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INFLATION TARGETING IN LATIN AMERICA

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Resumen

Este artículo analiza la reciente experiencia de América Latina en el uso de metas de inflación frente al progreso sustancial de la región en la erradicación de la alta inflación. El artículo analiza la aplicación y resultados de metas de inflación en América Latina desde una perspectiva amplia. Se inicia con una revisión de los temas relevantes para la elección de regímenes cambiarios y esquemas monetarios, documentando la evolución de los regímenes cambiarios y monetarios en América Latina durante las últimas dos décadas. Luego se describe las muestras mundiales y Latinoamericanas de países con metas de inflación y se compara su desempeño con países que no han seguido el esquema, enfocándose en el éxito de alcanzar las metas de inflación, el sacrificio en términos de producto por lograr una baja tasa de inflación y la volatilidad del producto. Un detallado análisis de cinco experiencias en metas de inflación incluye a Brasil, Chile, Colombia, México y Perú, con énfasis en el diseño de este esquema en la muestra mundial de países con metas inflacionarias. El artículo concluye enfocándose en la dinámica de la reducción de la inflación en la experiencia más larga de metas de inflación en la región (el caso de Chile), evaluando además cómo ella ha afectado las expectativas de inflación y, por ende, la efectividad de la política monetaria, a través de un conjunto de estimaciones de modelos alternativos y simulaciones.

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.

This paper has been presented at the Latin American Conference on Fiscal and Financial Reforms, organized by the Center for Research on Economic Development and Policy Reform of Stanford University, November 9-11, 2000; at the Workshop in Open Economy Macroeconomics and International Finance, Pontificia Universidad Católica de Chile, January 15-18, 2001; and, at the Research Seminar of the Economics Institute of the Pontificia Universidad Católica de Chile, January 22, 2001. We thank Agustín Carstens, Michael Kumhoff, Ronald McKinnon, Francisco Rosende, Alejandro Werner and other participants at the above mentioned seminars and conferences, and Oscar Facusse, Verónica Mies, Matías Tapia, and José Antonio Tessada for excellent discussion and outstanding assistance. E-mail: kschmidt@bcentral.cl.

1. Introduction

Latin America was the region with the highest inflation in the world until the early 1990s. High inflation was the result of many decades of massive neglect of 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. At this moment, most countries in Latin America launched 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 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 raised the public's demand for price stability. Second, a large improvement in the quality of the economic debate and policies was achieved due to the 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 public policy. They convinced policy makers and the public at large that inflation is costly, the main contribution of monetary policy lies in delivering low inflation, monetary policy does not have permanent effects on employment, and the cost of reducing inflation is much lower under rational expectations and credible policies. Third, the introduction of market-oriented reforms reflected a growing understanding that macroeconomic stability facilitates the functioning of markets and contributes to better resource allocation.

Stabilization has been achieved under different monetary and exchange regimes in Latin America, ranging from dollarization to inflation targeting under floating exchange rates. This paper focuses on the experience stabilization under inflation targeting. It does so by assessing the implementation and results of inflation targeting in Latin America from a broad

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

perspective. The paper 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 experience in the region (the 1991-2000 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? In choosing an exchange rate regime, initial conditions are important. In particular, for countries where due to a long history of high inflation and currency crises a substantial part of asset and liabilities are foreign currency denominated, the advantages of flexible exchange rates would be more limited as the room for an independent monetary policy would be restricted by its exchange rate effects. In contrast, for countries that have in place a monetary and institutional framework capable of delivering low inflation, exchange rate flexibility could be advantageous.

Historically the literature on the choice of an exchange rate regime was based on other structural country features. However after the early work on exchange rate choices and optimum currency areas or OCAs (Mundell 1961, McKinnon 1963), this literature fell into oblivion for three decades. 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]

[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).

For countries that can make a choice, 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. These benefits could be particularly important in countries without much room to run an independent monetary policy. 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 on a temporary basis.

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 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 rate regimes tend to be partial, emphasizing each factor separately.[3]

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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

(continued…)

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 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 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 D, 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 for countries that are well integrated to capital markets has shifted toward schedule E, consistent with the "corners hypothesis" (as espoused by Obstfeld

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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.

1995, Summers 2000, Mussa et al. 2000, Edwards and Savastano 2000 and Fischer 2001). 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 and the recent shift of El Salvador toward 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]

An exchange-rate anchor uses an exogenously determined trajectory of the exchange rate as 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

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

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, in an unsustainable expansion of credit, which could result in a financial bubble, increasing financial fragility in the process (Corbo and Fischer, 1995; Edwards and Végh, 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 policy 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 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

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

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

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.

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 (Figure 3.1). The share of countries with freely floating rates has increased from zero in 1979 to 32% in 2000. 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%. As compared to the 1999 world distribution of exchange rate regimes, LA has relatively more flexible exchange-rate arrangements.

In a recent paper (Fischer 2001), exchange rate regimes are classified using the judgment of IMF staff as reported in the IMF's Annual Report 2000 (pp. 141-143), and not the regimes declared by the countries. A comparison between the distribution of exchange rate arrangements in 1991 and 1999 shows that the share of countries with intermediate regimes have been reduced substantially (from 62% to 34%) while the share of the extreme cases have increased, from 16% to 25% for hard pegs (including the European countries that entered the monetary union) and from 23% to 42% for the floaters. For emerging markets (i.e., those developing markets that are more integrated into world capital markets), the change in the share of floaters is even more pronounced, from 30% in 1991 to 48% in 1999. In the case of 9 Latin American countries in 1999, Fischer classifies 5 as independent floaters (Brazil, Chile, Colombia, Mexico, and Peru), two as having hard pegs (Argentina and Panama), one with a crawling band (Venezuela), and one in the transition to dollarization (Ecuador). This stands in striking contrast with 1991, when only Peru was an independent floater, while, Argentina was in transition to a currency board and Panama was dollarized.

The other six countries had some variant sort of a soft peg (including crawling pegs) or a crawling band in place.

Levy-Yeyati and Sturzenegger (2000) provide another classification of exchange rate regimes, where exchange rate regimes are inferred from the actual behavior of nominal exchange rates and foreign reserves (Figure 3.2). In their classification "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 "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; except in Fischer (2001). Considering the recent regime 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. It is sometimes claimed that countries that declare themselves to have a flexible exchange rate act, in practice, as if their exchange rate was fixed or semi-fixed. According to this view they would exhibit "fear of floating" (Calvo and Reinhart, 2000). Not making use of exchange rate flexibility could be due to the central bank's fear of large pass-through effects from devaluation to inflation or large risks of exchange rate adjustment when private agents exhibit a currency mismatch of their assets and liabilities.[7] Following Calvo and Reinhart (2000), now we analyze how close to real floating these regimes are, 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 degree of volatility is approximated by 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.[8]

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[7] However, recent analytical and empirical work shows convincingly that pass-through effects are much weaker than initially thought (Obstfeld and Rogoff 2000; Goldfajn and Werlang 2000).

[8] Our monthly frequency is determined by data availability for foreign reserves, for which daily data are not available.

The results are reported in Table 3.1. If the exchange regime has not changed much, then the probabilities that the percentage changes in the two variables fall within the given ranges should not change. However, if official adoption of a float is for real, then the probabilities should be lower (higher) in the floating period for the variation in the exchange rate (foreign reserves). In Brazil and Mexico this is indeed the case for the nominal exchange rate but not for foreign reserves. In the case of Brazil, this result could be due to the deliberate decision to use foreign reserves to pay its foreign debt after the start of floating.[9] 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.[10] In particular, the central bank sells put option rights to buy dollars. Every day the Central Bank auctions 200 million dollars at a minimum exchange rate that is 2% above the preceding day market level.

In the case of Chile, although the two measures of volatility change in the right direction, the differences are not large. Although there has been no intervention since February 1999 in the foreign exchange market, the exchange rate volatility has increased only by little. This can be attributed that much volatility was already observed under the preceding regime of a wide exchange rate band. Levy-Yeyati and Sturzenegger (2000) who found that the Chilean exchange rate regime was de facto flexible during most of the 1990s confirm this. In Peru, exchange rate volatility is similar to the floating period of Chile but the volatility of foreign reserves is larger. The latter result indicates that Chile got more stability with less intervention.

