes, because an open economy expands the number of channels through which monetary policy influences the price level -by adding the exchange rate channel-, it can affect inflation more directly and at a lower output cost. However, neither the experience of the United States at the beginning of the 1980s, following the appreciation of the dollar which resulted from the combination of an expansionary fiscal policy and tight monetary policy, nor the empirical evidence available for OECD countries seem to fully validate the null hypothesis. Instead, what the international experience and the available empirical evidence seem to suggest is that while it is true that in disinflationary periods the speed of disinflation is increased by the economy's degree of openness, such openness does not lead to an improvement in sacrifice ratios.

Finally, there is the question of how the sacrifice ratio is influenced by the greater or lesser gradualism with which disinflationary policies are carried out. In accordance with the Keynesian school -which emphasizes the inertia with which prices and wages tend to adjust-, a more gradual disinflationary process would be less costly in terms of economic activity since it would give more time for prices and wages to adjust in the direction and magnitude entailed by the disinflationary policy applied. By contrast, the more neoclassical school -which stresses the role of expectations- states that the faster the disinflationary process, the greater its favourable impact on both inflationary expectations and inflation, and the lower its short-term output costs.

Although it may be reasonable to conclude on the basis of the experience of countries with extremely high inflation rates, that in such cases it may be better to implement relatively abrupt disinflationary policies in order to signal the commitment of the authorities and to foster a more rapid adjustment of inflationary expectations, the situation is quite different in countries which want to disinflate starting from more moderate inflation rates. The importance of empirically assessing which of the two viewpoints mentioned fits better the experience of industrial countries has given rise to several recent studies (Andersen, 1992, Ball, 1995) which carefully look at the

economic performance of OECD countries during episodes of disinflation. The conclusion reached in these studies is that, in general, the faster disinflation is, the lower the output cost tends to be. However, as the above authors state, this does not necessarily mean that stringent disinflationary policies should be implemented, for although the total output cost is lower, the impact on social welfare is greater as costs are concentrated in a shorter period. Consequently, a resolute but gradual implementation of disinflation policies would seem to be a reasonable alternative.

To summarize, this section has made it clear that while in the long run inflation is basically a monetary phenomenon, in the short term there are many factors which influence the evolution of the price level. In particular, the success of the authorities in moving to a lower rate of inflation relatively quickly and with low output costs critically hinges on the overall anti-inflationary credibility of macroeconomic policy and the degree of downward flexibility of wages and prices. Thus, it may be concluded that policy initiatives aimed towards strengthening budgetary discipline, improving the functioning of goods and labour markets, and adopting mechanisms to reinforce the antiinflationary stance of monetary policy will favourably contribute to the achievement of price stability at a low cost. Since it was pointed out in Section 2 that there are important permanent benefits in achieving price stability, the abovementioned policy initiatives would not only improve the benefit-cost ratio of moving towards price stability but would also make it easier, from a political-economy viewpoint, to achieve this goal.

4. Alternative monetary policy strategies for fighting inflation

Having analyzed in the preceding sections the problems confronted by monetary policy in achieving price stability and concluded that strengthening the anti-inflationary stance of monetary policy is very important for this purpose, I now turn to examining recent trends in national monetary policy strategies so as to discuss their underlying rationale and analyze their practical effectiveness.

As was seen from the analysis of the factors influencing inflation in the medium term, the problems of time inconsistency arising from a discretionary monetary policy introduce an inflationary bias. The initial solution proposed in the theoretical literature to the problem of time inconsistency involved replacing discretionality in the authorities' conduct of monetary policy with rigid or fixed rules

of the sort proposed by Milton Friedman (1959). These rules predetermine the time-path of monetary variables to be consistent with the achievement and maintenance of price stability, without taking into account the future course of economic or financial variables. This solution has, nevertheless, serious practical drawbacks. It prevents monetary policy from taking into account and reacting to macroeconomic disturbances, which are particularly frequent in financial markets. Furthermore, since there is no guarantee that a fixed rule will not be abandoned at some point in time, this undermines its anti-inflationary credibility.

Probably owing to these difficulties, virtually no country is implementing monetary policy with rigid or fixed rules. Those countries which do apply rules of some kind -usually linked to the performance of a monetary aggregate or the exchange rate- in practice tend to manage them with a certain degree of flexibility in order to take into account general economic conditions. However, it should be noted that the application of more flexible rules is not trouble-free (see Rojo, 1988). The attempt to combine the presumed advantages of rules as regards credibility with the ability to react to specific disturbances has led to excessive discretionality in most cases. This in turn has eroded public confidence in the anti-inflationary commitment of monetary policy.

Given the well-known inflationary risks associated with an excessively discretionary monetary policy and the problems with fixed or rigid policy rules, the idea has been gaining ground in recent years that a good way to ensure that the necessary flexibility in monetary policy management does not introduce inflationary biases is to assign to the central bank the primary goal of price stability and provide it with the necessary means to achieve it[19]. In some countries (e.g., New Zealand) contracts have recently been entered into under which the central bank undertakes vis-à-vis the government to achieve a specific inflation target within a given time by applying the monetary policy it deems appropriate. The central bank authorities are accountable to the government in the event that the target is not reached. The theoretical rationale for this approach is found in the work of Walsh (1993), and Persson and Tabellini (1993) (see Appendix).

