

A DECADE OF INFLATION TARGETING IN THE WORLD: WHAT DO WE KNOW AND WHAT DO WE NEED TO KNOW?

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The emergence of inflation targeting over the last ten years represents an exciting development in central banks' approach to the conduct of monetary policy. After initial adoption by New Zealand in 1990, a growing number of central banks in industrial and emerging economies have opted for inflation targeting, and many more are considering future adoption of this new monetary framework.

A full decade of inflation targeting in the world offers lessons on the design and implementation of inflation-targeting regimes, the conduct of monetary policy, and country performance under inflation targeting. In section 1, this paper briefly reviews the main design features of eighteen inflation targeting experiences, statistically analyzes whether countries under inflation targeting are structurally different from industrialized countries that do not target inflation, and considers the existing evidence on the success of inflation targeting. The interaction of inflation targeting design features and the conduct of monetary policy during the transition to low inflation are tackled in section 2. The paper then focuses on unresolved issues in the design and implementation of inflation targeting and their relation to the conduct of monetary policy (section 3). Brief conclusions close the paper.

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1. WHAT DO WE KNOW ABOUT INFLATION TARGETING AFTER A DECADE OF WORLD EXPERIENCE?

To discuss what we know about the inflation-targeting experience, we address three questions: (1) who targets inflation and how? (2) are inflation targeters different? and (3) is inflation targeting a success?

1.1 Who Targets Inflation and How?

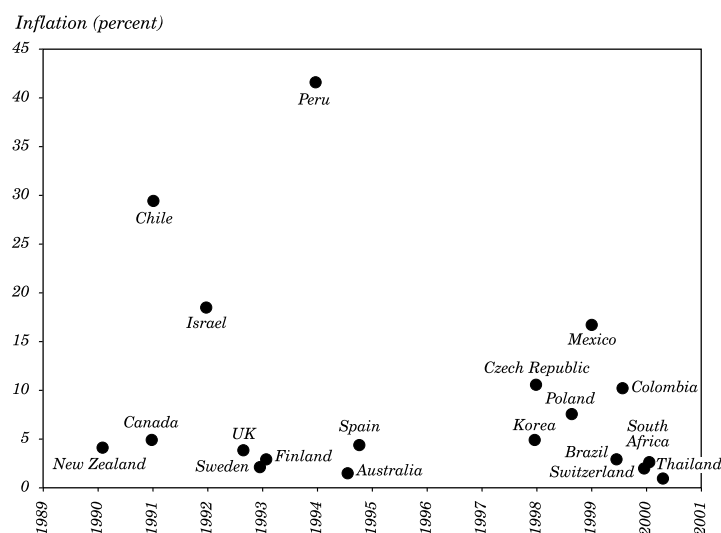
Inflation targeting started a decade ago, with public announcements of inflation targets in New Zealand and Chile. According to our count, nineteen countries have implemented inflation targeting as of November 2000. They include industrial and emerging economies, transition and steady-state inflation targeters, semi and full-fledged targeters, early and recent starters, and current and former targeters.¹ Figure 1 depicts adoption dates and initial inflation rates (at year of adoption) for the nineteen-country sample.²

We introduce two country groups as the basis for our empirical analysis conducted of the 1990s, a sample of inflation targeters and a control group of non-targeters (see table 1). The first sample, inflation targeters, comprises a heterogeneous group of eighteen industrial and emerging economies: Australia, Brazil, Canada, Chile, Colombia, the Czech Republic, Finland, Israel, Korea, Mexico, New Zealand, Peru, Poland, South Africa, Spain, Sweden, Thailand, and the United Kingdom. (Finland and Spain dropped out of this group when they relinquished monetary policy on adopt-

1. Classifying country cases into inflation-targeting and other monetary regimes involves subjective choices for two reasons. First, there is lack of full agreement on the main conditions and features of inflation targeting and how they apply during transition to low inflation—an issue that we discuss below. Second, some countries have simultaneously used inflation targets and other nominal anchors (the exchange rate or a monetary aggregate or both), particularly in their early years of inflation targeting. IMF (2000), Mahadeva and Sterne (2000), and Sterne (2000) discuss and present comprehensive country classifications of monetary regimes. The different classification criteria is reflected in the different country samples of recent cross-country studies of inflation-targeting experiences. See, for example, Bernanke and others (1999); Schaechter, Stone, and Zelmer (2000); Corbo, Landerretche, and Schmidt-Hebbel (in this volume); Corbo and Schmidt-Hebbel (2000).

2. 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 September 1990). The initial inflation level is defined as the year-on-year consumer price index (CPI) inflation rate of the last quarter before the first month of inflation targeting (for example, the fourth quarter of 1990 in the case of Chile).

Figure 1. Inflation at Adoption of Inflation Targeting in Nineteen Countries, 1988-2000^a



Source: Authors' calculations, based on data from IMF, *International Financial Statistics*, various issues; country sources; Schaechter, Stone, and others (2000).

a. Annual inflation rates are those observed one quarter before adopting inflation targeting.

ing the euro in 1999.³ The second sample is a control group of nine industrial economies that were not inflation targeters during the 1990s: Denmark, France, Germany, Italy, Japan, Norway, Portugal, Switzerland, and the United States. Among these, Germany and Switzerland had explicit monetary targets in place throughout most of the 1990s and could thus be classified as implicit inflation targeters (as argued by Bernanke and others, 1999).⁴ Japan and the United States had no explicit targets, and the remaining five European countries targeted their exchange rate to the deutsche mark before adopting the euro in 1999.⁵

3. The sample includes eighteen inflation targeters, as opposed to the nineteen listed in figure 1, because Switzerland did not adopt inflation targeting until 2000.

4. Germany adopted the euro in early 1999 and Switzerland adopted explicit inflation targeting in 2000.

5. The use of this control group of high-income industrial economies with alternative monetary frameworks in place reflects our objective of linking the adoption of inflation targeting with structural features, as observed in the world sample of eighteen industrial and higher-middle-income countries. Defining a control group of high-performing economies with similar features to those that have adopted inflation targeting makes it statistically more difficult to identify significant determinants of the choice of inflation targeting than if we had chosen a control group including developing countries that do not target inflation.

Table 1. Inflation Targeters and Nontargeters

<i>Inflation targeters</i>		<i>Nontargeters</i>
Australia	Mexico	Denmark
Brazil	New Zealand	France
Canada	Peru	Germany
Chile	Poland	Italy
Colombia	South Africa	Japan
Czech Republic	Spain	Norway
Finland	Sweden	Portugal
Israel	Thailand	Switzerland
Korea	United Kingdom	United States

Inflation targeters exhibit some commonalities and many differences in the preconditions, target design, and operational features of their inflation-targeting regimes. Four stylized facts emerge from country experiences and features, as summarized in table A1 in the appendix. First, full-fledged inflation targeting is based on five pillars: absence of other nominal anchors, an institutional commitment to price stability, absence of fiscal dominance, policy instrument independence, and policy transparency and accountability. While the second through the fifth of these pillars are necessary for effective conduct of monetary policy under any regime, they are particularly important prerequisites for effective policy under inflation targeting. The success of inflation targeting depends strongly on high market credibility in the central bank's resolve and ability to put into place policies geared at meeting the target, and credibility is fostered by the five institutional pillars.

Second, the adoption of inflation targeting ranges from evolutionary to revolutionary. Many countries adopted inflation targeting without satisfying one or more of the above conditions. For example, Chile and Israel targeted the exchange rate during most of the 1990s (as Israel still does today). The Bank of England started inflation targeting well before attaining instrument independence. Most countries adopted inflation targeting before achieving high levels of policy transparency (including the publication of inflation reports, inflation projections, and monetary policy meeting minutes) and full accountability, and some countries, including Colombia, Israel, Korea, Mexico, Peru, and South Africa, still do not publish inflation forecasts. On the other extreme is Brazil, who adopted full-fledged inflation targeting right from the start.

Country experience suggests that the adoption of inflation targeting in the 1990s represented a monetary policy learning process. There is now a broad consensus about the conditions that should be in place

for effective full-fledged inflation targeting. These prerequisites were less obvious in the first half of the 1990s, however, when early inflation targeters perfected their frameworks by learning from their own and the other inflation targeters' cumulative experience.

Third, inflation at the moment of adopting an inflation targeting framework ranges from moderately high to very low. Some countries adopted inflation targeting when their inflation rates were well above steady-state levels, using inflation targeting as the main device to build up credibility, bring down inflation expectations, and pursue a path of convergence to low, stationary inflation. This is the case of early inflation targeters in emerging countries that started at initial inflation rates of 15 to 45 percent (Chile, Israel, Peru) and subsequent emerging countries that adopted inflation targeting when initial inflation was in the range of 7 to 20 percent (the Czech Republic, Colombia, Mexico, Poland). This stands in contrast to all industrialized and some emerging inflation targeters that started at initial inflation close to stationary low levels.

Multi-year transitions toward steady-state inflation pose serious challenges and difficulties to inflation targeting, including the need for announcing annual inflation targets (that are much harder to meet) under conditions of high inflation expectations and limited policy credibility. We discuss the issues related to transition to low inflation in section 2.2 below.

Fourth, inflation targeters vary widely with regard to implementation features, including the target price index, target width, target horizon, escape clauses, accountability of target misses, goal independence, and overall transparency and accountability of the conduct of policy. Some of these differences can be attributed to country variation in institutions and history; others reflect the differences between inflation targeting in transition to low inflation versus inflation targeting at low inflationary levels. Additional differences in the design features of inflation targeting stem from divergent views among policymakers and academics about how monetary policy under inflation targeting should be conducted in conditions of low inflation.

1.2 Are Inflation Targeters Different?

Are the structural conditions and macroeconomic performance of countries that adopt inflation targeting different from those of industrial countries that do not target inflation? To tackle this question we compare the sample of eighteen inflation targeters to the

control group of nine industrialized nontargeters, focusing on the relation between having an inflation-targeting framework in place and exhibiting a set of structural, institutional, and macroeconomic features. The empirical analysis presented here is necessarily preliminary because (as discussed in footnote 1) it is not always easy to decide whether a country should be classified as engaging in inflation targeting.⁶ Furthermore, determining the exact date at which an inflation-targeting regime was adopted is often quite difficult. Officials at many of the central banks we consulted give adoption dates that are earlier than those given by outsiders (see, for example, Bernanke and others, 1999). The uncertainty of dating often follows from the fact that inflation targeting is adopted gradually, making the exact date of adoption difficult to determine.

