

Banco Central de Chile
Documentos de Trabajo

Central Bank of Chile
Working Papers

N° 406

Diciembre 2006

**UNDER WHAT CONDITIONS CAN INFLATION
TARGETING BE ADOPTED? THE EXPERIENCE OF
EMERGING MARKETS**

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Documentos de Trabajo del Banco Central de Chile
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Resumen

Aunque abundan los estudios sobre metas de inflación en países industriales, ha habido muy poco análisis de los efectos de las metas de inflación en las economías emergentes. Basado en una nueva y detallada encuesta a 31 bancos centrales, este artículo muestra que las metas de inflación en mercados emergentes traen beneficios significativos a los países que las adoptan en comparación con otras estrategias, tales como metas monetarias o cambiarias. En efecto, al comparar el desempeño de economías con metas de inflación con una muestra de países que aplican otros esquemas, los autores muestran que se logran mejoras sustanciales al anclar la inflación y las expectativas inflacionarias, sin por eso causar efectos adversos sobre el producto. Además, con las metas de inflación, las tasas de interés, el tipo de cambio y las reservas internacionales se hacen menos volátiles, y el riesgo de sufrir una crisis monetaria es menor que donde se siguen metas monetarias o cambiarias. Curiosamente, las metas de inflación parecen superar a los esquemas que fijan el tipo de cambio, incluso cuando la comparación considera solo aquellos que han tenido éxito. De la encuesta se deduce que no es necesario que los países cumplan con una serie de restricciones institucionales, técnicas o económicas para poder adoptar con éxito un régimen de metas de inflación.

Abstract

While there have been numerous studies of inflation targeting in industrial countries, there has been much less analysis of the effects of inflation targeting in emerging market countries. Based on a new and detailed survey of 31 central banks, this paper shows that inflation targeting in emerging-market countries brings significant benefits to the countries that adopt it relative to other strategies, such as money or exchange rate targeting. Indeed, by comparing the performance of the inflation-targeting countries with a sample of countries that pursue other regimes we show that there are significant improvements in anchoring both inflation and inflation expectations with no adverse effects on output. In addition, under inflation targeting interest rates, exchange rates, and international reserves are less volatile, and the risk of currency crises relative to money or exchange rate targets is smaller. Interestingly, IT seems to outperform exchange rate pegs—even when only successful pegs are chosen in comparison. The survey evidence indicates that it is unnecessary for countries to meet a stringent set of institutional, technical, and economic “preconditions” for the successful adoption of inflation targeting.

UNDER WHAT CONDITIONS CAN INFLATION TARGETING BE ADOPTED? THE EXPERIENCE OF EMERGING MARKETS

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Inflation targeting has become an increasingly popular monetary policy strategy, with 21 countries (8 industrial and 13 emerging market) targeting inflation and others considering following in their footsteps. Numerous studies of inflation targeting in industrial countries have been conducted; much less analysis has been done on its effects in emerging markets.¹

This article seeks to fill this void. It looks at the experience of the emerging market countries that have adopted inflation targeting since the late 1990s, focusing on both macroeconomic performance and the potential benefits and costs of inflation targeting adoption. It draws on a new and detailed survey of 31 central banks to support the analysis. Particular attention is paid to the implications for institutional change and to the feasibility and success of inflation targeting when specific conditions, such as central bank independence and lack of fiscal dominance, are initially absent.

1. WHAT IS INFLATION TARGETING AND WHY DOES IT MATTER?

It is now widely accepted that the primary role of monetary policy is to maintain price stability.² Alan Greenspan, Chairman of the

1. There is a large body of empirical literature on the performance of inflation targeting in industrial countries. More recently, work has been underway to extend this type of analysis to emerging market countries.

2. See Batini, Laxton and Yates (2003) and Pianalto (2005).

Monetary Policy under Inflation Targeting, edited by Frederic Mishkin and Klaus Schmidt-Hebbel, Santiago, Chile. © 2007 Central Bank of Chile.

Federal Reserve, has offered an operating definition of price stability that is broadly accepted: “Price stability obtains when economic agents no longer take account of the prospective change in the general price level in their economic decisionmaking” (Greenspan, 2001). This is often thought to correspond to an annual rate of inflation in the low single digits.³

Inflation targeting is one of the operational frameworks for monetary policy aimed at attaining price stability. In contrast to alternative strategies—notably money or exchange rate targeting, which seek to achieve low and stable inflation by targeting intermediate variables, such as the growth rate of money aggregates or the level of the exchange rate of an “anchor” currency—inflation targeting involves targeting inflation directly. The literature offers several different definitions of inflation targeting.⁴ In practice, however, inflation targeting has two main characteristics that distinguish it from other monetary policy strategies.

First, the central bank is mandated and commits to a unique numerical target in the form of a level or a range for annual inflation. A single target for inflation emphasizes the fact that price stabilization is the primary focus of the strategy; the numeric specification provides a guide to what the authorities intend as price stability.

Second, the inflation forecast over some horizon is the *de facto* intermediate target of policy. For this reason inflation targeting is sometimes referred to as “inflation forecast targeting” (Svensson, 1997). Since inflation is partially predetermined in the short term because of existing price and wage contracts or indexation to past inflation, monetary policy can influence only expected future inflation. By altering monetary conditions in response to new information, central banks influence expected inflation and bring it in line over time with the inflation target, which eventually leads actual inflation to become better anchored to the target.

The monetary policy strategy followed by 21 countries has these characteristics; these countries are treated here as inflation targeters (table 1).⁵ Defining inflation targeting according to these two characteristics makes it clear why, for example, neither the

3. See Bernanke and others (1999); Mishkin and Schmidt-Hebbel (2001); Brook, Karagedikli, and Scrimgeour (2002); Batini (2004); and Burdekin and others (2000).

4. See, among others, Leiderman and Svensson (1995); Mishkin (1999); Bernanke and others (1999).

5. According to these criteria, Chile and Israel are not classified as having adopted inflation targeting until the de-emphasis of their exchange rate targets, in 1999 (in Chile) and 1997 (in Israel).

Federal Reserve nor the European Central Bank is considered an inflation targeter: the Federal Reserve lacks a numerical specification for its price stability objective,⁶ and the European Central Bank has traditionally given a special status to a second numerical objective, a “reference value” for the growth of the euro-area M3 broad money aggregate.⁷

Table 1. Emerging Market and Industrial Countries that Target Inflation

<i>Country</i>	<i>Date inflation targeting adopted</i>	<i>Current inflation target (percent)</i>
<i>Emerging market countries</i>		
Israel	1997Q2	1–3
Czech Rep.	1998Q1	3 (+/- 1)
Korea, Rep. of	1998Q2	2.5–3.5
Poland	1999Q1	2.5 (+/- 1)
Brazil	1999Q2	4.5 (+/- 2.5)
Chile	1999Q3	2–4
Colombia	1999Q3	5 (+/- 0.5)
South Africa	2000Q1	3–6
Thailand	2000Q2	0–3.5
Hungary	2001Q3	3.5 (+/- 1)
Mexico	2002Q1	3 (+/-1)
Peru	2002Q1	2.5 (+/- 1)
Philippines	2002Q1	5–6
<i>Industrial countries</i>		
New Zealand	1990Q1	1–3
Canada	1991Q1	1–3
United Kingdom	1992Q4	2
Australia	1993Q1	2–3
Sweden	1993Q1	2 (+/- 1)
Switzerland	2000Q1	<2
Iceland	2001Q1	2.5
Norway	2001Q1	2.5

Source: International Monetary Fund (IMF) staff calculations.
 Note: All countries except Mexico publish forecasts of inflation.

6. See Kohn (2003a, and 2003b), Gramlich (2003), and Bernanke and Woodford (2005).

7. See European Central Bank (1999), Solans (2000), and Issing (2000). However, the European Central Bank has recently de-emphasized the weight attached to this reference value, moving toward a “pure” inflation targeting regime (see European Central Bank, 2003).

