

# INFLATION TARGETING: AN OVERVIEW

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After the emergence of a consensus in the 1980s on the harmful effects of inflation, the last decade of the twentieth century witnessed a marked reduction in inflation rates across the world. By the end of the 1980s, empirical evidence collected from large cross-country analyses and numerous case studies indicated that the negative effects of high and variable inflation on macroeconomic stability, economic growth, and income distribution largely outweigh the potential benefits derived from financing fiscal deficits through monetization. Similarly, short-term monetary policies aimed at higher output or lower employment were found to result in high inflation without, in the end, systematically achieving their explicit goals.

In the 1990s, the need to achieve price stability finally moved from the pages of research papers to the agendas of monetary authorities and politicians. After experiencing moderate but persistent inflation rates for more than two decades, industrialized economies have controlled and maintained inflation at historically low levels in recent years. Latin America, once the epitome of chronically high inflation, has also managed to achieve single digit inflation levels, a feat once thought to be undesirable and, more realistically, almost impossible.

The abatement of inflation is the result of a profound change in the conduct of monetary policy. Even if one concedes that the absence of significant supply shocks in the 1990s helped to control inflation in

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some countries, the driving force in this phenomenon is clearly the strong anti-inflationary stance adopted by the central banks of developed and developing countries. This change in central banks' attitude toward inflation is largely based on their recently obtained ability to conduct monetary policy with independence, transparency, and credibility. One monetary scheme that couples these virtues with a pragmatic use of policy instruments is inflation targeting. Following the pioneering example of New Zealand and Chile, several countries—as diverse as Brazil, England, and Sweden—have formally adopted inflation targeting as the defining feature of their monetary policies.

Although the term inflation targeting is now commonly used by bankers and scholars, several features of this monetary regime and its effects on economic performance remain elusive. The papers in this volume should contribute to bridging this knowledge gap in several key areas of interest. Most studies included here are substantially revised versions of papers presented at the Fourth Annual Conference of the Central Bank of Chile, on “10 Years of Inflation Targeting: Design, Performance, Challenges,” held in Santiago in November 2000. These articles provide an original contribution from a variety of methodological approaches. While some authors treat the issues theoretically, others adopt an empirical perspective, whether based on a single country or an international sample. To varying extent, all the papers in the volume have three central objectives: to understand the distinctive features of inflation targeting and appreciate the variety within this class of monetary regimes; to evaluate the performance of inflation targeting in reaching the goal of price and output growth stability, particularly in comparison with alternative monetary frameworks; and to analyze the optimal way to design policy objectives, instruments, and responses under inflation targeting, especially in the case of economies in transition to low inflation.

This overview paper selectively surveys the articles included in the volume. The purpose here is not to provide an exhaustive summary, but to highlight how the works address the three objectives posed above. The following sections group and discuss the papers in the order in which they are included in the volume. Section 1 deals with the definition and empirical evaluation of inflation targeting as a framework for monetary policy. Section 2 presents the theoretical analysis on, first, the merits and weaknesses of inflation targeting and, second, the best ways to implement it. Section 3 reviews the case studies on four inflation-targeting countries, namely, Chile, New Zealand, Australia, and Brazil. Section 4 offers some concluding remarks.

## **1. INFLATION TARGETING: DEFINITION AND EMPIRICAL EVALUATION**

Inflation targeting started a decade ago in New Zealand and Chile as a means of achieving low and stable inflation levels. It is thus a novel approach to monetary policy. Given the successful experience of these countries, the popularity of inflation targeting has risen steadily, as has the number of countries that have adopted it. According to Vittorio Corbo, Óscar Landerretche, and Klaus Schmidt-Hebbel, in their paper in this volume, by 2000 there were eighteen full-fledged inflation-targeting countries, and another five, mostly emerging economies, were considering implementing it. Except for two countries that became part of the European Monetary Union (Finland and Spain), no inflation-targeting country has ever abandoned the regime.

What exactly is inflation targeting? Although definitions differ in detail, there is some consensus on the main characteristics of this monetary regime: the existence of an explicit quantitative goal that engages the central bank in the primary objective of price stability; the lack of fiscal dominance and the absence of competing nominal objectives; and a monetary institution that enjoys instrument independence and operates transparently and openly to the public. The papers by Gabriel Sterne and Richard Agénor in this volume discuss how each of these characteristics is incorporated into a definition of an inflation-targeting regime.

Sterne and Agénor both emphasize that inflation targeting involves a framework for monetary policy and not a single policy rule (Bernanke and others, 1999, share this view). In a sense, inflation-targeting proposes a solution to the long-standing debate in economics of rules versus discretion. The monetary authority enjoys what Svensson (1999) calls constrained discretion: the inflation-targeting framework sets out very clear goals for monetary policy, defines responsibilities, and establishes measures of accountability and transparency. However, it leaves to the central bank the decision of which instruments to use and how to use them to hit the target. Inflation targeting also forces the central bank to forecast the future behavior of prices, giving it the opportunity to tighten policies before sustained inflationary pressures develop.