Our data set consists of annual variables for twenty-seven countries over ten years (1990–99). The focus is on a discrete variable for an inflation-targeting regime, which takes a value of 1 when an inflation-targeting regime is in place or 0 when an alternative monetary regime is in place, together a set of variables that could be associated with the choice of an inflation-targeting regime.⁷ The latter variables include measures of the use of alternative nominal anchors (a measure of exchange rate band width and a monetary target dummy), structural conditions (trade openness), measures of central bank independence (formal independence, instrument independence, and goal independence), and macroeconomic variables (the inflation rate and the fiscal surplus ratio to GDP).

Table 2 reports cross-country and panel statistics and correlations for inflation targeting and related variables. The data reflect large variation in all variable categories across countries and over time in our sample of twenty-seven countries. Panel correlations are sometimes very different from cross-country correlations, including cases changing signs. This is likely the result of the noise encountered in annual country data; we therefore focus on cross-country correlations.

6. For example, although the central banks of Peru and Colombia announce inflation targets, their monetary policy frameworks do not contain many crucial features of an inflation-targeting regime (Mishkin and Savastano, 2000). Korea is classified as an inflation targeter because it announces an inflation target, yet it appears to have pursued a de facto exchange rate peg in the first two years of its inflation-targeting regime, which is inconsistent with inflation targeting. Dropping these three countries from the sample does not appreciably affect the empirical results.

7. Similar definitions are used for other discrete variables used here (see the appendix for variable definitions and data sources).

Table 2. Descriptive Statistics and Simple Correlations for Cross-Section and Panel Samples, 1990–99^a

<i>Statistic</i>	<i>IT</i>	<i>Inf</i>	<i>Open</i>	<i>Fiscal</i>	<i>BW</i>	<i>MT</i>	<i>CBFI</i>	<i>CBGI</i>	<i>CBII</i>
<i>Cross-section statistics</i>									
Mean	0.29	0.11	0.50	−0.02	0.56	0.25	0.30	0.30	0.59
Standard deviation	0.46	0.37	0.19	0.04	0.45	0.43	0.46	0.46	0.49
Maximum	1.00	5.55	0.85	0.06	1.00	1.00	1.00	1.00	1.00
Minimum	0.00	0.00	0.03	−0.16	0.00	0.00	0.00	0.00	0.00
<i>Panel statistics</i>									
Mean	1.00	0.97	0.85	0.06	1.00	1.00	1.00	1.00	1.00
Standard deviation	0.00	0.00	0.03	−0.16	0.00	0.00	0.00	0.00	0.00
Maximum	0.30	0.08	0.50	−0.02	0.58	0.26	0.31	0.30	0.61
Minimum	0.46	0.15	0.19	0.04	0.45	0.44	0.46	0.46	0.49
<i>Variable correlations: panel/cross-section</i>									
<i>IT</i>	1.00	−0.11	0.35	0.10	0.24	−0.29	−0.03	−0.07	0.23
<i>Inf</i>	−0.20	1.00	−0.10	−0.17	−0.01	−0.04	−0.10	−0.12	−0.18
<i>Open</i>	0.25	−0.42	1.00	0.16	−0.08	−0.13	−0.11	0.08	−0.03
<i>Fiscal</i>	0.21	−0.22	0.27	1.00	−0.01	0.11	0.12	0.15	0.19
<i>BW</i>	0.02	−0.07	−0.32	0.16	1.00	0.08	−0.01	0.01	0.14
<i>MT</i>	−0.45	0.22	0.07	0.19	0.26	1.00	0.04	0.02	−0.01
<i>CBFI</i>	−0.22	−0.08	−0.09	0.25	−0.22	0.09	1.00	0.68	0.51
<i>CBGI</i>	−0.13	−0.23	−0.01	0.22	−0.35	−0.18	0.79	1.00	0.50
<i>CBII</i>	0.30	−0.15	0.18	0.35	−0.06	−0.03	0.40	0.52	1.00

Source: Authors' calculations.

a. The panel sample comprises ten years of data (1990–99) for each of the twenty-seven countries identified in the text. Panel sample correlations are reported in the upper-half matrix triangle, while cross-section correlations are reported in the lower-half matrix triangle. Standard errors are 0.06 for the panel sample and 0.19 for the cross section.

Having inflation targeting in place is positively and significantly correlated with no individual variable and negatively and significantly correlated only with monetary growth targets (*MT*). Inflation targeting is positively and not significantly correlated with trade openness (*Open*), the ratio of the fiscal surplus to GDP (*Fiscal*), the width of the exchange rate band (*BW*), and instrument independence of the central bank (*CBII*). It is negatively and not significantly correlated with normalized inflation (*Inf*), formal independence of the central bank (*CBFI*), and goal independence of the central bank (*CBGI*).⁸

Next we introduce a multivariate probit model for the likelihood of having an inflation-targeting regime in place, based on the observation of the variables identified above. The model specifies the probability of having an inflation-targeting regime in place ($\Pr(IT \mid \dots)$) as a function of these variables:

$$\Pr(IT \mid \dots) = f(\text{Inf}, \text{Open}, \text{Fiscal}, \text{BW}, \text{MT}, \text{CBFI}, \text{CBGI}, \text{CBII})$$

Expected coefficient signs are positive for *Fiscal*, *BW*, and the three measures of central bank independence, negative for *MT*, and ambiguous for *Inf* and *Open*.

Before turning to the results, we note that caution should be exercised in the causal interpretation of this equation. While certain structural features may be exogenous to the choice of inflation targeting, it is very likely that adoption of inflation targeting requires—and thus contributes to—renouncing the use of other nominal targets, improving macroeconomic performance (such as reducing inflation and improving the fiscal stance), and strengthening central bank independence. Potential reverse causation means that the empirical results should be interpreted carefully.

The full-panel probit regression produced noisy results. We therefore report cross-country results only, based on country decade-averages for each variable, including the dependent variable, that is, the choice of an inflation-targeting regime. We start by discussing the full-sample results in the first column of table 3.

Inflation targeting is positively and significantly associated with the level of normalized inflation. This result reflects the fact that inflation targeting has been adopted by countries that, on average, exhibited higher levels of inflation than have industrial nontargeters. Indeed, most emerging countries adopted inflation targeting as a device for bringing inflation down to low, single-digit levels, and most inflation targeters—both

8. There are only a few large positive or negative correlations among variables other than inflation targeting. In particular, the three measures of central bank independence are highly and positively correlated with each other.

Table 3. Empirical Results for the Likelihood of Implementing an Inflation-Targeting Regime

	<i>Full sample</i> (27 countries)		<i>Restricted sample 1^b</i> (24 countries)		<i>Restricted sample 2^c</i> (24 countries)	
<i>Variable</i>	(1)	(2)	(3)	(4)	(5)	(6)
<i>Cons.</i>	-9.7 (8.2)	-5.8* (2.2)	-13.4*** (7.5)	-5.7* (2.0)	-12.5 (8.2)	-4.7** (2.1)
<i>Inf</i>	45.2*** (25.2)	33.6* (12.3)	69.2** (28.5)	43.7* (13.5)	69.1** (27.8)	46.9* (15.7)
<i>Open</i>	11.5*** (6.7)	7.6** (3.0)	11.4** (5.0)	7.1* (2.7)	10.5*** (6.0)	5.3*** (3.1)
<i>Fiscal</i>	-20.4 (45.1)		-49.7 (45.7)		-46.7 (46.8)	
<i>BW</i>	0.3 (3.0)		3.4 (3.2)		3.2 (3.3)	
<i>MT</i>	-12.9** (5.7)	-9.3* (3.0)	-13.4* (4.3)	-9.6* (2.8)	-12.5** (5.3)	-7.9* (3.0)
<i>CBFI</i>	2.2 (1.9)		1.3 (1.7)		1.0 (2.0)	
<i>CBGI</i>	-14.7* (5.4)	-9.6* (3.2)	-11.3* (2.6)	-9.8* (2.8)	-10.5* (3.8)	-8.2* (3.1)
<i>CBII</i>	12.0** (6.0)	8.5* (2.7)	11.9* (4.2)	8.4* (2.3)	11.0** (5.1)	6.7** (2.7)
Wald chi-squared	9.8	10.8	23.0	13.7	18.3	11.9
Pseudo R^2	0.61	0.57	0.63	0.57	0.63	0.58
No. observations	27	27	24	24	24	24

Source: Authors' calculations.

* Statistically significant at the 1 percent level.

** Statistically significant at the 5 percent level.

*** Statistically significant at the 10 percent level.

a. Probit regressions for 1990–99 cross-country sample. Standard errors for the full and restricted samples are reported in parentheses.

b. Restricted sample 1 excludes three countries with very high inflation in the early 1990s (Brazil, Peru, and Poland).

c. Restricted sample 2 excludes three countries that may not be classified as inflation targeters (Colombia, Korea, and Peru).

emerging and industrial countries—made major progress in reducing inflation either during or shortly before or after adopting inflation targeting (Bernanke and others, 1999; Corbo, Landerretche, and Schmidt-Hebbel, in this volume). Countries that trade relatively more (because they are more open or smaller than nontargeters) are significantly more likely to adopt inflation targeting, while most large industrial countries are not inflation targeters.

Inflation targeting is negatively associated with the ratio of fiscal surplus to GDP. This result again follows from having a control group of nontargeters comprised by nine industrial countries that, on average, show a stronger fiscal position than the eighteen inflation targeters. This association does not attain conventional significance levels, however.

Inflation targeting is positively but not significantly associated with the width of the exchange rate band. As expected, inflation targeting is negatively and significantly associated with the adoption of monetary growth targets, reflecting the incompatibility of having explicit monetary and inflation targets in place at the same time.