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[9] More generally, one observes many changes in central bank holdings of foreign reserves in countries that float freely, for reasons that are unrelated to foreign exchange intervention purposes. Two of the main reasons are deliberate portfolio swaps by central banks and changes in cross-currency valuations that affect the value of foreign reserve holdings. Moreover, after adopting a free float, some countries reduce over time their initial levels of foreign reserves that are excessive under a float. However, in the absence of detailed information of portfolio shifts and valuation changes, we are not able to adjust our volatility measures for these factors. Hence our measures of reserve volatility under floats exhibit generally an upward bias.

[10] We divide the second period into two subsamples (1994:12-1997:12 and 1998:1-2000:9) to test if the high volatility of foreign reserves was observed during the full floating period. Our results confirm that from 1998:1 onwards, foreign reserves were more stable than in the previous period (61.7% of probability that the percentage change falls within the 2.5% band). So it appears that Mexico is really floating today.

The measures of volatility for the two industrial countries with free floats (Canada and New Zealand) show that they are not really free floaters in the limited sense of our unconditional tests: they exhibit significant volatility in foreign reserves and not much in the exchange rate. By contrast, the two industrial countries that were pegging their currencies to the deutschmark (Austria and The Netherlands) exhibit 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 that of New Zealand, we conclude 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 of exchange rate regimes, Ecuador joined Panama in early 2000 in choosing a credible fixed exchange rate regime by adopting the US dollar. El Salvador adopted a similar step toward this direction in late 2000, declaring the US dollar as legal tender on an equal footing to the Salvadoran currency.

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.[11]

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.[12] 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,

[11] 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 Savastano (2000), Schaechter et al. (2000).

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

have adopted the Euro after targeting their exchange rates for most of the 1990s to the deutschmark. We label this control group as non-inflation targeters (Non-ITers).[13]

Figure 4.1 depicts adoption dates and inflation rates at adoption of 15 full ITers and 3 LA partial ITers.[14] 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

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

[14] 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.[15] 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.[16] 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.

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

[16] 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 half or more in four IT countries cut volatility: 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 five Latin American countries: Brazil, Chile, Colombia, Mexico, and Peru. What did prompt their central banks to adopt this particular monetary regime? As in other regions, early IT adopters in the region started this new regime in an evolutionary way, by announcing public inflation objectives and learning only over time – from other countries' and their own experience – about the necessary prerequisites and components of what now is viewed as a full-fledged IT regime (see Bernanke et al. 1999 and Stealthier et al. 2000).

As elsewhere in the world, four main factors have prompted Latin American countries to adopt IT. First, public announcement of central bank inflation targets makes targets the economy's nominal anchor and the main policy objective of monetary policy. Second, forward-looking numerical inflation targets complement public information about monetary policy objectives and implementation to make monetary policy more effective in a world of forward-looking rational private agents. Third, publicly announced inflation targets are an easy way to make central banks accountable to society at large and their political representatives – a major prerequisite imposed on newly independent central banks. The latter factor can explain IT adoption in countries with long democratic tradition but have recently granted operational independence to central banks (like many industrial-country inflation targeters) and others that have embraced democracy only recently (like the Latin Americans in the 1990s).[17] Finally, disappointment of alternative monetary and exchange rate regimes – ranging from true disappointment with money growth targets to abandonment of fixed exchange rate regimes after full-fledged balance-of-payments crises – led many countries to adopt IT as the only remaining alternative.

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

[17] Among industrial countries the UK is an outlier of the general case of independence-to-IT sequencing: IT adoption in 1992 preceded operational independence granted by the Blair government in 1997 to the Bank of England. Among developing-country targeters, the Central Bank of Brazil adopted full IT in 1999 but has still not been granted full operational independence.

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 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, only Brazil (since June 1999) and Chile (since May 2000) have in place full-fledged IT regimes. Among other features, both countries have fully relinquished use of any monetary growth and exchange rate targets and issue regular inflation reports with numerical inflation forecasts over the relevant projection horizons.

Mexico announced in October 2000 inflation targets for the next three years in 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 had trouble in pursuing the inflation objective with sufficient strength due to persistent 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 adopted a float (September 1999), that the Central Bank could focus its attention more closely on reducing inflation. In Peru a strong stabilization commitment of the Ministry of the Economy and the Central Bank is in place, even in the absence of a full-fledged IT system. 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.

On paper, central bank legal objectives differ widely among countries. 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. Progress in reducing inflation and formalization of inflation targets has been made possible by institutional developments that

have provided larger degrees of independence to central banks. The central banks of the five countries have been provided substantial degrees of independence in the 1990s and central bank loans to the government are prohibited. Legal independence is observed in the five countries. However, full goal independence in setting inflation targets is only observed in Mexico where the target is set solely by the central bank. In Chile and Peru the target is set by the central bank in consultation with the government, while in Brazil and Colombia it is set jointly by the government and the central bank. With respect to the use of instruments, the central banks of Brazil, Mexico, and Peru enjoy full operational independence in using their monetary instruments (the interest rate or monetary base). In the case of Brazil, the monetary instrument is the overnight nominal rate of short-term government debt. In Chile it is the overnight real interest rate. In Colombia, Mexico and Peru the monetary instrument is the daily monetary base. In the five countries open market operations are used to attain target levels for the monetary instrument. They are conducted on central bank bonds (in Chile, Colombia, and Peru) or on treasury bonds (in Brazil and Mexico).

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 governments have not yet 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 raise coordination between fiscal and monetary policy makers. However, this has not always been the case – indeed many times it has been a source of friction between monetary and fiscal authorities.

Finally, all countries other than Peru issue regular inflation reports that differ significantly in scope and coverage from country to country.

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 both complete its transition toward a full-fledged IT framework and convergence to stationary inflation. Hence this country experience is of special interest. In particular, it may be of interest to study if IT has contributed to reduce inflation and if it made a difference in the speed and cost of price stabilization.

In their study of IT in industrial countries, Bernanke et al. (1999) found non-conclusive 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 analyze the role played by the introduction of IT 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 and inflation dynamics in particular.

In our model below, the main channel through which 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 (Latin American Consensus Forecasts, various issues). One could expect that announced inflation targets were not fully credible at 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

First we study if IT adoption in late 1990 made a difference for inflation dynamics. We start by generating inflation forecasts for the 1990s from single-equation inflation models estimated for the period before IT adoption. We use three models: (1) a Phillips curve, (2) a

reduced-form inflation equation, and (3) an ARIMA time-series model[18]. In all models we use a measure of core inflation that excludes perishable and petroleum products from the headline CPI. The models are estimated with monthly data (12-month rates of change) and quarterly data (quarter-on-quarter rates of change), from the mid-1980s through late 1999.

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 actual declining inflation levels.[19] This provides some prima facie evidence that something occurred 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 appreciation in the wake of large capital inflows during the early 1990s.

To take into account possible changes in the structure of the economy but short of specifying a complete semi-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.[20] 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 inflation forecasts obtained from these VAR models are reported in Figures 6.3 and 6.4. Although forecasts became closer to actual inflation rates when adding more recent years (and leaving out earlier ones), the ratio between the forecast errors and actual inflation levels stayed fairly constant over time.

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

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

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

Now we want to investigate if the announced inflation targets played a role in the path of inflation reduction. An obvious hypothesis to analyze is if the target affected inflation expectations, providing through this channel an anchor for the inflation process. If this were the case, then the unemployment cost of reducing inflation would be lower under IT than under a conventional 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: inflation expectations published in Latin American Consensus Forecasts (CF) by Consensus Economics.[21] First we compare the CF expectations measure with two measures derived from 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 headline (total) CPI inflation.[22] The second VAR (VAR2) adds the inflation target as an exogenous variable additional to those included in VAR1. Both VAR models are estimated with monthly data of 12-month variations 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 announced targets levels. 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.

[21] We thank Consensus Economics for providing this data series.

[22] We replaced core inflation by headline (total) CPI inflation because the targets are defined as December-to-December changes of the headline 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 IT introduction helped to reduce inflation, now we specify and estimate a small econometric model for Chilean inflation. The literature on the modeling of inflation in Chile using structural models is extensive.[23] We will concentrate on 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, hence 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.

