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INFLATION TARGETING IN LATIN AMERICA

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ABSTRACT

This paper analyzes Latin America's recent experience with the use of inflation targeting (IT) while the region has made substantial progress toward eradicating high inflation. The paper assesses the implementation and results of inflation targeting in Latin America from a broad perspective. It starts by reviewing the issues relevant for the choice of exchange-rate regimes and monetary frameworks, documenting the evolution of exchange rate and monetary regimes in Latin America during the last two decades. Then it describes the Latin American and world samples of inflation targeters and compares their performance to non-targeters, focusing on their success in meeting inflation targets, their output sacrifice in achieving low inflation, and their output volatility. A more detailed analysis of five IT experiences follows for Brazil, Chile, Colombia, Mexico, and Peru, with reference to the design of IT in the world sample of inflation targeters. The paper concludes by focusing on the dynamics of inflation reduction in the longest IT experience in the region (the case of Chile), evaluating how IT has affected inflation expectations and hence the effectiveness of monetary policy, using a battery of alternative model estimations and simulations.

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1. Introduction

Until the early 1990s, Latin America was the region with the highest inflation in the world. High inflation was the result of many decades of massive disregard for macroeconomic stability[1]. Fiscal dominance, in the sense that monetary policy was primarily dictated by fiscal financing needs, was the rule rather than the exception.

However, following the industrial countries' lead in their pursuit of price stability started in the 1980s, the region implemented a substantial departure from past policies around 1990. By then, country after country in Latin America embarked on stabilization efforts aimed at reducing inflation towards one-digit annual levels. The results have been dramatic. While in the 1980s four countries recorded inflation rates above 200% per annum, and the average annual regional inflation rate stood at 145%, by the end of the 1990s only two large countries (Mexico and Venezuela), had annual inflation rates above 10% and the region's average rate was below 10%. Currently many countries have attained low, single-digit, annual inflation rates, similar to industrial-country levels. However, following the industrial countries' lead in their pursuit of price stability started in the 1980s, the region implemented a substantial departure from past policies around 1990. By then, country after country in Latin America embarked on stabilization efforts aimed at reducing inflation towards one-digit annual levels. The results have been dramatic. While in the 1980s four countries recorded inflation rates above 200% per annum, and the average annual regional inflation rate stood at 145%, by the end of the 1990s only two large countries (Mexico and Venezuela), had annual inflation rates above 10% and the region's average rate was below 10%. Currently many countries have attained low, single-digit, annual inflation rates, similar to industrial-country levels.

Many factors have been behind the decision to make a frontal attack on inflation. First, the poor inflation record of the 1980s and the high political and economic costs that it entailed that raised the public's demand for stabilization. Second, the sharp improvement in the quality of the economic debate and policies, due to a critical mass of policy makers and academics trained at top U.S. and European graduate schools. Many of these students returned upon graduation to their countries to upgrade the quality of training and of public policy. This group of economists was able to convince policy makers and the public at large

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[1] But this was not all, during this period economic policies were characterized by having a distrust of markets, by promoting heavy government intervention and isolation from foreign trade.

that inflation is costly, that the main contribution of monetary policy is to deliver low inflation, that monetary policy does not have permanent effects on unemployment, and that under rational expectations and credible policies the cost of reducing inflation is much lower than previously thought. Third, the increasing introduction of market-oriented reforms and widespread understanding that macroeconomic stability facilitates the functioning of markets and, in particular, contributes to a better allocation of resources.

This paper assesses the implementation and results of inflation targeting in Latin America from a broad perspective. It starts by reviewing the issues considered in the choice of exchange-rate regimes and monetary frameworks in section 2, in the light of recent theory and policy experience. The next section documents the evolution of exchange-rate and monetary regimes in Latin America during the last two decades. Section 4 describes the Latin American and world samples of inflation targeters and compares their performance to non-targeters, focusing on their success in meeting inflation targets, their output sacrifice in achieving low inflation, and their output volatility.

The subject of section 5 is how monetary policy is carried out in five inflation-targeting countries in the region (Brazil, Chile, Colombia, Mexico, and Peru), with reference to the design of IT in the world sample of inflation targeters. Section 6 focuses on the longest inflation targeting in the region (the case of Chile), evaluating how IT has affected inflation expectations and hence the effectiveness of monetary policy, using a battery of alternative model estimations and simulations. The main conclusions close the paper.

2. Alternative Exchange-Rate and Monetary Policy Regimes

What determines the choice of currencies and exchange-rate regimes? This question fell into oblivion for three decades, after the early literature on exchange regime choices and optimum currency areas or OCAs (Mundell 1961, McKinnon 1963). Motivated by the experience of the European Monetary Union and the abandonment of intermediate regimes by emerging countries in the wake of financial turmoil of the late 1990s, a spate of new work is looking at the issue of optimal exchange regimes.[2]

Today's consensus view holds that the potential benefits from monetary union or dollarization (or a 100% credible currency board) stem from low(er) inflation, elimination of currency risk and its associated premium, elimination of currency transaction costs, and elimination of currency mismatch in foreign assets and liabilities. At the other extreme, maintaining a domestic currency under a free float offers potential benefits derived from allowing for nominal (and hence more real) exchange-rate flexibility, an independent monetary policy employed for stabilization purposes, direct access to seigniorage revenue, and direct central bank exercise in providing lender-of-last-resort services.

A host of structural and policy conditions determines the extent of the previous gains and losses associated to each regime choice. Traditional OCA factors to be considered comprise: the degree of international factor mobility and correlations of factor prices, the extent of domestic price and wage flexibility, the degree of foreign trade openness and integration, the degree of symmetry of domestic and external shocks and business cycles, and the extent of domestic output, export, and portfolio diversification. Other important factors, mostly in the realm of policies and financial markets, have been added recently: completeness and depth of domestic financial markets and their integration into world markets (particularly in their ability to hedge exchange risk and to accept domestic-currency denominated issues of foreign debt) and coordination of monetary union or dollarization with overall economic and political union, transfer payments, and adoption of similar regulatory and tax codes.

It is far easier to list the latter costs, benefits, and determining factors in choosing exchange regimes than putting numbers to such choices. In fact, an overall evaluation of the relation between regime choice and welfare is hampered by three serious limitations: there

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[2] Among recent work on exchange- rate regimes are Obstfeld (1995), Ghosh et al. (1997), Edwards and Savastano (2000), Frankel (1999), Mussa et al. (2000).

is no well-established encompassing framework that takes account of the various dimensions and variables that determine regime choice, there is not much agreement on the empirical weight of different costs and benefits that entail such a decision, and the costs and benefits may change over time in response to regime changes. Hence, regional or country specific evaluations of exchange regimes tend to be partial, emphasizing each factor separately.[3]

Having this difficulty in mind, we may however discuss the possible relations between overall country welfare and its choice of exchange regime, using the schedules drawn in Figure 2.1. Schedule A reflects the textbook case under which regime choice has no bearing on country welfare, as a result of instantaneous clearing in all domestic markets and their perfect integration into complete international goods and capital markets. In the absence of any market friction there is no gain from exchange-rate flexibility, independent monetary policy or providing lender-of-last-resort services when adopting a domestic currency and choosing any degree of exchange-rate flexibility – the only residual issue is a minor one, related to the international distribution of seigniorage revenue. At the same time, nothing is gained by giving up the domestic currency, as currency transaction costs are nil and perfect financial markets hedge the currency risk premiums and currency mismatch.

A monotonic positive (negative) schedule between exchange-rate flexibility and welfare arises when the net benefits (costs) of flexibility are positive and grow (decline) with flexibility. Countries that exhibit features like significant lack of factor mobility, domestic wage and price sluggishness, low trade integration, low (or negative) correlation of shocks and business cycles with the rest of the world, large concentration of output, exports and portfolios, lack of policy and regulatory coordination with other countries, low exchange risk premiums, high access to foreign markets for exchange-rate hedges and domestic-currency denominated debt, low inflation, a stabilizing monetary policy, and low

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[3] In addition to various studies on the costs and benefits of EMU, some country evaluations outside Europe include Coleman (1999) and Hargreaves and McDermott (1999) for New Zealand, and Morandé and Schmidt-Hebbel (2000) for Chile. The latter authors concludes that, among various Southern Hemisphere countries, Chile would gain the least (or lose the most) if it gave up its currency. Subject to large idiosyncratic shocks and significant temporary wage and price rigidity, and a conservative monetary policy, it is argued that Chile has to gain most from a floating exchange rate and an independent monetary policy.

currency transaction costs are reflected by schedule B, and the opposite is true for countries reflected by schedule C.

What about intermediate regimes? At their heyday a decade ago, adjustable pegs seemed to provide a perfect compromise between credibility (due to the nominal anchor provided by the exchange-rate peg or band) and flexibility (to allow for limited and gradual adjustment of the real exchange rate in response to shocks). Both academics and policy makers had in mind a non-monotonic relation such as schedule, arguing for and adopting variants of crawling pegs, fixed bands, or crawling bands. After a decade of growing disappointment with intermediate arrangements – caused by a spate of currency misalignment, speculative attacks, and mono or twin crises in Europe, Asia, and Latin America – the current consensus has shifted toward schedule E, consistent with the "corners hypothesis" (as espoused by Obstfeld 1995, Summers 2000, Mussa et al. 2000, and Edwards and Savastano 2000). While this view is not unanimous (see Williamson, 1996 and Frankel, 1999, for arguments in favor of intermediate regimes), the growing country migration toward the extreme arrangements provides policy support to the corners hypothesis. Furthermore, the disappointment about intermediate regimes is getting broader, encompassing fixed regimes and currency boards, on one side, and managed floats, on the other. Financial turmoil and contagion in open economies that have adopted currency boards (e.g. Argentina and Hong Kong), and protracted high exchange-rate risk premiums after 9 years of Argentina's currency board (reflected both directly and indirectly through large country-risk premiums, see Powell and Sturzenegger 2000), marks disillusion with currency boards and may explain Ecuador's outright dollarization. At the same time, a growing view that foreign-exchange interventions are costly and, at best, only yield temporary effects (as illustrated recently by the coordinated intervention in support of the euro), has led Latin American countries like Chile, Colombia, and Brazil to adopt clean floats.

With respect to monetary regimes, once a country decides to pursue a low inflation objective it needs to decide about the monetary regime to be used to anchor the evolution of the price level. Three fundamental options can be considered: an exchange-rate anchor, a monetary anchor, and an inflation target.[4]

[4] On monetary anchors, see Calvo and Vegh, 1999; Bernanke, B. S. and F. S. Mishkin, 1997; and Bernanke et al. 1999.

An exchange-rate anchor uses an exogenously determined trajectory of the exchange rate as a nominal anchor. A money anchor relies on a pre-committed path for the money supply to anchor inflation. In inflation targeting, the anchor for inflation is the publicly announced inflation target itself. The credibility of this policy relies on the power given to the Central Bank to orient monetary policy towards achieving the target and its willingness to use its power for this purpose.

When using an exchange-rate target, the Central Bank knows precisely what it has to do; the public knows at every moment whether the central bank is succeeding; and the exchange rate affects import prices and the prices of other tradables directly. An exchange rate peg can quickly garner credibility, at least for the short term; in the long term, credibility can be retained only by success in maintaining the exchange rate peg. But as we saw above, a fixed exchange rate is very costly for a government to maintain when its promises not to devalue lack credibility. In particular, credibility suffers when unemployment is high or the health of the banking system is in jeopardy.

But this is not all. The use of the exchange rate as an anchor also requires that the appropriate institutional structure be developed to prevent the financial system from becoming too vulnerable to an eventual exchange rate correction. The latter could be developed through appropriate financial sector regulation. This vulnerability develops as exchange rate fixing, with an open capital account and weak financial regulation, usually results in undue risk taking and, as a consequence, an unsustainable expansion of credit which could result in a financial bubble, increasing financial fragility in the process (Corbo and Fischer, 1995; Edwards and Vegh, 1997; and Mishkin, 1997). This problem is illustrated by the experience of Chile in the early 1980s and Mexico in the first half of the 1990s, and in the recent experience of Asia (Thailand, Korea, Malaysia and Indonesia). In all these cases, following the fixing of the exchange rate, the initial spread between the domestic and the foreign interest rate --adjusted for the expected rate of devaluation-- rose sharply, providing substantial encouragement for capital inflows and credit expansion. The final result was a combination of large capital inflows, an expenditure boom, and a sharp real appreciation. In these cases, a sudden reversal of capital flows is all that it took to set the stage for a major crisis.

For countries that are not ready or willing to go the avenue of currency boards or full dollarization, and decide instead to use a flexible exchange rate system, the question about the choice of a monetary framework is still open. For a monetary framework to be successful, it is necessary to provide sufficient independence to the central bank to be able to focus its monetary policy towards the ultimate objective of achieving low inflation.

Leaving out the use of an exchange rate peg, the remaining options are the use of a monetary aggregate or an inflation target.

The effectiveness of the use of a monetary aggregate as a nominal anchor for inflation depends, first of all, of the authority and capacity of the central bank to carry out an independent monetary policy aimed at achieving and maintaining low inflation. But at a more technical level, the effectiveness of a monetary anchor depends on the stability of the demand for the monetary aggregate that it is used as an anchor. It is the stability of the demand for the monetary aggregate what provides a link between the monetary anchor and the inflation rate. The stability of the demand for money presents a problem in cases where there is considerable financial innovation or when there is a sudden change in the level of inflation.

In particular, in an economy that has experienced a period of high and variable inflation, the demand for money becomes very unstable as economic agents develop ways to economize in the use of domestic money balances. And, therefore, when the rate of inflation is reduced, hysteresis effects emerge, generating a breakdown in the old demand for money relationship. That is, when the inflation rate returns to previous observed lower values, the quantity of money demanded is lower than before the outburst of inflation. In cases like these, predicting the quantity of money demanded becomes very difficult and the use of a money target could be a very ineffective way to achieve a given inflation objective. Thus, it is not surprising that as countries have moved to flexible exchange rate regimes they have searched for new monetary anchors. Here a third type of anchor is becoming increasingly popular: inflation targeting.

IT was initially introduced by industrial countries with the objective of keeping inflation close to a long-run low level. New Zealand introduced this system with this purpose first, in March 1990. Since then IT has been introduced in Canada (Feb. 1991), United Kingdom (Oct. 1992), Sweden (Jan. 1993), Australia (1993), and the ECB (Oct. 1998).

Under IT, the target rate of inflation provides a monetary anchor and monetary and fiscal policies are geared towards achieving the inflation target. The attractiveness of this framework is that its effectiveness does not rely on a stable relationship between a monetary aggregate and inflation and, at the same time, it avoids the problems associated with fixing the exchange rate. An additional advantage for emerging countries is that the trajectory of the market exchange rate provides important information on market evaluation of present and future monetary policy, such as the information provided by nominal and real yields on long-term government papers in industrial countries (Bernanke et. al., 1999).

A well defined IT framework requires to satisfy a set of conditions (Svensson, 2000 and King, 2000). First, public announcement of a strategy of medium-term price stability and an intermediate target level for inflation for a period into the future over which monetary policy could affect inflation. Second, an institutional commitment to price stability in the form of rules of operations for the monetary authority. Third, a clear strategy of how monetary policy will operate to bring inflation close to the announced target. This strategy usually starts from a conditional a forecast of inflation for the period for which the target is set. This strategy requires specifying operational procedures of what the central bank will undertake when the inflation forecast differs from the target. The procedures should be transparent and the monetary authority should be accountable for attaining the objective that has been set.