Finally, the likelihood of having inflation targeting in place is associated positively with the formal independence of the central bank (although its coefficient is not significant at conventional levels) and significantly with instrument independence. However, inflation targeting is negatively and significantly associated with central bank goal independence. The latter result suggests that when central banks have the freedom to determine their target levels, they are more likely to be operating under exchange rate or monetary-growth anchors than under inflation targets. Inflation targeting is thus associated with surrendering goal independence to governments. The second column of table 3 reports a regression that drops the less significant variables. All five remaining regressors become more significant.

The preceding results are based on the full sample of twenty-seven countries, which includes three countries with very high inflation rates in the early 1990s, namely Brazil, Peru, and Poland. Dropping the three from the sample yields regression results for a restricted sample (reported in columns 3 and 4 of table 3). Coefficient signs, values, and significance levels change little from those reported for the full sample. Thus our results are robust to exclusion of high-inflation outliers. We perform one more robustness test by dropping Colombia, Korea, and Peru from the sample. As discussed in footnote 5, there are some questions about whether these three countries should be classified as inflation targeters. The regression results for this alternative restricted sample, reported in columns 5 and 6 of table 3, also confirm our full-sample results.

1.3 Is Inflation Targeting a Success?

Many analysts argue that the structural features and macroeconomic performance of inflation-targeting countries differ in some respects from those of countries that have adopted alternative monetary

frameworks.⁹ Others find that some industrial countries without formal inflation targets (such as Germany before the euro, Switzerland before 2000, and the United States) pursue a monetary policy that is close to explicit inflation targeting (Mishkin, 1999a). This raises the question of whether inflation targeting is observationally equivalent to alternative monetary frameworks with regard to the conduct of policy and its results. To address this issue, we review the recent empirical literature evaluating a decade of worldwide experience with inflation targeting. Far from attempting a comprehensive evaluation, we identify a few tentative conclusions that provide a partial view of the relative success of inflation targeting.¹⁰

Central bank independence and inflation targeting are mutually reinforcing. Country experience in the 1990s suggests that extending larger degrees of independence to central banks often supports the adoption of inflation targeting. In some countries inflation targeting was adopted after granting formal and instrument independence to central banks, as was the case in New Zealand and Chile. In other countries, like the United Kingdom, instrument independence came after inflation targeting. Our empirical results confirm the positive association for formal and instrument independence, but not for goal independence.

Communication, transparency, and accountability are improved under inflation targeting. Adoption of inflation targeting has typically been followed (and sometimes preceded) by major improvement in central bank communication with the public and markets and by significant upgrade in monetary policy transparency. Most inflation targeters publish inflation reports, monetary policy statements, the minutes of central bank board meeting, central bank models, and inflation forecasts (see table A1). This major communication effort on the part of central banks is arguably more important under inflation targeting than under alternative monetary regimes, considering the central role played by policy credibility and inflation expectations in attaining inflation targets (Bernanke and others, 1999).

9. See, for example, Bernanke, and others (1999); Cecchetti and Ehrmann (2000); Schaechter, Stone, and Zelmer (2000); Corbo and Schmidt-Hebbel (2000); Corbo, Landerretche, and Schmidt-Hebbel (in this volume).

10. Inferences about inflation targeters' success are still highly tentative, in view of the ambiguities surrounding the sample definitions for inflation-targeting countries, the possible systemic equivalence of some features of inflation targeting with those of alternative monetary regimes, the relevant potential and counterfactual selection bias, and mutual causation of inflation-targeting adoption and country performance.

Inflation targeting helps countries reduce inflation below the levels they would have attained in the absence of inflation targeting. However, it does not yield inflation below the levels attained by industrial countries that have adopted other monetary regimes, as shown by Bernanke and others (1999) and our own results above. The adoption of inflation targeting is typically associated with a major up-front investment in inflation reduction (Corbo, Landerretche, and Schmidt-Hebbel, in this volume).

Inflation targeting has been tested favorably by adverse shocks. With the exception of the emerging country financial crises of 1997–99, the 1990s were very favorable to the world economy, led by the largest U.S. expansion in the post–World War II era. Many observers therefore argue that inflation targeting is as yet untested, since no major adverse shocks have strained the achievement of low, stable inflation in many inflation targeters. This is incorrect, however. Many inflation targeters are small, open economies that were subject to severe shocks in the aftermath of the 1997 Asian crisis, in contrast to the large industrial nontargeters that were unaffected by these shocks. The combined adverse financial and terms-of-trade shocks suffered by Australia, Chile, Israel, and New Zealand, among other inflation targeters, led to major exchange rate devaluation in these countries and thus significantly tested the attainment of their inflation targets. They weathered this storm successfully, by recording little pass-through from devaluation to inflation. The 1999–2000 oil price shock represented the second test for oil-importing inflation targeters, including the countries mentioned above as well as Brazil, the Czech Republic, and Poland. Significant increases in imported inflation—through both energy prices and exchange rate devaluation—could put these countries’ targets in jeopardy. The effects of the oil shock on core inflation appear to have been minor, however, and only temporary and modest increases in headline inflation have been observed.

Inflation targeting has helped reduce sacrifice ratios and output volatility in countries that have adopted inflation targeting, bringing them to levels close to those in industrial nontargeters. Bernanke and others (1999) find that inflation targeting does not make disinflation less costly in industrialized countries, as it does not alter sacrifice ratios and Phillips curves. Corbo, Landerretche, and Schmidt-Hebbel (in this volume), however, examine new evidence for a larger sample of inflation targeters and nontargeters. They conclude that sacrifice ratios have declined in emerging countries after the adoption of inflation targeting and that output volatility has fallen in both emerging and industrialized economies after adopting inflation targeting, reaching

levels that are similar to (and sometimes lower than) those observed in industrial countries that do not target inflation.

Inflation targeting may help bring down and guide inflation expectations and deal better with inflation shocks. According to Almeida and Goodhart (1998) and Bernanke and others (1999), inflation targeting does not reduced inflation expectations quickly, but rather does so gradually over time. Corbo, Landerretche, and Schmidt-Hebbel (in this volume) report that inflation forecast errors, based on country vector autoregression (VAR) models, fall consistently with the adoption of inflation targeting, approaching the low levels prevalent in nontargeting industrial countries. They also find that inflation persistence declined strongly among targeters in the 1990s, which suggests that inflation targets strengthen forward-looking expectations on inflation and thus weaken the weight of past inflation.

Monetary policy under inflation targeting is flexible inasmuch as it responds symmetrically to inflation shocks and accommodates temporary inflation shocks that do not affect the medium-term attainment of the target. Inflation targeters are not inflation nuts, as King (1996) holds, because they typically react symmetrically to positive and negative shocks, pursue disinflation gradually, and react to temporary output shocks. Cecchetti and Ehrmann (2000) show that output deviations have a positive weight in all objective functions of inflation targeters.

Monetary policy is more clearly focused on inflation under inflation targeting and may be toughened by inflation targeting. Central bank mandates to focus on price stability tend to be strengthened by inflation targeting (Bernanke and others, 1999). Cecchetti and Ehrmann (2000) provide evidence that central banks' aversion to inflation shocks (relative to output shocks) is toughened with the adoption of inflation targeting, a conclusion that is partly confirmed by Corbo, Landerretche, and Schmidt-Hebbel (in this volume).

We conclude that inflation targeting has proved to be a very successful new monetary framework, both in comparison to inflation targeters' preceding experience and relative to alternative monetary regimes adopted by a control group of highly successful industrial countries that pursued other monetary arrangements in the 1990s.

2. REVISITING OPERATIONAL DESIGN ISSUES

The previous section outlined some elements of the operational design of inflation-targeting regimes. Four design issues deserve detailed discussion: the interaction of the length of the target horizon, the width

of the target range, and the use of escape clauses; inflation targeting during the transition from high to low inflation; the designation of who should set the medium-term inflation target; and the role of the exchange rate and other asset prices. We discuss each of these in turn.

2.1 Interaction of the Target Horizon, Width of Target Range, Escape Clauses, and Choice of Core Inflation Targets

A central problem for the design of inflation-targeting regimes is that monetary policy affects the economy and inflation with long lags. For countries that have already achieved low inflation, the lags are estimated to be quite extended, at two years or even longer. Shorter time horizons are quite common in inflation-targeting regimes, however, which frequently specify annual inflation targets.

Using a time horizon that is too short can lead to a controllability problem, particularly when combined with a narrow target range of an inflation. The result may be frequent misses of the inflation target even when monetary policy is being conducted optimally. This occurred in New Zealand in 1995, when the Reserve Bank overshot its inflation target range of 0 to 2 percent by a few tenths of a percentage point in the one year horizon. This overshoot made the governor subject to dismissal under the central banking law, even though it was widely recognized that the overshoot was likely to be short-lived and that inflation would soon fall, as it later did. Although the breach of the inflation target range did not result in a substantial loss of credibility in the New Zealand case, under other circumstances or in an emerging market country, such an event could result in a serious loss of credibility for the central bank.

Combining too short a horizon with a narrow target range can also lead to instrument instability, in which excessive swings in the monetary policy instruments occur when the central bank tries to hit the inflation target. This problem can be especially serious in a small, open economy, where it results in greater reliance on manipulating the exchange rate to achieve the inflation target because exchange rate movements have a faster impact on inflation than do interest rates. The annual target in New Zealand and the 2 percentage point range for the inflation target were important factors in the Reserve Bank emphasis on exchange rates in the conduct of monetary policy. This resulted in overly tight monetary policy at the end of 1996—the overnight cash rate reached 10 percent because of fears that inflation would rise above

the target range in 1997. Another consequence of New Zealand's overly tight monetary policy was that it contributed to the recession in 1997 and 1998, which was made worse by the negative terms-of-trade shock resulting from the East Asian crisis. Too short a horizon and too narrow a range can thus induce undesired output fluctuations, as well.

Central banks can take four routes to avoid controllability and instrument instability problems in an inflation-targeting regime. First, they can build in formal escape clauses in their inflation-targeting regime to allow for misses of the inflation target under particular circumstances. Second, they can target core inflation rather than headline inflation. Third, they can widen the range of the inflation target. Fourth, they can set inflation targets for several years ahead.