Proponents of inflation targeting argue that it yields a number of benefits relative to other operating strategies (see, for example, Truman, 2003):

- *Inflation targeting can help build credibility and anchor inflation expectations more rapidly and durably.* It makes it clear that low inflation is the primary goal of monetary policy and involves greater transparency to compensate for the greater operational freedom that it offers. Inflation targets are also intrinsically clearer and more easily observable and understandable than other targets, since they typically do not change over time and are controllable by monetary means.⁸ Inflation targeting can thus help economic agents better understand and evaluate the performance of the central bank, anchoring inflation expectations faster and more permanently than strategies in which the task of the central bank is less clearly defined and more difficult to monitor (IMF, 2005a).
- *Inflation targeting provides more flexibility.* Since inflation cannot be controlled instantaneously, the target on inflation is typically interpreted as a medium-term objective. This implies that central banks pursue the inflation target over a certain horizon, by focusing on keeping inflation expectations at the target.⁹ Short-term deviations of inflation from the target are acceptable and do not necessarily translate into losses in credibility.¹⁰ The scope for greater flexibility could reduce variability in the output gap.¹¹

8. Money targets, for example, have to be reset yearly and are hard to control, because shifts in money demand or in the money multiplier impair the control of the money supply and alter the long-run relationship between money and inflation. Central bank control over exchange rate targets is also limited, because the level of the exchange rate is ultimately determined by the international demand and supply of the domestic currency vis à vis that of the “anchor” currency. Shifts in sentiment about the domestic currency can thus trigger abrupt changes in its relative value that cannot be offset easily by central bank actions. Many central banks have abandoned money and exchange rate targets on these grounds (see IMF, 2005b).

9. The horizon over which inflation-targeting central banks attempt to stabilize inflation usually varies with the types of shocks that have taken inflation away from the target and with the speed of monetary transmission. See Batini and Nelson (2001) for a discussion of optimal horizons under inflation targeting.

10. Under “full credibility,” economic agents under inflation targeting pre-emptively adjust their plans in the face of incipient inflationary pressures, so that the central bank has to move interest rates even less and price stabilization comes at even lower output gap variability costs (see, for example, King, 2005).

11. For an explanation of why some inflation targeting alternatives may imply higher output costs, see IMF (2005a).

- *Inflation targeting involves a lower economic cost in the face of monetary policy failures.* The output costs of policy failure under some alternative monetary commitments, such as exchange rate pegs, can be very large, usually involving massive reserve losses, high inflation, financial and banking crises, and possibly debt defaults.¹² In contrast, the output costs of failing to meet the inflation target are limited to inflation that is temporarily higher than targeted and growth that is temporarily slower, as interest rates are raised to bring inflation back to target.¹³

Critics have argued that inflation targeting has disadvantages and imposes excessive constraints on central banks:

- *Inflation targeting offers too little discretion and thus unnecessarily restrains growth.* Since the success of inflation targeting relies on the establishment of a reputational equilibrium by the central bank interacting with agents in the domestic economy, inflation targeting can work effectively only if the central bank acts consistently and convincingly to attain the inflation target. In other words, for inflation targeting to work well, the central bank must demonstrate its commitment to low and stable inflation through tangible actions. In the initial phases of inflation targeting, demonstrating commitment may require an aggressive response to inflationary pressures, which could temporarily reduce output. More generally, inflation targeting constrains discretion inappropriately: it is too confining in terms of an ex ante commitment to a particular inflation number and a particular horizon over which to return inflation to target.¹⁴ By obliging the central bank to hit the target so restrictively, inflation targeting can unnecessarily restrain growth.¹⁵
- *Inflation targeting cannot anchor expectations, because it offers too much discretion.* In contrast to those who worry that inflation targeting may be too restraining, some argue that inflation targeting cannot help build credibility in countries that lack it

12. The experience of Argentina in 2001 is an example of this.

13. The experience of South Africa in late 2002 is one such case.

14. The horizon over which inflation targeting central banks attempt to stabilize inflation at target is not always specified and varies from country to country. See Batini and Nelson (2001) for a discussion of optimal horizons under inflation targeting.

15. See, among others, Rivlin (2002) and Blanchard (2003).

because it offers excessive discretion over how and when to bring inflation back to target and because targets can be changed.¹⁶

- *Inflation targeting implies high exchange rate volatility.* Because it elevates price stability to the status of the primary goal for the central bank, inflation targeting requires benign neglect of the exchange rate. If this is the case, it could have negative repercussions on exchange rate volatility and growth.
- *Inflation targeting cannot work in countries that do not meet a stringent set of preconditions,* making the framework unsuitable for the majority of emerging market economies. Preconditions often considered essential include the technical capability of the central bank to implement inflation targeting, the absence of fiscal dominance, sound financial markets, and an efficient institutional set-up to support and motivate the commitment to low inflation.

2. INFLATION TARGETING: AN ASSESSMENT OF THE IMPACT

Empirical studies have focused primarily on the experience of industrial economies, because these countries, many of which adopted inflation targeting in the early 1990s, have longer track records.¹⁷ These studies generally suggest that inflation targeting has been associated with performance improvements, although the evidence is typically insufficient to establish statistical significance of these improvements. No study, however, finds that performance has deteriorated under inflation targeting.

The lack of strong evidence from industrial countries may reflect several factors. First, there are only eight inflation targeters to look at and a limited set of nontargeters against which to compare them. Second, the macroeconomic performance of inflation targeters and nontargeters alike improved during the 1990s, for a variety of reasons, including better monetary policy (some aspects of the performance of many nontargeters along some dimensions was improved by preparations for entry into the European Monetary Union, for example). Finally, the fact that most industrial countries entered the 1990s with relatively low and stable inflation makes

16. See, for example, Rich (2000); Genberg (2001); and Kumhof (2002).

17. See, for example, Ball and Sheridan (2003); Levin, Natalucci, and Piger (2003); Truman (2003); and Hyvonen (2005), among others.

it more difficult to discern any incremental improvement due to inflation targeting.

In many ways, the experience of emerging markets offers a richer set of data for assessing the effects of inflation targeting than that of the industrial countries. The time span covered is short—three to seven years—but the sample of inflation targeters and suitable comparison countries is considerably larger. Moreover, because many emerging market targeters experienced relatively high levels of inflation and macroeconomic volatility before adopting inflation targeting, it should be easier to discern the effects of inflation targeting. In addition, looking at the experience of emerging markets can provide more useful information about how inflation targeting performs during periods of economic turbulence. While the global inflation and financial market environment has generally been benign in recent years, a number of emerging market inflation targeters were under substantial stress during the course of their inflation targeting regimes (examples include Brazil and other Latin American countries in the early 2000s, South Africa in late 2002, and Hungary and Poland since 2000.)

For the analysis that follows, we look at 13 emerging market inflation targeters (shown in table 1).¹⁸ We compare them against the remaining 22 emerging market countries that are in the JP Morgan Emerging Markets Bond Index Index, plus 7 additional countries that are classified similarly.¹⁹

It is useful to begin by reviewing inflation performance of targeters and nontargeters over the past 15 years (figure 1). Inflation in both groups was high in the early to mid-1990s, but as of 1997 it was somewhat higher for the nontargeters, which, as a group had already begun to disinflate by 1995.²⁰ Inflation fell in both targeting and nontargeting countries, but even into 2004 a sizable wedge of roughly 3.5 percentage points remained. Such a wedge reflects the success of most inflation targeters in keeping actual inflation on average close to target, although targets have been missed, especially

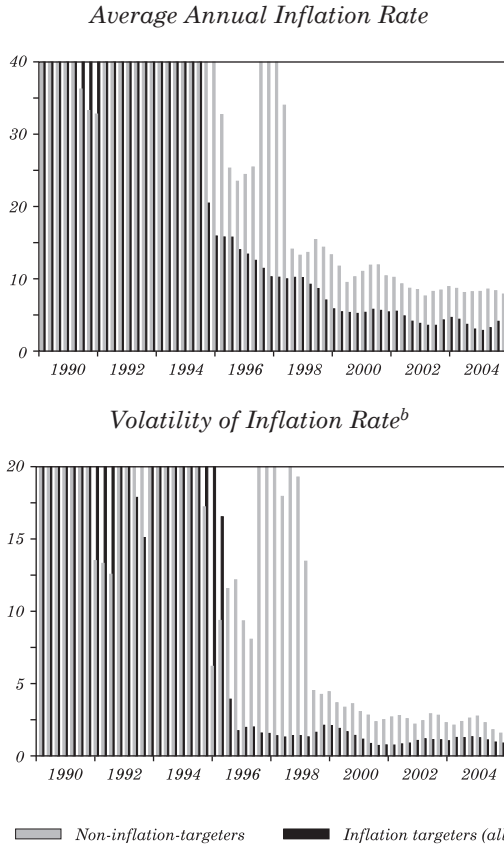
18. All of these countries except the Czech Republic and Israel are included in the JP Morgan Emerging Markets Bond Index.