[23] For earlier models for 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 reflected by the following equations:

$$(6.1)\quad p_t^S = a_0 + a_1 w_t + a_2 \hat{e}4_t + a_3 gap_{t-1} + a_4 D2 + a_5 D3 + a_6 D4 + a_7 p_t^E + a_8 p_t^*$$

$$(6.2)\quad w_t = b_0 + b_1 p_t^E + b_2 p_{t-2} + b_3 D2 + b_4 D3$$

$$(6.3)\quad gap_t = g_0 + g_1 gap_{t-1} + g_2 tot_t + g_3 prbc_{t-2} + g_4 KPIB_t \times D96$$

$$(6.4)\quad desem_t = d_0 + d_1 gap_t + d_2 desem_{t-1} + d_3 D2 + d_4 D3 + d_5 D4$$

$$(6.5)\quad gdcc_t = c_0 + c_1 gap_t + c_2 gdcc_{t-1}$$

$$(6.6)\quad \hat{e}_t = f_0 + f_1 p_{t-1} + f_2 p_{t-1}^* + f_3 \Delta RIN_t + f_4 DESV_t + f_5 KPIB_t \times D96$$

$$(6.7)\quad p_{t+1}^E = m_0 + m_1 Tar_{t+4} + m_2 \left[(p_t + p_{t-1} + p_{t-2} + p_{t-3})/4 \right] + m_3 \left[(p_t + p_{t-1} + p_{t-2} + p_{t-3})/4 - p_{t-4}^E \right]$$

$$(6.8)\quad p_t = l_0 + l_1 p_t^S + l_2 D3 + l_3 D4 + l_4 A93 + l_5 A94 + l_6 A96 + l_7 A98$$

Where:

p_t^S = core inflation, quarterly rate of change.

p_t = headline CPI inflation, quarterly rate of change.

p_{t+1}^E = expected rate of inflation, quarterly, for period t+1 based on information available at period t.

w_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 $\hat{e}_t$.

p_t^* = external Inflation in dollars, quarterly rate of change.

gap_t = gap between the seasonally adjusted quarterly GDP and its trend, 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 Central Bank debt paper with 90 days of maturity (PRBC-90), annual rate.

$KPIB_t$ = capital inflows as percentage of nominal GDP.

$desem_t$ = quarterly unemployment rate.

$gdcc_t$ = current account deficit of the year ending in quarter t, as percentage of nominal GDP.

ΔRIN_t = quarterly change in Central Bank foreign reserves, in US dollars.

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

Tar_t = quarterly inflation rate implicit in the inflation target announced by the Central Bank.[24]

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) to reflect the sharp increase in capital inflows.

A93, A94, A96, A98= dummy variables that take the value of one for 1993, 1994, 1996 and 1998, respectively, for irregular supply shocks that could affect the difference between core and headline CPI inflation.

Equation (6.1) for core inflation is specified as a weighted-average of inflation for tradable and non-tradable goods and services, and includes also expected inflation. Equation (6.2) for wage inflation includes lagged inflation (reflecting explicit indexation schemes in wage contracts) and expected inflation (reflecting forward-looking wage contracts). Equation (6.3) specifies 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) specifies the current account deficit ratio to GDP 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.

Model estimation results are reported in Table 6.2. We now proceed to compare 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. It can be observed

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

that model forecasts are quite close to 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[25]. 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 simulated values with those from the benchmark model is presented in Figure 6.6. Simulated values are above benchmark values, particularly 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 is through the effect of the inflation target on inflation expectations, and of the latter on wage inflation and core price 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 introducing 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 1995 had been set at 9% and actual inflation had reached 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).

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:

[25] For this purpose, we first estimate an equation for inflation expectations for the period before the introduction of IT (until the fourth quarter of 1990) and use this equation to model inflation expectations in the 1990s.

$$(6.9)\quad prbc_t = (1-\rho)\times\left(\gamma_0 + \gamma_1\left(p4^S_{t+3} - Tar4_{t+3}\right) + \gamma_2 gdcc_{t+2}\right) + \rho prbc_{t-1} + \gamma_3 D983$$ [26]

This policy reaction function is consistent with Corbo (2000), that extends previous work by Taylor (1993) and Clarida et al. (1998) for countries that follow a target of 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 ratio to GDP and a target ratio (which is set at 4.5% of GDP), and the lagged value of the policy rate.[27]

The amended model (that now includes the policy reaction function) is run to provide a new set of benchmark results (BENCHMARK 2). The results for simulated core inflation and actual core inflation are compared in Figure 6.7. Now the simulated values are closer to the actual values than 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 level, helping to bring actual inflation closer to the target.

The counter-factual simulation results for core inflation under the gradualist strategy (GRADUAL), the cold-turkey approach (COLD TURKEY), and the benchmark case (BENCHMARK 2) are reported in Figure 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.

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

[26] In this equation, $p4^S_t$ 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).

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

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.

Now 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 run again 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.

It could be claimed that the comparison between the cold-turkey and gradual approaches to disinflation conducted above does not represent properly the cold-turkey case because expected inflation does not adjust at once to the target level[28]. That is, it does not assume full credibility of the inflation target, which is still given by equation (6.7). Thus to take into account a fully credible cold-turkey approach (using the CF measure of inflation expectations) we impose in equation (6.7) the restrictions $\mu_0=\mu_2=\mu_3=0$ and $\mu_1=1$. The result of the simulation for this restricted version of equation (6.7) is reported in figures 6.12 and 6.13. As can be seen, the reduction of inflation would have been quicker at the beginning than in the case without full credibility, while the unemployment cost is not so much different in both cases. The sacrifice ratio for this case is –0.529 instead of the –1.26 obtained for the case with partial credibility and it is even lower than in the case of the gradualist approach. Therefore we conclude that the actual sacrifice ratio of the cold-turkey approach is bounded between –1.26 and –0.529.[29]

[28] We thank Alejandro Werner for this point.

[29] It should be mentioned that in the price and wage equations, the actual values of the coefficients also depend on the degree of credibility of the inflation target and therefore with full credibility the coefficients of expected inflation in both equations could be higher resulting in an even lower sacrifice ratio.

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 2.1
Exchange Rate Regimes and Welfare