In contrast to the contractual approach -but with similar objectives-, an increasing number of countries have opted in recent years for the more ambitious route of introducing legal reforms that establish price stability as the primary goal of monetary policy in the medium term and endowing the central bank with considerable

independence for achieving it. This considerably reduces the risks of short-term subordination of price stability to other monetary policy targets, and allows monetary policy decisions to be adopted with a sufficiently long time horizon and independently from the political cycle.

Indeed, as highlighted in the work of Goodhart and Viñals (1995) and Fernández de Lis (1996) among others, the central banks of a fairly large number of countries -both inside and outside the European Union- nowadays enjoy a high degree of independence in the conduct of monetary policy. In the specific case of European Union countries, the conviction that this is the proper approach for overcoming inflation on a lasting basis has been enshrined in the Maastricht Treaty, which contemplates the establishment of a European System of Central Banks (ESCB) which is fully independent to formulate and execute monetary policy so as to achieve and maintain price stability in the European Monetary Union as a whole. The Treaty also makes it mandatory for national central banks to have, by the establishment of the ESCB, a legal status that is fully compatible with that of the System. Doubtless, the provisions of the Treaty are behind the efforts now being made by many European countries to bolster the independence of their respective central banks.

In view of the many studies that justify from a theoretical standpoint granting considerable independence to central banks in conducting a monetary policy that achieves price stability, it is particularly useful to review, albeit briefly, the empirical evidence on the degree of success which independent central banks have had in combating inflation.

The record would seem to indicate that countries having a well-established tradition of central bank independence perform best as regards price stability. The German example is a case in point. The Bundesbank not only has a long history of independence, it has also achieved enviable success in maintaining low inflation rates over the past forty years. However, it must be said that the success of the Bundesbank is not solely the result of its independence vis-à-vis the government. It also stems from the strong aversion to inflation of the German people, which has its roots in the devastating impact of the hyperinflation experienced in the inter-war period. It is quite likely that the underlying reason for the independence of the Bundesbank lies precisely in German society's fear of again having to suffer the terrible economic and social consequences of the erosion of monetary stability. ~~In all~~ honesty, however, and by way of exception, it must also be noted that there is a

country, Japan, which despite the relative dependence of its central bank on the government, has managed to maintain lower inflation rates than have countries whose central banks enjoy greater independence. Nevertheless, as will be discussed below, the conclusions generally drawn from considering the empirical evidence on international price trends and their relation to the degree of central bank independence are consistent with the hypothesis that, other things being equal, greater independence is associated with better inflationary performance in the medium term.

The more rigorous analyses conducted to verify the existence of a stable and robust relationship between inflation and central bank independence are generally based on relatively simple econometric models which rely on numerical indicators that proxy for the degree of political and operational independence of national central banks. In these analyses it is very difficult to synthesize the complexity of the many economic and institutional factors which shape a central bank's degree of independence. But even if the ultimate causes governing the relationship noted between the degree of independence and inflation performance are not sufficiently known, the results available for various groups of countries, for different periods, and using a variety of indices to approximate the degree of independence, generally tend to confirm the existence of a positive and significant relationship between a central bank's degree of independence and its success in fighting inflation (see Figure 4)[20].

[Figure 4 here]

In line with the above, if it is agreed that introducing an institutional framework that guarantees central bank independence helps to strengthen the credibility and anti-inflationary discipline of monetary policy, it must nevertheless be asked whether this is achieved at the cost of a less favourable performance by real variables, such as the level and variability of output. Fortunately, most of the available empirical evidence suggests that these adverse effects do not occur[21].

Given the various reasons offered in Section 2 to justify the favourable medium term economic effects of implementing policies aimed at achieving price stability, it is necessary also to review the reasons why granting more independence to the central bank does not adversely affect the stability of real variables in the short term. In this respect, although it is likely that an independent central bank seeking to achieve price stability will tend to be less accommodating to certain macroeconomic disturbances that affect output, it is also possible that its greater independence will

enable it to avoid disturbances of another kind, i.e. those that are political in origin[22]. Moreover, it may be argued that insofar as the monetary policy implemented by an independent central bank enjoys greater anti-inflationary credibility, the monetary authorities will tend to find they have more room for manoeuvre in countering specific macroeconomic disturbances that affect output, without running the risk that the public will incorrectly interpret transient changes in monetary conditions as a change in the monetary policy stance[23]. Finally, the increased credibility of monetary policy may also help economic agents to distinguish between changes in the general price level and changes in relative prices, thus prompting a more rapid adjustment of prices and wages to macroeconomic disturbances. This will reduce the need for monetary policy to play a compensating role in the short term.

