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Inflation Targeting in Emerging Market Economies

1. Introduction

The performance of inflation-targeting regimes around the world has been positive. Average inflation in both emerging markets and developed economies is substantially lower after the adoption of the inflation-targeting regime than immediately before its adoption (Figure 1).[1] However, emerging market economies (EMEs) have had a relatively worse performance. In these countries, deviations from both central targets and upper bounds are larger and more common.[2] This outcome suggests that either inflation targeters in EMEs are less committed to their targets or inflation targeting in these countries is a more challenging task than in developed ones. The latter explanation is related to the more volatile macroeconomic environment and to weaker institutions and credibility in these countries, which in turn lead to more acute trade-offs than the existing ones in developed economies.

We thank the participants in the NBER Eighteenth Annual Conference on Macroeconomics, especially Mark Gertler, Robert Hall, Frederic Mishkin, and Kenneth Rogoff, and seminar participants at Princeton University for their comments. We are also grateful to Fabia A. de Carvalho, Eduardo Loyo, and Marcio I. Nakane for their suggestions; to Thaís P. Ferreira and Myrian B. S. Petrassi for research assistance; and to Marcileide A. da Silva, Pedro H. S. de Sousa, and Raquel K. de S. Tsukada for assistance with data. The views expressed are those of the authors and not necessarily those of the Banco Central do Brasil.

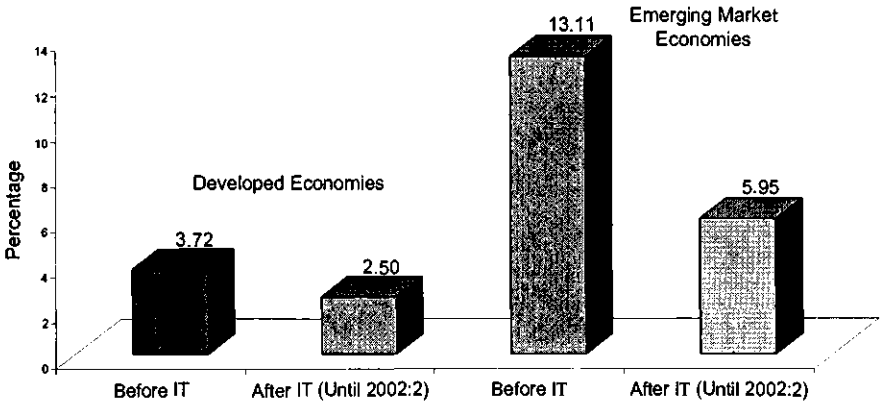
1. Bernanke, Laubach, Mishkin, and Posen (1999); Mishkin and Schmidt-Hebbel (2002); and Corbo, Landerretche, and Schmidt-Hebbel (2002) have found evidence of additional gains stemming from inflation targeting. Ball and Sheridan (2003) have found no evidence that inflation-targeting countries have enjoyed better performance in the OECD.
2. The deviations of inflation from central targets and from the upper bounds of targets were 81% and 167% higher than in developed economies, respectively (table available on request to the authors).

Under inflation targeting, EMEs have the challenge of breaking the vicious circle between, on one side, low credibility and more fragile institutions and, on the other side, higher macroeconomic instability and vulnerability to external shocks. It is a long process that involves acquiring credibility as a monetary policy institution committed to price stability in the context of higher instability.

This paper assesses inflation targeting in EMEs compared to that in developed economies and develops applied prescriptions for the conduct of monetary policy and inflation-targeting design. We verify that EMEs have faced more acute trade-offs than developed countries have: both output and inflation are more volatile, and the inflation level is higher. The explanation for the different performance of EMEs relies on the presence of more fragile institutions and imperfect credibility, and on the nature and magnitude of the shocks that hit these economies.

There are several instances where these more acute trade-offs emerge. Take the case of a sudden stop in the inflow of capital to an EME leading to a substantial depreciation of the currency (e.g., in 2002, Brazil was faced with a negative swing of US$30 billion—or 6% of gross domestic product (GDP)—in capital flows relative to an already difficult 2001, which led to a nominal depreciation of 50%). Even in a context of good initial conditions—low pass-through and 12-month forward inflation expectations on track—this event led to a breach of the inflation target and, given some inertia, to a worsening of both inflation expectations and actual future inflation (Brazil's target of 4% was breached with an inflation of 12.5%, and 12-month forward inflation expectations were 11.0% at the end of

Figure 1 INFLATION BEFORE AND AFTER ADOPTION OF INFLATION TARGETING (IT)



December 2002). In this context, what is the optimal response to these types of shocks? Should one take 24 months or longer to converge to the target, even when building credibility and reputation is still important?