Sterne goes beyond the general characterization given above and provides an in-depth study of the different monetary regimes in ninety-four countries, looking for a more operational definition of inflation targeting. This is certainly a difficult task and has decisive implications

for evaluating the effects of this monetary regime.<sup>1</sup> Adopting a narrow definition may cause one to understate inflation targeting's contribution to the design of monetary policy in a wide range of countries. Conversely, a loose definition may lead to overstating its contribution, since many of the characteristics of inflation targeting have previously been used in other regimes of monetary policy.

Sterne's paper uses a survey of monetary framework design to quantify ten characteristics, including central banks' objectives, targets, independence, accountability, transparency, and analytical capacities.<sup>2</sup> An interesting result of this paper is the finding that targets are increasingly being used in monetary policy worldwide. By 2000, more than half of the countries in the sample used explicit targets, and although inflation targets were a minority, their number expanded quite rapidly in the 1990s. According to Sterne, an important explanation behind the increased use of inflation targets relative to money targets is the capacity of inflation targets to provide a visible vehicle for guiding private sector expectations and communicating with the government. The use of targets, in general, appears to produce an incentive for the central bank to explain its policies to the public; the use of inflation targets, in particular, seems to facilitate the communication between central banks, fiscal authorities, and the private sector. Another potential advantage of inflation targets is that they can be more precisely obtained. Sterne shows that the number of inflation target misses was less than half that of money target misses. The median inflation target miss (in absolute terms) for countries that announce both inflation and money targets was 1.5 percentage points, compared with 3.2 percentage points for broad money growth. These results are consistent with the view that over a broad range of countries, the mix of shocks leads the economy to greater deviations from money targets than inflation targets.

Regarding institutional aspects of monetary policy, Sterne shows that almost all central banks in his sample consider instrument independence to be an important aspect of their ability to conduct autonomous policy. By contrast, goal independence tends to be important to central banks only in particular circumstances that are closely related

1. As mentioned by Sterne, it is difficult to distinguish between money-targeting and inflation-targeting frameworks by observing which countries publish inflation targets, because virtually all countries that classify themselves as money targeters also publish inflation targets, guidelines, or reference values.

2. See Fry and others (2000).

to the target-setting capacity. Countries that target money or the exchange rate are more likely to define independence according to statutory objectives, while central banks that focus their framework on inflation targets define independence less in reference to official mandate than to the practical ability to achieve their objectives.

The paper by Agénor provides a thorough survey of the analytical literature on the mechanics and effects of inflation targeting, particularly in developing countries. Following Svensson (1997, 1999), Agénor presents an analytical model for inflation targeting in both closed and open economies. The closed economy model shows how the inflation target drives the basic reaction rule of the central bank. The analysis is then extended to an open economy setting to highlight the role of the exchange rate in the transmission process of monetary policy. Based on these models, Agénor provides a comparison between inflation-targeting regimes and those based on money supply and exchange rate targeting. The most innovative section of the paper focuses on some unresolved analytical issues in the design of inflation-targeting regimes, namely, the role of nonlinearities and asymmetric effects in the Phillips curve, the uncertainty regarding behavioral parameters and the transmission process of monetary policy, and the treatment of credibility and reputation in empirical macroeconomic models of inflation. These subjects are particularly relevant for monetary policy in developing countries. Agénor's efforts thus contribute to bridging the gap between the rigorous analytical study of inflation targeting in developed countries and the practical problems of its application in developing economies. Agénor's paper builds on the assumption that inflation targeting is applicable to developing countries. This has been the subject of an interesting debate, with authors like Masson, Savastano, and Sharma (1997) taking a rather cautious view while Mishkin (2000) and Morandé and Schmidt-Hebbel (1999) adopt a more favorable position. The latter group holds that inflation targeting is possible at least in the case of high- and middle-income developing countries, where the financial system is sufficiently developed to permit the use of indirect instruments of monetary policy.

The papers by Sterne and Agénor provide a significant number of hypotheses and insights on the strengths and weaknesses of inflation targeting, but they do not assess them empirically. This is undertaken in the study by Frederic Mishkin and Klaus Schmidt-Hebbel in this volume, study which compares the experience of eighteen inflation-targeting countries with a group of ten developed economies. Using annual data for the 1990–99 period, these authors find that the likelihood

of having inflation targeting in place is positively associated with both formal and instrument independence of the central bank. Their results indicate, however, that inflation targeting is negatively associated with the central bank's goal independence. This suggests that when central banks determine their target levels, they are more likely to choose exchange rate or monetary growth anchors than inflation targets. This result highlights the difference between the formal and operative independence of the monetary authority.<sup>3</sup> Mishkin and Schmidt-Hebbel also find that the adoption of an inflation-targeting regime is more likely when the initial level of inflation is relatively high. Coupled with their result that inflation is reduced more rapidly under inflation targeting, this implies that central bankers perceive and use this regime as a tool for stabilizing prices. Mishkin and Schmidt-Hebbel further establish that the implementation of inflation targeting is associated with lower fiscal deficits, confirming the absence of fiscal dominance under this regime.