Only New Zealand has incorporated formal escape clauses into its inflation-targeting regime by allowing for misses of the inflation target range when there are significant changes in the terms of trade, changes in indirect taxes that affect the price level, or supply shocks such as a major livestock epidemic. Note that the New Zealand escape clauses are designed to deal exclusively with supply shocks because they are the only shocks that can be readily identified as being exogenous. Aggregate demand shocks may be exogenous, but they are just as likely to be induced by monetary policy. Allowing central banks to use them to justify misses of an inflation target would likely destroy central bank credibility and undermine the inflation-targeting regime. Thus formal escape clauses, although providing some increased flexibility, are only able to partially cope with the controllability and instrument instability problems from too short a horizon and too narrow a target range.

The second alternative for coping with supply shocks is to target a core inflation measure that excludes items such as food and energy from the price index, as they are especially subject to supply shocks. Using a core inflation measure has the advantage that it involves no discretion after a supply shock occurs. The use of such discretion, as in the case of escape clauses, can lead the public to question the central bank's honest commitment to achieving the inflation targets. Instead, which items are to be excluded from the construction of the inflation measure are decided *ex ante*. This is probably why targeting core measures of inflation has been used more widely than the specification of escape clauses.

Like escape clauses, however, targeting core inflation measures has the disadvantage of dealing only with instrument instability and controllability problems arising from supply shocks, and not those stemming from aggregate demand shocks. Furthermore, core inflation measures are not as well understood by the public as headline inflation

measures, thus making core inflation targets a somewhat weaker communication vehicle than headline inflation targets. Core inflation measures also exclude items that consumers care a lot about, particularly poorer consumers for whom food and energy form a larger share of their budget. If these items are excluded from the targeted inflation measure, the central bank may be subjected to criticisms that it does not care sufficiently about poorer members of society.

The third option, widening the target range, is similarly not, by itself, a solution to controllability and instrument instability problems. Estimates of the irreducible uncertainty around an inflation target with a one-year horizon are on the order of 5 percentage points, although over time, success with inflation targeting might decrease the volatility of inflation expectations and hence inflation.¹¹ Choosing such a wide range for the inflation target is highly problematic because it will likely confuse the public about the central bank's intentions. The resulting high ceiling for the range is likely to make the commitment to low inflation less clear-cut, thereby reducing the credibility of monetary policy. This type of problem occurred in the United Kingdom in 1995, when inflation exceeded the target midpoint of 2.5 percent by over one percentage point, but without breaching the 4 percent ceiling. This gave the Chancellor of the Exchequer cover to resist the Bank of England's recommendation for tightening of monetary policy (see Bernanke and others, 1999).

Finally, lengthening the target horizon to correspond more closely to the lags in the effect of monetary policy on inflation would seem to be the best solution to the problems of controllability and instrument instability. Given the problems encountered in New Zealand 1997 and 1998, the Reserve Bank of New Zealand now emphasizes a target horizon of six to eight quarters in their discussion of monetary policy (see Sherwin, 1999; Drew and Orr, 1999). Other central banks, including the Bank of Canada and the Bank of England, have for a long time, emphasized a target horizon of closer to two years; this has recently become a feature of the Chilean targeting regime, as well (Central Bank of Chile, 2000b).

As Svensson (1997) emphasizes, however, if central banks are concerned about output fluctuations and include a weight on output fluctuations in their loss function, then the inflation forecast should approach the long-run inflation target gradually. This implies that a horizon even longer than the policy lags might be appropriate for the inflation target. Such a long horizon for the inflation target may create problems for an inflation-targeting regime in that the long period be-

11. See, for example, Haldane and Salmon (1995); Stevens and Debelle (1995).

fore there is verification of hitting the target may weaken credibility, particularly if credibility of the central bank is not high to begin with. One possible way to deal with this is to recognize that the optimal horizon and the target range interact: the target horizon could be kept relatively short, say two years, if the target range is widened. The Reserve Bank of New Zealand, for example, now acknowledges that widening the target range from 2 to 3 percentage points improved the inflation-targeting regime, even though the Bank initially did not support this change. Widening the target range is not without its problems, however, because it can also increase confusion and weaken the credibility of the targeting regime.¹²

Another way to allow for longer horizons is to use multi-year annual targets, such that the path of the inflation target can approach the long-run inflation goal more gradually. Both Brazil and Mexico recently adopted this strategy (Central Bank of Brazil, 1999; Bank of Mexico, 2000). An alternative approach is for the central bank to continue to announce only one medium-term inflation target while also announcing a long-run target with a specific date as to when it should be achieved. A third alternative for the central bank is to announce only one long-term inflation target and to publish inflation forecasts for future years, thus describing the expected path of inflation toward the long-run target. Chile recently adopted this approach, following other industrial countries (Central Bank of Chile, 2000a).

2.2 Inflation Targeting during the Transition from High to Low Inflation

The credibility of the central bank is likely to be low when inflation starts out well above the long-run inflation goal consistent with price stability. In addition, with initially high inflation rates (say, over 10 percent), the monetary authorities cannot easily control inflation. In-

12. Mishkin (2000c) argues that a point target for inflation may be more desirable than a target range because the edges of the target range can take on a life of their own. Politicians, financial markets, and the public often focus on whether inflation is just outside or inside the edge of a range, rather than on the magnitude of the deviation from the midpoint. As discussed above, the opposite problem occurred in the United Kingdom in 1995, when inflation exceeded the target midpoint by over one percentage point, but without breaching the upper band. Too much focus on the edges of the range can lead the central bank to concentrate on keeping the inflation rate just within the bands rather than on trying to hit the midpoint of the range. It is difficult to imagine a sensible objective function for policymakers that would justify such asymmetric reactions to inflation rates just inside and outside the bands.

flation targeting faces extra challenges to achieve a disinflation from a high inflation rate.

One way to address the complications arising from an initially high inflation rate is to phase in inflation targeting gradually, making it more formal in line with increasing success on the disinflation front, as suggested by Masson, Savastano, and Sharma (1997). This is exactly the strategy that emerging market countries with initially high inflation have pursued (Mishkin, 2000b; Mishkin and Savastano, 2000).¹³ For example, when Chile adopted inflation targeting in 1991, inflation exceeded 20 percent, and the inflation target was treated more as an official inflation projection rather than as a formal hard target (Morandé and Schmidt-Hebbel, 1997, 2000; Morandé, in this volume). Over time, the Central Bank put greater emphasis on the price stability objective. The Central Bank's success in both lowering inflation and meeting its inflation objectives eventually led the public to interpret those objectives as hard targets for which the Central Bank could be held accountable. Finally, in May 2000, the Central Bank of Chile began to issue an inflation report, with all the features seen in similar documents in industrialized countries. For example, not only does the *Monetary Policy Report* outline developments on the inflation front and how the Bank intends to achieve its inflation target, but it also includes inflation and output forecasts, along with confidence intervals for these forecasts displayed in the famous fan charts pioneered by the Bank of England.

Mexico has also followed a gradual approach to implementing inflation targeting. Senior officials of the Bank of Mexico recently characterized Mexico's monetary policy framework as being in "a transition period toward a clear-cut inflation targeting scheme" (Carstens and Werner, 1999). The Bank of Mexico has increasingly emphasized the inflation goal as the central objective of its monetary policy. For a number of years, Mexico has made public an explicit inflation objective, which was initially announced when the Minister of Finance submitted to Congress the government's economic program for the following year. In 1999, after annual inflation fell below the 13 percent target to 12.3 percent, the central bank announced the 10 percent inflation target for the year 2000 before the Ministry of Finance submitted the year's economic program to Congress. Starting in April 2000, the Bank of Mexico has issued an *Inflation Report*, which documents what has

13. It has even been a feature of the adoption strategy of industrialized countries that adopted inflation targeting when inflation was at rates of less than 10 percent (Bernanke and others, 1999).

been happening on the inflation front and how the Bank of Mexico intends to achieve its inflation objectives, but which does not provide inflation and output forecasts. The third *Inflation Report*, published in October 2000, announced multi-year, annual targets that converge to a long-run target of 3 percent by December 2003.

Weak credibility stemming from high initial inflation increases the likelihood that the public and markets will not believe that the central bank is serious about hitting its targets if verification has to wait for more than one year in the future. This problem may make it very difficult for a central bank adopting inflation targeting under circumstances to choose inflation targets with horizons longer than a year. As discussed in the previous subsection, this presents the central bank with a dilemma, because the lags in transferring the effects of monetary policy to inflation are likely to be longer than one year. A solution to this dilemma is to specify a path for the inflation target with multi-year targets, which is what the central banks of Brazil, the Czech Republic, Mexico, and Poland have done since 1998. However, specifying a multi-year path for the annual inflation targets carries its own risk: even though a central bank is making good progress toward its long-run inflation goal, the greater uncertainty of controlling inflation at high rates might still cause inflation to deviate substantially from the multi-year path. This problem helps explain why the Central Bank of Chile chose not to specify multi-year inflation targets when it embarked on its inflation-targeting regime in 1991.

When countries are in the transition from high to low inflation, there appears to be a strong rationale for adopting a wide range for inflation targets to reflect the substantial uncertainty of controlling inflation when it is initially high. However, as discussed above, a wide range for the inflation target can lead to credibility problems, because the government may be willing to advocate that all is well on the inflation front when the inflation rate is substantially above the midpoint of the target range, but is still below the ceiling of the range. A point target makes this behavior on the part of the government less likely. Making sure that the government does not weaken its commitment to lowering inflation is especially important for inflation-targeting regimes when inflation is high because credibility is so much more precarious in these situations. This strengthens the argument for choosing a point target over a target range in an inflation-targeting regime during the transition from high to low inflation. Interestingly, the Central Bank of Chile switched from target ranges to point targets in 1994 in the process of hardening its inflation-targeting regime.

Imperfect credibility during the transition from moderately high to low inflation implies that inflation expectations are more geared to higher past inflation than to the lower official inflation targets. Inflation inertia is thus potentially larger, and rapid disinflation potentially more costly, in the transition to low inflation. Evidence for Chile, based on counterfactual simulations carried out by Corbo, Landerretche, and Schmidt-Hebbel (in this volume) and Morandé (in this volume), suggests that a quicker pace of disinflation toward the long-term 2–4 percent target would have involved a larger output sacrifice.