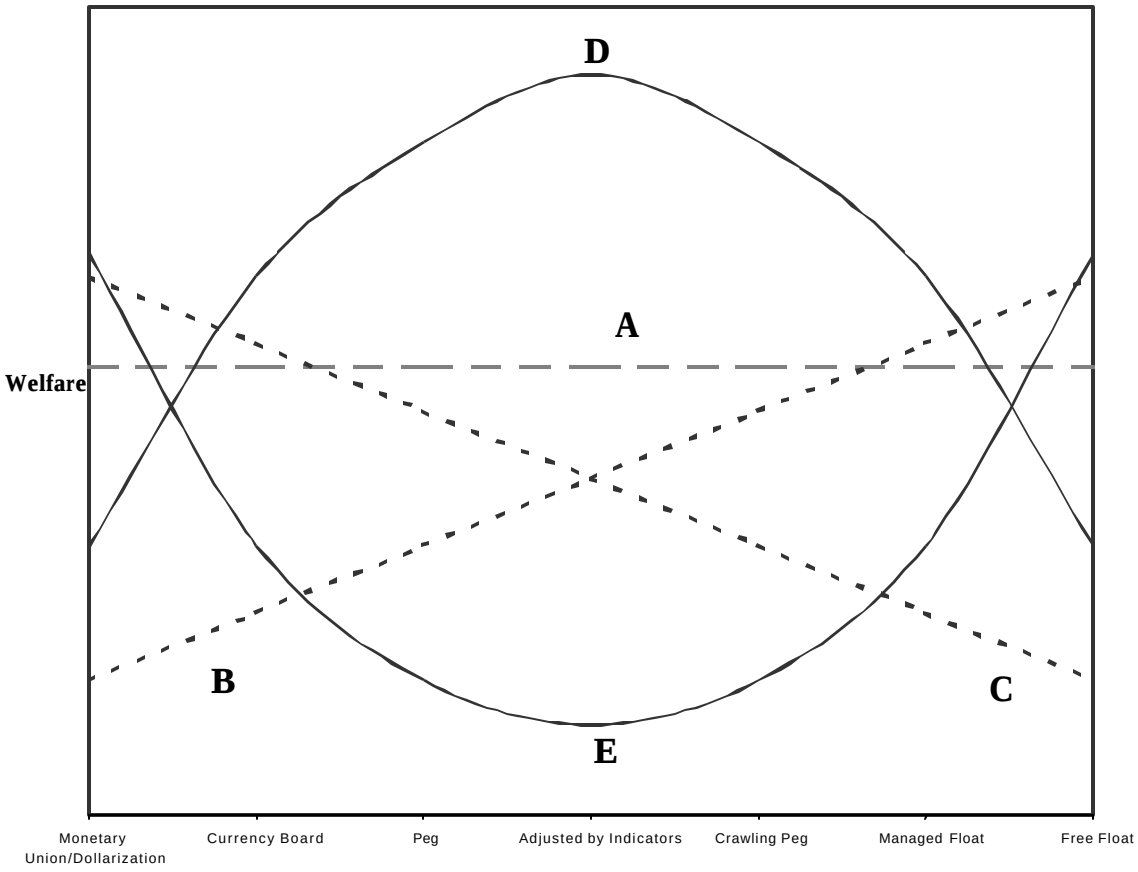
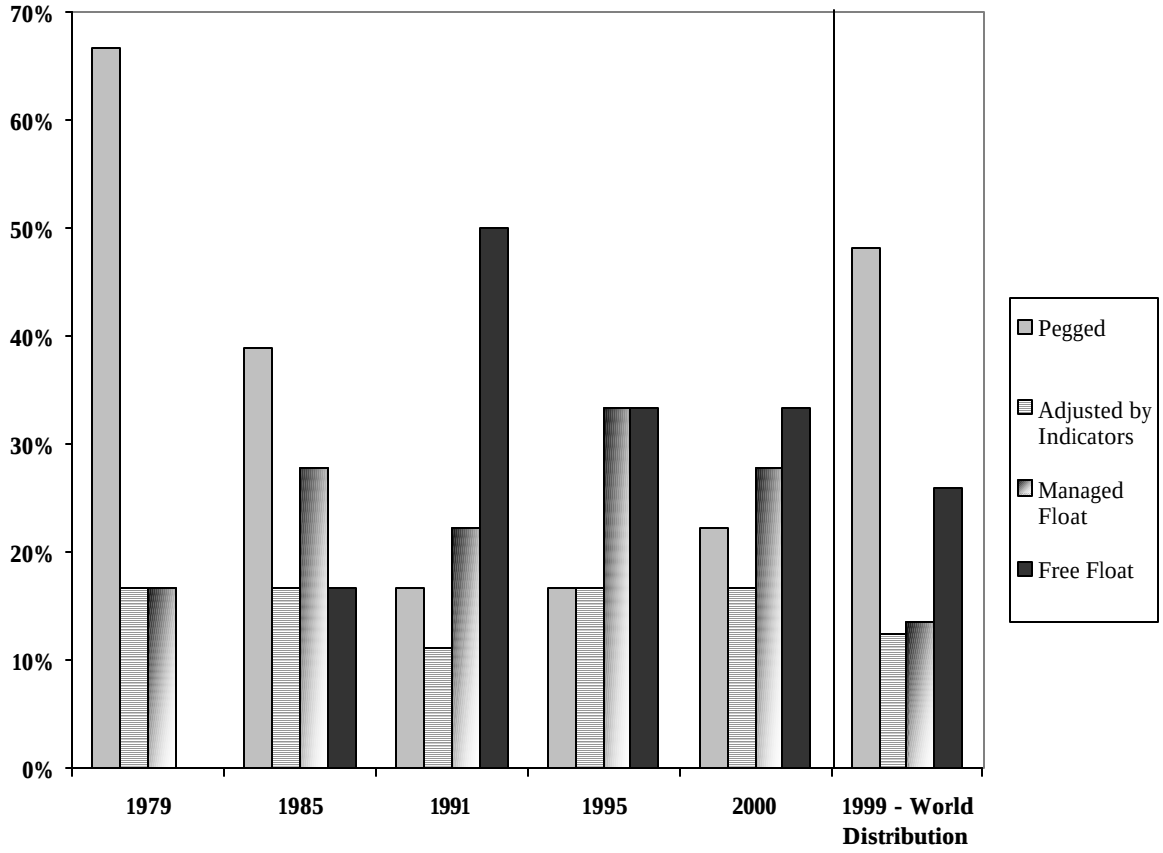
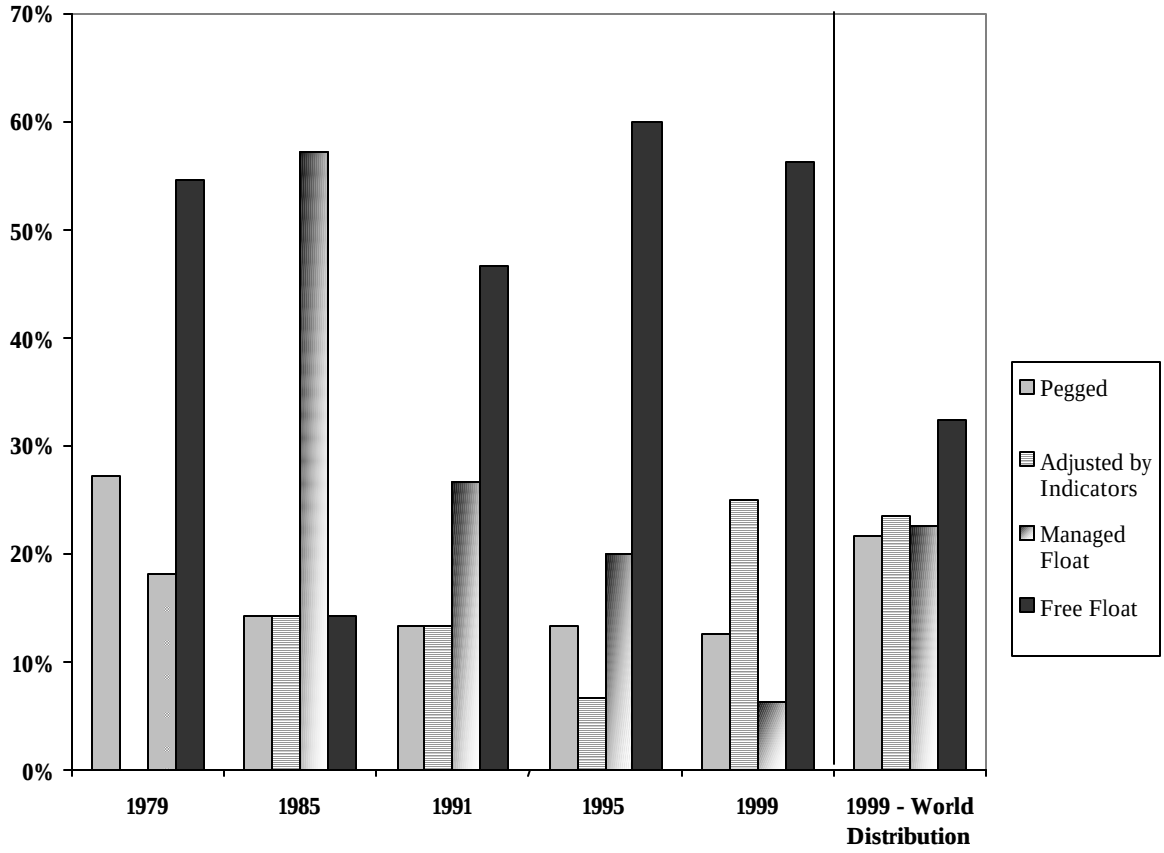


Figure 3.1
Country Distribution of Exchange-Rate Regimes in Latin America:
IMF Classification
1979-2000