19. These are Botswana, Costa Rica, Ghana, Guatemala, India, Jordan, and Tanzania. We also experimented with excluding these seven countries from the control group.

20. The hypothesis put forth by Ball and Sheridan (2003) that the countries that chose to adopt inflation targeting were those experiencing a transitory increase in inflation is broadly inconsistent with the data when the country sample is extended to include emerging markets.

Figure 1. Inflation, 1990–2004^a
(percent)

Average inflation has fallen for both inflation targeters and non-inflation targeters over the past 15 years, but more so for inflation targeting countries today



Source: IMF, *International Financial Statistics*; and IMF Staff Calculations.

a. Regional average for emerging market and selected developing countries; average inflation rates above 40 percent and volatilities above 20 percent are not shown, to enable clearer illustration of smaller average inflation differences in the recent past.

b. Rolling one year standard deviation of inflation.

for disinflating countries, which have tended to miss targets more often and by more than countries with stable inflation targets (table 2; Roger and Stone (2005).

To look at the experience in more detail, we compare the performance of inflation targeters before and after adopting inflation targeting relative with the performance of nontargeters. This approach raises the issue of what to use as the “break date” for nontargeters: while no partitioning of the sample is perfect, we follow Ball and Sheridan (2003) in using the average adoption date for inflation targeters (1999Q4) (dates range from 1997Q2 to 2002Q1). Other partitions of the sample yield similar results, as reported below.

As shown in the first panel of table 2, the level and volatility of inflation before inflation targeting was adopted are high and variable for many countries in the sample (Figure 2). The convergence to low and stable inflation following adoption is striking: all countries are clustered in the 1–7 percent range, with a maximum standard deviation of 2 percent. The nontargeters also show improvement along both dimensions, and many succeeded in stabilizing inflation at low levels. As a group, however, their convergence is weaker than the inflation targeters, with many continuing to experience relatively high and volatile inflation. For real output growth and volatility, the pattern is less clear: abstracting from one or two outliers, output volatility is generally lower in the post-adoption period for both groups, with little change in average growth rates.

Table 2. Actual Inflation Relative to Target in Selected Groups of Countries

<i>Item</i>	<i>Standard deviation from target (RMSE) (percentage points)^a</i>	<i>Frequency of deviations^b (percent)</i>		
		<i>Total</i>	<i>Below</i>	<i>Above</i>
All countries	1.8	43.5	24.2	19.3
Industrial countries	1.3	34.8	22.5	12.3
Emerging market countries	2.3	52.2	25.9	26.2
Stable inflation targets	1.3	32.2	21.7	10.6
Disinflation targets	2.2	59.7	27.7	32.0

Source: Roger and Stone (2005).

a. Figures represent equally weighted averages of statistics for individual countries in relevant groups. Individual country statistics are based on monthly (quarterly for Australia and New Zealand) differences between 12-month inflation rates and centers of target ranges.

b. Inflation outcomes relative to edges of target ranges.

2.1 Econometric Analysis

A more formal statistical analysis, along the lines proposed by Ball and Sheridan (2003), yields similar results. Underlying the analysis is the assumption that some gauge of macroeconomic performance—call it X —depends partly on a country’s own history and partly on some underlying mean value of the variable in question. In the case of the inflation rate for inflation targeters, this mean should, of course, correspond to the inflation target; for other countries, this would simply be the “normal” level of inflation to which observed inflation reverts. Mathematically, this process can be expressed as follows:

$$X_{i,t} = \phi [\alpha^T d_{i,t} + \alpha^N (1 - d_{i,t})] + (1 - \phi) X_{i,t-1}, \quad (1)$$

where $X_{i,t}$ is the value of a macroeconomic performance indicator X for country i at time t , α^T is the mean to which X reverts for inflation targeters, α^N is the mean to which X reverts for nontargeters, and $d_{i,t}$ is a variable equal to 1 for targeters and 0 for nontargeters. The parameter ϕ represents the speed with which X reverts to its group-specific α : a value of ϕ equal to 1 means X reverts completely after one period, while a value of ϕ equal to 0 implies that X depends only on its history, with no tendency to revert to any particular value.

The regression used by Ball and Sheridan (2003), and in the results reported in tables 3–6, is a version of equation (1), rewritten in terms of the change in X , appending an error term e , and assuming there are two periods, pre and post adoption:

$$X_{i,\text{post}} - X_{i,\text{pre}} = \phi\alpha^T d_i + \phi\alpha^N (1 - d_i) - \phi X_{i,\text{pre}} + e_i, \quad (2)$$

or, letting $\alpha_0 = \phi\alpha^N$, $\alpha_1 = \phi(\alpha^T - \alpha^N)$ and $b = -\phi$,

$$X_{i,\text{post}} - X_{i,\text{pre}} = \alpha_0 + \alpha_1 d_i + bX_{i,\text{pre}} + e_i. \quad (3)$$

The pre-period for inflation targeters is defined as 1985 until the quarter before the adoption of inflation targeting; the post-period runs from inflation targeting adoption through 2004. The break date for nontargeters is 1999Q4, which corresponds to the mean adoption date for emerging-market inflation targeters.

Table 3 reports the baseline results obtained from estimating equation (3) on the full sample of 35 emerging market economies of

the JP Morgan Emerging Markets Bond Index plus the Czech Republic and Israel (which are inflation targeters but not part of the index) plus 7 countries that are often classified as emerging markets. Included in the set of X variables are CPI inflation, inflation volatility, the volatility of real GDP growth, and the output gap.

Table 3. Baseline Results

<i>Variables</i>	<i>IT dummy variable</i>
CPI inflation	-4.820**
Volatility of CPI inflation	-3.638**
Volatility of real output growth	-0.633
Volatility of output gap	-0.010**

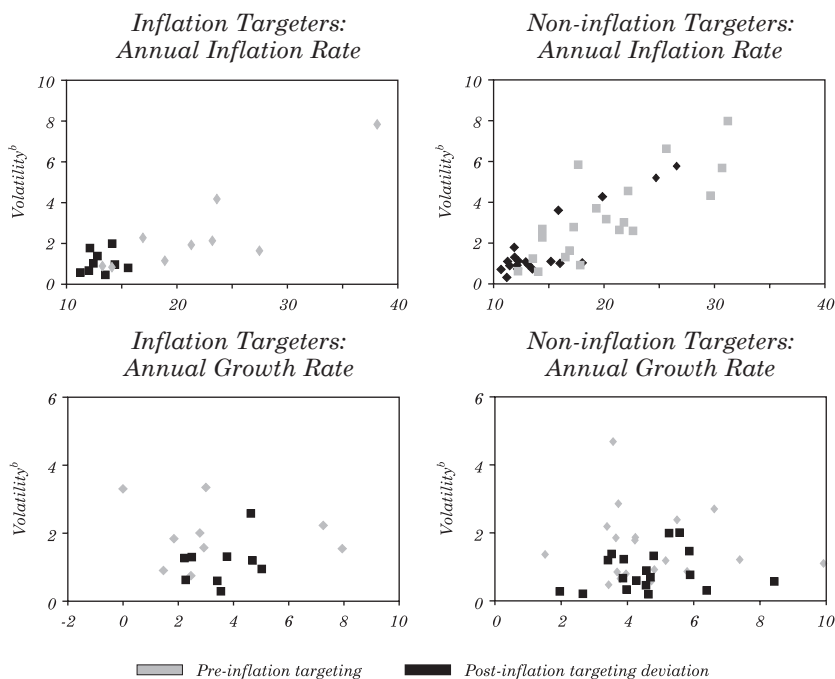
Sources: IMF, *International Financial Statistics*; and IMF staff calculations.
 Note: One, two, and three asterisks denote statistical significance at the 10, 5, and 1 percent level, respectively.