The most direct study in this volume to empirically analyze inflation targeting in relation to other regimes is the paper by Corbo, Landerretche, and Schmidt-Hebbel. They compare a sample of fifteen countries that adopted inflation targeting with a group of ten countries that follow a variety of other monetary frameworks. Their objective is to conduct a broad empirical search on the rationale and consequences of adopting inflation targeting. Thus the paper addresses a variety of issues that jointly give an overall evaluation of this regime. Some of these questions are the following. First, how effective have inflation-targeting countries been in reducing inflation, and at what cost? Second, how has the adoption of inflation targeting changed the behavior of the central bank, including its aversion to inflation? Third, what effect has inflation targeting had on the macroeconomy, particularly the predictability and variability of inflation and output growth?

Based on a number of econometric models, Corbo, Landerretche, and Schmidt-Hebbel conclude that inflation-targeting countries perform consistently better than the control group in terms of controlling inflation and, most importantly, without inducing additional volatility in output. They also find that output sacrifice ratios, as measured by industrial production, were lower in inflation-targeting countries than in potential inflation targeters and nontargeters during the 1990s. The volatility of industrial output fell to levels similar to those found among nontargeting countries. To some extent, this evidence contradicts

3. Walsh (1995) sparked an extensive literature that stresses the difference between goal and instrument independence.

Bernanke and others (1999, p. 298), who suggest that disinflation is costlier in the short run under inflation targeting. Although Corbo, Landerretche, and Schmidt-Hebbel's positive assessment applies to mature inflation-targeting regimes, in which credibility, transparency, and accountability in the conduction of monetary policy are well established, the authors find evidence that inflation targeting can facilitate the process of achieving these institutional virtues. In particular, inflation targeting can help bring down and guide inflation expectations so as to achieve a faster and less costly reduction in inflation. The paper uses country vector autoregressive (VAR) models to demonstrate that inflation forecast errors fall consistently with the adoption of inflation targeting. This reflects both a learning process on the part of economic agents with regard to the monetary framework and the increased credibility of the monetary authorities. Finally, Corbo, Landerretche, and Schmidt-Hebbel find that inflation-targeting countries have gradually gained a measure of credibility that allows them to achieve their targets with smaller changes in their policy instrument than previously. As the authors recognize, their results are more favorable to inflation targeting than are previous findings, such as those of Almeida and Goodhart (1998) and Bernanke and others (1999).

## **2. THE EFFECTIVENESS OF INFLATION TARGETING: THEORETICAL PERSPECTIVES**

Given the broad definition of inflation targeting, it appears reasonable to look for optimal inflation-targeting policies. Such policies would necessarily depend on the specifics of each economy. The paper by Jordi Galí in this volume obtains and compares optimal and near-optimal policies within the context of a monetary business cycle model in which agents optimize subject to staggered price restrictions. Following Calvo (1983), Galí's model incorporates price rigidities based on the assumption that only a fraction of producers are able to change their prices at any point in time. Inflation and its evolution over time are thus an immediate consequence of periodic price revisions by profit-maximizing firms. These price rigidities and periodic jumps give a stabilizing role to monetary policy.<sup>4</sup> This simple setup allows the author to derive an optimal forward-looking interest rate rule that implements an inflation-targeting regime. Such a rule generally depends on the structure

4. This specification is consistent with a forward-looking Phillips curve, such as that derived by Clarida, Galí, and Gertler (1999).

of the model, the settings for the parameters describing the economic environment, and the properties of the underlying sources of fluctuations. Galí shows that the stabilization of the output and inflation gaps requires a credible threat by the central bank to vary the interest rate sufficiently in response to any deviations of inflation or output from the target, yet the very existence of that threat makes its effective application unnecessary.

As with most models, the nature of the optimal inflation-targeting rule in Galí's paper suggests that its actual implementation would face major difficulties. First, the authorities would have to have complete knowledge of the structure of the economy and the value of the parameters. Second, they would need unbiased forecasts of the future path of all underlying exogenous disturbances. These considerations lead the author to propose an alternative rule that may both approximate the outcome of the optimal one and be easier to implement in practice. This rule is a simplified version of the so-called Taylor rule, under which the monetary authority adjusts the interest rate in response to deviations of inflation from target.<sup>5</sup> The analysis shows that in the absence of significant measurement error in the inflation data, a simple Taylor rule can approximate the outcome of the optimal inflation-targeting policy arbitrarily well, as long as the interest rate response to movements in inflation is sufficiently strong. If the inflation data are ridden with error, however, the alternative rule carries a risk of raising the volatility of inflation.