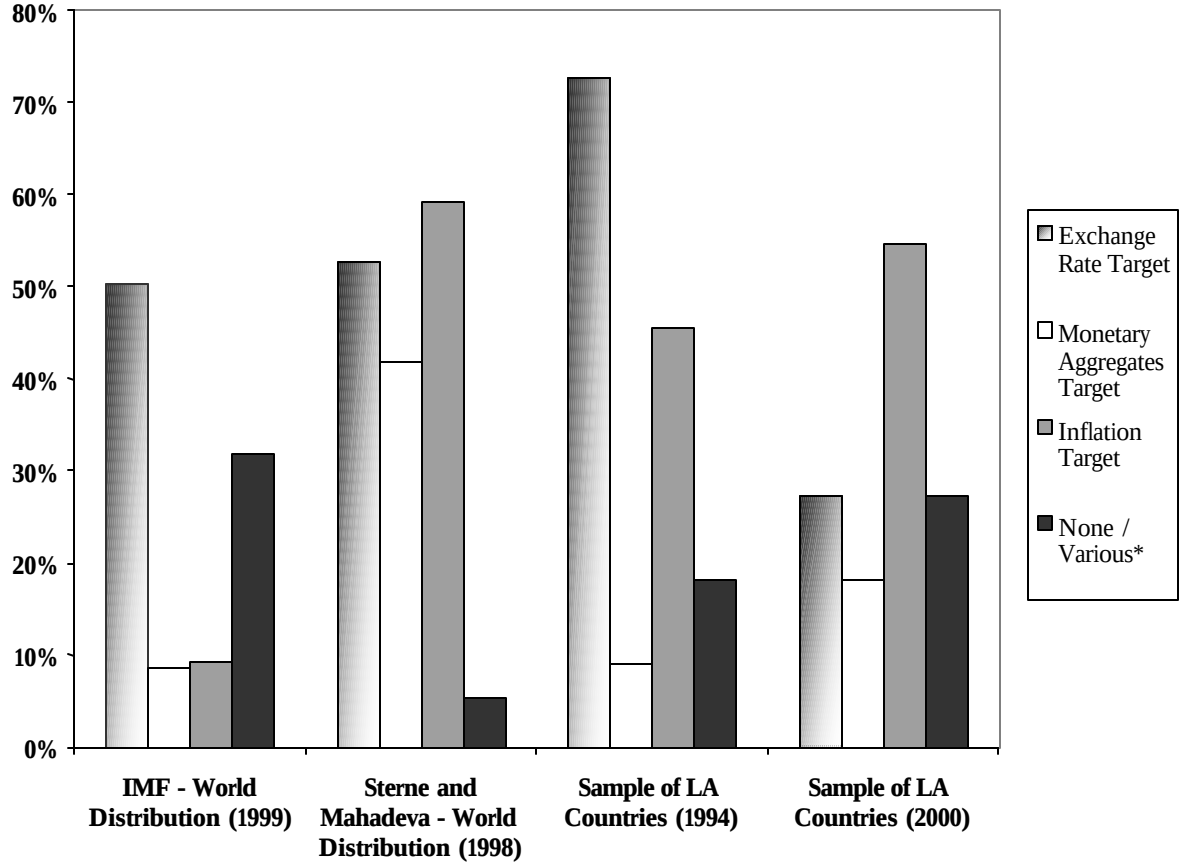
Source: For years 1979, 1985, 1991 and 1995 for Latin America and 1999 for World Distribution: IMF: International Financial Statistics (2000). For the year 2000 for Latin America: authors' classification based on central banks' statements and web pages.
18 countries are included in Latin America's distribution: 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 and Sturzenegger Classification Based on Cluster Analysis
1979-1999



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



Source: 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

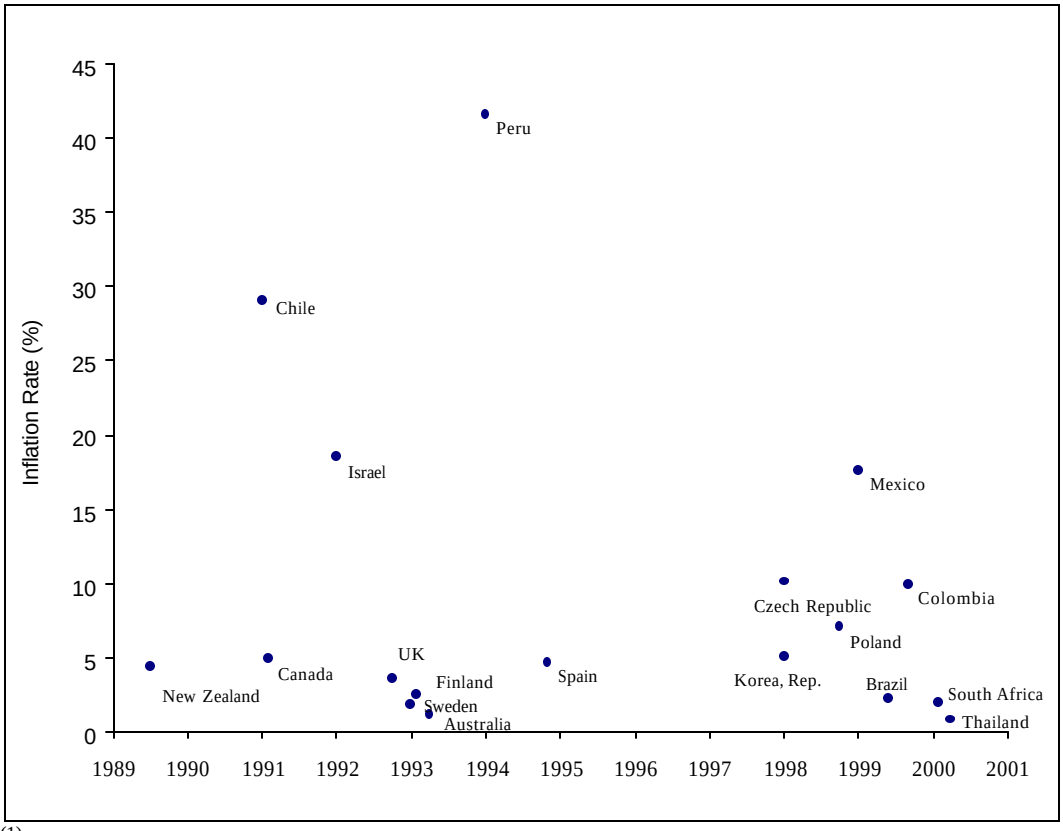
Source: Mishkin and Savastano (2000), Mahadeva and Sterne (2000), and central banks' statements and web pages.

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 (exc. 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 (exc. 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 (exc. 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 (exc. 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 (exc. Food, energy and indirect taxes)
Finland [1]	February 1993-June 1998	Annual average of 2% by 1995	EMU	Underlying CPI (exc. 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 (exc. 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)

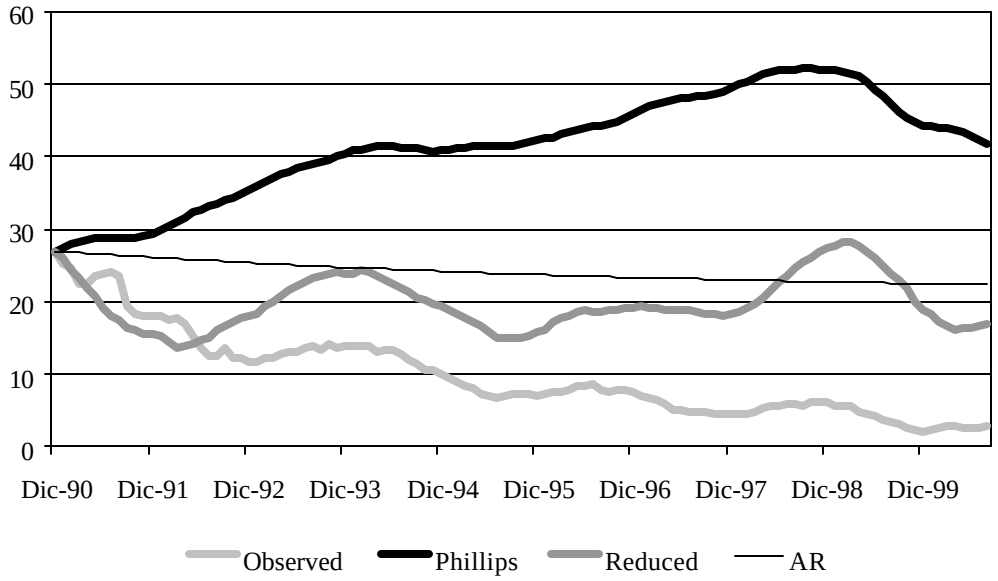


Figure 6.2
Out-of-Sample Forecasts: Quarterly Data (quarter to quarter rate of change)