As argued in Mishkin (2000a), focusing on not undershooting the inflation target is likely to improve the performance of inflation-targeting regimes. When inflation approaches levels that are consistent with price stability, a symmetric approach to inflation targeting, which seeks to avoid undershoots just as strongly as overshoots, reduces the likelihood of output declines and deflation. It also indicates that the central bank cares appropriately about output fluctuations and thus helps maintain support for its independence. However, an asymmetric approach to inflation targeting may have some advantages when credibility is weak as a result of relatively high inflation rates, which is often the situation for emerging market countries adopting inflation targeting. Overshooting the target when inflation is still high may create fears that monetary policy is going back to its old, high-inflation ways; they could thus have devastating effects on central bank credibility. Given high inflation, therefore, the central bank may want to be particularly aggressive if it thinks that inflation could possibly overshoot the target. This bias to preventing overshoots of the target necessarily implies that the central bank's preferences would be somewhat asymmetric, with overshoots receiving a greater weight in the loss function than undershoots. For example, the behavior of the Bank of Israel in recent years seems to be consistent with asymmetric preferences of this type.

Asymmetric preferences can be taken too far, however. If the central bank is not sufficiently concerned about undershooting the targets, uncertainty about inflation may increase and thus interfere with private sector planning. Undershooting the target can also lead to sharp declines in aggregate output, which is not only harmful to the economy, but can also lead to decreased public support for the central bank and the inflation-targeting regime. Even if asymmetric preferences make sense at high inflation rates, they are no longer appropriate once the transition from high to low inflation is complete.

2.3 Who Should Set the Medium-Term Inflation Target?

Debelle and Fischer (1994) and Fischer (1994) make the useful distinction between goal independence, in which the central bank sets the goals of monetary policy, and instrument independence, in which the central bank controls monetary policy instruments. Instrument independence for central banks is supported by the need to insulate the central bank from short-run political pressures that may lead it to pursue time-inconsistent, expansionary policy that produces bad long-run outcomes. However, the argument that a central bank's long-run preferences should coincide with society's preferences suggests that a central bank should be goal dependent. Having the government decide on the long-run inflation target for the central bank thus receives a lot of support.

Whether the government rather than the central bank should set the medium-term inflation target is a trickier question. If inflation is currently low, the medium-term target is likely to be the same as the long-run target and so there is no conflict between them. This makes it easier to argue that the government should set the medium-term target, as it does in many inflation-targeting regimes. If inflation is currently far from the long-run target, however, the designation of who sets the medium-term target is more complicated. The length of the lags from monetary policy to inflation is a technical issue that the central bank is far more qualified to determine than are politicians. How long it should take for inflation to return to the long-run target necessarily requires judgement about these lags; such decisions should be insulated from short-term political pressure if time-inconsistent policies are to be avoided. This points to having the central bank set the medium-term inflation target, because how quickly it approaches the long-run target reflects the lags of monetary policy effects on inflation.

On the other hand, preferences on the weight given to minimizing output fluctuations relative to inflation fluctuations affect the speed at which inflation should be adjusted toward the long-run goal (Svensson, 1997). Thus if the government's long-run preferences are to be reflected in monetary policy, the government should have a role in setting the medium-term target, because this determines how fast inflation converges to the long-run target.

Clearly, there is a tradeoff with regard to who should set medium-term inflation targets when inflation is far from the long-run goal. The argument for instrument independence suggests that the central bank should set the medium-term target, while the argument for goal depen-

dence indicates that the government should set the medium-term target. For industrial countries, this may not represent much of a dilemma because medium-term targets and long-run targets are likely to be quite close. For countries in the transition from high to low inflation, however, it is far less obvious that the government should determine the medium-term inflation target.

2.4 The Role of the Exchange Rate and Other Asset Prices

Movements of the exchange rate are clearly a major concern of central banks in both inflation-targeting and non-inflation-targeting countries. Changes in the exchange rate can have a major impact on inflation, particularly in small, open economies. For example, depreciations lead to a rise in inflation as a result of the pass-through from higher import prices and greater demand for exports, while an appreciation of the domestic currency can make domestic business uncompetitive. A depreciation is often seen as a sign of failure on the part the central bank, as has recently been the case for the European Central Bank, even if this view is an unfair one. In addition, the public and politicians pay close attention to the exchange rate, and this puts pressure on the central bank to alter monetary policy.

Emerging market countries, quite correctly, have an even greater concern about exchange rate movements. Not only can a real appreciation make domestic industries less competitive, but it can lead to large current account deficits which can make the country more vulnerable to currency crisis if capital inflows turn to outflows. Depreciations in emerging market countries are particularly dangerous because they can trigger a financial crisis along the lines suggested in Mishkin (1996b, 1999b). These countries have much of their debt denominated in foreign currency; when the currency depreciates, the debt burden of domestic firms increases. Since assets are typically denominated in domestic currency and so do not increase in value, net worth declines. This deterioration in balance sheets then increases adverse selection and moral hazard problems, which leads to financial instability and a sharp decline in investment and economic activity. This mechanism explains why the currency crises in Mexico in 1994–95 and East Asia in 1997 pushed these countries into full-fledged financial crises, with devastating effects on their economies.

The fact that exchange rate fluctuations are a major concern in so many countries raises the danger that monetary policy may put too much

focus on limiting exchange rate movements, even under an inflation-targeting regime. The first problem with a focus on limiting exchange rate movements is that it can transform the exchange rate into a nominal anchor that takes precedence over the inflation target. For example, as part of its inflation-targeting regime, Israel established an intermediate target of a quite narrow exchange rate band around a crawling peg, whose rate of crawl was derived from the inflation target for the coming year. Although the Bank of Israel downplayed the exchange rate target relative to the inflation target over time, the use of a secondary target slowed the Bank's efforts to win support for disinflation and the lowering of the inflation targets (see Bernanke and others, 1999).

The second problem that results from a focus on limiting exchange rate fluctuations is that the impact of changes in exchange rates on inflation and output can differ substantially depending on the nature of the shock that causes the exchange rate movement. Different types of shocks call for different monetary policy responses. If the domestic currency depreciates because of a pure portfolio shock, inflation is likely to rise; the appropriate response to keep inflation under control is for the monetary authorities to tighten monetary policy and raise interest rates. If the depreciation occurs in an emerging market country which has a substantial amount of foreign-denominated debt, tightening monetary policy to prevent a sharp depreciation may be even more necessary to avoid financial instability. On the other hand, if the exchange rate depreciation occurs because of real shocks, the impact is less likely to be inflationary and a different monetary policy response is warranted. Even here, however, the response depends on the nature of the shock. A negative terms-of-trade shock, which lowers the demand for exports, reduces aggregate demand and is thus likely to be deflationary. In this situation, the correct interest rate response is to lower interest rates to counteract the drop in aggregate demand, and not to raise interest rates. If the negative terms-of-trade shock is instead due to a rise in import prices, the result is a negative income effect, which could be offset by lowering interest rates. But there is also a direct inflationary effect, particularly if there is high indexation and pass-through, which might suggest that interest rates should rise to prevent second-round effects.

One graphic example of a focus on limiting exchange rate fluctuations that induced the wrong policy response occurred in New Zealand in 1997 and 1998. As mentioned above, the short horizon for the inflation target in New Zealand led the Reserve Bank to focus on the exchange rate as an indicator of the monetary policy stance because of the direct impact of exchange rate movements on inflation. By early

1997, the Reserve Bank institutionalized this focus by adopting as its primary indicator of monetary policy a Monetary Conditions Index (MCI) similar to that developed by the Bank of Canada. The idea behind the MCI, which is a weighted average of the exchange rate and a short-term interest rate, is that both interest rates and exchange rates on average have offsetting impacts on inflation, on the assumption that portfolio shocks dominate exchange rate movements. The adoption of the MCI in 1997 led to a questionable monetary policy response to the East Asian crisis. When the crisis began in July 1997 after the devaluation of the Thai baht, depreciation set in and the MCI began a sharp decline, indicating that the Reserve Bank needed to raise interest rates, which it did by over 200 basis points. The result was very tight monetary policy, and the overnight cash rate exceeded 9 percent by June of 1998. Because the depreciation was due to a substantial negative terms-of-trade shock that decreased aggregate demand, the tightening of monetary policy, not surprisingly, led to a recession and an undershooting of the inflation target range, with actual deflation occurring in 1999.¹⁴ The Reserve Bank of New Zealand eventually reversed its course: it lowered interest rates sharply beginning in July 1998 after the economy had entered a recession. It also recognized the problems with using an MCI as an indicator of monetary policy and abandoned the measure in 1999. Now the Reserve Bank operates monetary policy more conventionally, using the overnight cash rate as its policy instrument and placing far less emphasis on the exchange rate in its monetary policy decisions.

Another example is the case of Chile in 1998. At that time Chile's inflation-targeting regime included a focus on limiting exchange rate fluctuations by having an exchange rate band with a crawling peg that was loosely tied to lagged domestic inflation. In response to the combined financial and terms-of-trade shock stemming from the Asian crisis, the Central Bank of Chile adopted a stringent monetary policy and a defense of the peso, with a narrowing of the exchange rate band and intervention in the foreign exchange market. When the economy entered into a mild recession in late 1998, the tight monetary policy was reversed, interest rates were lowered, and the peso was allowed to decline. The exchange rate band was abolished in September 1999 and the peso now floats freely.

14. The terms-of-trade shock, however, was not the only negative shock the New Zealand economy faced during that period. The farm sector experienced a severe drought that also hurt the economy. Thus a mistake in monetary policy was not the only source of the recession; bad luck played a role too. See Drew and Orr (1999); Brash (2000).