The paper by Eric Parrado and Andrés Velasco in this volume develops a general equilibrium, open economy model with monopolistic competition and short-term price rigidities. The model enriches the discussion initiated by Galí by explicitly considering the existence of both domestic and foreign goods, which in turn gives a role to different exchange rate regimes (fixed versus flexible), and by allowing the existence of both nominal and real shocks. The authors use this framework to compare the welfare impact of various specifications of Taylor rules in the presence of different shocks; they find that when the economy suffers a real shock, a regime with flexible exchange rates and inflation targeting is superior in terms of welfare to one based on fixed exchange rates. The opposite conclusion obtains when a nominal shock hits the economy.

5. Taylor rules are monetary reaction functions in which the policy instrument, such as a short-term interest rate, changes in response to current or expected output and inflation gaps.



The Parrado and Velasco model allows the authors to systematically explore two recurrent issues in the literature. The first deals with the best inflation measure to be targeted. Since consumers in this model demand both domestic and foreign goods, it is possible to evaluate under what conditions targeting an index of domestic prices is superior to targeting headline consumer price index (CPI) inflation. In Parrado and Velasco's model, domestic inflation targeting is welfare superior to CPI inflation targeting. Because the CPI is affected by exchange rate variations that escape the control of the central bank, responding to all CPI fluctuations may be an overreaction that destabilizes output. Conversely, the paper by Pablo García, Luis Óscar Herrera, and Rodrigo Valdés in this volume (which is reviewed below) finds that in the presence of widespread backward price and wage indexation to CPI inflation, only targeting its domestic component may result in higher volatility of output and headline (CPI) inflation. The second issue addressed by Parrado and Velasco involves a comparison of strict rules (that is, interest rate rules that only react to inflation gaps) with flexible rules (those that also react to output gaps). Given that output volatility also enters into their welfare function, it is not surprising that they conclude in favor of flexible rules.

The interpretation of empirical studies on inflation targeting is difficult because the adoption of this regime has taken place in a period when supply shocks were largely absent (until the recent oil shock). Moreover, most countries have adopted inflation targeting under rather favorable macroeconomic conditions, including low fiscal deficits and foreign exchange availability. Both conditions can bias the evaluation of inflation targeting's efficiency in comparison with other monetary regimes. The paper by Michael Kumhof in this volume takes the perspective that inflation targeting is not intrinsically superior to other monetary frameworks and in fact is as vulnerable to external shocks as exchange rate targeting in the presence of fiscal dominance and disequilibria. Kumhof's model shows that given a high degree of pass-through from exchange rates to domestic prices, an inflation target can lead to greater instability than exchange rate or money targets. Following this logic, however, Kumhof's results have a rather limited application to countries that have achieved a high degree of fiscal discipline and a low pass-through, as is the case in most current inflation-targeting countries. Kumhof's analysis reinforces two lessons presented above. First, countries that are considering adopting inflation-targeting policies should be aware of the need to achieve and ensure fiscal discipline and avoid exchange rate misalignment. This lesson is consistent with the empirical evidence presented by

Mishkin and Schmidt-Hebbel. Second, countries that have already implemented inflation targeting should avoid fiscal imbalances, or they will run the risk of increased output instability.

The paper by Bennett McCallum in this volume analyzes a rather recent criticism of inflation targeting, namely, that in countries that experience deflation, the nominal interest rate may approach a zero bound. If, in addition, the economy is in a recession and thus requires expansionary monetary policy, the central bank faces a liquidity trap, since it is not able to place open market bonds at below-zero nominal rates. The case of Japan in the 1990s appears to support this claim. From a theoretical perspective, it has been suggested that the dangers of an expectations trap and indeterminacy are created by variants of inflation targeting, the latter when forecasts of future inflation enter the policy rule. McCallum's paper shows that these alleged dangers are not an exclusive characteristic of inflation targeting and, more importantly, are probably not of practical importance. He develops an open economy model to evaluate the likelihood of encountering a liquidity trap for several policy rules. Following the work of Evans and Honkapohja (1999, 2001) on expectational stability and least squares learning, McCallum shows that the risk of falling into this liquidity trap is mostly a theoretical curiosity, given that the deflationary solution is not stable. Furthermore, through calibration and simulation of a structural model, he finds that a liquidity trap can be avoided by having an inflation target and a long-run average real interest rate whose sum does not fall below a certain lower bound; according to McCallum's calibrations, this bound is 5 percent per year. Also, if the usual interest rate instrument is immobilized by a liquidity trap, monetary policy can still exert stabilizing effects by means of an exchange rate channel. The relevant target variable can still be the inflation rate.

The implementation of inflation targeting does not only raise interesting analytical questions but has also prompted a reassessment on the part of the International Monetary Fund (IMF) of its conditionality policies. It would appear that the inflation-targeting framework, by the very nature of its operating procedures, is not compatible with the traditional IMF monetary conditionality framework. As discussed by most authors in this volume, inflation targeting is based on the premise that an independent central bank can use its various instruments in the proportions considered appropriate in each particular circumstance to ensure the attainment of its inflation goal. This seems to clash with IMF conditionality schemes that set explicit and somewhat rigorous quantitative objectives for key monetary variables.