In this framework the relevant parameter for gauging the economic impact of inflation targeting is α_1 , the coefficient on the inflation targeting dummy variable. This parameter is reported in tables 3–6 (α_0 captures whether there has been a generalized improvement in macroeconomic performance across countries independently of differences in monetary regimes). Consider the row on CPI inflation in table 3, showing estimates of equation (3) when X = CPI inflation. There $\alpha_1 = -4.8$, implying that in countries that have adopted inflation targeting, the reduction in CPI inflation was on average 4.8 percentage points greater than in countries that did not do so. Note that if ϕ were known to be zero (that is, complete mean reversion), the estimated α_1 would be nothing more than the difference between average $X_{\text{post}} - X_{\text{pre}}$ for inflation targeters and nontargeters; the only advantage of the regression method is that it controls for the initial level of X_{pre} . Furthermore, by focusing on relatively long periods of time, the analysis is largely a comparison of steady states, saying nothing about what happens during the transition to an inflation targeting (or any other) policy framework; doing so would require a very careful control of cyclical conditions to distinguish transition effects from the normal trajectory of the business cycle.

The results in table 3 reaffirm the descriptive statistics and the visual impression from the plots: inflation targeting is associated with a significant 4.8 percentage point reduction in average inflation and

Figure 2. Inflation and Growth Performance^a
(1985–2004; percent; average on x-axis)

Over the past 15 years, there has been a stronger convergence to low and stable inflation for inflation targeters than non-inflation targeters. Growth performance is also more homogeneously better for inflation targeters.



Source: IMF, *International Financial Statistics*; OECD Analytical Database; and IMF staff calculations.

a. Period average for emerging market and selected developing countries, with pre-inflation targeting average inflation less than 40 percent.

b. Rolling one year standard deviation of inflation.

a reduction in its standard deviation of 3.6 percentage points relative to other strategies.²¹ The standard deviation of real output gap is also slightly lower for the inflation targeters, and the difference between targeters and nontargeters is statistically significant at the 5 percent

21. This finding is at odds with arguments raised by Kumhof (2002), Genberg (2001), and Rich (2000), among others, that inflation targeting is too soft or too discretionary to enable central banks to reduce inflation on a durable basis.

level. Thus there is no evidence that inflation targeters meet their inflation objectives at the expense of real output stabilization.²²

The result that inflation targeting improves inflation performance more than other regimes is in a sense unsurprising, as the control of inflation is, after all, the central bank's overriding medium-term objective. An interesting question is how performance compares on other dimensions that are not directly related to inflation per se, including survey-based inflation expectations; their volatility; and the volatility of the nominal exchange rate, foreign reserves, and real interest rates. Inflation targeting performance was checked with respect to a proxy for the probability of exchange rate crises, using the exchange market pressure index, based on the seminal work of Girton and Roper (1977) and developed by Eichengreen, Rose, and Wyplosz (1994) and Eichengreen (1995).

Using the same statistical framework as before, we find that inflation targeting leads to a reduction in the level and volatility of inflation expectations, along with inflation itself (Table 6). This confirms the notion that inflation targeting has an advantage over other regimes in anchoring expectations and building credibility on a more durable basis, even if inflation targets are missed more frequently in emerging markets than in industrial countries. In the sample used here, the fiscal position before adoption of inflation targeting or the absence of fiscal improvement following adoption does not seem to affect the ability of inflation targeting to deliver lower or more stable inflation (or inflation expectations) relative to other strategies.²³ Nominal exchange rate volatility is lower than in nontargeters, as is the standard deviation of the real interest rate and the volatility of international reserves.²⁴ Interestingly, there is evidence at the 5 percent significance level that inflation targeting is associated with a lower probability of crises, perhaps in part reflecting the greater *de jure*, if not *de facto*, flexibility of the exchange rate regime.

22. This result suggests that concerns raised by, among others, Benjamin Friedman (2001); Baltensperger, Fischer, and Jordan (2002); Meyer (2002); Rivlin (2002); and Blanchard (2003) that inflation targeting is too rigid and constrains discretion inappropriately at the expense of the rate or variability of economic growth may be unwarranted, at least for emerging markets.

23. An event study by Celasun, Gelos, and Prati (2004) over time samples predating the adoption of inflation targeting finds that fiscal improvements may have helped lower inflation expectations in some emerging market countries.

24. Exchange rate volatility in inflation targeting countries is lower than in nontargeters, even when countries with exchange rate targets are dropped from the nontargeting control group.

Robustness Checks

Next, we examined how sensitive the results are to: (i) the way the sample was partitioned into “pre” and “post” periods; (ii) the exclusion of countries whose inflation was high in the “pre” period; (iii) the exclusion of low income countries or of both these and countries that are not “upper middle income” according to the World Bank classification by income; (iv) the exclusion of the seven non-IT countries not included in the JP Morgan EMBI; (v) the exclusion of countries that are severely indebted according to the World Bank classification of country indebtedness; (vi) the exclusion of countries with an exchange rate peg in the “post” period; and, finally, (vii) different degrees of fiscal discipline across countries.

The partitioning of the sample into pre and post periods is somewhat arbitrary, both in determining the starting date for the calculation of the pre-period averages and in the assigning of 1999:Q4 as the hypothetical break date for the nontargeters. In an effort to assess any distortion created by the arbitrariness of the partitioning, we re-estimated equation (3) using two alternative sample partitioning schemes. The first is to start the pre period in 1990 rather than 1985, thus largely removing any effects of the Latin American debt crisis from the sample. The second is to change the break date for nontargeters from 1999:Q4 to the date of the most recent de facto change in monetary policy framework (based on IMF staff calculations and the IMF’s *Annual Report on Exchange Arrangements and Exchange Restrictions*). Under these schemes and the baseline partitioning, however, the pre and post samples vary across countries. To eliminate any possibility that simple time effects could account for the results, a third partitioning was tried, using a standardized 1994–96 pre period, and a standardized 2002–04 post period.

Several additional checks were performed to ensure that the results are robust to sample selection and to the inclusion of other potentially important factors affecting macroeconomic outcomes. First, to guard against the possibility that a handful of extreme inflation observations might be exerting undue influence on the regression, a control was included for countries whose inflation rate exceeded 40 percent in the pre period; a threshold of 100 percent was also tried. Second, equation (3) was reestimated over a smaller sample that excluded countries defined as low-income by the World Bank, as well also over a sample that excluded the seven countries in the control group that were not listed

in the JP Morgan Emerging Markets Bond Index. Third, on the full sample a control was included for countries that are severely indebted externally, in line with the World Bank classification of countries' external indebtedness. Fourth, on the full sample a control for countries with an exchange rate peg during the post period was used. Finally, on the full sample controls were included for the public debt-to-GDP ratio in the pre period and on the change between post and pre periods to rule out the possibility that the observed gains in macroeconomic performance are ascribable not to the introduction of inflation targeting but rather to improvements in fiscal discipline. Results for these two sets of robustness checks are reported in tables 4–6.

The significance, sign, and magnitude of additional controls is reported after the slash next to each estimate of the α_j coefficient (when nothing is reported it means that the control was not significant). In the first column of the bottom panel of table 6, for example, the significance of a precondition on the debt/GDP ratio is examined. Results indicate that the control is significant only for the volatility of 6- to 10-year inflation expectations, suggesting that having a “bad” debt/GDP ratio before adopting inflation targeting reduced the volatility of inflation expectations usually associated with inflation targeting by 0.018 percentage points relative to nontargeting.