The experiences of New Zealand and Chile during this period contrast sharply with that of Australia, another small open economy with an inflation-targeting regime. Prior to adopting its inflation-targeting regime in 1994, the Reserve Bank of Australia adopted a policy of allowing the exchange rate to fluctuate without interference, particularly if the source of the exchange rate change was a real shock, such as a terms-of-trade shock. When faced with the devaluation in Thailand in July 1997, the Reserve Bank recognized that it would face a substantial negative terms-of-trade shock because of the large component of its foreign trade conducted with the Asian region and that it should not fight the inevitable depreciation of the Australian dollar.¹⁵ It thus immediately lowered the overnight cash rate by 50 basis points to 5 percent and kept it near this level until the end of 1998, when it was lowered again by another 25 basis points.

The adoption of the inflation-targeting regime probably helped the Reserve Bank of Australia to be even more aggressive in its easing in response to the East Asian crisis, and it helps explain why their response was so rapid. The Reserve Bank was able to make clear that easing was exactly what inflation targeting called for in order to prevent an undershooting of the target, so that the easing was unlikely to have an adverse effect on inflation expectations. The outcome of the Reserve Bank's policy actions was extremely favorable. In contrast to New Zealand and Chile, real output growth remained strong throughout this period. Furthermore, there were no negative consequences for inflation despite the substantial depreciation of the Australian dollar against the U.S. dollar by close to 20 percent: inflation remained under control and actually fell during this period, finishing slightly under the target range of 2 to 3 percent.

Targeting the exchange rate is thus likely to worsen the performance of monetary policy. This does not imply, however, that central banks should pay no attention to the exchange rate. The exchange rate serves as an important transmission mechanism for monetary policy, and its level can have important effects on inflation and aggregate demand, depending on the nature of the shocks. This is particularly true in small, open economies. The control of inflation and aggregate demand therefore requires monitoring exchange rate developments and factoring them into decisions on setting monetary policy instruments. A depreciation of the exchange rate resulting from portfolio shocks requires a tightening of monetary policy to keep inflation

15. See MacFarlane (1999); Stevens (1999).

from rising. On the other hand, a depreciation from a negative terms-of-trade shock stemming from falling export prices requires a different response, namely, an easing of monetary policy as pursued in Australia in 1997.

Mishkin (2000b) and Mishkin and Savastano (2000) emphasize another reason why central banks should not pursue a benign neglect of exchange rates. As mentioned above, emerging market countries with large foreign-denominated debt may not be able to afford sharp depreciations of their currencies, which can destroy balance sheets and trigger a financial crisis. Central banks in these countries may thus have to smooth excessive exchange rate fluctuations, although without attempting to prevent the exchange rate from reaching its market-determined level over longer horizons. Exchange rate smoothing via foreign exchange market interventions might sometimes be necessary because such interventions can prevent dynamics in the microeconomic structure of this market that may lead to exchange rate fluctuations that are divorced from fundamentals. Continuing exchange market interventions, particularly unsterilized ones, are likely to be counter-productive, however, because they are not transparent. Instead, exchange rate smoothing via changes in the interest rate instrument are more transparent, and they indicate that the nominal anchor—and not the exchange rate—continues to be the inflation target. Central banks can also explain to the public the rationale for exchange rate intervention in a manner analogous to that for interest rate smoothing, that is, as a policy aimed not at resisting market-determined movements in an asset price, but at mitigating potentially destabilizing effects of abrupt and sustained changes in that price.

The conclusion that targeting the exchange rate is likely to worsen the performance of monetary policy also applies to targeting other asset prices. Clearly, setting monetary policy instruments to achieve inflation targets requires factoring in asset price movements. Changes in asset prices such as common stock, housing or long-term bonds have important effects on aggregate demand and inflation, and they thus act as important transmission mechanisms for monetary policy (see Mishkin 1996a). The response to fluctuations in these asset prices cannot be mechanical, however, because optimal monetary policy responds in different ways depending on the nature of the shocks driving these asset prices. Furthermore, because many asset prices matter, targeting just one would be suboptimal.

It is also highly problematic for a central bank to target variables that are hard to control—and asset prices such as housing and stock

prices clearly fall into this category. Central banks look foolish if they act to control asset prices and then are unable to do so. Furthermore, when central banks act as if they can control asset prices such as common stocks, the public may begin to fear that central banks are too powerful and thus to question support for central bank independence. Some researchers (such as Cecchetti and others, 2000) suggest that the monetary authorities should act to limit asset price bubbles to preserve financial stability. However, this requires that the monetary authorities identify appropriate asset values. It is, to say the least, highly presumptuous to think that government officials, even if they are central bankers, know better than private markets what the asset prices should be, given that markets have stronger incentives to get things right. Furthermore, as pointed out in Bernanke and Gertler (1999), an inflation-targeting approach that does not target asset prices, but instead makes use of an information-inclusive strategy in setting policy instruments, has the ability to make asset price bubbles less likely, thereby promoting financial stability.

The bottom line is that the optimal conduct of monetary policy requires that many asset prices, whether the exchange rate, stock prices, housing prices, or long-term bond prices, be factored into decisions about the setting of monetary policy instruments. Doing so is completely consistent with inflation targeting, which is an information-inclusive strategy for the conduct of monetary policy. Targeting asset prices, on the other hand, is likely to lead to serious mistakes in monetary policy, and it may weaken not only the commitment to the inflation target as a nominal anchor, but also the support for central bank independence.

3. SOME UNRESOLVED ISSUES

Inflation-targeting regimes are continually evolving as experience and new research suggests better ways to conduct monetary policy. Two unresolved issues that are central to inflation-targeting regimes are currently high on the research agenda of monetary economists: the specification of the optimal long-run inflation goal and the merit of targeting the price level rather than inflation.

3.1 Long-Run Inflation Goal

A key question for any central bank pursuing an inflation-targeting strategy is what the long-run goal for inflation should be. Much research finds a negative relationship between inflation and economic

growth.¹⁶ As pointed out in Bruno and Easterly (1996), however, the evidence for this negative relationship is weak at low inflation rates.

Because the empirical evidence on the direct relationship between inflation and growth is unlikely to help discriminate between different long-run goals that are under 10 percent, another approach to deciding on the appropriate long-run inflation target is to ask the deeper question of what price stability means. Alan Greenspan has provided a widely-cited definition of price stability: a rate of inflation that is sufficiently low that households and businesses do not have to take it into account in making everyday decisions. This definition of price stability is a reasonable one, and, operationally, any inflation number between 0 and 3 percent seems to meet this criterion. Some economists, such as Feldstein (1997) and Poole (1999), argue for a long-run inflation goal of 0 percent, which has a psychological appeal. Indeed, one concern is that an inflation goal greater than zero might lead to a decline in central bank credibility and an increase in the instability of inflation expectations, which could, in turn, trigger an upward creep in inflation. However, Bernanke and others (1999) suggest that maintaining an inflation target above zero—but not too far above (less than 3 percent)—for an extended period does not lead to instability in the public's inflation expectations or to a decline in central bank credibility.

One prominent argument against setting the long-run inflation target at zero is that setting inflation at too low a level produces inefficiency and will result in a higher natural rate of unemployment (Akerlof, Dickens, and Perry, 1996). The authors argue that downward rigidity of nominal wages, which they say is consistent with the evidence, indicates that reductions of real wages can occur only through inflation. The implication is that a very low rate of inflation might prevent real wages from adjusting downward in response to declining labor demand in certain industries or regions, thereby leading to increased unemployment and hindering the re-allocation of labor from declining sectors to expanding sectors.

The evidence for the Akerlof-Dickens-Perry mechanism through which low inflation raises the natural rate of unemployment is not at all clear-cut. Carruth and Oswald (1989), Ingrams (1991), McLaughlin (1994), and Yates (1995) all find little evidence for downward nominal rigidities in wages in the United States and the United Kingdom. As pointed out by Groshen and Schweitzer (1996, 1999), inflation can not

16. For example, see Kormendi and Meguire (1985); Grier and Tullock (1989); Cozier and Selody (1992); Fischer (1993); Andersen and Gruen (1995); Barro (1995); Andres and Hernando (1999).

only “grease” the labor markets and allow downward shifts in real wages in response to a decline in demand along the lines of Akerlof, Dickens, and Perry (1996), but it can also put in “sand” by increasing the noise in relative real wages. This noise reduces the information content of nominal wages and hence the efficiency of the process by which workers are allocated across occupations and industries.

A more persuasive argument for a long-run inflation goal above zero is that the economy is less likely to experience episodes of deflation. Deflation is a key factor promoting episodes of financial instability in industrialized countries (Mishkin, 1991, 1997). Because debt contracts in industrialized countries frequently have long maturities, a deflation leads to an increase in the real indebtedness of firms and households, which in turn leads to a decline in their net worth and a deterioration of their balance sheets. Irving Fisher (1933) named this phenomenon debt deflation (although it might more accurately be referred to as debt inflation in real terms through deflation) and saw it as a major factor promoting the economic downturn of the Great Depression.¹⁷ With decreased net worth, adverse selection and moral hazard problems increase for lenders, who therefore cut back on lending. The decline in net worth also leads to a decline in the amount of collateral a lender can grab if the borrower’s investments turn sour, and the reduction in collateral therefore increases the consequences of adverse selection, because loan losses resulting from default are likely to be more severe. In addition, the decline in net worth increases moral hazard incentives for borrowers to take on excessive risk because they now have less to lose if their investments fail. This reasoning indicates that deflation can promote financial instability in industrialized countries through the debt-deflation mechanism. A recent example of this phenomenon is the case of Japan in the last decade (Mishkin, 1998; Bernanke, 1999).

Another reason for choosing an inflation goal that reduces the likelihood of deflation is that deflation may make it more difficult to conduct monetary policy. Frequent periods of deflation resulting from too low a level of the inflation target will cause short-term interest

17. Technically this debt-deflation mechanism requires that the deflation be unanticipated, that is, it must come as a surprise after the debt contracts have been written. Because in industrialized countries many of these contracts are quite long, a deflation that becomes anticipated after a period of time may still be unanticipated from the point of view of many debt contracts, such that the debt-deflation story still holds. If debt contracts are of very short duration, as is typically the case in emerging market countries, then deflations are less likely to be unanticipated, and so the debt deflation mechanism is inoperative (see Mishkin 1997).

rates to hit a floor of zero during deflations, as occurred during the Great Depression and recently in Japan. Some economists argue that monetary policy becomes ineffective when the interest rate hits a floor of zero.¹⁸ This argument is a fallacy for the reasons outlined in Meltzer (1995) and Mishkin (1996a). Monetary policy works through many other asset prices besides those of short-term debt securities. Even when short-term interest rates hit the floor of zero, monetary policy can still be effective, and indeed was so during the Great Depression (see Romer, 1992).