The paper by Mario Blejer, Alfredo Leone, Pau Rabanal, and Gerd Schwartz in this volume describe how IMF conditionality has traditionally relied on two performance criteria: a ceiling on the central bank's net domestic assets and a floor on its net international reserves. Since inflation targeting is usually implemented alongside a floating exchange rate regime, floors on reserves would appear to be irrelevant. However, while an inflation-targeting central bank would not be expected to use its foreign reserves to stabilize the exchange rate per se, it may react to movements of the exchange rate to the extent that they threaten the inflation target. Trade-offs between domestic objectives (that is, inflation) and external objectives (that is, external viability) may be unavoidable, at least conceptually. Even when the exchange rate is flexible, retaining a floor on net international reserves may simply reflect the fact that one important aspect of an IMF program is to safeguard external viability. In contrast, retaining a ceiling on net domestic assets in the context of inflation targeting is more problematic. In the first place, inflation, in most cases, is not primarily a function of net domestic financial assets or its components, and it is therefore unlikely to respond predictably or immediately to changes in base money. Second, transparency and consistency problems can arise, as there would generally be little correspondence between the monetary objectives underlying IMF programs and the relevant instruments chosen by the central bank to achieve the inflation target. There is also an apparent tension between the forward-looking nature of inflation targeting and the backward-looking mechanics of setting limits on the growth rates of net domestic assets employed in IMF programs. The authors evaluate the recent experience of Brazil—the only inflation targeting country with an IMF-supported adjustment program—to make suggestions for modifying the standard conditionality framework of the IMF. Among other measures, they propose using the central bank's inflation target as an indicator of monetary stance and considering simple monetary policy rules (such as Taylor rules or McCallum rules) as potential trigger mechanisms for policy consultations. These rules should be simple but forward looking, in the sense of reacting to inflationary expectations.

### **3. COMPARING DIFFERENT WAYS OF IMPLEMENTING INFLATION TARGETING**

Sterne's extensive survey of monetary regimes around the world suggests that inflation targeting is a multifaceted creature and that idiosyncratic factors are important for understanding the strengths and limitations of this monetary framework. The final part of this vol-

ume is devoted to the experience of four countries. The decade-long experience of the pioneers of inflation targeting, namely, Chile and New Zealand, allows us to draw interesting conclusions on the implementation, effectiveness, and long-run performance of inflation-targeting economies. This vision is complemented by the study of two successful, though quite different, experiences: Australia, which exemplifies the ability of inflation targeting to deal efficiently with external shocks, and Brazil, which has achieved a record-fast convergence of inflation to international levels without inducing internal disequilibria.

All country studies benefit from detailed insights and observations on the operational aspects of inflation targeting, as perceived by the officials in charge of implementing and running daily operations.

### **3.1 Chile**

After a decade of central bank independence and explicit inflation targets, the results of this monetary framework appear to be satisfactory in Chile. Endemic inflation has finally been defeated, and its current level is both comparable to that of industrial countries and consistent with the central bank's current medium-term annual inflation target of 3 percent, within a 2–4 percent range.<sup>6</sup> The inflation-targeting framework was adapted somewhat to the more steady-state goal of keeping inflation low (as compared to reducing inflation year after year) in September 1999, when the crawling exchange rate band operating since 1985 was abandoned to eliminate a possible source of policy inconsistencies between two (eventually) conflicting objectives.

In reviewing the Chilean experience, the paper by Felipe Morandé in this volume derives interesting lessons regarding the rules-versus-discretion dilemma. When implementing inflation targeting, the authorities face a classic but difficult trade-off: the more they emphasize commitment and reputation building through strict application of the inflation-targeting framework, the less flexibility they have to accommodate shocks that eventually lead to lower output or higher inflation in the short run. Chile's case suggests that in a transition from moderately high to steady-state low inflation rates, emphasizing the nominal anchoring provided by inflation targeting might be justified. Tough

6. Inflation in Chile was high and very volatile. Annual inflation averaged 31 percent between 1890 and 1999, with a standard deviation of 79 percent. In the 1930–99 period, when the state's intervention and relevance within the economy began to grow, average annual inflation reached 45 percent, with a standard deviation of 96 percent.

monetary policy buys credibility at a cheaper long-run price.

However, the application of a strict monetary policy does not automatically imply that low inflation targets should be set immediately. Morandé argues that in the transition from moderately high to low inflation, gradualism in target setting is crucial. In Chile, price stabilization in the 1990s evolved very gradually, taking nine years to reach what was originally considered the long-run objective: an annual inflation rate of 3 percent. Gradualism reflects the fact that in the policy reaction function of the central bank (and perhaps in its objective function as well), both inflation and output stabilization matter.