From the discussion so far, it may be concluded that endowing the central bank with considerable independence can favourably contribute to the achievement of price stability. Nonetheless, as experience shows, such contribution will be all the more important the wider the support that the final goal of price stability receives from overall economic policy.

The increasing attention paid in recent years to making legislative changes to ensure that monetary policy can be conducted in a medium-term perspective and without government interference has shifted the discussion about which monetary strategy best performs the role of "nominal anchor" from a relatively technical to an institutional level. In this regard, it can be stated that once price stability has been legally established as the primary goal of monetary policy and the central bank granted an independent status, the resulting strengthening of anti-inflationary credibility provides more room for manoeuvre in the choice of specific monetary strategies (e.g., monetary vs. inflation targets). This may explain why a number of central banks, all of which enjoy considerable independence, nevertheless conduct their monetary policy on the basis of different monetary policy strategies[24].

However, it should be noted that inflation targeting has appealed both to countries with independent central banks and to those whose central banks are under government control. Leaving aside considerations of a technical nature -which are important when choosing a particular monetary strategy- the adoption of inflation targeting by countries with independent central banks may be viewed as an attempt to complement and further develop the independence law in order to make the central

bank's commitment to nominal stability more concrete, credible and transparent. In turn -again leaving aside the technical reasons which may have made it advisable to abandon intermediate targets- the adoption of inflation targets by non-independent central banks may be rationalized as an attempt by the central bank to take a clearer stand on inflation and therefore to affirm its "de facto" independence vis-à-vis the government.

Finally, the recent trend in many countries toward introducing legal reforms that place price stability as the primary goal of monetary policy and provide central banks with a significant degree of independence, can be regarded as a useful compromise between rules and discretion which, by strengthening the anti-inflationary credibility of monetary policy, allows greater flexibility in adapting monetary conditions to changing economic and financial circumstances[25]. How to make use of this flexibility on a day-to-day basis is the great challenge facing central banks in the context of what is known as *the art of central banking.*

5. Conclusions

This paper has discussed a number of issues which are relevant to a proper understanding of the causes and effects of the inflationary process, and to an assessment of the contribution that monetary policy may make to achieving price stability. It began by identifying the various channels through which inflation generates economic costs, and provided evidence of the actual empirical magnitude of these costs. It then went on to examine the various factors that influence inflation in the short and the medium term, focusing particularly on the role played by monetary policy. Finally, it reviewed the recent experience of central banks in their efforts to develop successful anti-inflationary monetary policy strategies.

It was concluded on section 2 of this paper that the popular belief that inflation is costly for society is supported both by economic principles and by the experience of many countries. It was thus determined that the most significant costs of inflation are those resulting from its interaction with a legal and contractual framework which is not fully adapted to coping with it, and those linked to the uncertainty and volatility of the inflationary process itself. The international empirical evidence tends to confirm that countries entering into an even moderate inflationary situation never see an improvement in their growth prospects and, in contrast, have a high probability of experiencing a deterioration in economic growth during

prolonged periods of time. It may therefore be said that the evidence is broadly consistent with the popular perception that inflation erodes standards of living, although it must be acknowledged that we are still far from fully understanding the complexity of the inflationary process in modern economies, to say nothing about providing precise estimates of the magnitude of its costs. However, this should not obscure the main conclusion: price stability is a highly desirable economic policy goal.

The analysis in section 3 of the factors affecting price trends made it clear that as inflation in the medium term is fundamentally a monetary phenomenon, it is monetary policy that is best able to ensure price stability, and it should accordingly assume responsibility for doing so. However, it was also found that as monetary policy is a highly complex process in which a whole series of economic, political, and social factors converge, it is often the case that the rate of monetary expansion diverges from that which would be compatible with maintaining price stability. It was also concluded that the main difficulties in implementing an anti-inflationary monetary policy can be traced to unsustainable budgetary polices, to the relatively low priority that may be assigned by the authorities to price stability relative to other economic policy goals, to the short-sightedness of monetary policy decisions, and to the distortions and rigidities prevailing in goods and factor markets.

In this paper, we have also examined the factors that influence inflation in the short term in order to gauge the actual capacity of monetary policy to guide price trends in this time frame. At the same time, we have sought to determine why policies aimed at price stability are often postponed or phased in gradually, even when it is generally recognized that achieving such a goal will have a favourable medium-term impact on the economy. Our examination showed that since various and very different factors influence inflation in the short term, the temporary output or employment costs of a monetary policy aimed at reducing inflation become smaller, the greater the anti-inflationary credibility of macroeconomic policy as a whole and the greater the degree of downward price and wage flexibility. It may thus be concluded that strengthening budgetary discipline, implementing structural reforms to improve the functioning of goods and labour markets, and adopting mechanisms to enhance the anti-inflationary orientation of monetary policy, are of fundamental importance for achieving price stability as rapidly as possible and at the lowest cost.