None of these modifications significantly alters the baseline results. Inflation targeting continues to be associated with a statistically significant larger reduction in the level and standard deviation of inflation relative to other regimes and little or no effect on the volatility of output.²⁵ The main results of the analysis, therefore, appear to be robust, even when the improvement in fiscal performance in the post-targeting period is accounted for. Interestingly, inflation targeting seems to outperform exchange rate pegs, even when only successful pegs are chosen in comparison.

The conclusions of this analysis are subject to two important caveats. First, although the success of inflation targeting in emerging markets to date is encouraging, the time elapsed since these countries adopted inflation targeting is short, making it hard to draw definite

25. The advantages of inflation targeting relative to other strategies are robust independently of the controls used. However, countries with an initial level of inflation of more than 40 percent show smaller reductions in inflation and inflation volatility before and after adopting inflation targeting. When severely indebted countries are excluded, inflation targeting still implies statistically significant macroeconomic improvements relative to not targeting, although the reduction in inflation volatility and output gap volatility is no longer statistically significant.

Table 4. Different Classifications

<i>Variables</i>	<i>World Bank classification by income</i>		<i>World Bank classification by foreign indebtedness</i>		<i>EMBI classification</i>
	<i>No low income country</i>	<i>No lower middle income country</i>	<i>No severely indebted country</i>	<i>Emerging markets</i>	
	<i>IT dummy variable</i>				
CPI inflation	-5.025**	-9.406*	-3.820**	-4.972**	-4.653**
Volatility of CPI inflation	-4.138**	-4.209	-1.842	-4.828**	-3.959**
Volatility of real output growth	-0.898	-3.128*	-0.435	-1.235	-0.937
Volatility of output gap	-0.012**	-0.024**	-0.009	-0.014**	-0.012**

Sources: IMF, *International Financial Statistics*; J.P. Morgan; national sources; World Bank; and IMF staff calculations.

Note: One, two, and three asterisks denote statistical significance at the 10, 5, and 1 percent level, respectively.

Table 5. Robustness Checks

Variables	Different dates				
	Starting date 1990	Actual dates for non-inflation-targeters Starting date: 1985 Time periods 1994–96 vs. 2002–04			
		<i>IT dummy variable</i>			
CPI inflation	-4.818**	-6.519***			
Volatility of CPI inflation	-3.636**	-4.159***			
Volatility of real output growth	-0.653	-1.221			
Volatility of output gap	-0.009**	-0.013**			
		<i>Control variables</i>			
	<i>Fiscal discipline</i>	<i>Inflation</i>			
	<i>Debt/GDP (Pre)^a</i>	<i>Pre-inflation > 40 percent^d</i>	<i>Pre-inflation >100 percent^e</i>	<i>Exchange rate regime pegs</i>	
	<i>Debt/GDP (Change)^{b,c}</i>	<i>IT dummy/control variables</i>			
CPI inflation	-5.254***	-5.910**	-4.411**/10.036**	-4.758**	-5.829**
Volatility of CPI inflation	-3.461**	-4.084**	-3.498**/7.695**	-3.631**	-3.835**
Volatility of real output growth	-0.595	-0.868	-0.649/2.650**	-0.633	-0.751
Volatility of output gap	-0.010**	-0.011**	-0.011**/0.015**	-0.010**	-0.013**

Sources: IMF, *International Financial Statistics*; national sources; and IMF staff calculations.

Note: One, two, and three asterisks denote statistical significance at the 10, 5, and 1 percent level, respectively. Control variables missing when not significant.

a. Debt in percent of GDP prior to adoption of inflation targeting.

b. Difference in debt in percent of GDP between latest available and prior to adoption of inflation targeting.

c. The sample does not include Argentina and China because fiscal changes in these countries were many times larger than the average in non-inflation targeting countries, and so were biasing the results (showing when included that an improvement in the fiscal stance worsens inflation expectations).

d. Period average inflation prior to adoption of inflation targeting above 40 percent.

e. Period average inflation prior to adoption of inflation targeting above 100 percent.

Table 6. Additional Performance Indicators
(Baseline model robustness checks)

<i>Variables</i>	<i>Starting date</i>		<i>Actual dates for non-inflation-targeters</i>		<i>Time periods</i>
	1985	1990	Starting date: 1985	2002-04	
5-year π forecast 5 ^f	-2.672**	-2.672**	-3.016**		-2.197
Volatility of 5-year π forecast	-2.076**	-2.076**	-1.330**		-1.717**
6-10-year π forecast	-2.185**	-2.185**	-2.558**		-2.184
Volatility of 6-10-year π forecast	-1.737***	-1.737***	-1.232**		-1.596**
Exchange market pressure index	-0.340**	-0.327*	-0.330		-0.494*
Exchange rate volatility	-11.090*	-11.107**	-9.303		-3.654
Reserves volatility	-16.333***	-16.384***	-21.945***		-14.770**
Volatility of real interest rate	-5.025***	-5.025**	-4.695***		-3.020**
<i>IT dummy variable</i>					

Table 6. (continued)

Variables	Control Variables				Exchange rate regime pegs
	Fiscal discipline		Inflation		
	Debt/GDP (Pre) ^a	Debt/GDP (Change) ^{b,c}	Pre-inflation >40 percent ^d	Pre-inflation >100 percent ^e	
	<i>IT dummy/control variables</i>				
5-year π forecast ^f	-2.906**	-2.901**	-2.578**	-2.726**	-1.721
Volatility of 5-year π forecast	-1.840*	-1.755**	-1.765**	-2.103**	-1.491**
6-10-year π forecast	-2.203*	-2.404*	-2.085**	-2.146*	-1.592*
Volatility of 6-10-year π Forecast	-1.350**/ 0.018***	-1.548***	-1.645***	-1.704**	-1.675*
Exchange market pressure index	-0.328**	-0.384**	-0.339**	-0.340*	-0.519***/ -0.4333*
Exchange rate volatility	-9.510**	-7.958*	-9.721*	-11.927*	-13.240**
Reserves volatility	-15.458**	-20.886***/ 0.186**	-16.072***	-16.328***	-20.109***
Volatility of real interest Rate	-4.985**	-6.186**	-5.129** /8.790**	-5.019**	-5.817**

Sources: IMF, *International Financial Statistics*; national sources; and IMF staff calculations.

Note: One, two, and three asterisks denote statistical significance at the 10, 5, and 1 percent level, respectively. Control variables missing when not significant.

a. Debt in percent of GDP prior to adoption of inflation targeting.

b. Difference in debt in percent of GDP between latest available and prior to adoption of inflation targeting.

c. The sample does not include Argentina and China because fiscal changes in these countries were many times larger than the average in non-inflation targeting countries, and were, therefore, biasing the results (showing when included that an improvement in the fiscal stance worsens inflation expectations).

d. Period average inflation prior to adoption of inflation targeting above 40 percent.

e. Period average inflation prior to adoption of inflation targeting above 100 percent.

f. π refers to CPI inflation.

conclusions about its effects. Nevertheless, the observed similarities in the behavior of inflation expectations in emerging market and industrial country inflation targeters over a comparable time span bodes well for what may lie ahead for emerging market targeters (see IMF, 2005a).

Second, in the absence of a counterfactual, it is difficult to resolve definitively whether inflation targeting is causal in generating the observed benefits. In many cases the adoption of inflation targeting coincided with the passage of significant reforms of central banking laws in the early 1990s, which might be interpreted as the manifestation of a shift in preferences toward lower inflation. The fact that these banks still felt the need to install a new monetary framework, however, suggests that a change of heart is not enough without a framework that allows the central bank to follow through on its intention.

3. DO PRECONDITIONS NEED TO BE MET BEFORE INFLATION TARGETING IS ADOPTED?

A common objection to inflation targeting is that it is costly in terms of institutional and technical requirements, making the framework unsuitable for some emerging market economies. The most detailed exposition of this point was made by Eichengreen et. al (1999), who argue that technical capabilities and central bank autonomy were severely lacking in most emerging market economies (including several that subsequently adopted inflation targeting).²⁶ Such countries, the argument goes, would be better off sticking with a conventional policy framework, such as an exchange rate peg or money growth targeting.