Given the lags in the operation of monetary policy, the inflation target has to be set for a period far enough into the future to ensure that monetary policy could have a role in determining future inflation. In practice, central banks announce a target for the next twelve or twenty-four months. For this time frame they develop a conditional forecast of inflation – based on the existing monetary policy stance and a forecast of the relevant exogenous variables – and set a strategy and communicate to the public the policy actions they would take in response to deviations of inflation from target levels.

Under IT, the official inflation target is the ultimate objective of policy, and an inflation forecast (not always made public) is the intermediate objective[5]. Monetary policy, with appropriate fiscal underpinnings, is the main instrument used to pursue the target. When the conditional inflation forecast is above the inflation target, the level of the intervention interest rate is raised with the purpose of bringing inflation close to the target. One advantage of IT is that inflation itself is made the target, committing monetary policy to achieve an explicit inflation objective and thus helping to shape inflation expectations. However, herein also resides its main disadvantage. As inflation is not directly under control of the central bank, it becomes difficult to evaluate the monetary stance on the basis of the observed path of inflation. Furthermore, as monetary policy operates with substantial lags, it could be costly to pre-commit an unconditional inflation target – independently of

[5] Sometimes the rate of growth of a monetary aggregate is used as an intermediate objective.

changes in external factors that affect inflation – and to change monetary policy to bring inflation back to the target. Aiming at the inflation target when a shock causes a temporary rise in inflation could be very costly in terms of a severe growth slowdown or increased output volatility (Cecchetti, 1998).

To address some of these problems, several options have been proposed. First, to set the inflation target in terms of a range rather than a point. Second, to set a target for core inflation rather than observed inflation. Third, to exclude indirect taxes, interest payments, and energy prices from the targeted price index. Fourth, to set the target for periods long enough so that short-term shocks to inflation do not require a monetary response[6].

Emerging markets that have adopted an inflation target starting at inflation levels well above their long-run objectives have had to deal with the problem of inflation convergence. Usually these countries have started reducing inflation without a full-fledged IT framework and place. Once they have made enough progress in reducing inflation, they have announced annual targets and gradually put into place the components of a full-fledged IT regime, on their way to low and stationary inflation.

[6] For a review of the costs and benefits of these alternative options see Bernanke et al. (1999), chapter 3.

3. Exchange Rate and Monetary Regimes in Latin America

The recent evolution of exchange rate and monetary regimes in Latin America has been conditioned by the region's increasing integration into world capital markets. Thus LA has been moving lately towards two extremes: credible fixed exchange rate systems (currency boards or full dollarization) and floating exchange-rate systems. As a result, the once popular exchange-rate target regimes of the 1980s and 1990s – difficult to sustain because of increasing capital mobility – are being abandoned in the region (Obstfeld and Rogoff 1995, IMF 2000).

Indeed, Latin America shows a strong and continuing trend from pegged exchange-rate regimes toward more flexible arrangements during the last two decades. According to the IMF classification of exchange-rate regimes, the share of countries with pegs, among 18 LA countries, has fallen from 67% in 1979 to only 23% in 2000 while the share of countries with freely floating rates has increased from zero in 1979 to 32% in 2000 (Figure 3.1). Intermediate regimes, such as those where the exchange rate is adjusted by various indicators have remained stable at 27%, while managed floats have increased from 27% to 37% during the same period. As compared to the 1999 world distribution of exchange rate regimes, LA has relatively more flexible exchange-rate arrangements.

Latin America's trend toward more flexible regimes is somewhat weaker in the country classification of exchange rate regimes made by Levy-Yeyati and Sturzenegger (2000), where exchange rate regimes are inferred from the actual behavior of nominal exchange rates and foreign reserves (Figure 3.2). Yet "de facto" pegs are shown to decline from 20% in 1979 to 6% in 1999. Moreover "de facto" free floats represent the dominant share (60%) of regimes in LA – a figure that is almost twice the share of "de jure" share of floats in the IMF classification.

Hence, on average, LA shows an unambiguous decline of pegs and an increase in floating regimes, while intermediate regimes do not show much of a trend. Considering the very recent shifts that have taken place during the last two years (not all of them reflected in the data in figures 3.1 and 3.2), various medium-sized and large countries have adopted free floats, including Brazil, Chile, and Colombia. Following Calvo and Reinhart (2000), we studied how close to real floating are these regimes by comparing the volatility of exchange rates and international reserves before and after the formal announcement of a free float. We also compare these measures of volatility with the ones for four other countries that are used as a control group. The volatility measures are defined as the probability that the monthly changes in exchange rates and foreign reserves fall within ranges of 1.0% and

2.5%, respectively. When carrying out this exercise, we do not control for the fundamentals or shocks that could affect the exchange-rate and foreign-reserve trajectories, so our conclusions are conditional on this assumption.

The results are presented in table 3.1. If the regime did not change much, then the probabilities that the percentage changes in the two variables fall within the given ranges should not change. However, if floating was for real, then the probabilities should be much lower (higher) in the floating period for the exchange rate (foreign reserves) variations. In Brazil and Mexico this was indeed the case for the nominal exchange rate. However, for the case of the foreign reserves this was not the case in either country. In the case of Brazil, this result could be due to the deliberate decision to use foreign reserves to pay its foreign debt. For Mexico, there was a deliberate policy to avoid large jumps in the nominal exchange rate through explicit exchange rate market interventions through the use of foreign reserves[7]. In particular, the Central Bank sell put options rights to buy dollars. Furthermore, everyday the Central Bank auctions 200 million dollars with a minimum price 2% above the preceding day's market price. In the case of Chile, although the two measures of volatility change in the right direction, the differences are not large. However, although there is much less intervention in the foreign exchange market, the volatility of the exchange rate increases but not by much. Indeed, this latter result was also found by Levy-Yeyati and Sturzenegger (2000) as they found that in the Chilean case the exchange rate regime was always fairly flexible. In Peru, exchange rate volatility is similar to the floating period of Chile, however, the volatility of foreign reserves is larger. The latter result indicates that Chile got more stability with less intervention.

The measures of volatility for the two industrial countries with free floats (Canada and New Zealand) show that they are not really free floaters as they have a lot of volatility in foreign reserves and not much in the exchange rate. In contrast, the two industrial countries that were pegging their currencies to the deutschmark (Austria and The Netherlands) had very low volatility in their exchange rates and high volatility in their foreign reserves. When comparing the volatility of the LA declared free floaters with New

[7] We divide the second period into two subsamples (1994:12-1997:12 and 1998:1-2000:9) to test if the high volatility of the foreign reserves was observed during all the floating exchange rate period or not. Our results confirm that from 1998:1 onwards, the foreign exchange reserves were more stable than in the previous period (61.7% of probability that the percentual change falls within the 2.5% band). So it appears that Mexico is today really floating.

Zealand, it is found that Chile and Colombia exhibit similar exchange-rate volatility but lower foreign-reserve volatility. In contrast, Brazil has larger exchange-rate volatility.

At the other extreme, Ecuador has recently joined Panama in choosing a credible fixed exchange rate regime, adopting the US dollar.

Hence a very recent shift, not yet reflected in the data, and away from the intermediate arrangements and toward the extremes is taking place in the region, consistent with the "corners hypothesis".

Now let's focus on the country distribution of nominal targets (or nominal anchors) chosen by central banks in their conduct of monetary policy (Figure 3.3). According to the IMF survey of 185 countries in the world for 1999, half of them have an exchange-rate anchor in place, while 8% use monetary aggregates, and 9% use inflation targets. A 32% share of countries has either no explicit target or uses a combination of targets. In an alternative study by Sterne and Mahadeva (1998) for 93 countries (where countries that choose more than one target appear more than once), the country distribution among the three anchors is much more balanced. Moreover, more than half of the countries in their group targets inflation, either exclusively or among other nominal targets.

Our own measures of country distribution for LA (also with double counting) show a distinct shift away from exchange-rate targets in LA. Of 11 LA countries representing more than 90% of LA GDP, 8 countries targeted the exchange rate in 1994 (under a peg, a band or a managed float) while only 3 countries continued doing so in 2000 (Argentina, Uruguay, and Venezuela). At the same time those targeting monetary aggregates increased from 1 in 1994 to 2 in 2000 (Mexico and Peru). However, in Mexico monetary aggregates have been used increasingly as an intermediate objective with the final objective of targeting inflation. Inflation targeters increased from 5 in 1994 to 6 in 2000 (Brazil, Chile, Colombia, Mexico, Peru, and Uruguay). Among the latter, full inflation targeters (as of October 2000) are Brazil, Chile, and Mexico.

Finally let's consider the combined time trend of exchange-rate and monetary regimes in LA. Table 3.2 shows how the number of countries with intermediate combinations (currency boards to adjustable pegs, combined with exchange-rate or monetary-aggregate targets) is declining between 1994 and 2000. In fact, there is a trend away from intermediate arrangements, weakly toward the upper-left corner and much more strongly toward the lower-right corner. In fact, one additional country has been added to the upper-left corner (Ecuador adopting dollarization) and four additional countries have positioned closely to the lower-right corner (Brazil, Chile, Colombia, and Mexico, in addition to Peru, adopting a free float combined with inflation targeting). The lower-right corner dominates not only regarding number of countries but also in terms of the combined weight of its members as a share of Latin America's GDP.

4. The World Experience with Inflation Targeting Regimes: Preliminary Results in Latin America in Comparison to Other Regions and Regimes

In this section we describe the Latin American and world sample of inflation targeters (ITers) and compare their performance to that of non-targeters. We focus in particular on their inflation performance and success in meeting their targets, as well as their output sacrifice in achieving lower inflation and their output volatility.[8]

IT started in 1990 with public announcements of inflation targets in New Zealand and Chile. According to Schaechter et al. (2000), there had been 13 "full-fledged" IT experiences in the world up to February 2000: Australia, Brazil, Canada, Chile, Czech Republic, Finland, Israel, New Zealand, Poland, South Africa, Spain, Sweden, and United Kingdom. Of the latter, Finland and Spain had abandoned IT in January 1999 when they joined the European Monetary Union (EMU). In our count 17 "full-fledged" IT country experiences have been started before or until October 2000, as we add Korea, Mexico, Thailand, and Switzerland to the 13 above-mentioned countries.

However, in order to conduct our empirical analysis for the 1986-1999 period, we consider a sample of 18 countries, subdivided into 3 main groups, according to the extent of IT adoption (Table 4.1). The first is comprised by 15 full inflation targeters (call "ITers"), subdivided into Latin American full ITers (Brazil and Chile), 8 "old" full ITers from other regions (countries that have had IT in place dating back at least to 1995) and five "recent" ITers (countries that have adopted IT during the last 2 years). The second group is comprised by three "partial" ITers in LA (Colombia, Peru, and Mexico), which have officially announced targets in place but lack some of the components of a full-fledged IT framework.[9] Our third set is a control group of 10 industrial economies that either target the exchange rate or monetary aggregates, or have no explicit target in place, or, in the case of EMU members, have adopted the euro after targeting their exchange rates for most of the

[8] Recent books and articles describe the design features and general results of inflation targeting (IT) in the small but quickly growing number of countries that have adopted inflation targeting (IT) since 1990. See in particular Leiderman and Svensson (1995), Mishkin and Posen (1997), Bernanke et al. (1999), Kuttner and Posen (1999), Haldane (1999), Mishkin (2000), Mishkin and Savatano (2000), Schaechter et al. (2000).

[9] Mexico became a full ITers in October 2000 but is considered a partial ITers for the purpose of the historical analysis.

1990s to the deutschmark. We label this control group as non-inflation targeters (Non-ITers).[10]

Figure 4.1 depicts adoption dates and inflation rates at adoption of 15 full ITers and 3 LA partial ITers.[11] The following stylized facts are apparent from inspection. Only 5 industrial countries had IT in place in 1999. Among emerging economies, Chile, Israel, and Peru adopted IT in the early 1990s. However 8 additional emerging countries have been added since 1998.

One salient feature of the international IT experiences is that many emerging countries adopted IT while they were still at inflation levels well above stationary inflation rates. In Chile and Israel inflation stood at 25% and 17%, respectively, when adopting IT in the early 1990s. In Peru inflation was 42% when adopting IT in early 1994. Among the newcomers, Colombia, the Czech Republic, and Mexico had inflation rates of 10% at adoption, Korea and Poland had initial inflation rates in the 5.0-7.0% range, and Brazil, South Africa, and Thailand had inflation levels below 3%. The subsequent success of emerging countries in bringing inflation toward low stationary levels is prima facie evidence that IT can be successfully adopted to reduce inflation from (low) double-digit levels toward low single-digit rates.

How successful have been countries in reducing inflation and meeting their targets under IT? We measure IT success in three simple dimensions: the reduction of inflation shortly before and after adopting IT, the speed at which inflation was brought down from the start of IT through the attainment of stationary inflation, and the average deviation of inflation outcomes from target levels.

A general feature of IT is that countries prepare when adopting IT by reducing inflation around the date of IT adoption (year t). This feature is generally observed in industrial and emerging, transition and stationary, full and partial ITers (Table 4.2). All 18

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[10] Switzerland fully adopted IT in February 2000 but is considered a non-ITer for the purpose of the historical analysis.

[11] Starting dates are defined by the first month of the first period for which inflation targets have been announced previously. For example, the starting date for Chile is January 1991 (the first month of calendar year 1991, for which the first inflation target was announced in Sep. 1990). The initial inflation level is defined as the year-on-year CPI inflation rate of the last quarter before the first month of inflation targeting (For instance 1990.4 in the case of Chile).

countries, with the exception of Chile, have reduced their inflation rates between years t-3 and t+1.[12] The range of inflation reduction scores is very wide, as it includes massive stabilization cases that brought inflation down from high inflation levels (at the extreme: from triple-digit levels in Peru) as well as cases where inflation was close to low stationary levels (e.g. in Canada, Spain, and Thailand).

Now let's consider the speed of convergence to stationary inflation among ITers (Table 4.3). Average convergence time of inflation to stationary inflation (or to current inflation in the case of ITers that have not converged yet) has been 8 quarters, at an average disinflation rate of 0.6% per quarter.[13] Among the countries that have completed transition to their long-term stationary target levels, Chile and Israel had the longest transition periods (around 8 years) – perhaps not surprising, considering their high initial inflation rates. Australia and Sweden were on the other extreme as they adopted IT when they had already attained stationary inflation.

ITers have been generally very successful in meeting their inflation targets. Performance is measured here as each country's average annual absolute or relative inflation deviation from its officially announced point or range target. We express these figures both in percentage points and relative to inflation (Table 4.4).

The overall record of the 18 IT experiences in the world is an annual average absolute deviation of 1.04 percentage points (or 0.50 per percentage point of inflation). However the dispersion of individual country records is large. Among old full ITers – those countries that have had at least 4 years of IT experience – the average annual absolute inflation miss from target is lowest in Canada (at 0.20 percentage points), followed by Chile and New Zealand (at 0.40 percentage points, and is highest in Israel at 1.67). Relative to inflation, the best target performance among old full ITers is achieved by Chile and the UK (at a 0.12 deviation relative to inflation), followed closely by Israel (at 0.14), while the largest misses are recorded by Australia (1.44) and Finland (2.12). At a regional level, the record of full and partial ITers in LA – with the exception of Colombia – is comparable to the attainment of inflation targets in other regions.