After examining the problems facing monetary policy in achieving price stability and concluding that reinforcement of the anti-inflationary stance of monetary policy is essential for establishing the framework of nominal stability required for sustained economic growth, section 4 reviewed recent changes in national monetary policy strategies, discussed their underlying rationale, and analyzed their effectiveness. In accordance with the analysis in this section, the inflationary risks arising from an excessively discretionary monetary policy and the problems linked to rigid or fixed policy rules help to explain why in recent years the idea has been gaining ground that a convenient way to prevent an inflationary bias from emerging without unduly constraining monetary policy is to assign to the central bank the basic objective of achieving and maintaining price stability, and to endow it with the necessary means for doing so. Indeed, as corroborated by experience, this constitutes a useful blend of rules and discretion which, by strengthening the anti-inflationary credibility of monetary policy, allows greater flexibility in adapting monetary conditions to a changing economic and financial environment. However, it was also stressed that, regardless of the chosen institutional framework, anti-inflationary monetary policies will be all the more effective, the greater the support that price stability receives from other economic policies and, ultimately, from society as a whole.

Appendix[26]

This appendix contains a formal analysis of some of the concepts discussed in the text. Specifically, concepts such as time inconsistency, discretionality, the role of the central bank, and inflation targets are examined within the framework of various strategic interactions between the authorities/central bank and the private sector. In the interest of simplifying formal treatment, the model used is non-stochastic and the sources of uncertainty are omitted.

1. The Model

The model considered below is static and represents a closed economy. As is usual in the literature, it is assumed that the authorities minimize a quadratic loss function (L) consisting of the deviations of inflation (π) relative to target (π^*) and of the deviations of output relative to the equilibrium level (y) with regard to another objective level (y^*), using the inflation rate as an instrument. That is,

$$\min_{\pi} L = \frac{1}{2}\left[(\pi - \pi^*)^2 + \lambda\,(y - y^*)^2\right],\ \lambda > 0 \qquad (A.1)$$

subject to an aggregate supply function of the Lucas type (1972)

$$y = \alpha\,(\pi - \pi^e),\ \alpha > 0 \qquad (A.2)$$

in which π^e are private sector inflation expectations. In (A.1), the parameter λ indicates the relative importance for the authorities of the two objectives included in the loss function, so that if $\lambda=0$ ($\lambda=\infty$), the inflation target (the output target) is the only one that counts. Equation (A.2) tells us that only unexpected inflation has real effects. Without losing generality, let us assume that $\pi^*=0$ and $y^*=\alpha\bar{y} > 0$. This latter assumption indicates that owing to the existence of rigidities in the goods and labour markets, the authorities' target in terms of output deviates from $y^* = 0$.

Substituting (A.2) for (A.1) therefore gives

$$\min_{\pi} L = \frac{1}{2}\left[\pi^2 + \lambda\,\alpha^2\,(\pi - \pi^e - \bar{y})^2\right] \qquad (A.3)$$

1.1. Time Inconsistency

If the authorities had sufficient credibility to commit themselves to a specific rate of inflation, the private sector would have confidence in this commitment, so that $\pi=\pi^e$ and y=0. As a result, the loss function in this case would be

$$L = \frac{1}{2}\left[\pi^2 + \lambda\ \alpha^2\ \bar{y}^2\right] \qquad (A.4)$$

so that optimal inflation and the related output, designated in this case as π^c and y^c, would be

$$\pi^c = 0 \quad , \quad y^c = 0 \qquad (A2.5)$$

Nevertheless, in equilibrium the authorities have an incentive for deviating from the optimal inflation rate since

$$(\partial L / \partial \pi)_{\pi=\pi^e=\pi^c} = \pi + \lambda\ \alpha^2\ (\pi-\pi^e-\bar{y})\,|_{\pi=\pi^e=\pi^c} = -\lambda\ \alpha^2\ \bar{y} < 0 \qquad (A.6)$$

that is, around π^c, a small increase in inflation reduces the value of the loss function, which is to the advantage of the authorities. Therefore, the prior assumption of credibility no longer holds, and the private sector recognizes this when forming its inflationary expectations. This is the problem popularly known as *time inconsistency.*

1.2 Time Consistency and Discretionality

Time consistency without a credible commitment means that the authorities take π^e as given when selecting π and that agents form their expectations rationally, so that π^e equals the optimal value of π. In other words, the authorities are aware that the private sector will internalize any deviation from the optimal inflation rate π^c. Therefore, in minimizing (A.3), a new optimal inflation rate π^d is obtained which satisfies the first order condition:

$$\pi^d + \lambda\ \alpha^2\ (\pi^d-\pi^e-\bar{y})\,|_{\pi^e=\pi^d} = \pi^d - \lambda\ \alpha^2\ \bar{y} = 0 \qquad (A.7)$$

the optimal rate of inflation and the relevant output being represented in this case by

$$\pi^d = \lambda\ \alpha^2\ \bar{y} > \pi^e = 0 \quad , \quad y^d = \alpha\ (\pi^d - \pi^e) = y^e = 0 \qquad (A.8)$$

It should be noted that there is an inflationary bias, represented by $\lambda\ \alpha^2\ \bar{y}$, without any gain in real terms, compared with the case in which $\pi^e=0$ is selected. This is the so called *discretionality problem*. In turn, the inflationary bias will be higher: the lower the priority given by the authorities to fighting inflation (greater λ), the greater the short-term impact of inflationary surprises on output (greater α), and the greater the market distortions (greater $\bar{y}$).