Faced with a credibility-flexibility trade-off, the policymaker should favor the credibility side when initial conditions are marked by high inflation, a record of poor inflationary performance, and backward-looking indexation. It takes time for people to get used to the notion that stable prices could be the norm rather than the exception. Once inflation reaches a figure close to its expected long-run level, the central bank's improved reputation will allow for more flexibility and the inflation-targeting parameters can be eased up. Two additional challenges appear as the inflation-targeting regime matures. First, the targeting horizon becomes more stringent: the authorities now face the need to control any inflationary pressure within an explicitly defined and rather short period. In the case of Chile, for example, stabilization is now expected to be achieved within two years instead of nine as was the case in the early 1990s. Second, maintaining credibility must be achieved through transparency in the conduct of monetary policy, rather than solely from hitting headline inflation target accurately at the end of the year.

Chile's disinflation program did not cause, on average, significant costs in terms of real variables. On the contrary, the economy showed an impressive record of sustained growth, declining inflation and unemployment, and a healthy external balance. All along, the monetary authorities remained concerned with determining the best way to implement the inflation-targeting regime. As discussed in the paper by García, Herrera, and Valdés, the Chilean monetary authorities confronted a variety of questions, in many cases without the advantage of previous experience. Should the central bank react to unemployment or the output gap (and by how much)? Should it focus on current headline inflation, core inflation, or a forecast of one of them? If a forecast, over what horizon? Should the central bank conduct restrictive monetary policy when faced with negative external shocks (such as oil price shocks, changes in international interest rates, or sovereign risk premiums)? What should be the role of the exchange rate in the monetary policy rule?

To formally assess these questions, García, Herrera, and Valdés present a macroeconometric model that describes the mechanics of the Chilean economy and allows them to calculate the performance of alternative monetary policy rules through stochastic simulation. An interesting contribution of this paper is the development of a methodology for calculating the envelope of efficiency frontiers for different families of policy rules. These frontiers track the trade-off between inflation and output volatility arising from alternative policy rules, given a fixed distribution of exogenous shocks. While similar comparative studies focus on the efficiency of various monetary policy rules (see Levin, Wieland, and Williams, 1999), García, Herrera, and Valdés search for optimal rules from a welfare perspective, highlighting the importance of choosing appropriate loss functions for the central bank.

Following Romer (2000), the authors build and calibrate what might be called an IS-MP model of the Chilean economy, in which the standard LM curve is replaced by a monetary policy rule (MP). The model is simulated stochastically for the following inflation-targeting rules: contemporaneous headline inflation targeting, contemporaneous core inflation targeting, forecast headline inflation targeting, forecast headline inflation targeting with leaning against external financial shocks, and forecast headline inflation targeting without leaning against international financial shocks. The paper shows that it is efficient for monetary policy to take output stabilization into account even if its ultimate goal is inflation control. This is so because the output gap is an important determinant of the acceleration of inflation. A more controversial result is that it may not be efficient to target core inflation, as many countries do, whereas targeting the forecast of headline inflation may be more effective. The reason behind this result is that in economies in which indexation with respect to CPI (headline) inflation is widespread, not responding to CPI inflation (but rather to a subset of those prices) will allow the inflation shock to be propagated to all prices and perpetuated over time through indexation.

### **3.2 New Zealand**

Inflation in New Zealand fell to 2 percent a year in 1991 and remained low and stable within a 0 to 2 percent band throughout the decade, despite significant domestic and external shocks. The stability of inflation in New Zealand is remarkable considering that the country's economic activity, exchange rates, and interest rates fluctuated markedly in the 1990s. The paper by Aaron Drew in this volume reviews the

main questions for monetary policy that arose during this period and the corresponding responses by the Reserve Bank of New Zealand. To provide a quantitative evaluation of these issues, Drew uses the Reserve Bank's economic forecasting and policy system (FPS) model.

Among the most interesting lessons that emerge from the analysis of this experience is the importance of preempting inflationary pressures arising from wealth effects. A feature of the expansion that occurred in New Zealand in the mid-1990s was that consumption growth outstripped income flows, leading to substantial increases in household debt. This was also observed at a national level: net foreign assets to gross domestic product (GDP) deteriorated considerably following a sequence of substantial current account deficits. This behavior can be explained as the response to an expected permanent increase in wealth. The Reserve Bank's inflation projections in the early 1990s did not adequately incorporate this wealth effect on current consumption. Drew's simulation results suggest that had wealth effects been better understood, the duration of the upward pressures on interest and exchange rates might have been noticeably shorter.

Drew's paper also explores the rationale behind the evolution of monetary policy at the Reserve Bank of New Zealand. As the structure of the economy changes, it is likely that the lags in monetary policy transmission will also change, and policy design should take this into account. Starting in the early 1990s, the pass-through from nominal exchange rate fluctuations to local prices became more muted in New Zealand, thereby lengthening the lags of monetary policy transmission. This occurred as the slower transmission mechanism that works through aggregate demand gained importance relative to the quicker exchange rate mechanism. In response, the Reserve Bank tended to extend the forecast horizon that it uses to guide its policy decisions. Coupled with the reduction of both inflation and inflation expectations over the 1990s, the extended policy horizon eventually led to a more flexible inflation-targeting approach in New Zealand. This means that the Reserve Bank now more freely exercises the option of centering its reaction on the more persistent sources of inflationary pressures when deciding on the stance of monetary policy.