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[12] This result is not sensitive to the choice of period around IT adoption.

[13] When considering only the 14 countries that have achieved convergence to their stationary inflation targets by early 2000, roughly the same averages are obtained.

It is straightforward to compute sacrifice ratios – i.e. percentage GDP losses per percentage units of inflation reduction – as measures of the costs of disinflation under IT. Sacrifice ratios are computed for 18 ITers and for the inflation stabilization from 3 years before to 1 year after IT adoption (see Table 4.5) – the strong stabilization period identified in Table 4.2.

Among LA IT experiences, GDP sacrifice ratios have been very low – even negative in 3 of the 5 countries. The same is true for the 5 recent full ITers outside the region. In contrast, sacrifice ratios have been positive and relatively large for the 8 full and old ITers outside the region, with an average sacrifice of 0.88 percentage points of GDP per percentage point of inflation reduction. (The only exemption was Canada with a large negative sacrifice ratio).

An alternative way is to compare sacrifice ratios for disinflation periods under IT to sacrifice ratios before adopting IT, and to comparable sacrifice ratios among non-ITers (Table 4.6). Sacrifice ratios for ITers before IT adoption are computed for the period from 1980 to the year of adoption, and afterwards through 1999. For the control group of 10 non-ITers, sacrifice ratios are calculated for the decade of the 1990s. In both Chile and Peru – the longest IT experiences in LA – sacrifice ratios turned from positive before IT to negative afterwards. This stands in contrast to the group of 8 full old ITers outside the region, where sacrifice ratios changed, on average, from –0.32 to +0.19 after IT adoption. Also here there are two exceptions, however: in Israel and Finland sacrifice ratios turned negative after IT adoption.

Among non-ITers, sacrifice ratios have been larger during the 1990s, on average, than among IT countries after their IT adoption. The average sacrifice ratio among 10 industrial-country non-ITers is 0.30 for the last decade, with a dispersion that includes countries with positive and negative ratios.

The results suggest that IT does not make necessarily reduce sacrifice ratios in industrial countries that already had relatively low inflation before adopting IT and does not necessarily improve their performance in comparison to other non-IT industrial countries. However, there is some evidence that IT reduces the cost of stabilization in emerging economies that start at moderate or high levels of inflation – possibly a double bonus earned from the reduction of inflation per se and the gain in credibility from guiding inflation expectations by announcing (and attaining) official inflation targets.

Finally we report volatility of industrial output before and after IT adoption, and compare it to output volatility among industrial-country non-ITers (Table 4.7). Volatility –

measured as the standard deviation of quarterly industrial output from its Hodrick-Prescott trend – fell in 10 of 11 IT countries after adoption of IT, in comparison to their pre-IT volatility. Output volatility was cut by half or more in four IT countries: Chile, Peru, Australia, and Canada. Average post-IT volatility in the 10 IT countries is 2.4, a figure that is somewhat lower than the 3.3 average volatility in the control group of 10 non-IT industrial countries. In sum, adoption of IT by emerging and industrial countries is correlated with a large decline in their output volatility, to levels that are similar to (or somewhat smaller than) those observed in non-IT OECD economies.

5. The Recent Shift toward Inflation Targeting in Latin America

Different varieties of IT are applied today in Brazil, Chile, Colombia, Mexico, and Peru. Chile started to build up IT in 1990, following the announcement of an inflation objective introduced in the first report to the Senate by the then newly independent Central Bank. The second country that announced inflation targets, although without a formal IT system, was Peru in 1991. At the time the announced inflation objective was part of a broader stabilization program supported by the IMF. Then Colombia, Brazil, and finally Mexico moved toward announcing targets. As of today, three Latin American country - Brazil, Chile, and Mexico- have in place full-fledged inflation target systems. These regimes include issuing regular inflation report where the central banks present their views on the prospects for inflation, reflected by an inflation forecast.

The main design and implementation features of IT in LA are summarized in Table 5.1. For comparison, the features of IT are summarized for inflation-targeting countries in other regions, divided into newcomers (Table 5.2) and old-timers (Table 5.3).

The third and fourth columns of Table 5.1 report announced target levels and actual inflation rates for the five LA targeters. The last two columns of the table report the exchange rate system and the target index considered. The five countries have adopted a floating exchange-rate system after using (with the exception of Peru) currency bands in the 1980s or 990s. The first country to abandon the currency band was Mexico after its late-1994 crisis. The three other countries abandoned their exchange-rate bands in 1999, when they faced high costs in interest rates and activity when defending the exchange-rate bands.

Chile (since 1999) and Brazil (since June 1999) have put into place full-fledged IT frameworks. Mexico has just announced (in October 2000) inflation targets for the next three years within a system that it is quickly converging toward a full-fledged IT framework. Colombia has been struggling with the introduction of IT since the early 1990s. The country has not been able to pursue the inflation objective with sufficient strength due to problems of fiscal dominance and the simultaneous pursuit of a real exchange rate objective. As a result, its stabilization program lacked full credibility and, not surprising, inflation performance has suffered too. It was only after Colombia abandoned its exchange rate band, and adopting a float, that the Central Bank could focus its attention more closely on reducing inflation (September 1999). In Peru exists a strong commitment of the authorities (the Ministry of the Economy and the Central Bank) to reduce inflation, but there is not a full-fledged IT system in place yet. Rather, the Central Bank pursues monetary targets, usually in conjunction with IMF programs. But as progress has been made in reducing inflation, the country has been moving towards the adoption of more formal IT.

The progress in reducing inflation and the formalization of inflation targets have been made possible by institutional developments that have provided more independence to central banks. In Brazil and Colombia the inflation target is set jointly by the government and the central bank, while in Chile and Peru it is set by the central bank in consultation with the government. In contrast, in Mexico the target is set solely by the central bank.

In the five countries, central banks have been provided a substantial degree of independence in the 1990s and central bank loans to the government are prohibited. In Mexico and Peru the official objective of the central bank is defined as the attainment of price stability, while in Brazil the central bank pursues a dual objective of currency and price stability. In Chile and Colombia there are multiple official objectives: price stability and the stability of the domestic and foreign payments systems. However, in all countries the primary objective governing monetary policy has become price stability.

With respect to the use of instruments, the central banks of Brazil, Mexico, and Peru have full operational independence in using their monetary instruments (interest rate or monetary base). In Chile, the Minister of Finance is a non-voting member of the Central Bank Board and is entitled to suspend board decisions for up to two weeks, for decisions that have not been approved unanimously by the Board. However the governments have never exercised this option since central bank independence was granted in 1990. In Colombia the Minister of Finance is the President of the Central Bank Board and one of seven members. The rationale for this arrangement is that it purportedly contributes to increase the coordination between fiscal and monetary policy. However, this has not always been the case and many times it has been a source of friction between monetary and fiscal authorities.

Finally, all countries other than Peru issue regular inflation reports. Coverage of the report differs from country to country; only the Brazilian and Chilean reports include formal inflation forecasts.

6. The Inflation Targeting Experience of Chile: Does the introduction of a target make a difference?

Chile was the first country to start IT in Latin America and is the first to has completed its transition toward a full-fledged inflation targeting framework, as well as its convergence to stationary inflation. Hence this country experience is of special interest. In particular, it might be of interest to study if IT contributed in reducing inflation and if it made a difference in the speed and cost of price stabilization.

In their study of the experience of IT in industrial countries, Bernanke et al. (1999) found inconclusive evidence on the latter questions. Thus, although IT made a difference in the behavior of variables related to inflation, they did not find evidence that countries that applied IT benefited from lower stabilization costs. However they found that the introduction of IT made a difference in the trajectory of macroeconomic variables related to inflation.

Here we study the role played by the introduction of an IT framework on the reduction of Chilean inflation, as well as the costs associated to this reduction. The main question to be addressed is if the setting of IT had an effect on the structure of the economy in general and the inflation dynamics in particular.

In our model below, the main channel through which an inflation target affects inflation dynamics is through is effect on inflation expectations, that in turn affect price and wage inflation. Inflation expectations, an endogenous variable in our model, are measured in two alternative ways. First, by comparing nominal and real interest rates of similar instruments. Second, using exogenous inflation forecasts published by Consensus Economics. One could expect that announced inflation targets were not fully credible at the early stages, and thus their effects on inflation expectations should become more important only over time. This learning period should show up in the results.

The Effects of IT on Expected Inflation

We start by studying if adoption of IT in late 1990 made a difference for the dynamics of inflation. We start by generating inflation forecasts for the 1990s with single-equation inflation models estimated for the period before IT adoption. We use three type of models: (1) a Phillips curve, (2) a reduced-form inflation equation, and (3) a, ARIMA time series model[14]. In all models we use a measure of inflation that excludes perishable products, called core inflation. The models are estimated with monthly (12-month rate-of-change) and quarterly data (quarter-on-quarter), from mid-1980s through the end of 1990. Model-based out-of-sample inflation forecasts are reported in figures 6.1 and 6.2. The results are informative and consistent, showing that forecasts based on the three models are well above the actual declining inflation levels[15]. This provides some prima facie evidence that something happened during this period – after introducing it – that contributed to reducing inflation.

However, the simple comparison of forecasts does not address the question about what was behind the success in achieving inflation rates below the forecasts. One could argue that inflation reduction was not a result of introducing IT but due to other factors such as the payoff from earlier structural reforms, fiscal orthodoxy or the sharp increase in capital inflows during the early 1990s.

To take into account possible changes in the structure of the economy but short of specifying a complete structural model (which is our task below), we estimate an unrestricted VAR model. The VAR system comprises as endogenous variables core inflation, the rate of change of the monthly index of aggregate economic activity, the rate of change of nominal money (M1), the rate of change of the nominal exchange rate, and the policy interest rate. Foreign inflation is taken as an exogenous variable[16]. All variables are expressed as 12-month rates of change. We estimate this VAR model using rolling regressions leaving out the first year of the sample and adding one year at a time, starting with data through December 1991. The forecasts obtained with these VAR models are in figures 6.3 and 6.4. Although the forecasts become closer to actual inflation when adding more recent years (and leaving out earlier ones), the ratio between the forecast errors and actual inflation stayed fairly constant over time.

Now we want to investigate if the announced inflation target has played a role in the path of inflation reduction. An obvious hypothesis to analyze is if the target affected

[14] After the model selection procedures, we estimate an ARMA model for the core inflation, with quarterly and monthly data.

[15] The difference between the forecasts and the actual values becomes very large after 1993.

[16] We also used the terms of trade as an additional exogenous variable but the results were not much affected by their inclusion.

inflation expectations, providing through this channel an anchor for the inflation process. If this were the case, then the unemployment cost of reducing inflation could have been much lower than under a conventional, orthodox stabilization strategy not based on IT.

In order to analyze the effects of the targets on inflation expectations, we start with the most direct measure of inflation expectations of the available measures: the inflation expectation measure published in the Latin American Consensus Forecasts (CF) of Consensus Economics[17]. We first compare the CF expectations measure with two measures derived from two different VAR models and with actual inflation. The first VAR model (VAR1) comprises the variables defined for the previous VAR model, except for replacing core inflation by total CPI inflation[18]. The second VAR (VAR2) adds as an additional exogenous variable the target inflation to those included in VAR1. Both VAR models are estimated using monthly data of 12-month variation of the variables by rolling regressions with data through December of each preceding year.

The results of these comparisons, for December-to-December inflation, are reported in Table 6.1.They show that CF market inflation expectations are quite different from the values estimated from the VAR models and from the announced targets. Moreover, the discrepancy between CF inflation expectations and the inflation targets becomes smaller over time. This result provides evidence that inflation targets became more credible with the passing of time and the attainment of annual inflation rates close to announced target levels. Hence the use of IT, along with an appropriate institutional support allowing the public to understand that the main objective of monetary policy is to attain inflation close to target levels, facilitated Chile's process of price stabilization. Furthermore, inflation itself is less sensitive to nominal shocks than in a system without the IT anchor. In addition, the existence of the target and a clear Central Bank commitment to its achievement also provides some insurance against conventional time inconsistency problems of macroeconomic policies.

[17] We thank Consensus Economics for providing us with this data series.

[18] We replaced the core inflation by the total CPI inflation because the targets are defined as December-to-December changes of the total CPI index.

The Effects of IT on Inflation: A Small Structural Model of Chilean Inflation

In order to learn more about the process, by which the introduction of IT helped to reduce inflation, now we specify and estimate a small econometric model of Chilean inflation. The literature on the modeling of inflation in Chile using structural models is extensive[19]. We will concentrate on the open economy type models studied during the last fifteen years. Corbo (1985) built a model of Chilean inflation to study inflation dynamics up to the early 1980s, using a reduced form of the Salter-Swan-Dornbusch dependent economy model. Corbo and Solimano (1991) investigated the dynamics of Chilean inflation up to the late 1980s, using a small structural model. Edwards (1993) examined the question of Chilean inflation dynamics and inertia in the context of the use of the exchange rate as a nominal anchor for the 1974 to 1982 period.

Corbo and Fischer (1994) estimated a small structural model similar to that used in Bruno (1978), Corbo (1985) and Bruno (1991). In their solution of the structural model, they found that substantial inertia characterized inflation during the 1980s. Finally, Corbo (1998) estimates a model where inflation expectations enter in the wage equation but not in the price equation. Also in his model the policy interest rate and the output gap are taken as exogenous, that is they are not solved within the model.

The model that we use is an extension of the model used in Corbo (1998), where inflation expectations, measured by the comparison of nominal and real interest rates of similar instruments, enters explicitly into the wage and inflation equation. Furthermore, inflation expectations are determined by a four-quarter moving average of the previous inflation, the inflation target and an expectation error.

[19] For earlier models of the Chilean inflation, see Harberger (1963). For a review of inflation models for countries with moderate inflation, see Dornbusch and Fischer (1993).

The full model is given by the following equations:

$$(6.1)\quad \pi_t^S = \alpha_0 + \alpha_1\omega_t + \alpha_2\hat{e}4_t + \alpha_3 gap_{t-1} + \alpha_4 D2 + \alpha_5 D3 + \alpha_6 D4 + \alpha_7\pi_t^E + \alpha_8\pi_t^*$$

$$(6.2)\quad \omega_t = \beta_0 + \beta_1\pi_t^E + \beta_2\pi_{t-2} + \beta_3 D2 + \beta_4 D3$$

$$(6.3)\quad gap_t = \gamma_0 + \gamma_1 gap_{t-1} + \gamma_2 tot_t + \gamma_3 prbc_{t-2} + \gamma_4 KPIB_t \times D96$$

$$(6.4)\quad desem_t = \delta_0 + \delta_1 gap_t + \delta_2 desem_{t-1} + \delta_3 D2 + \delta_4 D3 + \delta_5 D4$$

$$(6.5)\quad gdcc_t = \chi_0 + \chi_1 gap_t + \chi_2 gdcc_{t-1}$$

$$(6.6)\quad \hat{e}_t = \phi_0 + \phi_1\pi_{t-1} + \phi_2\pi_{t-1}^* + \phi_3\Delta RIN_t + \phi_4 DESV_t + \phi_5 KPIB_t \times D96$$

$$(6.7)\quad \pi_{t+1}^E = \mu_0 + \mu_1 Tar_{t+4} + \mu_2\left[(\pi_t + \pi_{t-1} + \pi_{t-2} + \pi_{t-3})/4\right] + \mu_3\left[(\pi_t + \pi_{t-1} + \pi_{t-2} + \pi_{t-3})/4 - \pi_{t-4}^E\right]$$

$$(6.8)\quad \pi_t = \lambda_0 + \lambda_1\pi_t^S + \lambda_2 D3 + \lambda_3 D4 + \lambda_4 A93 + \lambda_5 A94 + \lambda_6 A96 + \lambda_7 A98$$

Where:

$\pi_t^S =$ Core inflation, quarterly rate of change.