Nonetheless, monetary policy becomes more difficult during deflationary episodes when interest rates hit a floor of zero because the usual guides to the conduct of monetary policy are no longer relevant. In recent years, much of the research on how central banks should optimally conduct monetary policy focus on so-called Taylor rules, in which the central bank sets the short-term interest rates at a level that depends on both output and inflation gaps. The Taylor (1999) volume is an excellent example of this type of research. Once the interest rate hits a floor of zero, however, this entire class of research on optimal monetary policy rules is no longer useful because manipulating short-term interest rates ceases to be an effective tool of monetary policy. In such a deflationary environment, central banks do have the ability to lift the economy out of recession by pursuing expansionary policy and creating more liquidity, but it becomes much less clear how far they need to go. This rightfully makes central bankers quite uncomfortable. Therefore, an important disadvantage of too low a level of the long-run inflation target is that it makes deflationary environments more likely to occur, leaving central bankers at sea without the usual knowledge to guide them and thus making it harder for them to get monetary policy exactly right.

Another reason why central banks might be better off with a long-run inflation goal above zero is that it is crucial that they not be perceived as being overly obsessed with controlling inflation at the expense of output stability. A central bank is likely to lose the support of the public if it is perceived as being inflation nutters, in Mervyn King's (1996) terminology, and putting no weight on output fluctuations in making its decisions about monetary policy. Too low an inflation target, say, 0 or even 1 percent, may signal to the public that the central bank does not care sufficiently about the public's concerns.

18. Summers (1991) is one prominent example, and officials of the Bank of Japan recently used this argument to indicate that expansionary monetary policy is likely to be ineffective in promoting Japanese recovery.

On the other hand, Fischer (1986), Feldstein (1997), and the papers in Feldstein (1999) find that lowering the inflation rate from currently low levels to zero in industrialized countries reduces distortions caused by the interaction of inflation with the tax system. This can produce substantial welfare gains, on the order of 1 percent of GDP.¹⁹ However, these distortions can also be eliminated by changes in the tax code, so they do not provide a clear justification for choosing a zero long-run inflation goal.

Emerging market countries that grow at high levels may be better off having inflation rates that are slightly higher than those in industrialized countries. High-growth countries typically experience real exchange rate appreciation that is proportional to the difference in the productivity growth of the traded and nontraded sectors relative to the rest of the world (the Harrod-Belassa-Samuelson effect). If it is appropriate for these countries to aim for a long-run traded goods inflation similar to that of industrialized countries, then trend real appreciation requires a domestic nontraded goods inflation that is somewhat higher. Hence, the long-run inflation goal in high-growth economies might need to be slightly higher than would be desirable for average-growth countries. This explains why Chile, a high-growth country, has chosen a long-term inflation target range of 2–4 percent per year.

Given these conflicting arguments, the definition of an appropriate long-run goal for inflation is still an open question. As a practical matter, all inflation-targeting countries have chosen long-run inflation goals slightly above zero, with the midpoints of the long-run target ranges lying between 1 and 3 percent. Future research may help central banks decide whether a long-run goal outside this range is appropriate and provide more precision as to what this goal should be.

3.2 Price-Level versus Inflation Targets

All countries that currently implement an inflation-targeting regime have chosen to target inflation rather than the price level. However, which of these two targets would result in better economic performance is an open question.

A price-level target has two key advantages relative to an inflation target. First, a price-level target can reduce the uncertainty about what

19. Welfare costs arising from inflation because interest is not paid on high-powered money (the so-called shoe leather costs) are estimated to be an order of magnitude smaller than costs stemming from tax distortions, and they are thus unlikely to be important for deciding the optimal long-run inflation goal. See Lucas (1981, 2000); Fischer (1986); Cooley and Hansen (1989).

the price level will be over long horizons. With an inflation target, misses of the inflation target are not reversed by the central bank. Consequently, inflation will be a stationary stochastic process, that is, integrated of the order zero, $I(0)$, while the price level will be nonstationary, an $I(1)$ process. The uncertainty regarding the future price level thus grows with the forecast horizon. This uncertainty can make long-run planning difficult and may therefore lead to a decrease in economic efficiency. Although McCallum (1999) argues that the amount of long-run uncertainty about the future price level arising from successful adherence to an inflation target may not be all that large, it still complicates the planning process and may lead to more mistakes in investment decisions.

The second possible advantage of a price-level target is that it produces less output variance than an inflation target in models with a high degree of forward-looking behavior on the part of firms.²⁰ However, empirical evidence (such as that presented in Fuhrer, 1997) does not clearly support the formation of forward-looking expectations, and models with forward-looking behavior have counterintuitive properties that seem to be inconsistent with inflation dynamics (Estrella and Fuhrer, 1998).

The traditional view, forcefully articulated by Fischer (1994), argues that a price-level target produces more output variability than an inflation target because unanticipated shocks to the price level are not treated as bygones and must be offset.²¹ A price-level target requires that overshoots or undershoots of the target must be reversed, which could impart significantly more volatility to monetary policy and, with sticky prices, to the real economy in the short run. Although the models with forward-looking price setting cited above do not find that this feature of a price-level target increases output variability, they do not focus on one particular problem with a price-level target: the fact that a price-level target may lead to more frequent episodes of deflation. As demonstrated in the previous subsection, episodes of deflation present policymakers with two problems, namely, a possible increase in financial instability with potentially high output losses for the economy and an increased likelihood that nominal interest rates hit a floor of zero, which complicates the conduct of monetary policy.

20. For example, Svensson (1999); Woodford (1999); Svensson and Woodford (1999); Clarida, Galí, and Gertler (1999); Dittmar and Gavin (2000); Dittmar, Gavin, and Kydland (1999); Vestin (2000).

21. This view is supported by simulations of macroeconometric models with backward-looking expectations, which typically find that a price-level target leads to greater variability of output and inflation than an inflation target. See, for example, Haldane and Salmon (1995).

Another problem for a price-level target that has received little attention in the literature is the presence of measurement error in inflation. Most research on measurement error takes the view that it is inflation that is measured with error rather than the price level. This was the approach taken by the Boskin Commission.²² This implies that the measurement error in the price level is $I(1)$, such that a price-level target results in growing uncertainty about the true price level as the forecast horizon lengthens. Many of the arguments that a price-level target results in lower long-run uncertainty about the true price level may thus be overstated.

Such conflicting arguments indicate that whether price-level rather than inflation targets would produce better outcomes is an open question. Given this uncertainty about the benefits of price-level targeting, it is not surprising that no central bank has decided to target the price level in recent years. However, the arguments made here for preferring an inflation target over a price-level target do not rule out hybrid policies that combine features of an inflation target and a price-level target and so might provide the best of both worlds. For example, an inflation target could be announced with a commitment to some error correction in which target misses would be offset to some extent in the future. Recent research shows that an inflation target with a small amount of error correction can substantially reduce the uncertainty about the price level in the long run, while generating very few episodes of deflation (Black, Macklem, and Rose, 1997; King, 1999; Batini and Yates, 1999). Furthermore, putting a small weight on the price-level error correction term improves the trade-off between output and inflation fluctuations (see Williams, 1999; Smets, 2000; Gaspar and Smets, 2000; McLean and Pioro, 2000). Evaluating hybrid policies of this type is likely to be a major focus of future research.

One issue that would have to be addressed if such a hybrid policy were adopted is how to explain the mechanism to the public. As emphasized in Bernanke and Mishkin (1997), Mishkin (1999a), and Bernanke and others (1999), a critical factor in the success of inflation targeting is that it provides a vehicle for more effective communication with the public. The public will clearly not understand the technical jargon of error correction models. However, an error correction feature of an inflation-targeting regime could be communicated fairly easily by not only announcing an intermediate-term inflation target, but also indi-

22. See, for example, Boskin and others (1996); Moulton (1996); Shapirio and Wilcox (1996).

cating that there is a target for the average inflation rate over a longer period, say five years.

Another possible hybrid policy would be to pursue an inflation target under normal conditions, but to provide an escape clause that activates a price-level target only when the unusual condition of deflation sets in, particularly if interest rates near a floor of zero. The inflation target under normal conditions would not require that overshoots of the inflation target be reversed and so would not increase the likelihood of deflation. On the other hand, if deflation sets in, then activating a price-level target to induce expectations of reflation of the economy would not only make it less likely that nominal interest rates would hit a floor of zero, but would also lead to higher inflation expectations. This would lower real interest rates, thereby stimulating the economy, and would help induce a rise in the price level, which would repair balance sheets. Given the success of a price-level target in ameliorating the effects of the Great Depression in Sweden in the 1930s (Berg and Jonung, 1998), price-level targets have recently been proposed to help jumpstart the Japanese economy (Bernanke, 1999; Blinder, 1999; Goodfriend, 1999; Svensson, 2000).

4. CONCLUSIONS

The emergence of inflation targeting over the last ten years is an exciting development in the central banks' approach to the conduct of monetary policy. The review in this paper has indicated that inflation targeting has been quite successful in controlling inflation and improving the performance of the economy. However, our discussion of operational design issues for inflation targeting and unresolved issues indicates that there is still much to learn about how best to operate inflation-targeting regimes. We expect that future experience and research will help refine the inflation targeting approach and further improve the process of monetary policymaking.