### **3.3 Australia**

As the paper by Guy Debelle and Jenny Wilkinson in this volume shows, Australia's recent experience in dealing with the adverse effects of the Asian crisis has provided substantial empirical support to the

claim that inflation targeting can efficiently accommodate inflationary shocks from external sources. An important issue that confronts an inflation-targeting central bank in an open economy is that exchange rate fluctuations can have a significant effect on inflation, mainly through traded goods prices. If the central bank is pursuing a strict inflation target, the policy responses required to offset the effects of exchange rate fluctuations may hurt the nontraded sector of the economy and generate a large degree of output volatility. The conventional advice in this case is to focus the policy reaction on controlling the prices of nontraded goods (Svensson, 1999). Debelle and Wilkinson challenge this point of view. They hold that the monetary reaction to external price shocks should depend on the sources of the shocks, the extent to which aggregate and nontraded inflation are affected by movements in the exchange rate, and whether inflation expectations are forward looking. Debelle and Wilkinson derive an econometric model to evaluate different policy rules in the face of external shocks.

Debelle and Wilkinson find that for the Australian economy, the choice of inflation target does not make much difference on the outcomes of inflation or output variability. This may be explained by the observation that the pass-through from the exchange rate to aggregate inflation is not immediate but delayed in this country. As Debelle and Wilkinson point out, a protracted pass-through has not always been a feature of the process of inflation formation in Australia. Over the last two decades, the response of domestic prices to external price shocks has become more diffused, and inflation formation has grown less vulnerable to specific changes. The main conclusion of Debelle and Wilkinson's paper is that the Australian economy has become more resilient to temporary price-level shocks.

### **3.4 Brazil**

The recent history of inflation in Brazil is perhaps one of the most remarkable cases of the 1990s. In 1994, inflation reached 994 percent a year; by 1998, it had dropped to less than 2 percent. The stabilization program known as the Real Plan was successful in putting an end to Brazil's history of chronic high inflation. However, it did not provide the basis for long-term sound macroeconomic policy, as it led to significant exchange rate misalignments. The initial decision to float the new currency, the real, was later reversed, and the country initiated a fixed exchange rate regime. By early 1999, substantial fiscal imbalances and a lack of policy credibility—compounded by foreign shocks such as the Asian



crisis—put in evidence the gross overvaluation of the Brazilian currency and led to a massive exchange rate attack. The fixed exchange rate regime had to be abandoned, and the Central Bank adopted an inflation-targeting regime, while the government implemented severe fiscal measures.

The paper by Joel Bogdanski, Paulo Springer de Freitas, Ilan Goldfajn, and Alexandre Tombini in this volume examines the recent evolution of monetary policy since the adoption of formal inflation targeting in Brazil. An interesting feature of the new monetary policy regime is its gradual implementation. It was not feasible to adopt formal inflation targets right after the floating, given the uncertainties regarding the post-devaluation inflationary process. At the same time, the adoption of the new monetary framework required institutional changes to ensure operational independence for the Central Bank, as well as sufficient time for consolidating the fiscal policy measures. Consequently, the intention to adopt an inflation-targeting framework was announced immediately, but its formal implementation (including the announcement of the target) was delayed for half a year. The authors provide an interesting discussion of backward price indexation and its effect on the efficiency of monetary policy. Backward price adjustment is widespread in Brazil, and it is particularly important in some administered tariffs for public utilities. These tariffs have a prominent weight in the consumer price index. Using simulations of a small macroeconomic model, the authors show that when the adjustment of these prices is based on past inflation, the degree of inertia increases, which forces the Central Bank to be more restrictive in order to disinflate the economy. This effect, however, diminishes in importance as inflation gets closer to steady-state values.

Another interesting issue that arises in the case of Brazil is how to monitor inflation targeting under agreements with the IMF. In a simple structural model, the authors show that the behavior of relevant macroeconomic variables does not change significantly when the frequency at which monetary policy is evaluated is increased from yearly to quarterly. This does not mean, however, that a central bank should be indifferent between year-end accountability and quarterly accountability. The reason is simple: there can be circumstances in which the probability of meeting the target by year-end is high, but the probability of breaching the tolerance bands in the intermediate quarters is also high. This is a very likely phenomenon when the variables are initially out of equilibrium. Under such circumstances, monitoring quarterly figures can send unnecessary false alarms, introducing unwarranted noise in the conduct of monetary policy by affecting expectations.

Although the Brazilian inflation-targeting regime is quite young, it has already been subjected to large external shocks (high oil prices and increased international financial volatility) and domestic challenges (fiscal fragility, indexation, and financial sector weakness) that have tested its robustness. Bogdanski, Freitas, Goldfajn, and Tombini make a good case that inflation targeting in Brazil is here to stay.