$\pi_t =$ CPI inflation, quarterly rate of change.

$\pi_{t+1}^E =$ Expected rate of inflation, quarterly, for period t+1 in base of information available at period t.

$\omega_t =$ Quarterly rate of change of the wage rate.

$\hat{e}_t =$ Quarterly rate of change of the nominal exchange rate, in pesos per dollar.

$\hat{e}4_t =$ 4-quarter moving average of $\hat{e}_t$.

$\pi_t^* =$ External Inflation in dollars, expressed at a quarterly rate of change.

$gap_t =$ Gap between the seasonally adjusted quarterly GDP and its trend, expressed as a percentage of the trend. The trend is measured using a Hodrick-Prescott filter.

$tot_t =$ 4-quarter moving average of the log of the terms of trade.

$prbc_t =$ Real interest rate of the Central Bank's debt with 90 days of maturity (PRBC-90) expressed at an annual rate.

$KPIB_t =$ Capital inflows as a percentage of the nominal GDP.

$desem_t =$ Quarterly Unemployment Rate.

$gdcc_t =$ Current Account Deficit of the year ending in quarter t, as percentage of the nominal GDP.

$\Delta RIN_t =$ Quarterly change in the foreign reserves of the Central Bank, in dollars.

$DESV_t =$ Difference between the log of the market nominal exchange rate and the log of the central parity of the band, both in period t.

$Tar_t =$ Quarterly inflation rate implicit in the inflation target announced by the Central Bank[20].

D2, D3, D4= Seasonal dummies for the second, third and fourth quarter, respectively.

D96= Dummy variable that takes the value of one from the first quarter of 1996 until the end of the sample (2000:III).

A93, A94, A96, A98= Dummies that take the value of one for 1993, 1994, 1996 and 1998, respectively.

Equation (6.1), the equation for core inflation, is specified as the weighted average of the inflation equations for tradable and non-tradable goods and services, and includes also expected inflation. Equation (6.2) is the wage inflation equation, including lagged inflation reflecting explicit indexation schemes in wage payments and expected inflation reflecting forward-looking wage contracts. Equation (6.3) determines the output gap as a function of its own lag, the terms of trade, the lagged value of the real interest rate, and capital inflows. Equation (6.4) relates the unemployment rate to the output gap (Okun's law). Equation (6.5) relates the current account deficit to GDP ratio as a function of the output gap and its lagged value. Equation (6.6) describes the evolution of the nominal exchange rate within the exchange-rate band that was in place until late 1999. Equation (6.7) relates expected inflation to the forward-looking inflation target, a moving average of lagged inflation levels, and an inflation forecast error term. Equation (6.8) relates actual inflation to core inflation, introducing also seasonal dummies and annual dummies for particular weather and oil- related shocks.

The estimated model is summarized in table 6.2 below. We now proceed to compare the simulated values (obtained from the model's dynamic simulation) and actual values for core inflation. In the first simulation we take the actual real interest rate as given. The comparison of simulated and actual values for core inflation is shown in figure 6.5 below.

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[20] Computed by the authors linearizing the target expressed as a December-to-December rate of change.

From the figure it can be observed that the model forecasts are quite close to the actual values, except for 1997. Using these simulated values as a benchmark (BENCHMARK 1), we proceed now with the first counter-factual simulation. Here we analyze (SIMULATION 1) what would have happened if the target had not been made public and therefore had not affected expectations[21]. That is, in SIMULATION 1 we simulate the dynamic response of the Chilean economy if inflation expectations in the 1990s had been formed in the way they were formed in the 1980s.

The comparison of the simulated values with the model benchmark is presented in figure 6.6. The simulated values are above the benchmark values, especially starting at the end of 1996. These results are consistent with the hypothesis that the introduction of explicit inflation targets helped in reducing inflation. The mechanism at work here is through the effects of the targets on inflation expectations, and of the latter on wage inflation and core inflation. A clearer picture emerges when comparing the cumulative sum over four quarters of quarterly inflation simulated by SIMULATION 1 to the benchmark values (Table 6.3). The comparison suggests again a clear break since late 1996, showing that the effect of the target on actual inflation became important only some time after the introduction of IT. This is not surprising, as in the early stages the public was probably uncertain about the Central Bank's commitment to attain the inflation target. It was also for 1996 that the Central Bank announced (in September 1995) a more aggressive target of 6.5%, while the target for the previous year had been set at 9% and actual inflation had been 8.2%.

A final issue that we address is regarding the likely macroeconomic effects of alternative stabilization paths. Here we run two counter-factual simulations for the speed and intensity of price stabilization in the 1990s: a more gradualist disinflation path (SIMULATION 2) and a more aggressive path (SIMULATION 3). The gradualist strategy considers a reduction in target inflation by only 0.5 percentage point per year starting in 1994. The cold-turkey stabilization assumes a target inflation of 3% for 1996 and beyond (Table 6.4).

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[21] For this purpose, we first estimate an equation for inflation expectations for the period before the introduction of IT, that is up to the fourth quarter of 1990, and use this equation to model inflation expectations in the 1990s.

When altering the targets, the policy interest rate has to be changed accordingly. Hence the structural model presented above has to be extended to include the following policy reaction function for the Central Bank:

$$(6.9)\quad prbc_t = (1-\rho)\times\left(\psi_0 + \psi_1\left(\pi 4^S_{t+3} - Tar4_{t+3}\right) + \psi_2 gdcc_{t+2}\right) + \rho prbc_{t-1} + \psi_3 D983$$ [22]

This policy reaction function is consistent with Corbo (2000), that extend previous work by Taylor (1993) and Clarida et al. (1998) for countries that follow a target of a gradual inflation reduction. In this equation, the policy interest rate is specified as a function of the gap between expected inflation and target inflation, the gap between the current account deficit to GDP ratio and its target value (the latter set at 4.5% of GDP), and the lagged value of the policy rate[23].

The amended model (that now includes the policy reaction function) is run for providing a new set of benchmark results (BENCHMARK 2). The results for simulated core inflation and actual core inflation are compared in figure 6.7. The simulated values from this exercise are closer now to the actual values that the ones obtained by the BENCHMARK1 model results. Hence, by endogenizing the policy interest rate, the interest rate is adjusted when the inflation forecast differs from the target, helping to bring actual inflation closer to the target.

The counter-factual simulation results core inflation under the gradualist strategy (SIMULATION 2), the cold-turkey approach (SIMULATION 3), and the benchmark case (BENCHMARK 2) is reported in Figures 6.8. Unsurprisingly, core inflation under the gradualist (cold-turkey) approach is well above (below) the BENCHMARK 2 path. However the differences between the gradualist and benchmark simulations start declining toward the end of the simulation period. In the case of the cold-turkey target, the convergence of the simulated values toward target values is much slower, confirming that inflation exhibits substantial inertia and that the selection of a hard target could have resulted in higher unemployment and only a small gain in terms of lower inflation.

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[22] In this equation, $\pi 4^S_t$ is the four-quarter cumulative sum of quarterly core inflation rates, $Tar4_t$ is the four-quarter cumulative sum of quarterly target inflation rates, and D983 is a dummy variable (equal to 1 in the third quarter of 1998).

[23] As the right hand side variables of this equation are endogenous variables, we estimate this equation using the generalized method of moments in order to obtain consistent and efficient estimates of the coefficients.

The comparison of unemployment paths for both strategies is presented in figure 6.9. The latter is a result of slow adjustment of expected inflation towards the target level. To throw further light on the cost of disinflation we also compute the sacrifice ratio for the reduction of inflation, comparing the cumulative sum of the unemployment increases with the cumulative sum of the gains in inflation reduction. The computed sacrifice ratio is –1.26. By contrast, in the case of the gradualist strategy the sacrifice ratio is only –0.95, showing that alternative disinflation speeds entail different costs of employment and output.

Finally we check the robustness of our results by using an alternative definition of expected inflation, that is the CF measured instead of the difference between nominal and real interest rates. For this purpose, we re-estimate equations (6.1), (6.2) and (6.7), using the alternative measure of inflation expectations. Then after introducing these new equations in the model, we re-run the benchmark and the two counter-factual simulations. The results, reported in Figures 6.10 and 6.11, are fairly similar to the ones discussed above. The sacrifice ratios are –1.26 for the cold-turkey strategy and -0.99 for the gradualist approach. This confirms the robustness of our results to alternative measures for inflation expectations.

7. Conclusions

After 40 years of high and variable inflation, during the last decade Latin America has made major progress toward eradicating inflation. As a result, at the beginning of the twenty-first century average inflation is below 10% and several countries are well on the way towards achieving and maintaining low one-digit inflation levels. Inflation reduction was made possible by a frontal attack on public sector deficits and by a deliberate effort to break the historical inflation dynamics that resulted in high inertia. The recent experience of industrial countries in their pursuit of price stability played an important role by providing a technology to accommodate exchange rate flexibility with monetary discipline: inflation targeting. Ultimately it has been the combination of progress in achieving fiscal discipline and the restricted discretion embedded in IT that made possible the success in inflation reduction.

This paper has examined the recent experience of inflation targeting in Latin America. A review of alternative exchange rate and monetary policy regimes allowed setting the stage by analyzing different arrangements and their pros and cons, in the light of theory and recent international experience. Then a brief review of the empirical evidence on the distribution of regimes during the last two decades in the world at large and Latin America in particular was conducted. A clear, recent shift away from intermediate exchange regimes is noted particularly in Latin America where a few countries have adopted currency boards or outright dollarization, while many more countries have adopted free floats, typically in conjunction with IT.

A worldwide comparison of implementation and performance of IT provides various preliminary results of interest for the 5 Latin American inflation targeters. Most ITers brought inflation significantly down around the year of adoption of IT, were successful in attaining their target levels, and exhibit sacrifice ratios and output volatility that are lower after than before adopting IT and comparable to (or sometimes lower than) the levels observed in non-IT industrial economies. Among ITers, the Latin Americans have performed comparatively well. Fiscal discipline and institutional developments that have provided more independence to central banks have supported the adoption of IT and the progress in reducing inflation.

Chile is the country that has used IT for the longest period and where inflation has already converged to the steady-state long-term target. Hence it is of much interest to draw the lessons from this experience. Three main lessons emerge. First, the initial progress in reducing inflation toward the target is slow as the public is learning about the true commitment of the central bank to attain the target. Second, the gradual phasing in of IT helped in reducing inflation expectations, contributing to reduce inflation directly by lowering inflation expectations and indirectly by changing wage and price dynamics. Third, with respect to the speed of inflation reduction, a cold–turkey approach would have resulted in a larger sacrifice ratio stemming from higher unemployment during the early years of IT when credibility was gradually built up.

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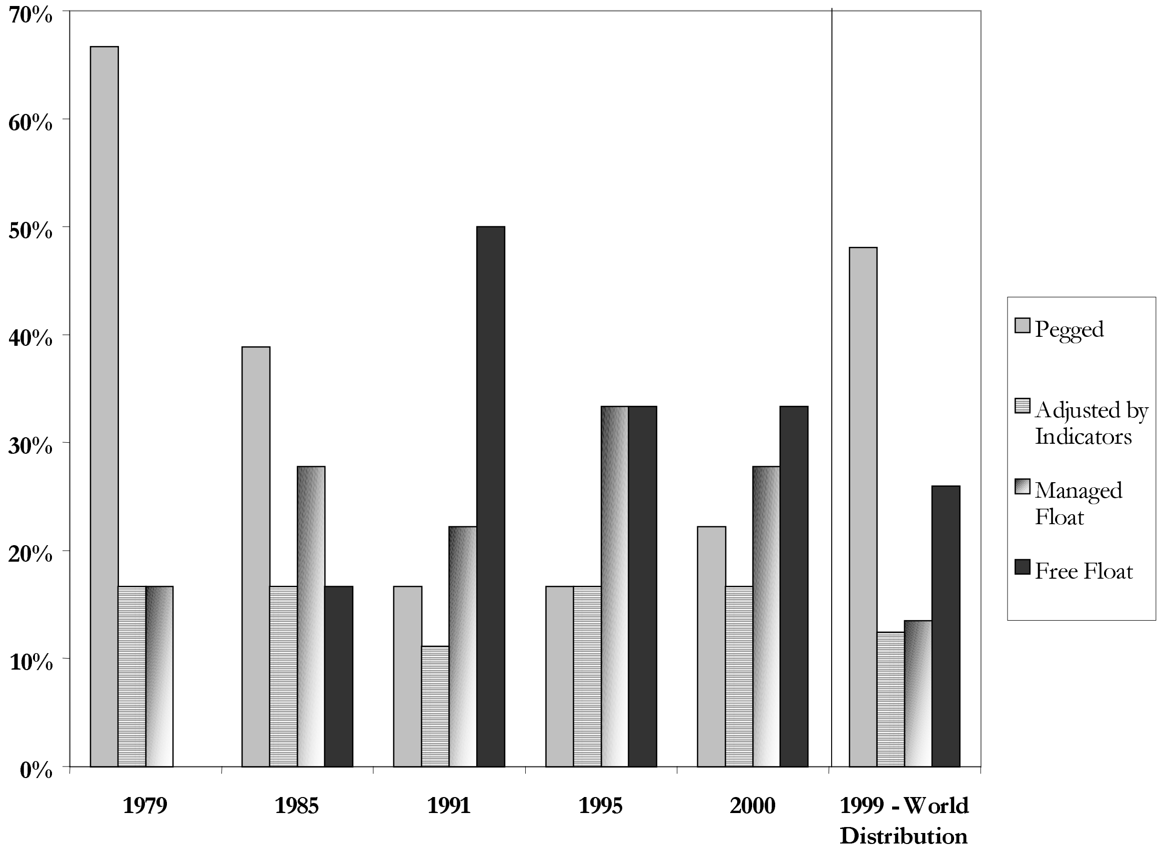
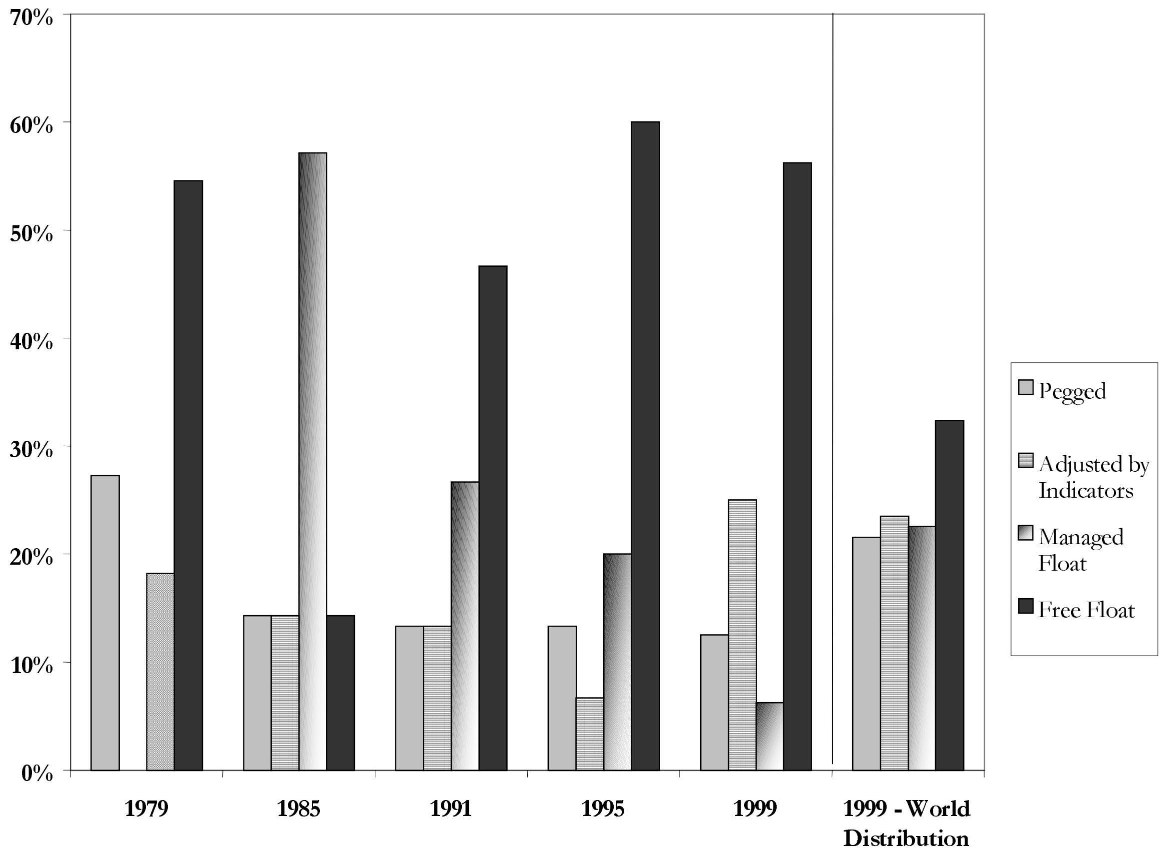
Figure 3.1
Country Distribution of Exchange-Rate Regimes in Latin America:
IMF Classification
1979-2000