“Preconditions” fall into four broad categories:

- *Institutional independence.* The central bank must have full legal autonomy and be free from fiscal and political pressure that create conflicts with the inflation objective.

26. Agénor (2002); Schaechter, Stone, and Zelmer (2000); IMF (2001); Carare, Schaechter, and Stone, (2002); and Khan (2003) also stress the relevance of preconditions. More neutral or benign views on the conceptual relevance of preconditions can be found in Truman (2003), Jonas and Mishkin (2005), Debelle (2001), and Amato and Gerlach (2002).

- *A well-developed technical infrastructure.* The central bank must have inflation forecasting and modeling capabilities and the data needed to implement them.
- *Economic structure.* Prices must be fully deregulated, the economy should not be overly sensitive to commodity prices and exchange rates, and dollarization should be minimal.
- *A healthy financial system.* In order to minimize potential conflicts with financial stabilization objectives and guarantee effective monetary policy transmission, the banking system should be sound and capital markets well developed.

To assess the role of preconditions for the adoption of inflation targeting, we administered a survey to 21 inflation-targeting central banks and 10 nontargeting central banks in emerging markets.²⁷ The version of the survey given to inflation-targeting central banks focused on how policy was formulated, implemented, and communicated and how various aspects of central banking practice had changed before and during the adoption of targeting.²⁸ Survey responses were cross-checked with independent primary and secondary sources and in many cases augmented with “hard” economic data (see appendix). Overall, the evidence indicates that no inflation targeter had these preconditions in place before adopting inflation targeting, although—unsurprisingly—industrial economy targeters were generally in better shape than emerging market inflation targeters at least in some dimension (table 7).

Institutional Independence

Most of the central banks enjoyed at least *de jure* instrument independence at the time they adopted inflation targeting.²⁹ However,

27. These countries included Botswana, Guatemala, India, Indonesia, Malaysia, Pakistan, Russia, Tanzania, Turkey, and Uruguay.

28. The version for targeters was similar in all respects but focused on change before and after the current monetary regime.

29. Instrument independence, which allows the central bank full control over setting the policy instrument, is by far the more important criterion of central bank independence. Goal independence, or the ability of the central bank to set macroeconomic objectives unilaterally, is rare, even in industrial countries, where goals are typically determined by the elected government or through consultation between the central bank and the government (see Debelle and Fischer, 1994).

Table 7. Preconditions and Current Conditions in Inflation Targeting and Nontargeting Emerging Market and Industrial Countries

<i>Item</i>	<i>Targeters</i>				<i>Nontargeters</i>	
	<i>Emerging markets</i>		<i>Industrial countries</i>		<i>Emerging markets</i>	
	<i>Pre-adoption</i>	<i>Current</i>	<i>Pre-adoption</i>	<i>Current</i>	<i>Pre-adoption of current regime</i>	<i>Current</i>
Technical infrastructure	0.29	0.97	0.74	0.98	0.51	0.62
Data availability	0.63	0.92	0.84	0.94	0.65	0.70
Systematic forecast process	0.10	1.00	1.00	1.00	0.60	0.80
Models capable of conditional forecasts	0.13	1.00	0.38	1.00	0.28	0.35
Financial system health	0.41	0.48	0.53	0.60	0.40	0.49
Bank regulatory capital to risk-weighted assets	0.75	1.00	0.75	1.00	0.71	0.86
Stock market capitalization to GDP	0.16	0.21	0.28	0.44	0.16	0.19
Private bond market capitalization to GDP	0.10	0.07	0.40	0.31	0.29	0.20
Stock market turnover ratio	0.29	0.22	0.28	0.35	0.37	0.45
Currency mismatch	0.92	0.96	1.00	1.00	0.67	0.97
Maturity of bonds	0.23	0.43	0.46	0.52	0.18	0.29

Table 7. (continued)

<i>Item</i>	<i>Targeters</i>				<i>Nontargeters</i>	
	<i>Emerging markets</i>		<i>Industrial countries</i>		<i>Emerging markets</i>	
	<i>Pre-adoption</i>	<i>Current</i>	<i>Pre-adoption</i>	<i>Current</i>	<i>Pre-adoption of current regime</i>	<i>Current</i>
Institutional independence	0.59	0.72	0.56	0.78	0.49	0.64
Fiscal obligation	0.77	1.00	0.75	1.00	0.50	0.70
Operational independence	0.81	0.96	0.63	1.00	0.70	1.00
Central bank legal mandate	0.50	0.62	0.16	0.44	0.40	0.55
Governor's job security	0.85	0.85	1.00	1.00	0.80	0.80
Fiscal balance as percentage of GDP	0.48	0.47	0.45	0.78	0.38	0.42
Public debt as percentage of GDP	0.47	0.47	0.53	0.54	0.35	0.46
Central bank independence	0.26	0.64	0.44	0.72	0.32	0.55
Economic structure	0.36	0.46	0.47	0.55	0.55	0.44
Exchange rate pass-through	0.23	0.44	0.31	0.50	0.33	0.42
Sensitivity to commodity prices	0.35	0.42	0.44	0.56	0.67	0.55
Extent of dollarization	0.69	0.75	1.00	1.00	0.63	0.60
Trade openness	0.18	0.21	0.13	0.16	0.56	0.19

Sources: IMF, *Global Financial Stability Report*; IMF, *International Financial Statistics*; national sources; OECD; Ramon-Ballester and Torsten (2005); World Bank, *Financial Structure and Economic Development Database*; IMF staff calculations.
 Note: A value of 1 represents best current practice.

survey responses—corroborated by consulting the relevant central bank laws—indicate that only one fifth³⁰ of the emerging market targeters contemporaneously satisfied other key indicators³¹ of independence at adoption and thus can be characterized as having adopted inflation targeting under a very high degree of legal autonomy.³² Of course, it is possible that even legal provisions designed to shield the central bank from pressures to monetize might be overwhelmed by a dire fiscal imbalance.

The data suggest that inflation targeters faced a wide variety of fiscal conditions at the time they adopted inflation targeting. Israel and the Philippines, for example, had high public debt/GDP ratios and large fiscal deficits, while Chile was in good fiscal shape. The emerging market inflation targeters did, however, tend to have somewhat higher public debt levels than the industrial country targeters.

Technical Infrastructure

Central bank survey responses indicate that the majority of industrial and emerging market targeters started with little or no forecasting capability and no forecasting model; when a small model was available, most central banks report that it was not suitable to make forecasts conditional on different assumptions for the monetary policy instrument.³³ In addition, although industrial country targeters often had some sort of systematic forecast process in place, most emerging market targeters did not. Key data to generate forecasts and analyze spending and price patterns were missing or of low quality

30. This overall picture is borne out by broader measures of central bank independence, notably by indices prepared by Arnone and others (2005), based in turn on the methods of Grilli, Masciandaro and Tabellini (1991).

31. These include freedom from any obligation for the central bank to purchase government debt, thus preventing monetization; a high degree of job security for the central bank governor (a fixed term and provisions that allow the governor to be fired only with cause); and the presence of an inflation-focused mandate in which price stability is the sole stated objective.

32. Legal autonomy has sometimes been granted concurrently with—or, in one case, after—the adoption of inflation targeting. Many of the central banks in the sample achieved greater independence in the early 1990s (see Jácome, 2001 for a survey of developments in Latin America). Hungary and the Republic of Korea became fully independent just as inflation targeting was being adopted, suggesting a recognition of the close connection between the two phenomena. The Central Bank of Thailand, which adopted inflation targeting in 2000, continues to operate under a charter from 1942 that says almost nothing about monetary autonomy. A new central bank law is reportedly under consideration by the Thai parliament.

33. Exceptions are Canada, Sweden, and the United Kingdom among industrial countries and Poland and South Africa among emerging markets.

at the time inflation targeting was adopted, with emerging market targeters at a disadvantage relative to industrial country targeters.