2. The role of the central bank

As a solution to the problem of discretionality described earlier, Rogoff (1985) suggests that the authorities delegate the selection of π to a "conservative" central banker. This means that if the preferences of the central banker are such that λ is small (i.e., he cares a lot about inflation relative to output) the inflationary bias will tend to be reduced without any real output loss. In fact, at the limit, if $\lambda=0$, the optimal solution expressed in (A.5) is obtained.

3. Inflation Targets

The above result as regards delegation to a "conservative" central banker is valid only in the absence of uncertainty. If there were uncertainty owing, for example, to the presence of a disturbance in the aggregate supply function (A.2), it is easy to show the impossibility of implementing the optimal situation. In fact, there would be less variability in inflation than in the case of discretion, but more variability in output. Therefore, there exists an optimum degree of aversion to inflation (λ) which minimizes the sum of both variances, but which in no case achieves the optimal variability associated with a solution of the (A.5) type in a context of uncertainty.

For this reason, other alternatives have been suggested based on a "contractual" approach (see Walsh, 1993) under which a linear penalty is applied to the central bank if inflation exceeds the target $\pi^*= 0$. In such a case, the loss function in (A.3), now referred to the central bank, is converted into

$$\min_{\pi} L^b = L + h\pi = \frac{1}{2}\left[\pi^2 + \lambda\,\alpha^2\,(\pi-\pi^e-\bar{y})^2\right] + h\pi \qquad (A.9)$$

where h is the penalty imposed on the central bank for every point of deviation in inflation. Operating in the same manner as in (A.7), the first-order condition implies

$$\pi^b + \lambda\,\alpha^2\,(\pi^b-\pi^e-\bar{y}) + h\big|_{\pi^b=\pi^e} = \pi^b - \lambda\,\alpha\,\bar{y} + h \qquad (A.10)$$

so that selecting $h = \lambda\,\alpha\,\bar{y}^2$ gives $\pi^b = \pi^e = 0$ and $y^b = y^e = 0$; that is, the optimal solution is implemented.

Svensson (1995) has shown that implementing the contract referred to above is equivalent to providing the central bank with a loss function such as that of the authorities, but with a different inflation target ($\tilde{\pi}$). In this case, (A.9) would be

$$\tilde{L}^b = \frac{1}{2}\left[(\pi-\tilde{\pi})^2 + \lambda\alpha^2\,(\pi-\pi^e-\bar{y})^2\right] =$$

$$= \frac{1}{2}\left[\pi^2 + \lambda\alpha^2\,(\pi-\pi^e-\bar{y})^2\right] - \tilde{\pi}\pi + \text{constant} = \qquad (A.11)$$

$$= L - \tilde{\pi}\pi + \text{constant}$$

It should be noted that (A.11) has the same form as (A.9), in which $\tilde{\pi} = -h = -\lambda\,\alpha^2\,\bar{y}$. Therefore, it is necessary that $\tilde{\pi} < 0$, which is equivalent to assuming that the inflation target of the central bank is lower than that of the authorities $\pi^*=0$. Obviously, the fact that $\tilde{\pi}$ is negative is a consequence of the assumption $\pi^*=0$; if we had assumed $\pi^*>0$, it would have resulted that $\tilde{\pi}<\pi^*$.

ENDNOTES

1. This pragmatic definition of price stability was coined by Alan Greenspan, Chairman of the Federal Reserve.

2. See, for instance, the article by Edey (1994), which summarizes and gives supporting evidence for the various ways in which actual inflation rates are statistically overestimated.

3. See Akerlof, Dickens and Perry (1996). Although it has also been pointed out by Summers (1991)that a positive rate of inflation is desirable since it allows negative interest rates in severe recessions, this argument would not seem to be applicable to the medium term.

4. See, inter alia, the survey articles of Fischer and Modigliani (1978), Driffil, Mizon and Ulph (1990), Edey (1994), and Briault (1995).

5. The costs estimated by Lucas (1994) for the United States are significantly higher, and the costs estimated by Mulligan and Sala-i-Martin (1996) are much lower, than those of Bailey (1956) when the initial rate of inflation is very low.

6. See, among others, Edey (1994), Fischer (1994), Black , Macklem, and Poloz (1993), and Feldstein (1996). For an opposite viewpoint, see Aiyagari (1990).

7. For a critical view of the assumed empirical relationship between inflation and the degree of uncertainty, see Driffil, Mizon, and Ulph (1990). See also Groshen and Schweitzer (1997) for an analysis of the impact of inflation on labour markets.

8. A synthesis of these studies may be found, among others, in Fischer (1994), De Gregorio (1996), and Andrés and Hernando (1996).