#### **4. CONCLUSIONS**

The main conclusion that can be drawn from the studies in this volume is that there is substantial evidence in favor of inflation targeting as the guiding framework for monetary policy. Along with the theoretical considerations that support inflation targeting, its success in controlling inflation without incurring large costs of output volatility is evident from both cross-national and country-case studies. However, this does not imply that inflation targeting is a sufficient condition for success: as with any other monetary policy regime, its success depends on the consistency and credibility with which it is applied. Erroneous or irresponsible fiscal, exchange rate, and monetary policies will condemn to failure any monetary regime, and inflation targeting is no exception.

Given the basic role of policy credibility and inflation expectations in achieving the goal, an important merit of inflation targeting is that it forces the Central Bank to communicate its decisions effectively and transparently to the public and to be accountable for its actions. By diminishing the asymmetries of information between the Central Bank and other economic agents, good communication and transparency of monetary policy warn the public about inconsistent policies and diminish the uncertainty about future actions. Inflation targeting has achieved price stability, which is now deemed to be the central concern of monetary policy, while also providing for output stabilization and helping countries deal with the turbulence of international markets.

This volume highlights the fact that many questions do not yet have a satisfactory answer. This is partly due to the broadness in the definition of inflation targeting. There is agreement on its basic features but not on the details of its actual implementation. These details can make the difference in the success of the monetary regime. The implementation of inflation targeting will remain a complex issue, given that its operational aspects must be chosen on a country-by-country basis, with only basic guidelines to be applied cross-nationally. Thus the selection of the actual price inflation to be targeted,

the policy time horizon, and the weight given to output gaps and other variables in the Central Bank's reaction function depend to a large extent on the specific characteristics of each economy, including the types of shocks that it faces.

Although inflation targeting is far from a magical solution, it is a reliable monetary alternative for countries that have the political willingness and technical capacity to adopt and communicate responsible macroeconomic policies. More countries can be expected to adopt inflation targeting in the coming years, most likely in connection with a policy of flexible exchange rates. The specific implementation of this monetary regime will continue to be a source of future research.

## REFERENCES

- Almeida, A., and C. Goodhart. 1998. "Does the Adoption of Inflation Targets Affect Central Bank Behaviour?" *Banca Nazionale del Lavoro Quarterly Review* 51(204), March Supplement: 19–107.
- Bernanke, B. S., and others. 1999. *Inflation Targeting: Lessons from the International Experience*. Princeton University Press.
- Calvo, G. 1983. "Staggered Prices in a Utility-Maximizing Framework." *Journal of Monetary Economics* 12(3): 383–98.
- Clarida, R., J. Galí, and M. Gertler. 1999. "The Science of Monetary Policy: A New Keynesian Perspective." *Journal of Economic Literature* 37 (December): 1661–707.
- Evans, G. W., and S. Honkapohja. 1999. "Learning Dynamics." In *Handbook of Macroeconomics*, edited by J. B. Taylor and M. Woodford. Amsterdam: North-Holland.
- . 2001. *Learning and Expectations in Macroeconomics*. Princeton University Press.
- Fry, M. J., and others. 2000. "Key Issues in the Choice of Monetary Policy Framework." In *Monetary Frameworks in a Global Context*, edited by L. Mahadeva and G. Sterne. London: Routledge.
- Levin, A., V. Wieland, and J. C. Williams. 1999. "Robustness of Simple Monetary Policy Rules under Model Uncertainty." In *Monetary Policy Rules*, edited by J. B. Taylor. Cambridge, Mass.: National Bureau of Economic Research.
- Masson, P. R., M. A. Savastano, and S. F. Sharma. 1997. "The Scope for Inflation Targeting in Developing Countries." Working Paper 97/130. Washington: International Monetary Fund (IMF).
- Mishkin, F. S. 2000. "Inflation Targeting in Emerging Market Countries." Working Paper 7618. Cambridge, Mass.: National Bureau of Economic Research.
- Mishkin, F. S., and M. A. Savastano. "Monetary Policy Strategies for Latin America." Working Paper 7617. Cambridge, Mass.: National Bureau of Economic Research.
- Morandé, F., and K. Schmidt-Hebbel. 1999. "Inflation Targets and Indexation in Chile." Santiago: Central Bank of Chile. Mimeographed.
- Romer, D. 2000. "Keynesian Macroeconomics without the LM Curve." *Journal of Economic Perspectives* 14(2): 149–69.
- Svensson, L. E. O. 1997. "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets." *European Economic Review* 41 (June): 1111–46.

- . 1999. “Price Level Targeting vs. Inflation Targeting: A Free Lunch?” *Journal of Money, Credit and Banking* 31 (August), 277–95.
- Walsh, C. E. 1995. “Optimal Contracts for Central Bankers.” *American Economic Review* 76 (March): 150–67.