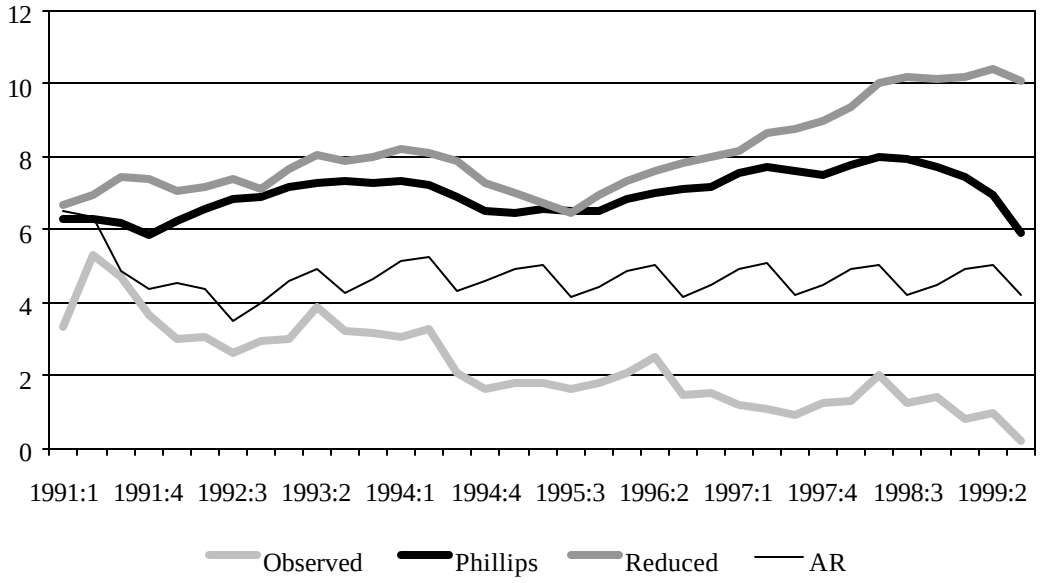


Figure 6.3
Out-of-Sample Forecasts from Rolling VARs
(12-month rate of change)

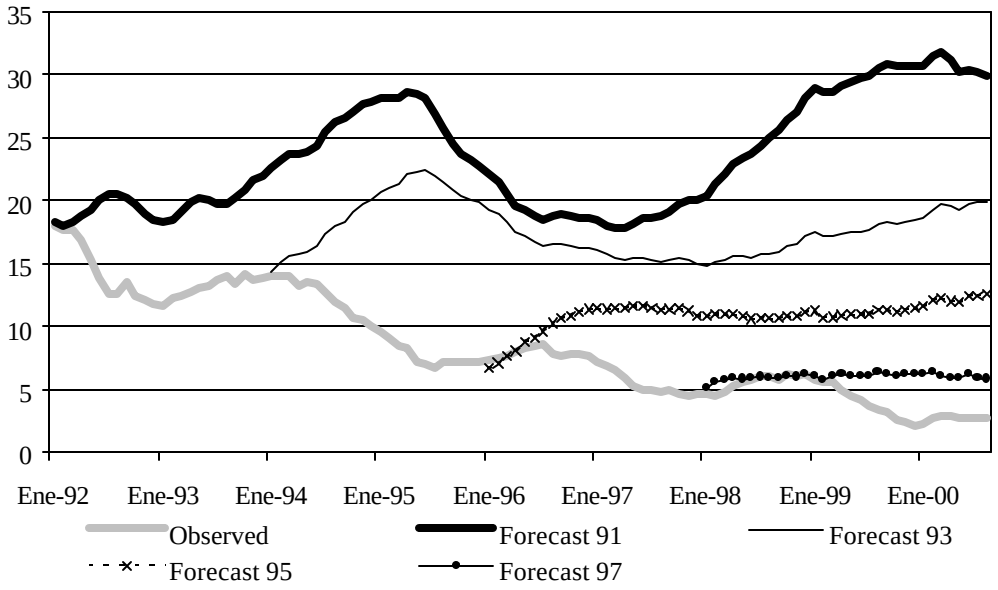


Figure 6.4
Out-of-Sample Forecasts from Rolling VARs
(12-month rate of change)

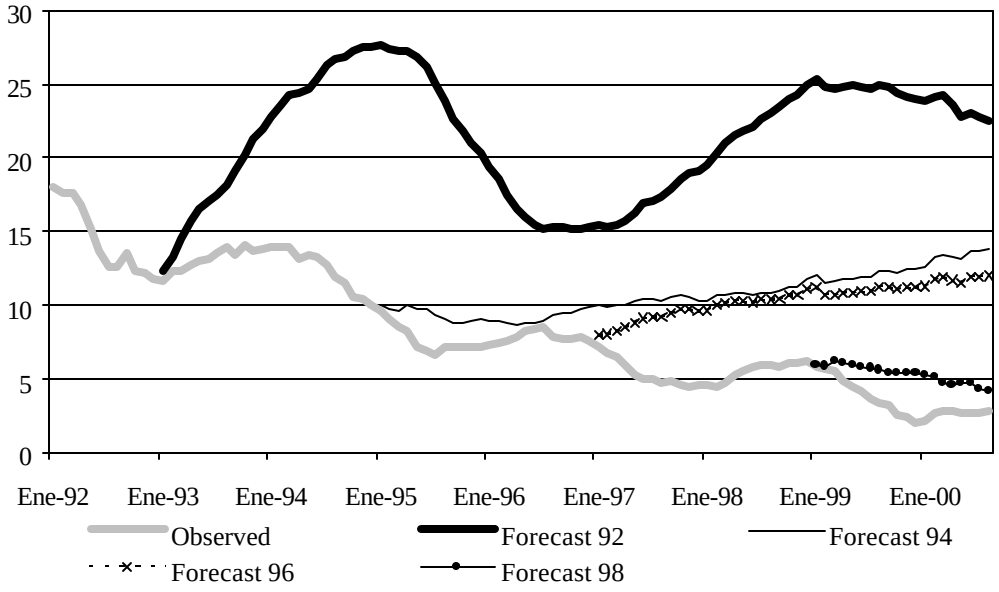


Figure 6.5
Observed and Benchmark values of the Core Inflation
(Quarterly rate of change)

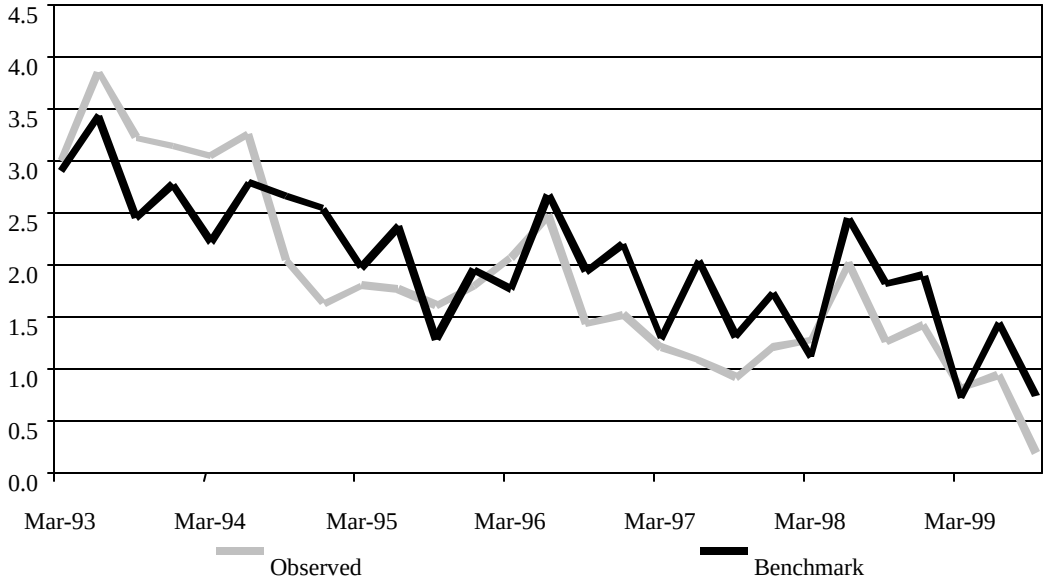


Figure 6.6
Core Inflation: Counterfactual 1
(Quarterly rate of change)