APPENDIX A

Summary of Inflation-Targeting Regimes

Table A1. Implementation and Design of Inflation Targeting in Nineteen Countries

<i>Country</i>	<i>Date introduced</i>	<i>Target price index</i>	<i>Target width</i>	<i>Target horizon</i>	<i>Escape clauses</i>	<i>Accountability of target misses</i>	<i>Entity that sets target</i>	<i>Publications and accountability</i>
Australia	Sept. 1994	Core CPI	2–3%	Over one business cycle	None	None	Jointly by government and central bank	Inflation report; inflation projections (2-year point estimate)
Brazil	Jun. 1999	Headline CPI	1999: 8% ($\pm 2\%$) 2000: 6% ($\pm 2\%$) 2001: 4% ($\pm 2\%$)	1 year	None	Issuance of open letter to Minister of Finance explaining target breach and measures taken to bring inflation within the target (and the time required)	Government in consultation with central bank	Inflation report; inflation projections (2-year fan chart); extract of board meetings; models used for inflation outlook
Canada	Feb. 1991	Core CPI (excl. food, energy, and indirect taxes)	1991: 3–5% 1992: 2–4% Jun. 94: 1.5–3.5% 1995–2001: 1–3%	1991: 22 months; since 1992: multi-year	Revision of target path under exceptional circumstances (e.g., major oil price shock, natural disaster)	Public explanation	Jointly by government and central bank	Monetary policy report; inflation projections (1-year point estimate)

APPENDIX A (continued)

<i>Country</i>	<i>Date introduced</i>	<i>Target price index</i>	<i>Target width</i>	<i>Target horizon</i>	<i>Escape clauses</i>	<i>Accountability of target misses</i>	<i>Entity that sets target</i>	<i>Publications and accountability</i>
Chile	Jan. 1991	Headline CPI	1991: 15–20% 1992: 13–16% 1993: 10–12% 1994: 9–11% 1995: 8% 1996: 6.5% 1997: 5.5% 1998: 4.5% 1999: 4.3% 2000: 3.5% 2001 onwards: 2–4%	1991–2000: 1 year; 2001 onwards: indefinite	None	None	Central bank in consultation with government	Inflation report (2000); minutes of monetary policy meetings; inflation projections (2-year fan chart)
Colombia	Sept. 1999	Headline CPI	1999: 15% 2000: 10% 2001: 8% 2002: 6%	1 year	None	None	Jointly by government and central bank	Inflation report
Czech Republic	Jan. 1998	Core CPI (excl. regulated prices and indirect taxes)	1998: 5.5–6.5% 1999: 4–5% 2000: 3.5–5.5% 2001: 2–4%	1 year	Natural disasters, global raw material price shocks, exchange rate shocks unrelated to domestic economic fundamentals and monetary policy, and agricultural production shocks	None	Central bank	Inflation report (1998); minutes of monetary policy meetings; inflation projections (1-year range)

APPENDIX A (continued)

<i>Country</i>	<i>Date introduced</i>	<i>Target price index</i>	<i>Target width</i>	<i>Target horizon</i>	<i>Escape clauses</i>	<i>Accountability of target misses</i>	<i>Entity that sets target</i>	<i>Publications and accountability</i>
Finland	Feb. 1993 to Jun. 1998	Core CPI (excl. indirect taxes, subsidies, housing prices, and mortgage interest)	Annual average of 2% by 1995	Until 1995: multi-year; since 1996: indefinite	None	None	Central bank	None
Israel	Jan. 1992	Headline CPI	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: 2.5–3.5%	1 year	None	Public explanation of deviation of inflation forecast from target in excess of 1%	Government in consultation with central bank	Inflation report (1998)
Korea	Jan. 1998		1998: 9% ($\pm 1\%$) 1999: 3% ($\pm 1\%$) 2000: 2.5% ($\pm 1\%$) 2001 onwards: 2.5%	1998–2000: 1 year; 2001 onwards: indefinite	None (before 2000: changes caused by major forces)	None	Government in consultation with central bank	Inflation report (and submission to Parliament); monthly announcement of monetary policy direction; minutes of monetary policy meetings

APPENDIX A (continued)

<i>Country</i>	<i>Date introduced</i>	<i>Target price index</i>	<i>Target width</i>	<i>Target horizon</i>	<i>Escape clauses</i>	<i>Accountability of target misses</i>	<i>Entity that sets target</i>	<i>Publications and accountability</i>
Mexico	Jan. 1999	Headline CPI	1999: 13% 2000: < 10% 2001: 6.5% 2002: 4.5% 2003: similar to trade partners' inflation (3%)	1998–2002: 1 year; 2002 onwards: indefinite	None	None	Central bank	Inflation report (2000)
New Zealand	Mar. 1990	Headline CPI (since 1999, headline CPI excludes interest charges; prior to 1999, targets were defined in terms of headline CPI less interest charges and other first-round-effect prices)	1990: 3–5% 1991: 2.5–4.5% 1992: 1.5–3.5% 1993–1996: 0–2% Since 1997 0–3%	1990–92: 1 year; 1993–96: multi-year; since 1997: indefinite	Unusual events, provided they do not cause general inflationary pressures	Public explanation of target breach and measures taken to bring inflation within the target (and the time required); Minister of Finance may ask for resignation of RBNZ Governor	Jointly by government and central bank	Inflation report (1990); inflation projections
Peru	Jan. 1994	Headline CPI	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%	1 year	None	None	Central bank in consultation with government	None

APPENDIX A (continued)

<i>Country</i>	<i>Date introduced</i>	<i>Target price index</i>	<i>Target width</i>	<i>Target horizon</i>	<i>Escape clauses</i>	<i>Accountability of target misses</i>	<i>Entity that sets target</i>	<i>Publications and accountability</i>
Poland	Oct. 1998	Headline CPI	1998: < 9.5% 1999: 6.6–7.8% 2000: 5.4–6.8% 2003: < 4%	1998-2000: 1 year; 2000-03: multi-year; 2003 onwards: indefinite	None	None	Central bank	Inflation report; inflation guidelines; report on monetary policy implementation
South Africa	Feb. 2000	Core CPI (excl. Interest costs)	2003: 3–6%	Multi-year	Major unforeseen events outside central bank's control	None	Central bank	Inflation report
Spain	Nov. 1994 to Jun. 1998	Headline CPI	Jun. 1996: 3.5–4% 1997: 2.5% 1998: 2%	Until 1996: multi-year; 1997–98: 1 year	None	None	Central bank	Inflation report (1995); governor reports regularly to Parliament
Sweden	Jan. 1993	Headline CPI	Since 1995: 2% (±1%)	Until 1995: multi-year; since 1996: indefinite	None	None	Central bank	Inflation report (1997); minutes of monetary policy meetings; inflation projections (2-year fan chart); submission of monetary policy report to Parliament

APPENDIX A (continued)

<i>Country</i>	<i>Date introduced</i>	<i>Target price index</i>	<i>Target width</i>	<i>Target horizon</i>	<i>Escape clauses</i>	<i>Accountability of target misses</i>	<i>Entity that sets target</i>	<i>Publications and accountability</i>
Switzerland	Jan. 2000	Headline CPI	<2%	3 years	Unusual events, provided they do not cause general inflationary pressures	None	Central bank	Inflation report; inflation projections (3 years)
Thailand	Apr. 2000	Core CPI (excl. raw food and energy prices)	2000: 0–3.5%	Indefinite	None	Public explanation of target breach and measures taken to bring inflation within the target (and the time required)	Government in consultation with central bank	Inflation report (2000); inflation projections (2-year fan chart); minutes of monetary policy meetings
United Kingdom	Oct. 1992	RPIX (excl. mortgage interest)	1992–95: 1–4% Since 1996: 2.5%	Until 1995: multi-year; since 1996: indefinite	None	Issuance of open letter to the Minister of Finance explaining target breach and measures taken to bring the inflation within the target (and the time required)	Government	Inflation report; inflation projections (2-year fan chart); models used for inflation outlook

Source: J.P. Morgan, “Guide to Central Bank Watching,” country sources; central banks’ Web pages; Schaechter, Stone, and Zelmer (2000).

APPENDIX B

Specification of the Data Set

This appendix defines the variables and outlines the data sources used for the analysis in section 1.

IT: a dummy variable for implementing inflation targeting. Specifies a value of 1 (0 otherwise) for a year in which at least six months are covered by a previously announced inflation target. Source: country sources; Schaechter, Stone, and Zelmer (2000).

Inf: CPI inflation, normalized as the percentage variation of the annual average CPI divided by one plus the percentage variation of the average annual CPI. Source: IMF, *International Financial Statistics*, various issues (code 64e).

MT: a dummy variable for pursuing monetary growth targets. Specifies a value of 1 (0 otherwise) for a year in which any month is covered by a previously announced monetary target. Source: country sources; J.P. Morgan, "Guide to Central Bank Watching."

BW: the width of the exchange rate band, normalized as the band width divided by one plus the band width. Source: IMF, "Exchange Arrangements and Exchange Restrictions," various issues.

Fiscal: the ratio of the government surplus to GDP. Source: country sources; IMF, *International Financial Statistics*, various issues (codes 80 and 99b).

Fin: financial depth, measured as the ratio of M2 to GDP. Source: country sources; IMF, *International Financial Statistics*, various issues (codes 80 and 99b).

Open: trade openness, measured as the ratio of the sum of exports and imports to GDP. Source: country sources; IMF, *International Financial Statistics*, various issues (codes 90c, 98c, and 99b).

CBFI: a dummy for formal independence of the central bank. Specifies a value of 1 (0 otherwise) for a year in which any month is covered by central bank formal independence. Formal independence is attained when a central bank is established as a legally independent or autonomous state institution. Source: country sources; J.P. Morgan, "Guide to Central Bank Watching."

CBGI: a dummy for goal independence of the central bank. Specifies a value of 1 (0 otherwise) for a year in which any month is covered by central bank goal independence. Goal independence is attained when the central bank alone determines the levels for its monetary policy targets (that is, the exchange rate, monetary growth, and inflation targets). When target levels are determined separately by the government or

congress, jointly by the bank and either government or congress, or by a government representative who casts votes on central bank board decisions, the central bank is considered goal dependent. Source: country sources; J.P. Morgan, "Guide to Central Bank Watching."

CBII: a dummy for instrument independence of the central bank. Specifies a value of 1 (0 otherwise) for a year in which any month is covered by central bank instrument independence. Instrument independence is attained when the central bank freely sets its instrument in its pursuit of monetary policy goals. When central bank policy decisions are either subject to government approval or can be reversed by the government, instrument independence is not in place. Source: country sources; J.P. Morgan, "Guide to Central Bank Watching;" Schaechter, Stone, and Zelmer (2000).

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