<u>Source</u>: *For years 1979, 1985, 1991 and 1995 for Latin America and 1999 for World Distribution: IMF: International Financial Statistics (2000). For the year 2000 for Latin America: authors' classification based on central banks' statements and web pages.*
18 countries are included in Latin America's distribution: Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and Venezuela.
World distribution includes 185 countries.

Figure 3.2
Country Distribution of Exchange-Rate Regimes in Latin America:
Levy Yeyati Classification Based on Cluster Analysis
1979-1999



<u>Source:</u> Levy Yeyati and Sturzenegger (2000).
Latin America: Same countries as in Figure 1. However, sample size varies in time, as some country regimes are deemed "inconclusive" under this analysis. Those regimes are not included in the distribution. "Inconclusive" countries are:
1979: Ecuador, Guatemala, Mexico, Paraguay, and Venezuela. No information available for Nicaragua and Uruguay.
1985: El Salvador and Venezuela. No information available for Colombia, Nicaragua, and Uruguay.
1991: Chile and El Salvador. No information available for Nicaragua.
1995: El Salvador and Paraguay. No information available for Nicaragua.
1999: El Salvador.
World distribution includes 102 countries (after eliminating 23 "inconclusive" countries).

Figure 2.1
Exchange Rate Regimes and Welfare

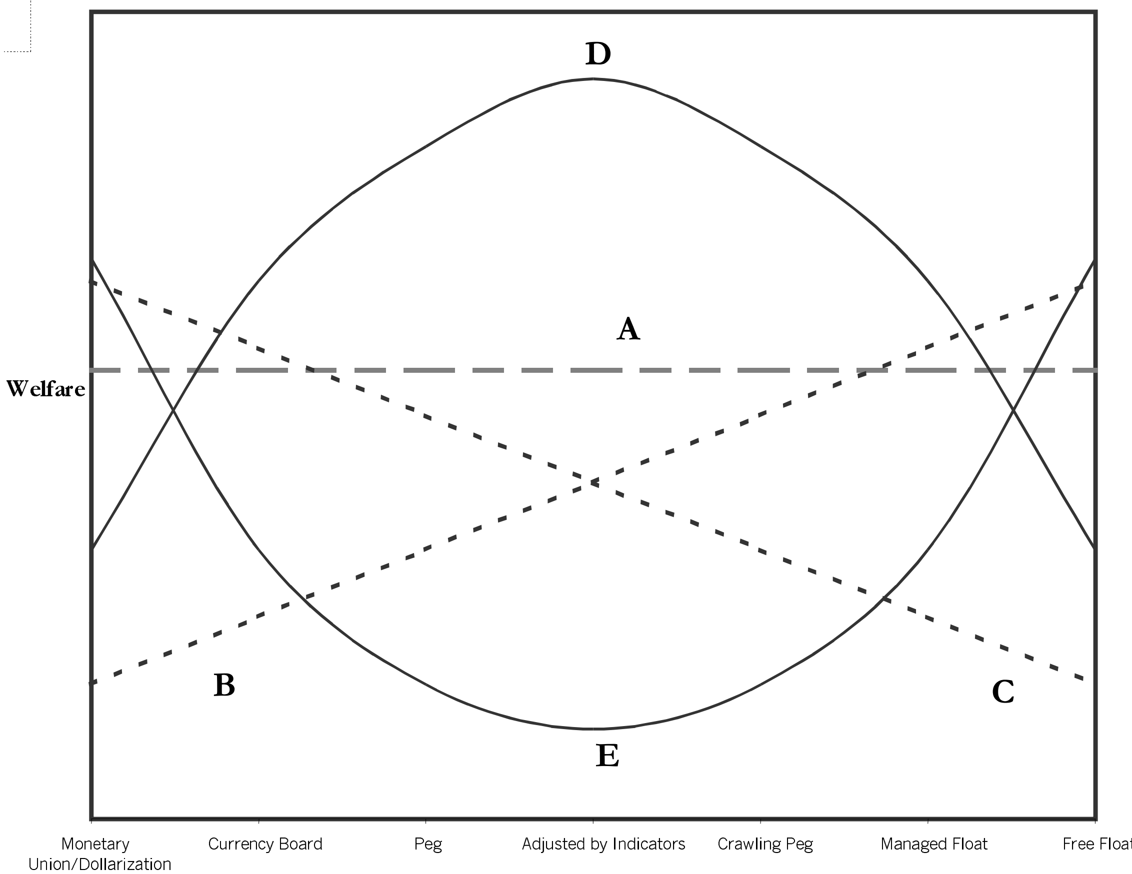
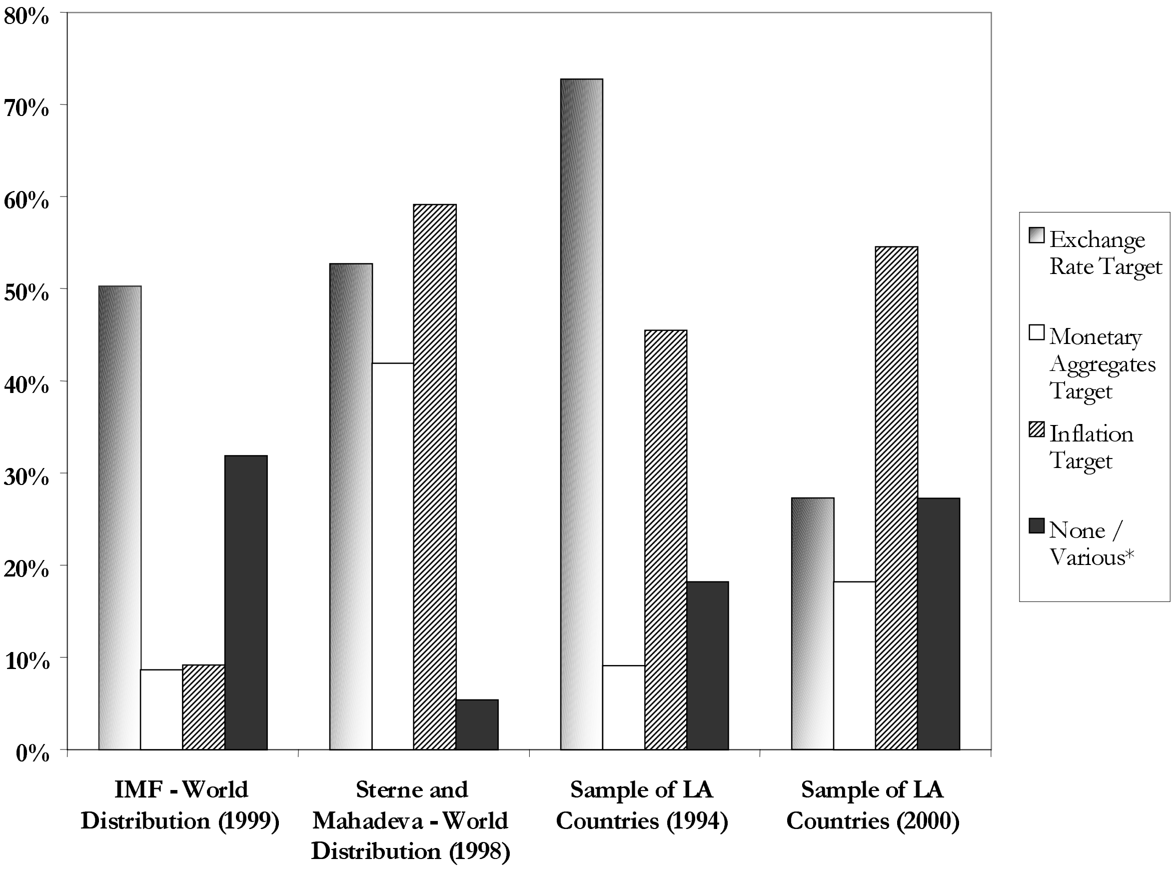


Figure 3.3
Country Distribution of Nominal Targets for Monetary Policy:
World and Latin American Samples



<u>Source:</u> IMF: International Financial Statistics (2000) and Sterne and Mahadeva (2000) for world distribution.
Mishkin and Savastano (2000) and central banks' statements and web pages for Latin American countries.
IMF classifies 185 countries. Stern and Mahadeva (2000) include 93 countries.
LA sample: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Panama, Peru, Mexico, Uruguay, and Venezuela
**: Countries with more than one nominal anchor or explicit targets are classified by the IMF in the "None/Various" group, the same as countries with no explicit targets. Sterne and Mahadeva (2000) separately account for each possible target, so countries appear in more than one category. Hence, only countries with no explicit nominal target are included under "None/Various" in their classification. The same applies to the sample of Latin American countries (Bolivia's credit target is classified as "None/Various").*

Table 3.1: Exchange Rate and Foreign reserves Volatility.

Country	Period	Nominal Exchange Rate		Foreign Exchange Reserve	
		Probability that the monthly percent change falls within			
		+- 1%	+- 2.5%	+- 1%	+- 2.5%
BRAZIL	1995:1-1998:12	58.8	97.3	9.7	24.0
	1999:1-2000:7	4.9	14.4	6.8	16.9
Chile	1985:1-1989:12	29.8	67.0	10.4	25.5
	1990:2-1999-8	46.2	87.7	20.3	48.1
	1999:9-2000:9	34.9	74.6	46.2	86.3
Colombia	1990:2-1999:8	30.9	68.5	25.8	58.9
	1999:9-2000:9	30.7	66.1	31.4	68.0
Mexico	1990:2-1994:11	65.7	98.2	5.9	14.7
	1994:12-2000:9	12.4	30.4	3.6	9
Peru	1992:2-2000:9	29.8	66.3	13.8	33.7
Austria	1990:1-1998:12	100	100	15.2	36.8
Canada	1990:1-2000:5	63.4	97.5	1.1	2.8
Netherlands	1990:1-1998:12	100	100	15.7	37.9
New Zealand	1993:2-2000:9	36.7	76.5	12.0	29.3

Source: Authors' calculations based on each country Central Bank's information, except for Austria, Canada and Netherlands, which are based on IFS.

Table 3.2
Exchange-Rate Regimes and Nominal Targets in 11 Latin American Countries: 1994 and 2000

	Dollarization/ Monetary Union	Currency Board	Peg	Adjustable Peg/ Exchange Rate Band	Managed Float	Free Float
1994						
No Explicit Target/ Other Targets	Panama			Bolivia (Credit Target)		
Exchange Rate Target		Argentina	Venezuela	Bolivia Brazil Chile Ecuador Mexico Uruguay		
Monetary Aggregates Target				Colombia	Peru	
Inflation Target				Chile Colombia Ecuador Uruguay (1995)	Peru	
2000						
No Explicit Target/ Other Targets	Ecuador Panama			Bolivia (Credit Target)		
Exchange Rate Target		Argentina		Uruguay Venezuela		
Monetary Aggregates Target					Mexico Peru	
Inflation Target				Uruguay	Mexico Peru	Brazil Chile Colombia

Source: Mishkin and Savastano (2000), Mahadeva and Sterne (2000), and central banks' statements and web pages.

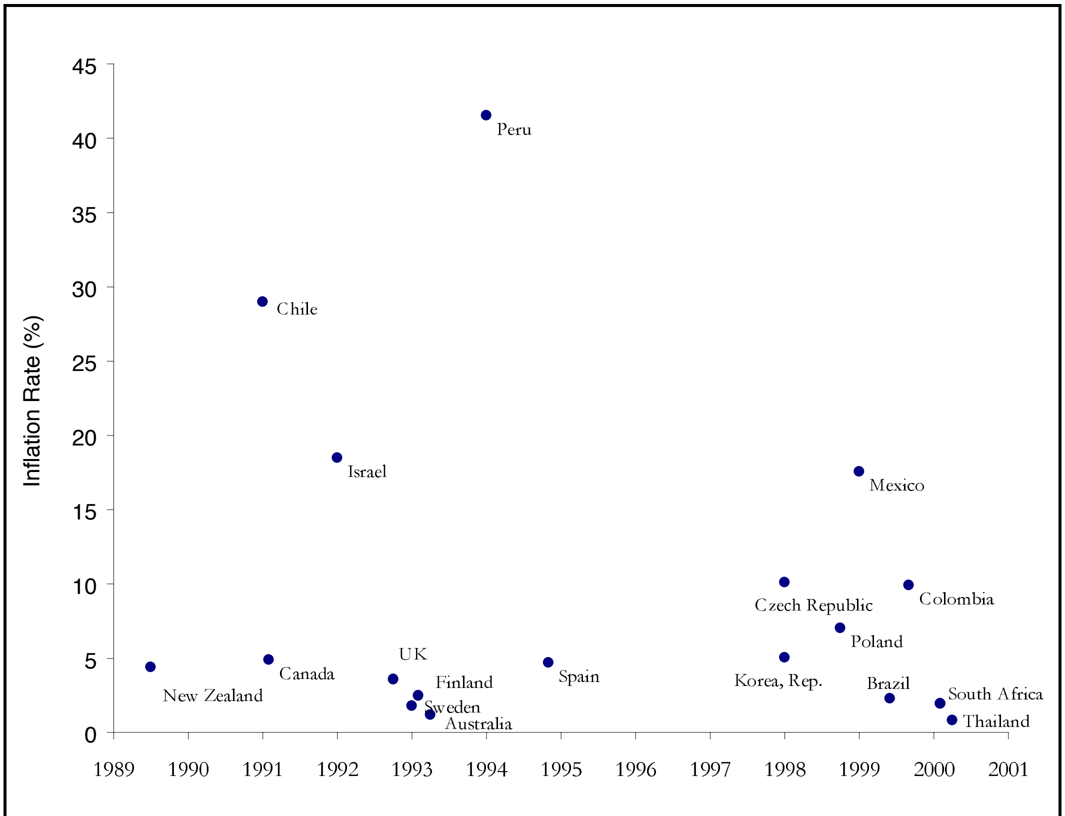
Table 4.1

Country Sample

Latin America		**Rest of the World**		
Full ITers	***Partial ITers***	***Old Full ITers***	***Recent Full ITers***	***Non ITers***
Brazil	Colombia	Australia	Czech Republic	Denmark
Chile	Mexico	Canada	Poland	France
	Peru	Finland	South Africa	Germany
		Israel	Korea	Italy
		New Zealand	Thailand	Japan
		Spain		Netherlands
		Sweden		Norway
		United Kingdom		Portugal
				Switzerland
				United States

Source: Authors' elaboration.