9. The studies by Andrés and Hernando (1996), and Andrés, Hernando, and Krüger (1996) referred to are based on a neoclassical growth model expanded with human capital. They find that the effect of inflation on the growth rate lasts for decades, although it is not permanent. In any case, the level of steady-state per capita income declines permanently when inflation increases.

10. For example, Cukierman, Webb, and Neyapti (1992).

11. See Lucas (1996). In Canzoneri and Diba (1998), debt plays a fundamental role in the determination of the price level.

12. See Wallace (1981), and Canzoneri and Diba (1998).

13. This specific example is also linked to the issue of dynamic inconsistency discussed below. See endnote 16.

14. Ultimately, efforts to keep nominal interest rates low through faster money supply growth result in greater inflation and higher nominal interest rates, without

reducing real interest rates. In this way, the deficit is ultimately financed indirectly by the central bank.

15. The seminal studies are those of Kydland and Prescott (1977), and Barro and Gordon (1983). Englander (1990) and Cukierman (1992) analyze in depth the various factors determining the inflationary bias of monetary policy. See also the Appendix to this paper.

16. There are also problems of time inconsistency linked to the existence of budgetary and balance of payments targets, as pointed out by Cukierman (1992).

17. In those cases where hysteresis effects exist, the costs of disinflation are felt not only in the short term, but also in the medium term.

18. These issues have recently been empirically examined by Ball (1993). The remainder of this subsection draws heavily on his results.

19. A pioneer study along these lines is that of Rogoff (1985) who notes the advantage of appointing a central banker whose degree of aversion to inflation is relatively greater than that of society as a way to reduce the inflationary bias. Cukierman (1992) presents a theoretically and empirically very complete analysis of the issues related to central bank independence.

20. See, among other empirical studies, those of Grilli, Masciandaro, and Tabellini (1991), Cukierman (1992), Cukierman, Webb, and Neyapti (1992), De Long and Summers (1992), Alesina and Summers (1993), Debelle and Fischer (1995), Eijffinger and De Haan (1995), and De Gregorio (1996). Posen (1993) criticizes most of these studies, noting that the inverse relationship between the degree of central bank independence and inflation does not arise because the former "causes" the latter. Posen argues rather that societies which are highly averse to inflation tend both to establish independent central banks and to register lower inflation rates. For a reply to criticisms of this kind, see Cukierman, Webb, and Neyapti (1992).

21. An updated summary of this evidence is provided by Cukierman (1995) and De Gregorio (1996). See also Debelle and Fischer (1995), and Walsh (1993) for critical views of the impact of central bank independence on the costs of disinflation, and De Gregorio (1996) for a reply.

22. On this point, see Alesina and Gatti (1995).

23. On this point, see Begg *et al.* (1991).

24. The international experience with inflation targets is examined by Almeida and Goodhart (1998). See also Melcón (1995).

25. On this point, see Crockett (1993).

26. Juan Dolado contributed to preparing this Appendix.

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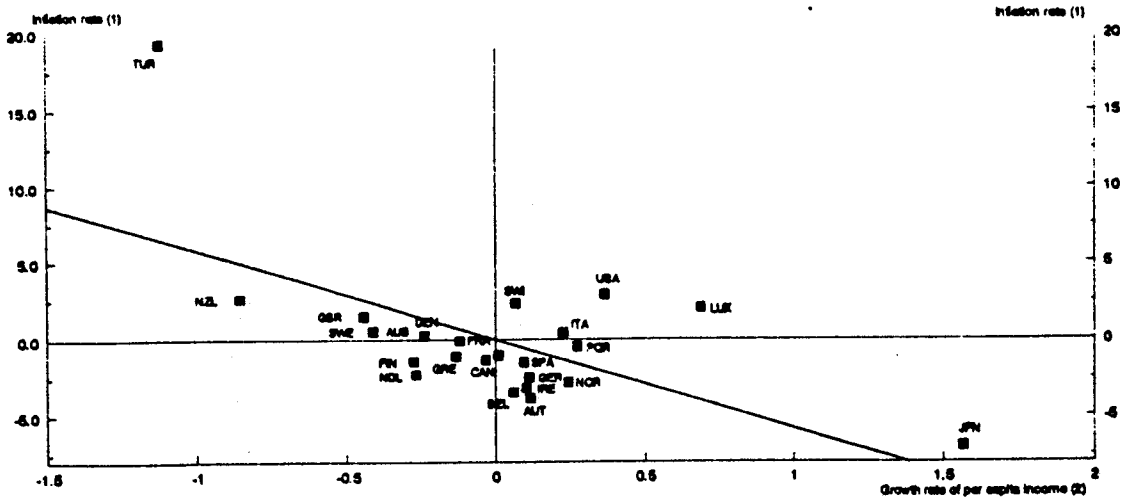
Figure 1

Growth of per capita income and inflation rates (1961-1993)
Components not explained by initial per capita income