Economic Structure

None of the targeters enjoyed ideal economic conditions at the time of they adopted targeting. Countries were sensitive to changes in exchange rates and commodity prices when they adopted inflation targeting. Dollarization was not a problem for industrial country targeters; the evidence on dollarization from the survey and from data collected by Ramon-Ballester and Wezel (2005) indicate different degrees of dollarization across emerging market targeters, with Peru the most dollarized targeter.³⁴ Last but not least, the survey indicates that the consumer price index in a number of targeting countries included at the time of adoption (and in most case still includes) a significant share of administered prices.

Healthy Financial and Banking System

At adoption most targeters scored poorly in terms of the risk-weighted capital adequacy ratio; measures of financial market depth (ratios of stock market capitalization to GDP, private bond issuance to GDP, and stock market turnover or the maximum maturity of actively traded government or corporate nominal bonds); and the extent of banks' foreign currency open positions.

Failure to Meet Preconditions

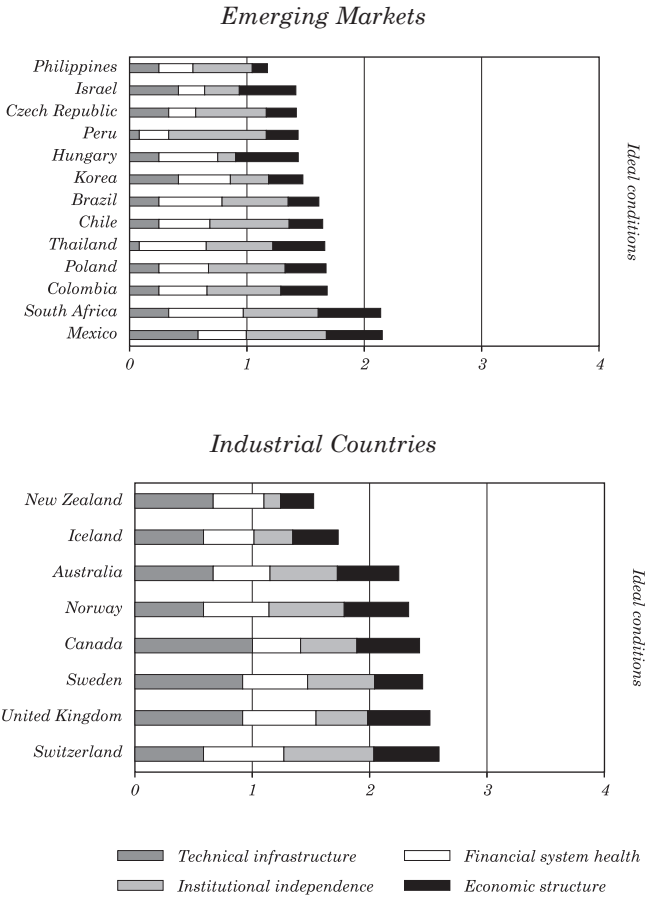
The fact that none of today's inflation targeters—either individually or on average—met preconditions suggests that failure to meet them is not by itself an impediment to the adoption and success of inflation targeting (Figure 3). This finding is confirmed by econometric tests. Using the preconditions listed in table 3 as additional control variables in the regressions from the previous section, we find that no precondition enters significantly in the equations explaining the improvement in macroeconomic performance following the adoption of inflation targeting (table 8).³⁵

34. These data are broadly in line with those of Reinhart, Rogoff, and Savastano (2003).

35. The only exception is represented by evidence of greater exchange rate volatility for countries with better developed financial systems before adopting inflation targeting.

Figure 3. Initial Conditions Prior to Adopting Inflation Targeting

Most of the inflation targeters had poor initial conditions prior to the adoption of inflation targeting.



Source: IMF staff calculations.

Note: For each of the four categories of initial conditions, 0 = poor and 1 = ideal.

Two other messages emerge from table 7. First, in terms of institutional, technical, and economic characteristics, the gap between inflation targeters (at the time of adoption) and potential emerging market inflation targeting adopters (today) is relatively small, suggesting that these factors should not stand in the way of the successful adoption of inflation targeting in these countries. It is impossible to be completely confident from this analysis that this will be true for other countries that may have much weaker initial conditions than those documented here. But the evidence based on the sample clearly rejects a common view that emerging markets are too fragile and lack the necessary prerequisites to successfully implement an inflation targeting regime.

Second, the evidence and survey responses indicate that the adoption of inflation targeting has been associated with rapid improvements in institutional and technical structures, including developments in data availability and forecasting. Thus even if meeting institutional and technical standards may not be critical before inflation targeting is adopted, a proactive approach to making improvements by the central bank and other parts of government after adopting targeting may be essential to ensure the conditions needed for success.

4. CONCLUSIONS

Inflation targeting is a relatively new monetary policy framework for emerging market countries. While the short time period that has elapsed since the adoption of these frameworks means that any assessment must be preliminary, the evidence from the initial years of operation is encouraging, with targeting associated with lower inflation, lower inflation expectations, and lower inflation volatility. There have been no visible adverse effects of targeting on output, and performance along other dimensions—such as the volatility of interest rates, exchange rates, and international reserves—has been favorable. All this may explain the appeal of this strategy for emerging markets in which poor past inflation records have made it difficult to build credibility and minimizing the output costs of reducing inflation is imperative for social and political reasons. It also may explain why no country has yet abandoned inflation targeting.

The evidence suggests that it does not appear to be necessary for emerging market countries to meet a stringent set of institutional, technical, and economic preconditions before successfully adopting

Table 8. Do Preconditions Need To Be Met before Inflation Targeting Is Adopted?

<i>Variable</i>	<i>Technical infrastructure</i>	<i>Financial system health</i>	<i>Economic structure</i>	<i>Institutional independence</i>
CPI inflation	5.599	6.553	0.831	-1.517
Volatility of CPI inflation	1.056	-0.260	-2.759	-1.141
Volatility of real output growth	4.288	-0.561	-2.907	-2.275
Volatility of output gap	-0.007	-0.006	-0.004	-0.032
5-year inflation forecast	0.358	-1.479	2.193	-0.463
Volatility of 5-year inflation forecast	-0.198	0.192	0.216	-0.064
6- to 10-year inflation forecast	-0.615	-1.778	0.432	-1.719
Volatility of 6-10-year inflation forecast	-0.287	0.507	0.227	-0.077
Exchange market pressure index	0.464	0.599	-0.203	0.796
Exchange rate volatility	22.302	39.792*	-14.650	0.786
Reserves volatility	5.610	2.674	-1.437	-28.867
Volatility of real interest rate	-3.034	-3.169	-1.330	1.011

Source: IMF (2005) and IMF staff calculations.

* Significant at the 5 percent level.

inflation targeting. Instead, the feasibility and success of targeting appears to depend more on the authorities' commitment and ability to plan and drive institutional change after introducing targeting. Consequently, policy advice to countries that are interested in adopting targeting could usefully focus on the institutional and technical goals central banks should strive for during and after adopting targeting in order to maximize its potential benefits.

APPENDIX

Data from the Survey on Preconditions and Current Conditions**Variable Descriptions and Data Sources**

Unless otherwise noted, all data run from 1985:Q1 through 2004:Q4.

- *Inflation rate.* Calculated as the annual growth rate of the consumer price index. Quarterly data were obtained from the IMF's *International Financial Statistics* and data from the Organisation for Economic Co-operation and Development (OECD).
- *Output growth rate.* Annual growth rate of real GDP in local currency. Quarterly data were obtained from the IMF's *International Financial Statistics* and *World Economic Outlook* and from OECD data.
- *Output gap.* Calculated as the residual from a regression of the logarithm of real GDP on a constant term, a linear trend, and a quadratic trend.
- *Nominal short-term interest rate.* Three-month money market interest rate or deposit rate. Quarterly data were obtained from the IMF's *International Financial Statistics* and *World Economic Outlook* and from OECD data.
- *Foreign exchange rate.* Local currency per U.S. dollar. Quarterly data were obtained from the IMF's *International Financial Statistics*.
- *International reserves minus gold.* In U.S. dollars. Quarterly data were obtained from the IMF's *International Financial Statistics*.
- *Broad money.* In local currency, broadest definition available. Quarterly data were obtained from the IMF's *International Financial Statistics* and *World Economic Outlook*.
- *Inflation expectations.* Survey data were obtained from Consensus Economics, Inc. Availability varies by country.