Figure 4.1
Inflation at Adoption of Inflation Targeting Framework in 18 Countries: 1988-2000 [1]



(1) Inflation attained one quarter before adopting IT.

Source: Authors´calculations based on data from IFS, country sources, and Schaechter et al. (2000).

Table 4.2

Disinflation around Year of Adoption of Inflation Targeting: 18 Countries[1]

Latin America				**Rest of the World**			
Full ITers		***Partial ITers***		***Old Full ITers***		***Recent Full ITers***	
Brazil	-15.8	Colombia	-10.9	Australia	-5.4	Czech Republic	-7.0
Chile	0.8	Mexico	-24.9	Canada	-2.5	Poland	-20.2
		Peru	-398.4	Finland	-5.0	South Africa	-3.7
				Israel	-9.3	Korea	- 3.7
				New Zealand	-14.1	Thailand	-2.6
				Spain	-2.4		
				Sweden	-8.3		
				United Kingdom	-7.0		
Average	**-7.5**				**-6.8**		**-7.4**

[1]Disinflation measured as change in annual inflation rate between 3 years before and 1 year after IT adoption year.

Source: Authors´calculations based on data from IFS, country sources, and Schaechter et al. (2000).

Table 4.3

Convergence to Stationary Inflation under Inflation Targeting in 18 Countries: 1989-2000[1]

	Initial Inflation	*(Date)*	*Final Inflation*	*(Date)*	*Quarters of Conver-gence*	*Inflation Change*	*Average Inflation per Quarter*
LA Full ITers							
Brazil[2]	8.3	(1999.4)	7.9	(2000.1)	1	-0.4	-0.4
Chile	29.0	(1990.4)	3.8	(1999.1)	33	-25.2	-0.8
Average	**18.7**		**5.9**		**17**	**-12.8**	**-0.6**
LA Partial ITers							
Colombia	10.0	(1999.2)	10.6	(2000.2)	4	0.6	0.2
Mexico	17.6	(1998.4)	10.6	(2000.1)	5	-7.0	-1.4
Peru	41.5	(1993.4)	2.8	(1999.3)	23	-38.7	-1.7
Average	**23.0**		**8.0**		**11**	**-15.0**	**-1.0**
Old Full ITers							
Australia	1.2	(1993.1)	1.2	(1993.1)	0	0.0	-
Canada	4.9	(1990.4)	1.6	(1992.1)	5	-3.3	-0.7
Finland	2.5	(1992.4)	2.0	(1993.3)	3	-0.5	-0.2
Israel	18.5	(1991.4)	1.9	(1999.4)	24	-16.7	-0.7
New Zealand	4.4	(1989.2)	2.8	(1991.2)	8	-1.6	-0.2
Spain	4.7	(1994.3)	1.6	(1997.2)	11	-3.1	-0.3
Sweden	1.8	(1992.4)	1.8	(1992.4)	0	0.0	-
United Kingdom	3.6	(1992.3)	1.8	(1993.1)	2	-1.8	-0.9
Average	**5.2**		**1.8**		**7**	**-3.4**	**-0.5**
Recent Full ITers							
Czech Republic	10.1	(1997.4)	2.9	(1999.1)	5	-7.2	-1.8
Poland	7.0	(1998.3)	10.3	(2000.1)	6	3.3	0.6
South Africa	2.0	(1999.4)	2.0	(1999.4)	0	0.0	-
Korea	5.1	(1997.4)	0.7	(1999.1)	5	-2.4	-0.5
Thailand	0.8	(2000.1)	0.8	(2000.1)	0	0.0	-
Average	**5.0**		**3.3**		**3**	**-1.3**	**-0.6**
Overall Avg.	**9.6**		**3.7**		**8**	**-5.8**	**-0.6**

Source: Authors´ calculations based on data from IFS, country sources, and Schaechter, et al. (2000).

(1) Convergence refers to most recent available observation. Stationary inflation for countries that do not explicitly announce a long-term inflation target is calculated as inflation attained by industrial countries (2-3%).

(2) Initial Inflation is calculated 2 quarters ahead, in order to adjust for the extraordinarily low inflation in 1999:1.

Table 4.4

Annual Average Deviation of Actual from Target Inflation under Inflation Targeting in 18 Countries: 1989-2000 (various subperiods)[(1)]

	(Percentage points)		(As a ratio to current inflation)	
	Relative	***Absolute***	***Relative***	***Absolute***
LA Full ITers				
Brazil	0.00	0.00	0.00	0.00
Chile	-0.12	0.40	-0.08	0.12
Average	**-0.06**	**0.20**	**-0.04**	**0.06**
LA Partial ITers				
Colombia	-5.23	5.23	-0.54	0.54
Mexico	-0.68	0.68	-0.06	0.06
Peru	-0.67	0.77	-0.05	0.14
Average	**-2.19**	**2.23**	**-0.22**	**0.25**
Old Full ITers				
Australia	-0.18	1.13	1.25	1.44
Canada	-0.15	0.20	-0.60	0.67
Finland	-0.69	0.69	-2.12	2.12
Israel	0.46	1.62	0.02	0.14
New Zealand	0.06	0.40	-0.08	0.25
Spain	0.15	0.45	-0.01	0.21
Sweden	-0.71	0.71	1.05	1.05
United Kingdom	0.09	0.31	0.00	0.12
Average	**-0.12**	**0.69**	**-0.06**	**0.75**
Recent Full ITers				
Czech Republic	-0.60	0.82	-0.26	0.29
Poland	1.00	1.00	0.10	0.10
South Africa	-	-	-	-
Korea	-2.30	2.30	-0.71	0.71
Thailand	-	-	-	-
Average	**-0.63**	**1.37**	**-0.29**	**0.37**
Overall Average	**-0.60**	**1.04**	**-0.13**	**0.50**

[(1)] Relative (absolute) deviation: sum of relative deviations divided by number of periods. Relative (absolute) deviation as a ratio to current inflation: sum of relative (absolute) deviations as ratios to inflation divided by number of periods. Depending on the IT framework, inflation target is defined as a range or as a point.

Source: Authors´calculations based on data from IFS, country sources, and Schaechter, et al. (2000).

Table 4.5

Sacrifice Ratios during Inflation Stabilization with Inflation Targeting in 18 Countries: 1998-2000 (based on annual GDP data, various subperiods)[(1)]

Latin America				**Rest of the World**			
Full ITers		***Partial ITers***		***Old Full ITers***		***Recent Full ITers***	
Brazil	-0.15	Colombia	0.15	Australia	1.14	Czech Republic	-0.66
Chile	-0.40	*Mexico*	-0.03	Canada	-2.25	Poland	-1.07
		Peru	0.06	Finland	2.44	South Africa	-2.27
				Israel	0.60	Korea	0.39
				New Zealand	0.16	Thailand	1.89
				Spain	2.50		
				Sweden	0.64		
				United Kingdom	0.89		
Average	**-0.28**		**0.06**		**0.77**		**-0.87**

(1) Sacrifice ratios calculated as cumulative GDP variation (to a trend calculated by a Hodrick-Prescott filter) divided by inflation change between 3 years before and 1 year after IT adoption year.
Source: Authors´calculations based on data from IFS and country sources.

Table 4.6

Sacrifice Ratios during Inflation Stabilization in 18 IT Countries and 10 Non-IT Countries: 1980(1990)-2000 (based on annual GDP data, various subperiods)[(1)]

Latin America						**Rest of the World**								
Full ITers			***Partial ITers***			***Old Full ITers***			***Recent Full ITers***			***Non ITers***	
	Before	After		Before	After		Before	After		Before	After		During 1990s
Brazil	0.42	-	Colombia	-0.06	-	Australia	-1.41	0.01	Czech Rep.	-5.69	0.36	Denmark	0.90
Chile	0.37	-0.7	Mexico	-0.11	-	Canada	-6.84	0.64	Poland	0.04	-	France	-0.45
			Peru	0.84	-0.75	Finland	0.03	-4.74	South Africa	-0.17	-	Germany	-0.12
						New Zealand	-0.67	0.22	Korea	-1.92	0.59	Italy	0.25
						Spain	-0.85	0.82	Thailand	-1.72	-	Japan	1.46
						Sweden	0.08	0.22				Netherlands	1.47
						United Kingdom	0.75	0.02				Norway	-0.87
						Israel	0.17	-0.14				Portugal	-0.39
												Switzerland	0.87
												United States	0.78
Average	**0.40**	**-0.7**		**-0.09**	**-0.75**		**-0.32**[(2)]	**0.19**[(2)]		**-2.83**	**0.48**		**0.39**

[(1)] Sacrifice ratios calculated as the cumulative GDP variation (to a trend calculated by a Hodrick-Prescott filter) divided by inflation change in any disinflation period. ITers´ sacrifice ratios are calculated before (since 1980) and after adopting IT framework.
[(2)] Excluding Canada and Finland.
Source: Authors' calculations based on data from IFS and country sources.

Table 4.7

Output Volatility in 18 IT Countries and 10 Non – IT Countries: 1980-2000
(based on quarterly industrial production data, various subperiods)(1)

Latin America						**Rest of the World**							
Full ITers			***Partial ITers***			***Old Full ITers***			***Recent Full ITers***			***Non ITers***	
	Before	After		Before	After		Before	After		Before	After		
Brazil	4.8	-	Colombia	4.5	-	Australia	2.8	1.2	Czech Rep.	9.4	4.3	Denmark	2.8
Chile	6.2	3.1	Mexico	4.0	-	Canada	4.4	2.2	Poland	8.5	-	France	1.6
			Peru	11.5	5.1	Finland	3.1	2.5	South Africa	3.2	-	Germany	2.4
						Israel	2.9	1.7	Korea	3.6	-	Italy	2.3
						New Zealand	3.4	3.1	Thailand	5.5	-	Japan	3.3
						Spain	2.4	1.7				Netherlands	2.2
						Sweden	3.1	3.4				Norway	2.8
						United Kingdom	2.4	1.3				Portugal	10.8
												Switzerland	2.8
												United States	2.3
Average	**5.5**	**-**		**6.7**	**-**		**2.6**	**2.1**		**6.0**	**-**		**3.3**

(1) Volatility calculated as standard deviation of industrial production variation (to a trend calculated by a Hodrick-Prescott filter).
Source: Authors' calculations based on data from IFS and country sources.

Table 5.1: Latin American inflation targeters

Country	Date Introduced	Target Inflation Rate	Effective Inflation Rate	Exchange Rate Regime	Target Index
Brazil	June 1999	1999: 8% (+ - 2%) 2000: 6% (+ - 2%) 2001: 4% (+- 2%)	1999: 8.9% 2000: 7,9%[1]	Floating since 1999. Crawling exchange rate band used before	IPCA (National CPI)
Chile	1991	1991: 15-20% 1992: 15% 1993: 10-12% 1994: 9-11% 1995: 9% 1996: 6.5% 1997: 5.5% 1998: 4.5% 1999:4.3% 2000: 3.5% 2001 onwards: 2-4%	1991:18.7% 1992: 12.7% 1993: 12.2% 1994: 8.9% 1995: 8.2% 1996: 6.6% 1997: 6% 1998: 4.7% 1999: 2.3% 2000: 4,2%[2]	Floating since September 1999. Exchange rate band used before	Total CPI
Colombia	September 1999	1999: 15% 2000:10% 2001:8% 2002:6%	1999: 9.2% 2000: 9,2%[2]	Floating since September 1999. Crawling exchange rate band used before and led to conflicts between exchange rate and inflation objectives. Intervention can be used to smooth fluctuations	Total CPI
Mexico	1999	1999: 13% 2000: < 10% 2001: 6.5% 2002: 4.5% 2003: similar to principal trade partners inflation (3%)	1999: 12.3% 2000: 8,9%[2]	Floating with intervention since financial crisis in 1994	Total CPI

Table 5.1: Latin American inflation targeters (continued)

Country	Date Introduced	Target Inflation Rate	Effective Inflation Rate	Exchange Rate Regime	Target Index
Peru	1994	1994: 15-20% 1995: 9-11% 1996: 9.5-11.5% 1997: 8-10% 1998: 7.5-9% 1999: 5-6% 2000: 3.5-4% 2001: 2.5-3.5% 2002: 1.5-2.5% 2003: 1.5-2.5%	1994: 15.4% 1995: 10.2% 1996: 11.8% 1997: 6.5% 1998: 6% 1999: 3.7% 2000: 3,9%[2]	Floating since 1994. Intervention can be used to smooth fluctuations	Total CPI

1/ 12 months to August
2/ 12 months to September

Table 5.1: Latin American inflation targeters (continued)

Country	Target set by	Monetary Policy Operating Target	Inflation report	Central Bank Legal Framework
Brazil	Jointly by Government & Central Bank	Overnight interest rate	Yes	- Instrument independence - Loans to National Treasury prohibited - If the target is failed, the Central Bank has to send an public letter to the Minister of Finance explaining the reasons of the failure and the actions necessaries to return to the correct path - Currency stability and price stability as objectives
Chile	Central Bank in consultation with Minister of Finance	Overnight interest rate (real terms)	Yes	- Instrument independence, but Finance Minister can suspend Board decisions for two weeks except for decisions unanimously taken by the Board - Loans to Government prohibited - Price stability as primary objective. Normal functioning of the internal and external payment systems as secondary objectives
Colombia	Jointly by Government & Central Bank	Monetary Base (daily)	Yes	- Minister of Finance is the President of the Board - Loans to the Government prohibited - Price stability and financial system's strength as objectives
Mexico	Central Bank	Monetary Base (daily)	Yes	- Instrument Independence - Loans to Government prohibited - Price stability as objective
Peru	Central Bank in consultation with Minister of Finance	Monetary Base (daily)	No	- Instrument independence - Loans to Government or state institutions prohibited - Restrictions to loan portfolio composition prohibited - Multiple exchange rates prohibited - Price stability as objective

Source: Authors' elaboration.