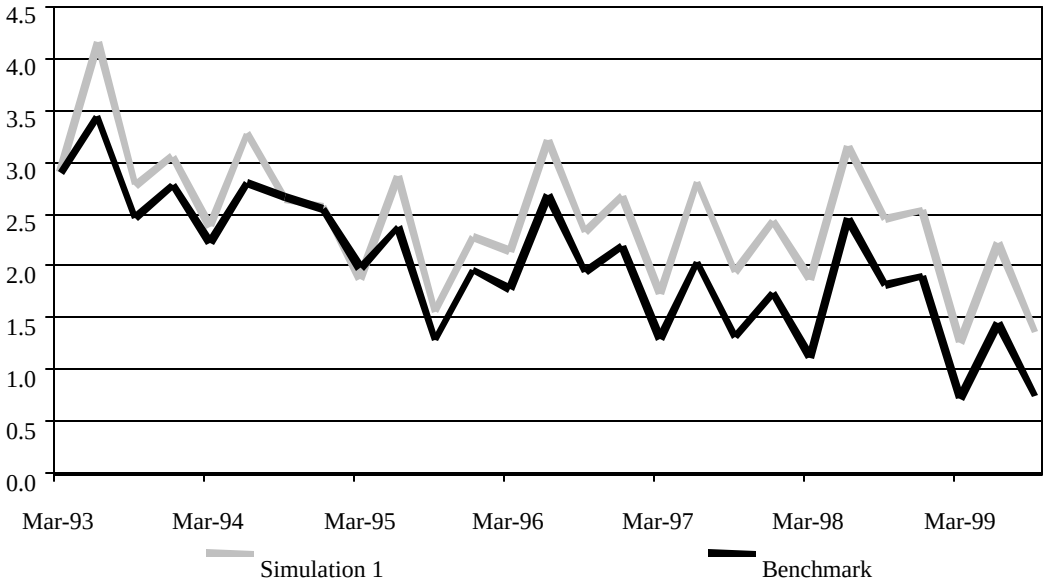


Figure 6.7
Observed and Benchmark 2 values of the Core Inflation
(Quarterly rate of change)

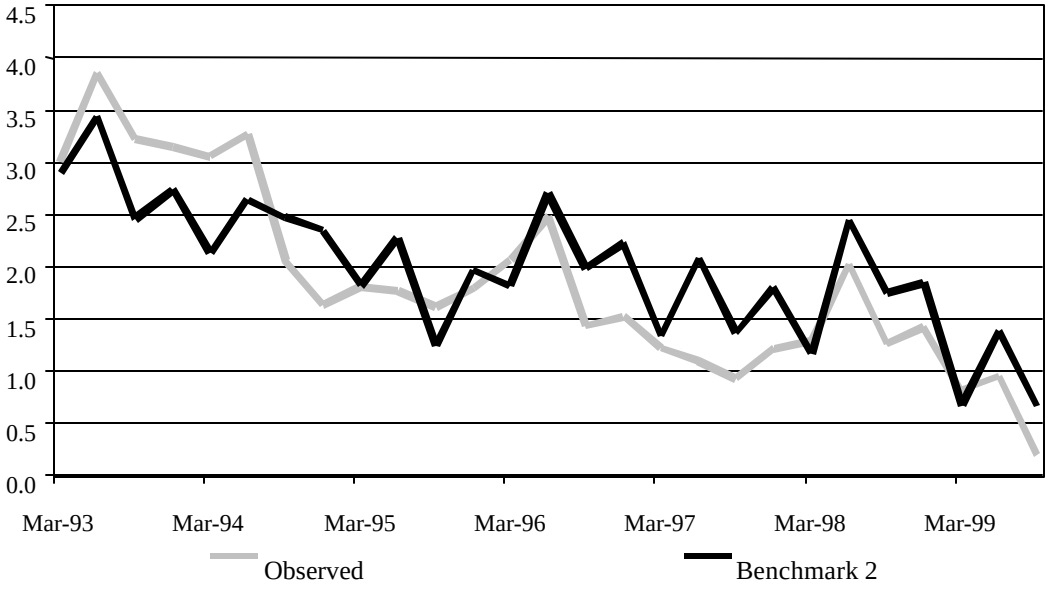


Figure 6.8
Core Inflation: Benchmark 2 and Alternative Targets
(Quarterly rate of change)

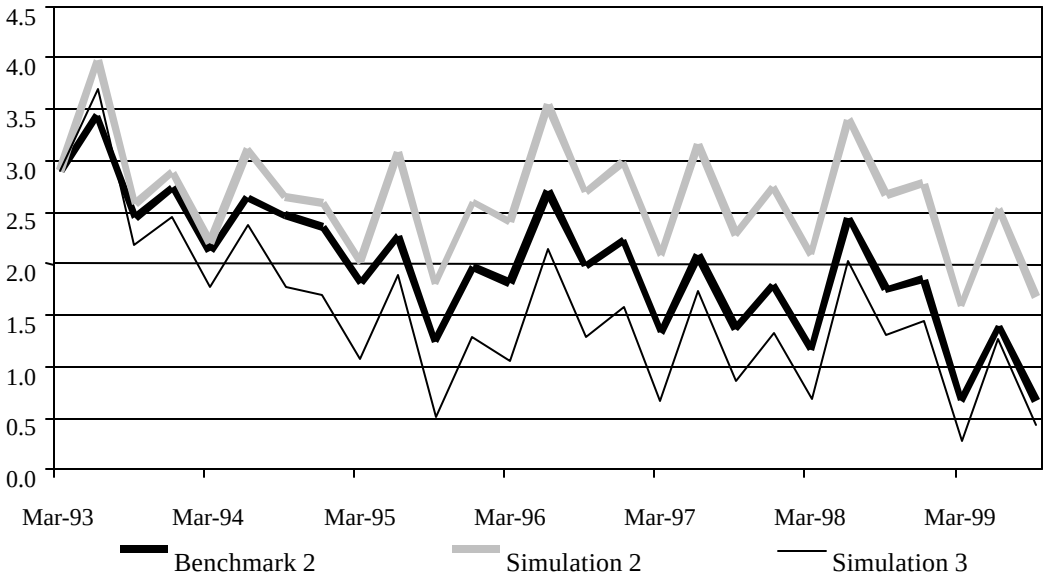


Figure 6.9
Unemployment: Benchmark 2and Alternative Targets
(Quarterly rate)

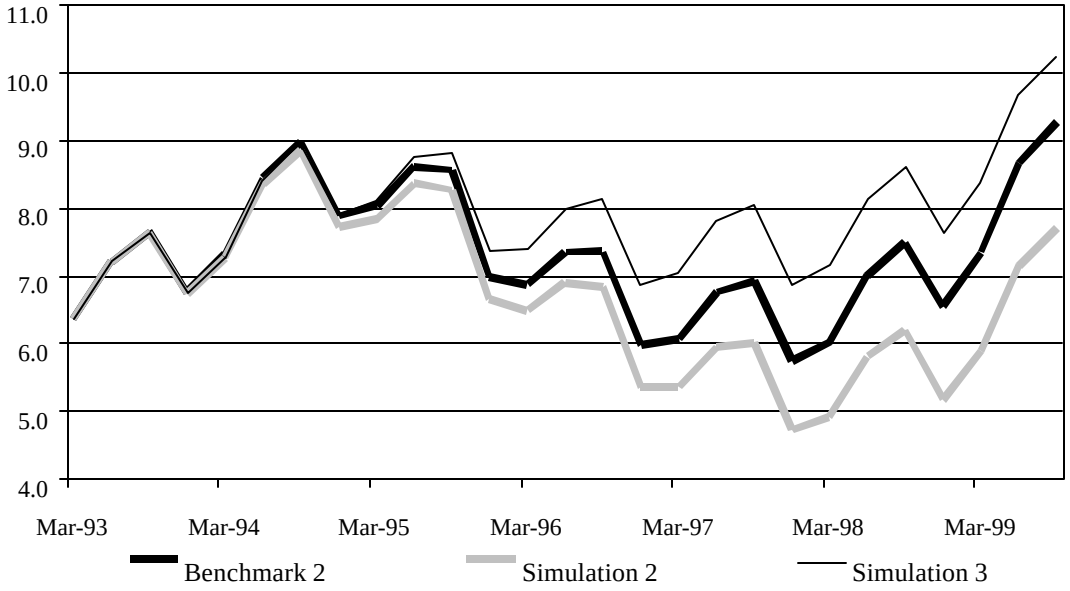


Figure 6.10
Core Inflation: Benchmark 2, Soft Targets and Aggressive Targets using CF
(Quarterly rate of change)