Indicators of Preconditions and Current Conditions

Central Bank Infrastructure

These three survey-based indicators are intended to measure central banks' data resources, modeling, and forecasting capabilities. For the regression analysis, an index of central bank infrastructure was created as the simple average of these three measures.

- *Data availability.* Survey questions 78 and 84 asked whether all essential macroeconomic data were available at the time inflation targeting was adopted. Answers were coded as 1 if all data were available, reliable, and of good quality and as 0 if any data were missing. A value of 0.25 was assigned if all data were available but most were either highly unreliable (because, for example, they were typically subject to large revisions or available only at low frequencies). A value of 0.75 was assigned if all data were available but all were not reliable or of good quality,
- *Systematic forecast process.* Survey questions 47–52 asked about the forecasting capabilities in place at the time of adoption. If a periodic, systematic forecast process was already in place, the variable was set at 1; if no such process was in place, the variable was set to 0.
- *Models capable of conditional forecasts.* Based on responses to survey questions 47–52, a variable was created and set to 1 if forecasting models capable of generating conditional forecasts were available; the variable was set to 0 if no such models were available.

Health of the Financial System

Six indicators measure the degree of development and degree of soundness of the banking and financial system. Two are taken from the survey responses; four are based on nonsurvey data sources. For the regression analysis, an index of banking and financial conditions was created as the simple average of these six measures. In most cases the health of the United Kingdom's financial system was taken as the benchmark in constructing the components of the index itself, on the grounds that the United Kingdom is widely considered to be financially developed and sound from a financial regulatory point of view.

- *Percentage of banks' risk-weighted assets.* Using data compiled and reported in a previous IMF study,³⁶ a variable was created and set to 1 for countries in which the banking system, in aggregate, had regulatory capital in excess of 10 percent of risk-weighted assets; the variable was set to 0 for countries not meeting this standard.
- *Stock market capitalization.* Using data from the World Bank, the ratio of stock market capitalization to GDP was calculated for each country in the sample and scaled to the ratio for the United Kingdom, so that a value of 1 indicates a degree of stock market capitalization comparable to that of the United Kingdom.³⁷
- *Depth of private bond market.* Using the same World Bank data, the ratio of privately issued bonds outstanding to GDP was calculated for each country in the sample and scaled to the ratio for the United Kingdom, so that a value of 1 indicates a degree of private bond market depth comparable to that of the United Kingdom.
- *Stock market turnover.* Using the same World Bank data, the ratio of stock market turnover to GDP was calculated for each country in the sample and scaled to the ratio for the United Kingdom, so that a value of 1 indicates a transaction volume comparable to that of the United Kingdom.
- *Lack of currency mismatch.* Survey question 106 asked central banks to characterize the degree of currency mismatch faced by domestically owned banks. From the responses to this question, a variable equal to 1 was created if the degree of mismatch was described as "none" or "low." The variable was set equal to 0.5 if "some" or "moderate" mismatch was reported. It was set to 0 if the degree of reported mismatch was "high."
- *Maturity of bonds.* Survey question 114 asked central banks to report the maximum maturity of actively traded bonds. The response to this question was converted to years and divided by 30, so that countries with actively traded 30-year bonds were assigned a value of 1 for this variable.

36. IMF (2005), table 22.

37. The underlying data were obtained from the World Bank Financial Structure and Economic Database (<http://www.worldbank.org/research/projects/finstructure/database.htm>).

Institutional Independence

Six indicators gauge the degree to which the central bank is able to pursue its monetary policy objectives free from conflict with other, competing objectives. Three are based on the responses to the survey administered to central banks (checked for consistency against other central bank sources), three are derived from independent data sources. For the regression analysis, an index of institutional autonomy was created as the simple average of these six measures.

- *Absence of fiscal obligation.* Survey questions 3 and 7 asked central banks whether there was an implicit or explicit obligation to finance government budget deficits. From the responses, a variable was created and set equal 1 if no such obligation existed and 0 otherwise.
- *Operational independence.* Survey questions 4 and 7 asked whether the central bank had full “instrument independence,” giving it sole responsibility for setting the monetary policy instrument. A variable was created and set to 1 for countries reporting full instrument independence and 0 otherwise.
- *Inflation-focused mandate.* Survey questions 14 and 18 asked central banks to describe their legal mandate. From these responses, a variable was created and set to 1 if inflation is the only formal objective, to 0.5 if other objectives are specified but inflation takes precedence, and to 0 if other objectives are specified on an equal footing with inflation.
- *Favorable fiscal balance.* Using primary fiscal balance data from the IMF and the OECD, a variable was created indicating a lack of pressure to finance fiscal deficits. For each country in the sample, the ratio of the primary fiscal balance to GDP was calculated and averaged over the two years before the adoption of inflation targeting. (For nontargeters, the most recent two years were used.) This ratio was converted to a score ranging from 0 to 1 using a logistic transformation, scaled in such a way that a budget that was in balance or in surplus was assigned a value of 1 and a budget deficit in excess of 3 percent of GDP was assigned a value of 0.³⁸

38. The transformation used is: $\exp(2 \times (\text{balance} + 1.5)) / [1 + \exp(2 \times (\text{balance} + 1.5))]$, where “balance” is the fiscal balance, expressed as a percentage of GDP.

- *Low public debt.* Using data from the OECD and the IMF's Fiscal Affairs Department/World Economic Outlook public debt database, the ratio of public debt to GDP was calculated for the year before inflation targeting was adopted. (For nontargeters, the most recent observation was used.) From this, a variable was created equal to the greater of 1 or 1 minus the ratio of debt to GDP. Thus a country with no public debt received a value of 1 and one with a ratio of debt to GDP equal to or greater than 100 received a value of 0.
- *Central bank independence.* This variable is the "overall" measure (the average of political and economic) of central bank independence reported by Arnone and others (2005).³⁹ These data are available for 1991–92 and 2003. They are scaled so that a value of 1 indicates complete independence while lower values indicate less independence.

Economic Structure

Five indicators capture a variety of economic conditions that are often thought to affect the likelihood of success of inflation targeting. For the regression analysis, an index of economic conditions was created as the simple average of these five measures.

- *Low exchange rate pass-through.* Survey question 96 asked central banks to characterize the degree of exchange rate pass-through. The responses were coded as follows: 1 for "not sensitive," 0.5 for "sensitive," and 0 for "very sensitive."
- *Low sensitivity to commodity prices.* Survey question 97 asked central banks to characterize the degree of sensitivity of inflation to commodity price fluctuations. The responses were coded as follows: 1 for "not sensitive," 0.5 for "sensitive," and 0 for "very sensitive."
- *Extent of dollarization.* Survey question 98 asked central banks to characterize the degree of dollarization in their economies. These responses and data from Ramon-Ballester and Wezel (2005) were used to construct a variable whose value was set to 1 for countries with little or no dollarization, 0.5 for countries with some dollarization, and 0 for countries with a high degree of dollarization.

39. See Arnone and others (2005).

- *Extent of trade openness.* The ratio of exports plus imports to GDP was calculated using data from the IMF's *International Financial Statistics* and *World Economic Outlook* and the OECD. This ratio was then scaled to that of Singapore (the economy with the largest trade share relative to GDP) and subtracted from 1, resulting in an index that equals 1 in the hypothetical case of a completely autarchic economy and 0 for an economy with a degree of trade openness comparable to that of Singapore. Inflation targeters' preconditions were calculated using an average of the trade to GDP ratio over the two years before they adopted inflation targeting; for nontargeters the score was based on the 2004 data.

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