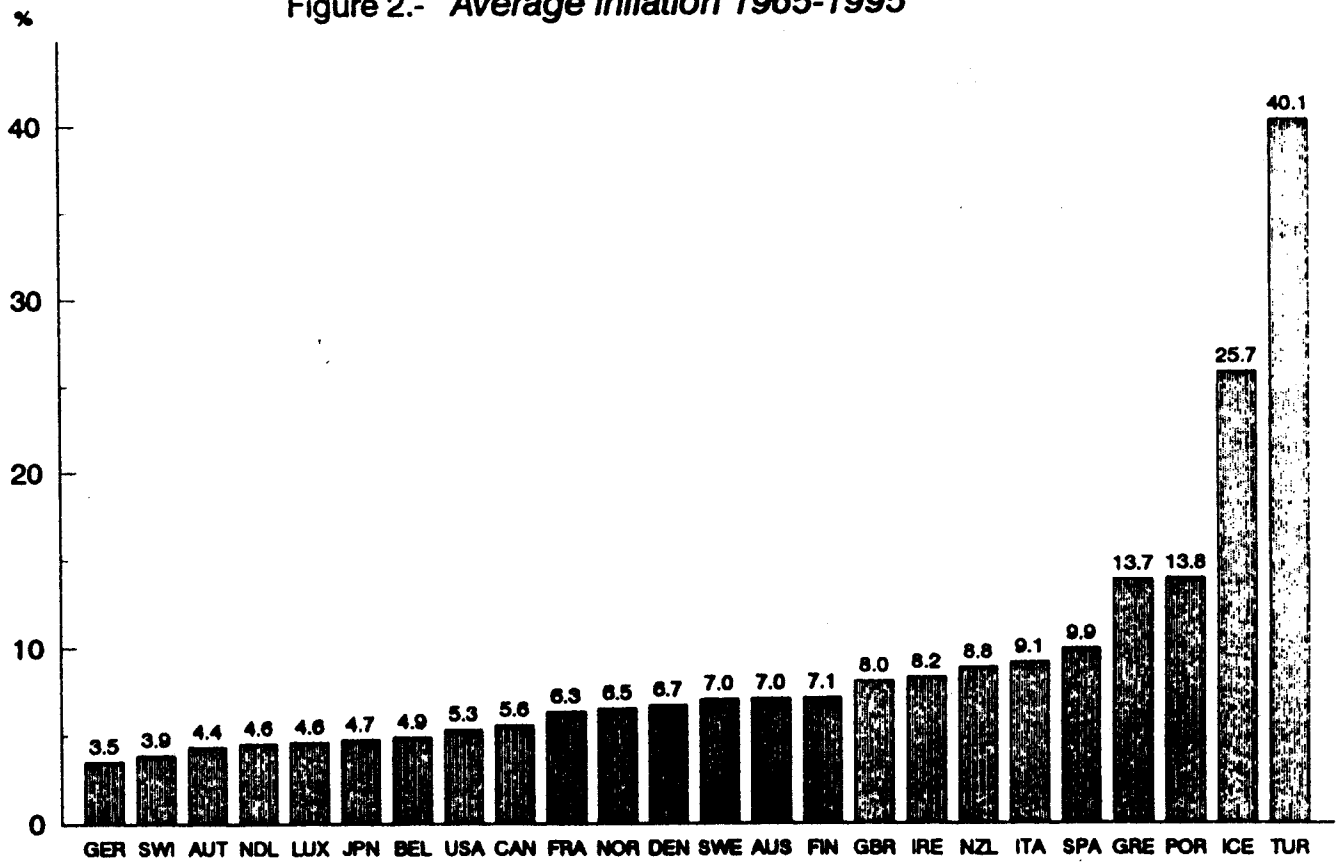


Sources: Andrés and Hernando 1996.

Notes: 1. Residuals of linear regression of inflation rate on the level of initial per capita income.