Table 5.2: Recent inflation targeting countries

Country	Date Introduced	Target Inflation Rate	Current Exchange Rate Regime	Target Index
Czech Republic	December 1997	1998: 5.5-6.5% 1999: 4-5% 2000: 3.5-5.5% 2001: 2-4% 2005: 1-3%	Floating	Underlying CPI (excl. Regulated prices and indirect taxes)
Korea	1998	1998: 9% +- 1% band 1999: 3% +- 1% band 2000: 2.5% +- 1% band From 2001 onwards: 2.5%	Floating. Exceptionally, if there is a large discrepancy in the exchange market, which increases volatility, Central Bank can intervene	Underlying CPI (excl. non cereal agricultural products and petroleum based product prices). In 1999 and 1998, the target was total CPI
Poland	October 1998	1998: <9.5% 1999: 6.6-7.8% 2000: 5.4-6.8% 2003: <4%	Floating	Total CPI
South Africa	February 2000	2002: 3-6%	Floating	Underlying CPI (excl. Interest costs)
Thailand	April 2000	From 2000 onwards: 0-3.5%	Floating. Short interest rates can be adjusted in the case of pressures over the exchange rate	Average quarterly underlying CPI (excl. raw food and energy prices)

Source: Authors' elaboration.

Table 5.3 : Old inflation targeting countries

Country	Date Introduced	Target Inflation Rate	Exchange Rate Regime	Target Index
Australia	1993	2-3% on average over business cycle	Floating	Since September 1998, a revised CPI Before, Treasury underlying CPI[2]
Canada	February 1991	Dec. 91: 3-5% Dec. 92: 2-4% June 94: 1.5-3.5% Since Dec. 95: 1-3% (in effect until Dec. 2001)	Floating	Underlying CPI (excl. Food, energy and indirect taxes)
Finland [1]	February 1993-June 1998	Annual average of 2% by 1995	EMU	Underlying CPI (excl. Indirect taxes, subsidies, housing prices and mortgage interest)
Israel	1992	1992: 14-15% 1993: 10% 1994: 8% 1995: 8-11% 1996: 8-10% 1997: 7-10% 1998: 7-10% 1999: 4% 2000: 3-4% 2001: 3-4%	Crawling exchange rate band	Total CPI
New Zealand	July 1989	1990: 3-5% 1991: 2.5-4.5% 1992: 1.5-3.5% 1993-1996: 0-2% Since 1997: 0-3%	Floating	Total CPI [3]
Spain [1]	November 1994-June 1998	June 1996: 3.5-4% Dec. 1997: 2.5% 1998: 2%	EMU	Total CPI
Sweden	January 1993	Since 1995: 2% (+-1%)	Floating	Total CPI
United Kingdom	October 1992	1992-1995: 1-4% Since 1995: 2.5%	Floating	RPIX (excl. Mortgage interest)

1/ Spain and Finland fixed their currencies to the euro in January 1999
2/ Treasury underlying CPI in Australia excludes roughly half of CPI basket. Since September 1998, authorities decide to set the target in terms of a revised total CPI index that is more ample and well known by the public.
3/ In 1999 the New Zealand Statistical agency removed interest charges from the CPI. Prior to then the inflation targets where defined in terms of the total CPI less interest charges and other first round effect prices

Table 5.3 : Old inflation targeting countries (continued)

Country	Escape Clauses	Target set by	Monetary Policy Operating Target	Central Bank Legal Framework
Australia	None	Jointly by government & Central Bank	Overnight "cash" interest rate	Instrument independence The RBA is required to consult with the Government. There is a formal dispute resolution mechanism Multiple objectives
Canada	Aim to get back on track over 2 years in the event of a temporary price shock affecting inflation by more than 0.5%	Jointly by government & Central Bank	Overnight interest rate	Instrument independence, but Minister of Finance can exceptionally issue a formal directive to the Central Bank Governor Loans to Government restricted Multiple objectives
Israel	None	Government in consultation with the Central Bank	Short-term interest rate	Instrument independence Loans to Government prohibited Multiple objectives (currency stability and real objectives)
New Zealand	Unusual events will be tolerated provided they do not generate general inflationary pressures	Jointly by government & Central Bank	Overnight interest rate	Instrument independence subject to a requirement that monetary actions be taken with regard to financial system soundness Price stability as primary objective (Central Bank Governor may be dismissed in case the target is not achieve)
Sweden	None	Central Bank	1-week interest rate	The Board is appoint by the Parliament Instrument independence Loans to Government prohibited Price stability as primary objective
United Kingdom	None	Government	Short term repo rate	Instrument independence Price stability as primary objective

Figure 6.1
Out-of-Sample Forecasts: Monthly Data (12-month rate of change)

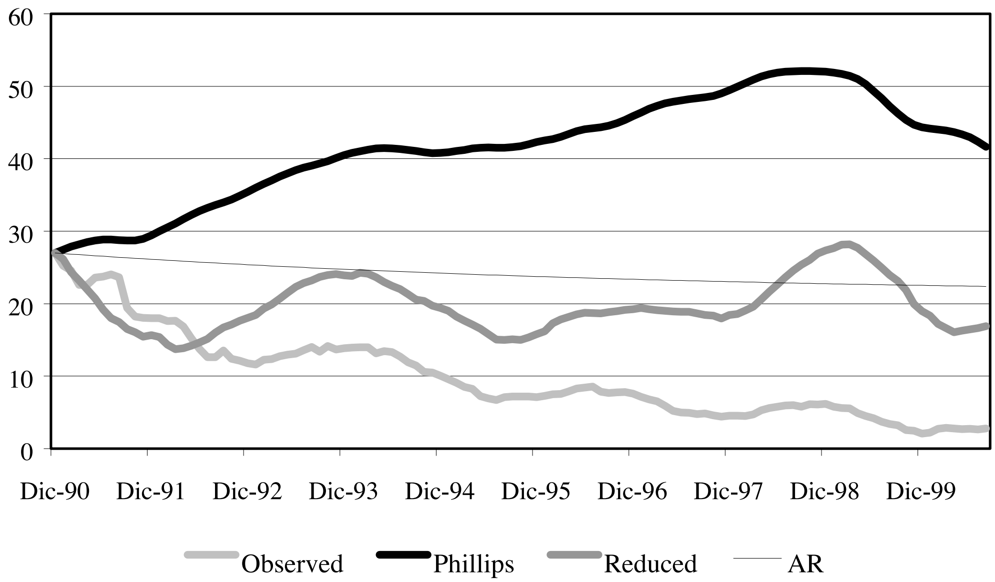


Figure 6.2
Out-of-Sample Forecasts: Quarterly Data (quarter to quarter rate of change)

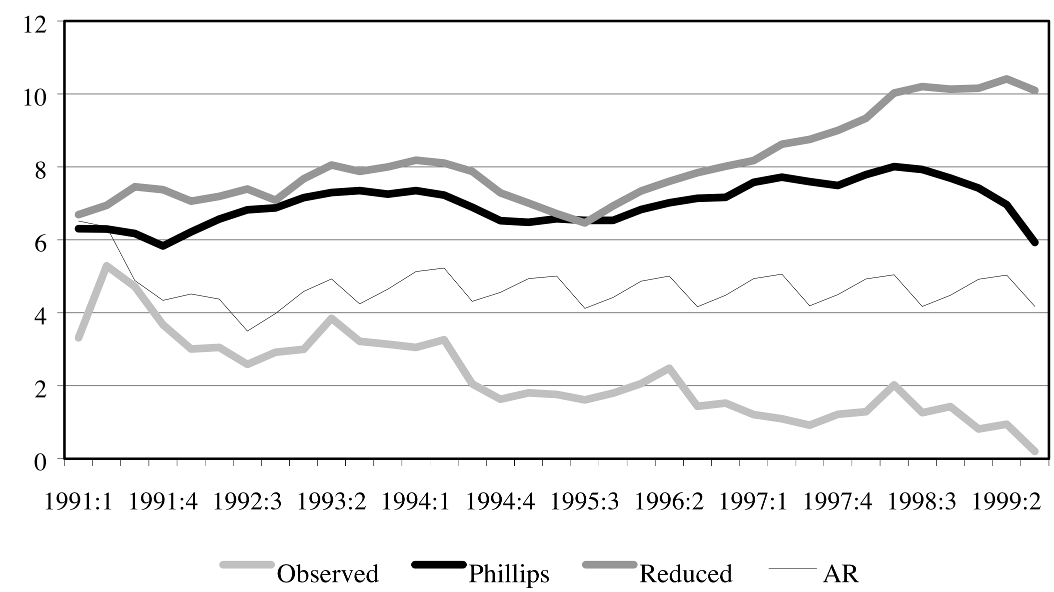


Figure 6.3
Out-of-Sample Forecasts from Rolling VARs
(12-month rate of change)

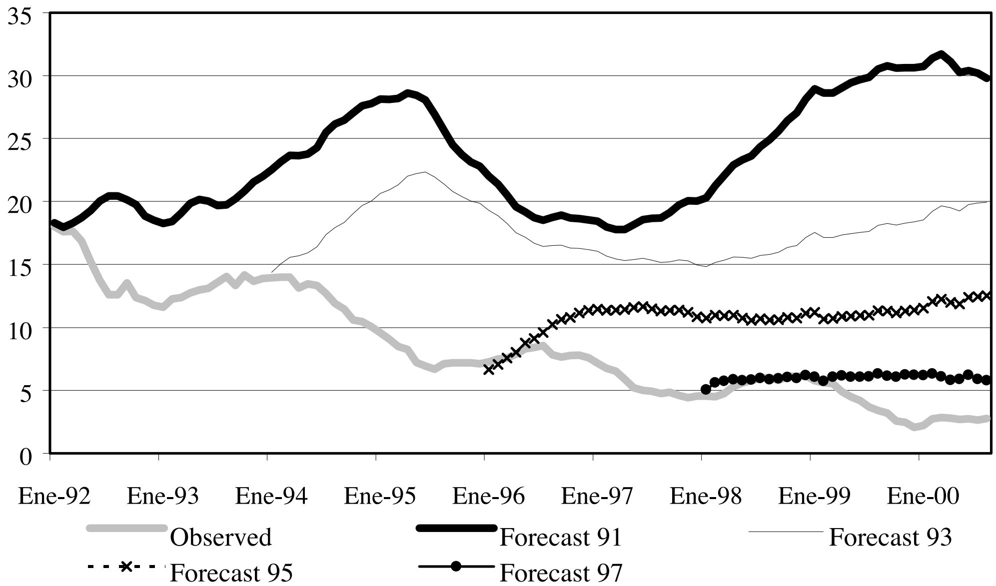


Figure 6.4
Out-of-Sample Forecasts from Rolling VARs
(12-month rate of change)

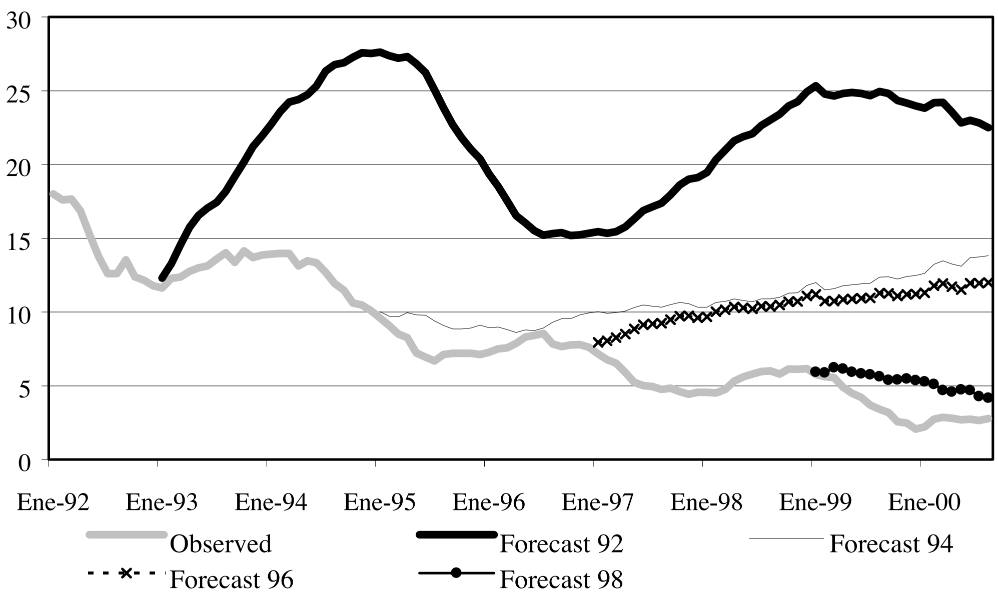


Figure 6.5
Observed and Benchmark values of the Core Inflation
(Quarterly rate of change)

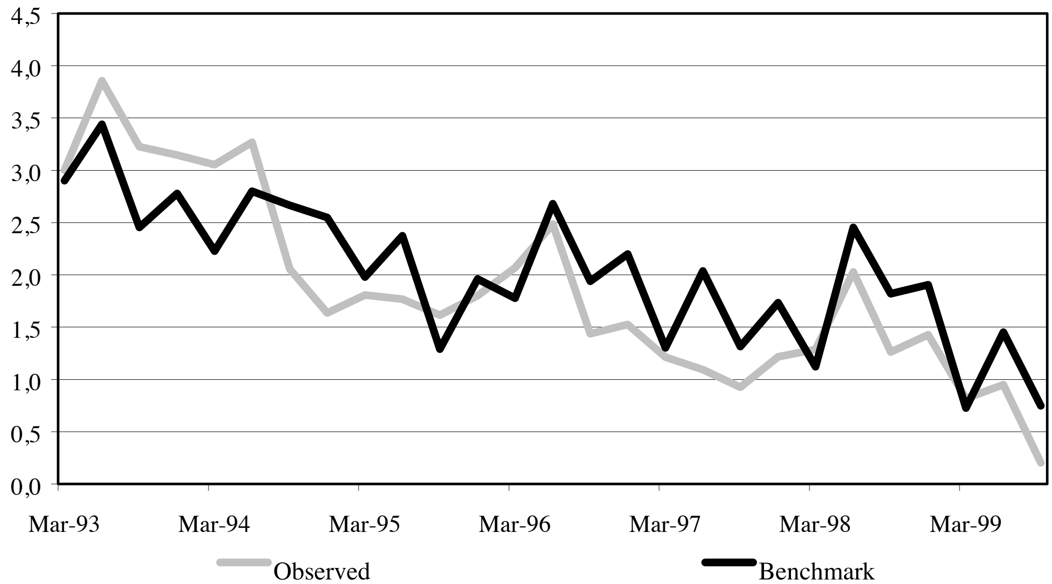


Figure 6.6
Core Inflation: Counterfactual 1
(Quarterly rate of change)

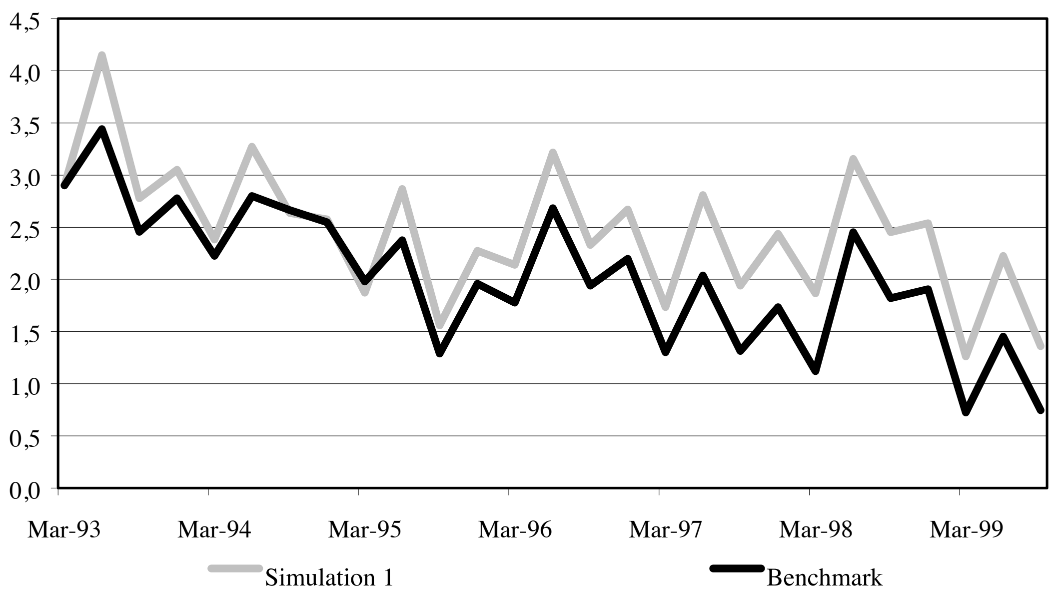


Figure 6.7
Observed and Benchmark 2 values of the Core Inflation
(Quarterly rate of change)