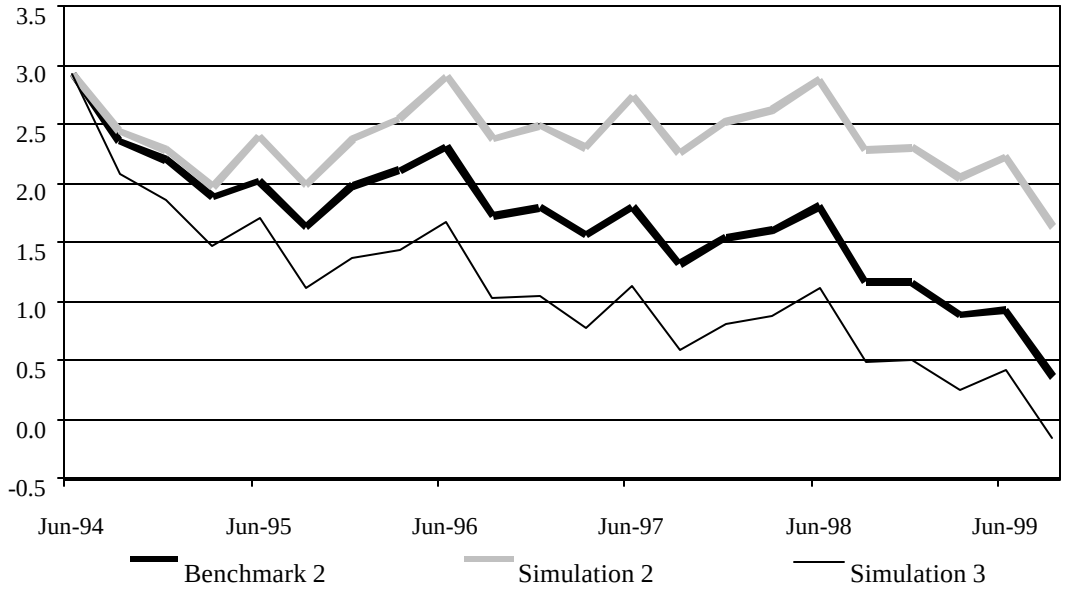


Figure 6.11
Unemployment: Benchmark 2, Soft Targets and Aggressive Targets using CF
(Quarterly Rate)

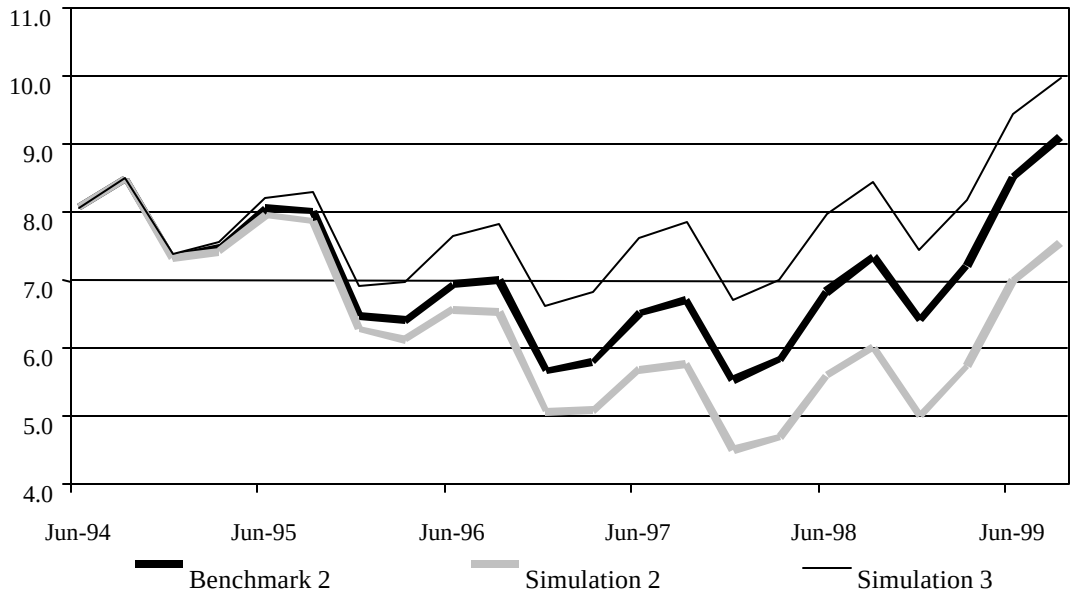


Figure 6.12
Core Inflation: Benchmark 2 and Aggressive Targets with Partial and Full Credibility using CF
(Quarterly rate of change)

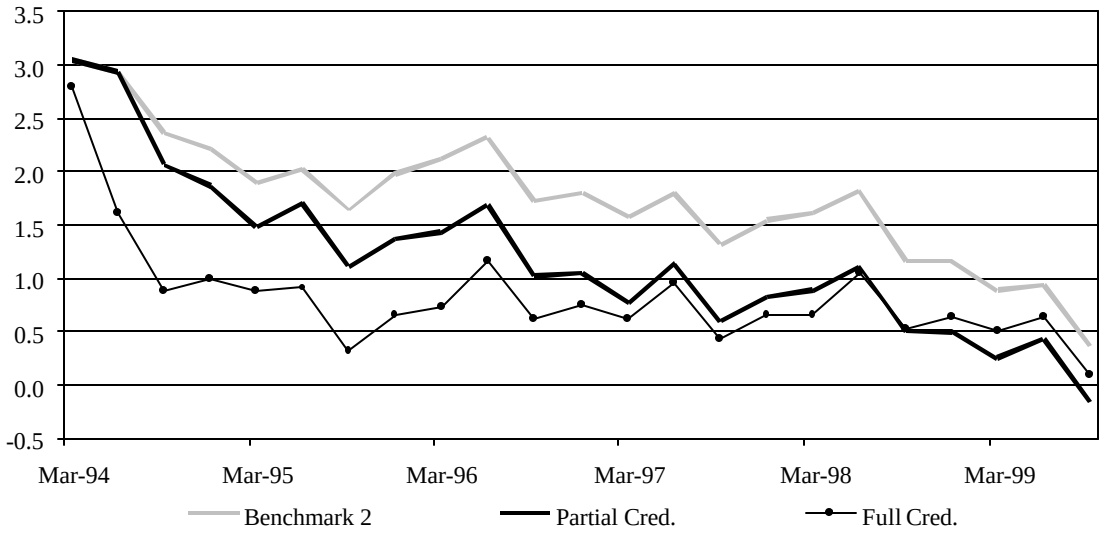


Figure 6.13
Unemployment: Benchmark 2 and Aggressive Targets with Partial and Full Credibility using CF
(Quarterly Rate)

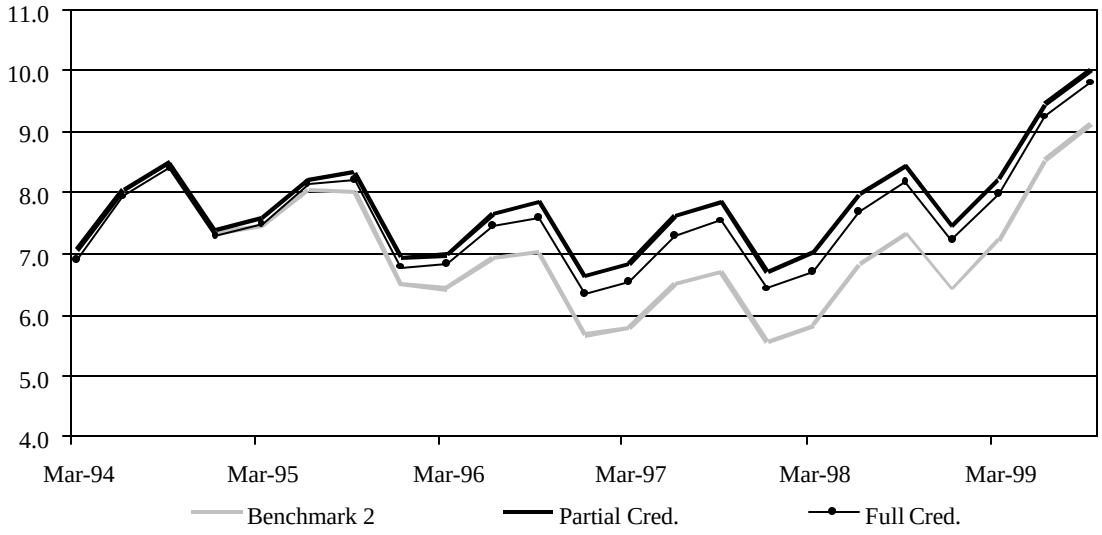


Table 6.1
Inflation Forecasts and Expected Inflation
(Dec. to dec. rate of change)

	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

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

$$(6.2)\quad w_t = 1.378 + 0.826 p_t^E + (1 - 0.826) p_{t-2} - 1.221 D2 - 1.249 D3$$

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

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

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

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

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

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

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.

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