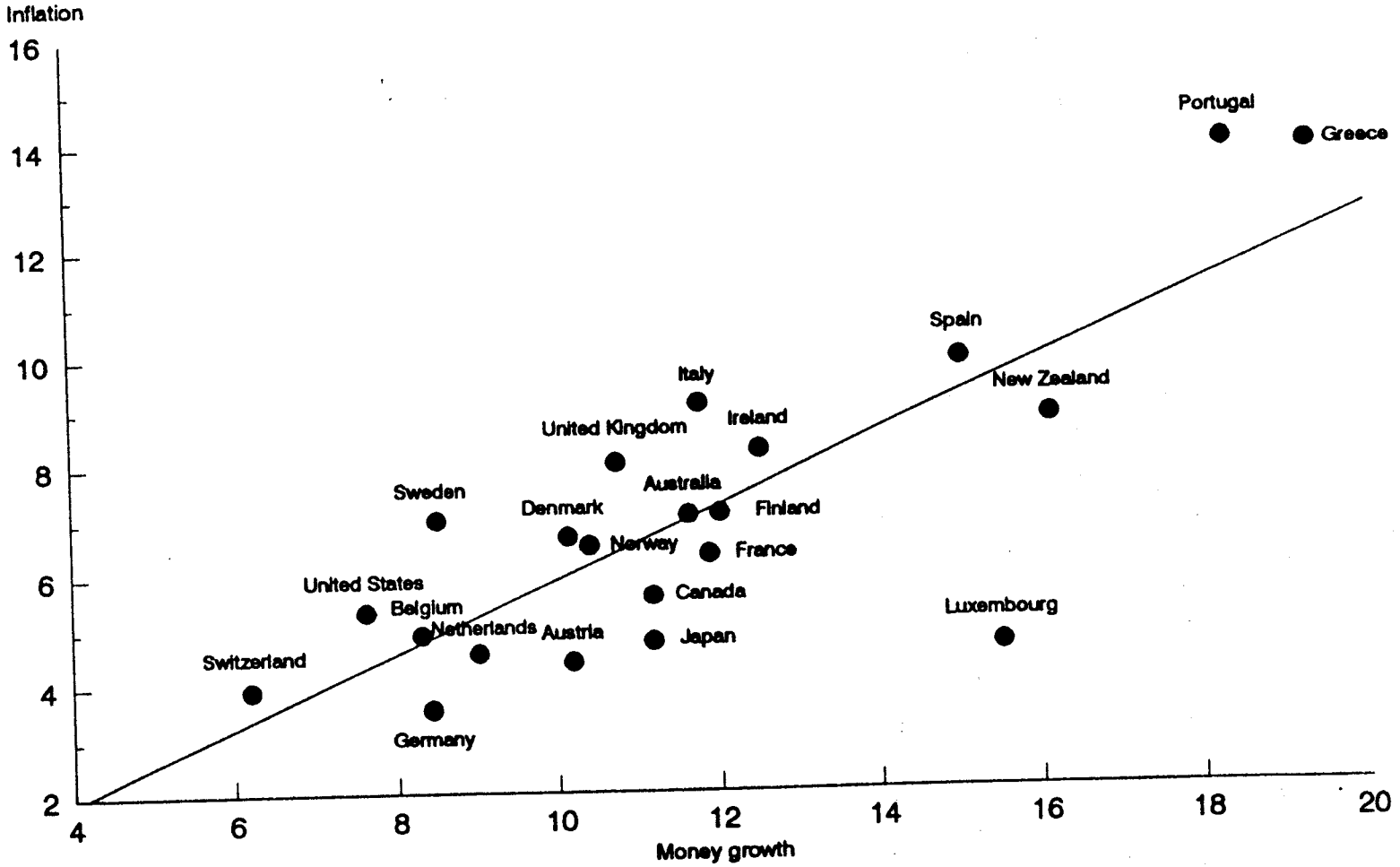
2. Residuals of linear regression of the growth rate of per capita income on the level of initial per capita income.

Figure 2.- *Average inflation 1965-1995*



Source: OECD

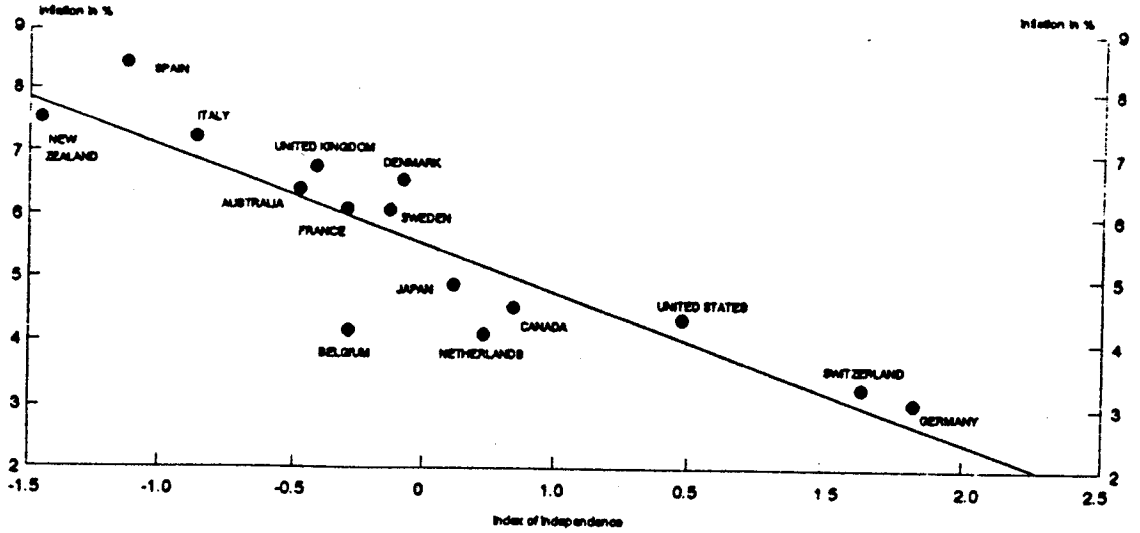
Figure 3.- *Average inflation and money growth 1965-1995*



Source: OECD and IMF

Figure 4

Inflation and Central Bank Independence
(1955-1990)



Sources: De Long and Summers (1992).

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