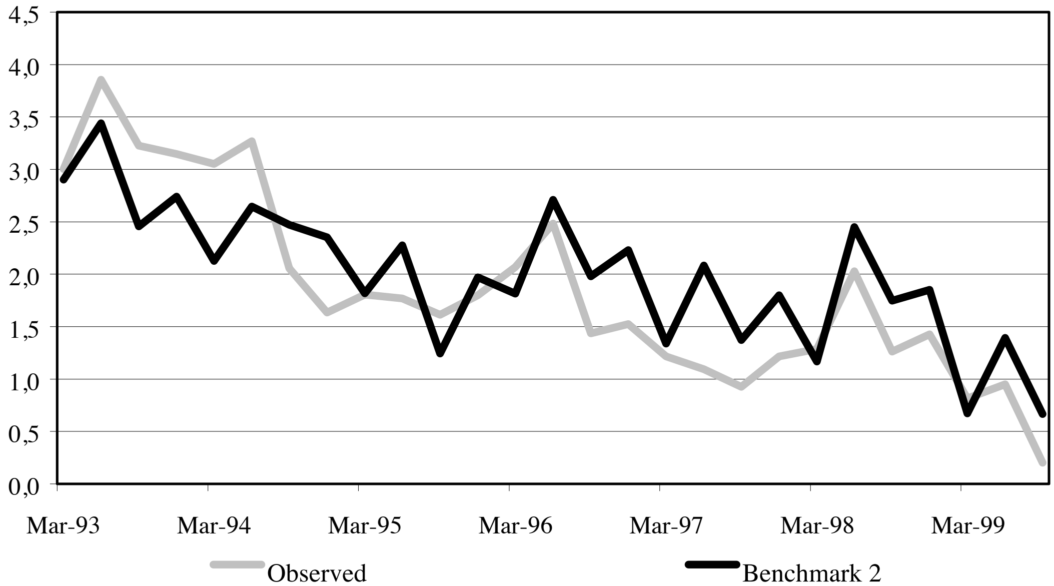


Figure 6.8
Core Inflation: Benchmark 2 and Alternative Targets.
(Quarterly rate of change)

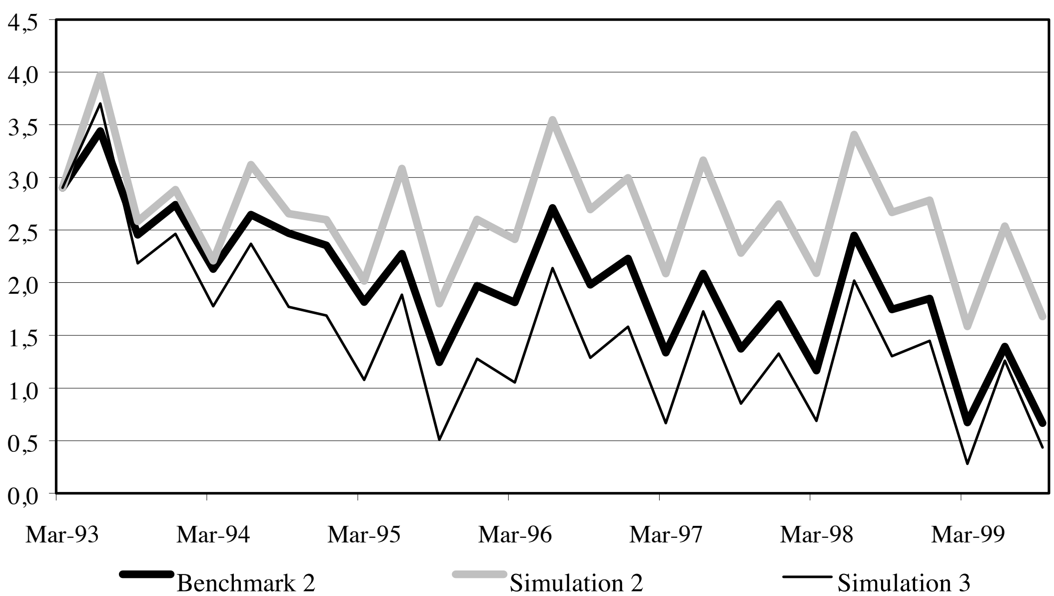


Figure 6.9
Unemployment: Benchmark 2, Soft Targets and Aggressive Targets.
(Quarterly rate)

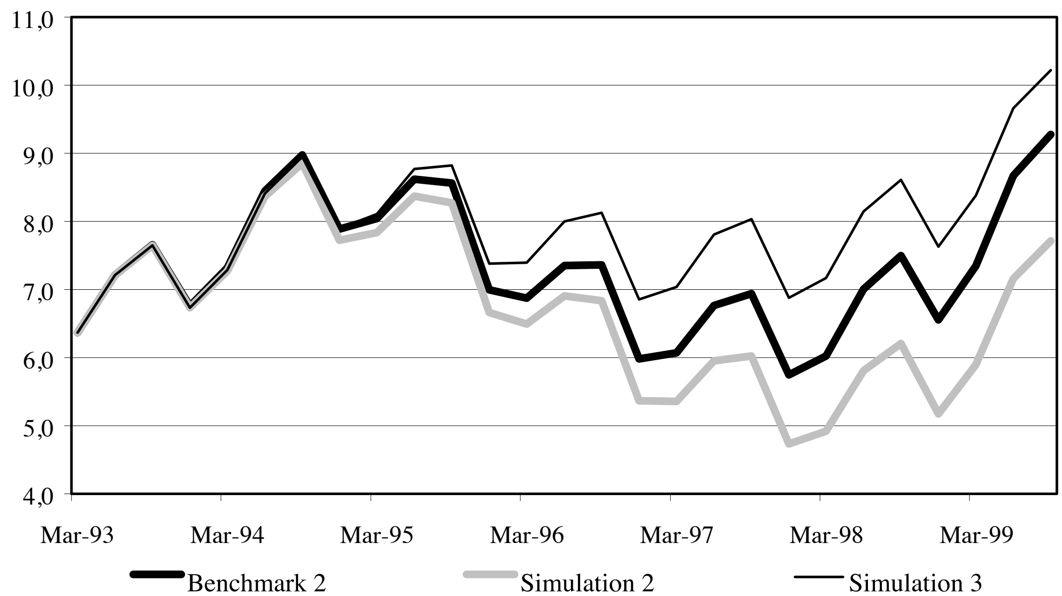


Figure 6.10
Core Inflation: Benchmark 2, Soft Targets and Aggressive Targets using CF.
(Quarterly rate of change)

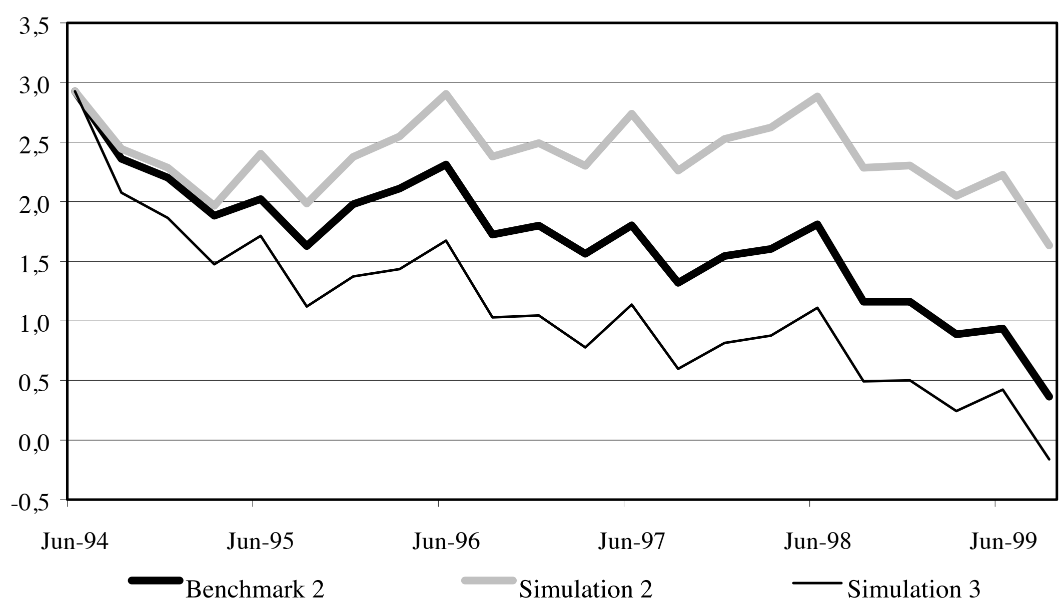


Figure 6.11
Unemployment: Benchmark 2, Soft Targets and Aggressive Targets using CF.
(Quarterly Rate)

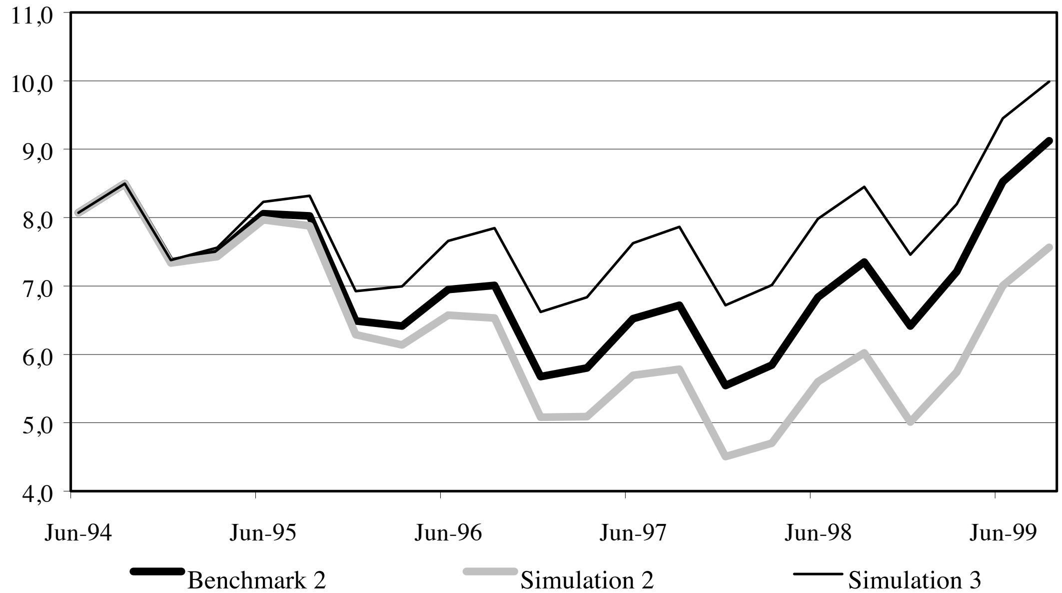


Table 6.1
Inflation Forecasts and Expected Inflation
(Dec. to dec. rate of change)

	Observed	Consensus	VAR1	VAR2	Target
1991	18,7				17,5
1992	12,7		19,4		15,0
1993	12,2	15,4	23,1		11,0
1994	8,9	11,3	18,5		10,0
1995	8,2	8,7	8,2		9,0
1996	6,6	7,1	9,4	9,1	6,5
1997	6	5,7	6,6	6,7	5,5
1998	4,7	4,8	6,7	5,2	4,5
1999	2,3	4,2	3,9	4,5	4,3

Source: Authors' calculation.

Table 6.2
Estimated Model Used in Simulations

$$(6.1)\quad \pi_t^S = -0.632 + 0.432\omega_t + 0.141\hat{e}4_t + 0.105 gap_{t-1} + 1.394D2 + 0.686D3 + 0.517D + 0.285\pi_t^E + 0.141\pi_t^*$$

$$(6.2)\quad \omega_t = 1.378 + 0.826\pi_t^E + (1-0.826)\pi_{t-2} - 1.221D2 - 1.249D3$$

$$(6.3)\quad gap_t = 1.621 + 0.675 gap_{t-1} + 0.059 tot_t + 0.427\, prbc_{t-2} + 0.055 KPIB_t \times D96$$

$$(6.4)\quad desem_t = 1.292 - 0.126 gap_t + 0.843 desem_{t-1} + 0.604D2 + 0.207D3 - 1.214D4$$

$$(6.5)\quad gdcc_t = -0.278 + 0.220 gap_t + 0.850 gdcc_{t-1}$$

$$(6.6)\quad \hat{e}_t = -0.326 + 0.379\pi_{t-1} - 0.70\pi_{t-1}^* - 0.002\Delta RIN_t - 0.245 DESV_t - 0.079 KPIB_t \times D96$$

$$(6.7)\quad \pi_{t+1}^E = 0.426 + 1 \times Tar_{t+4} + 0 \times \left[(\pi_t + \pi_{t-1} + \pi_{t-2} + \pi_{t-3})/4\right] + 0.125\left[(\pi_t + \pi_{t-1} + \pi_{t-2} + \pi_{t-3})/4 - \pi_{t-4}^E\right]$$

$$(6.8)\quad \pi_t = -0.347 + 1.078\pi_t^S + 0.982D3 + 1.093D4 - 0.711A93 - 0.762A94 - 0.617A96 - 0.702A98$$

Source: Authors' estimation.

This is the version used for the simulations and the counterfactuals. All the restrictions over the coefficients were tested before they were imposed, including the homogeneity of degree one for the price and wage equations, equation (6.1) and (6.2).

Table 6.3
Core Inflation: Benchmark and Simulation 1
(4-quarter accumulated sum of quarterly rates)

	Benchmark	Simulation 1
Dec-93	11,6	12,9
Jun-94	10,3	11,5
Dec-94	10,2	10,9
Jun-95	9,6	10,0
Dec-95	7,6	8,6
Jun-96	7,7	9,2
Dec-96	8,6	10,4
Jun-97	7,5	9,5
Dec-97	6,4	8,9
Jun-98	6,6	9,4
Dec-98	7,3	10,0
Jun-99	5,9	8,5

Source: Authors' calculation in base of the estimated model.

Table 6.4
Alternative Paths for the Inflation Targets
(Dec. to Dec. rate of change)

	Effective	Soft	Aggressive
Dec-91	17,5	17,5	17,5
Dec-92	15,0	15,0	15,0
Dec-93	11,0	11,0	11,0
Dec-94	10,0	8,0	10,5
Dec-95	9,0	5,0	10,0
Dec-96	6,5	3,0	9,5
Dec-97	5,5	3,0	9,0
Dec-98	4,5	3,0	8,5
Dec-99	4,3	3,0	8,0
Dec-00	3,5	3,0	7,5

Source: Authors' elaboration.