In general, in the more volatile environment in EMEs, some applied and theoretical issues deserve attention. (1) How can the country build credibility when faced with larger shocks? And how can it balance flexibility and credibility in such an instance? (2) How does an inflation-targeting regime work in a disinflation process? And in a credibility-building process? (3) How can a country deal with shocks that represent important changes in relative prices? (4) Should bands be wider and the central points of inflation targets be higher in EMEs? (5) How should International Monetary Fund (IMF) conditionality be designed with an inflation-targeting country?

This paper discusses these monetary policy issues. Its focus, therefore, is more applied. For that purpose, our analysis is based on empirical findings for EMEs and, in particular, on our own experience at the Banco Central do Brasil (BCB), besides the use of simulations of a model to guide our discussions. In a way, because the case of Brazil represents the first stress test of an inflation-targeting regime, the lessons learned may someday be useful for other countries.

We stress the role of communication and transparency as crucial for the process of building credibility. This paper lays out the main issues and, as a by-product, also includes two applied proposals. The first is a transparent procedure that a central bank under inflation targeting can apply and communicate when facing strong supply shocks. The second is a design of a monitoring structure for an inflation-targeting regime under an IMF program.

The paper is organized as follows. Section 2 presents some stylized facts about EMEs and developed countries. It contains a statistical comparison of the conduct and results of monetary policy in EMEs and developed countries. Section 3 presents a theoretical model of a small open economy, which is employed to simulate the effects of some shocks and changes in inflation targets. Section 4 discusses some reasons why EMEs face higher volatility. It analyzes the challenge of constructing credibility and reducing inflation levels, analyzes the effect of large external shocks, and addresses issues on fiscal and financial dominance. Section 5 addresses how to deal with shocks.

2. *Stylized Facts About Inflation Targeting in Emerging Market Economies*

In this section we present basic stylized facts comparing the volatilities of inflation, output, exchange rates, and interest rates, and the average of inflation and output growth in emerging markets and developed

Table 1 INITIAL TARGETS AND INFLATION AROUND ADOPTION OF INFLATION TARGETING (12-MONTH ACCUMULATED INFLATION)

	Date of adoption inflation targeting	*First target*	*Inflation right before IT adoption*	*Inflation 12 months after IT adoption*
Developed economies				
Australia	Apr 1993	2% – 3%	1.22	1.74
Canada	Feb 1991	3% – 5%	6.83	1.68
Iceland	Mar 2001	2.5% (–1.5% + 3.5%)	4.05	8.72
New Zealand	Mar 1990	3% – 5%	7.03	4.52
Norway	Mar 2001	2.5	3.64	1.10
Sweden	Jan 1993	2% (± 1%)	1.76	1.70
Switzerland	Jan 2000	≤ 2%	1.63	0.90
United Kingdom	Oct 1992	1% – 4%	3.57	1.35
Average		**2.8**	**3.72**	**2.71**
Median		**2.5**	**3.61**	**1.69**
Emerging market economies				
Brazil[1]	Jun 1999	8% (± 2%)	3.15	6.51
Chile	Jan 1991	15% – 20%	27.31	19.47
Colombia	Sep 1999	15%	9.22	9.35
Czech Republic	Jan 1998	5.5% – 6.5%	9.98	3.5
Hungary	Jun 2001	7% (±1%)	10.78	4.87
Israel	Jan 1992	14% – 15%	18.03	10.74
Mexico	Jan 1991	≤13%	18.61	11.03
Peru	Jan 1994	15% – 20%	39.49	13.71
Poland	Oct 1998	≤9.5%	10.44	8.82
South Africa[2]	Feb 2000	3% – 6%	2.65	7.77
South Korea	Jan 1998	9%(±1%)	6.57	1.46
Thailand	Apr 2000	0% – 3.5%	1.04	2.47
Average		**10.3**	**13.11**	**8.31**
Median		**9.3**	**10.21**	**8.30**

1. In Brazil, the inflation of the period previous to the adoption of inflation targeting was in part a result of the overappreciation of the domestic currency.
2. First target established for 2002.

economies.[3] We have faced two difficulties in defining the differences between the two country groups. First, some differences exist across EMEs; therefore, not all characteristics that we list are common to all these economies. Because they are present in a significant part of the group, however, we call them stylized facts. Second, in most EMEs, the adoption of inflation targeting is recent, making it difficult to draw conclusions and to apply econometric methods. Table 1 shows the dates of adoption for

3. The assessment of the experiences of some countries and of some issues involved in the design of inflation targeting can be found in Bernanke, Laubach, Mishkin, and Posen (1999); Truman (2003); Mishkin and Schmidt-Hebbel (2002); Schmidt-Hebbel and Werner (2002); Corbo and Schmidt-Hebbel (2001); and Minella, Freitas, Goldfajn, and Muinhos (2002).

Table 2 VOLATILITY AND AVERAGE OF SELECTED VARIABLES FOR 1997:1–2002:2

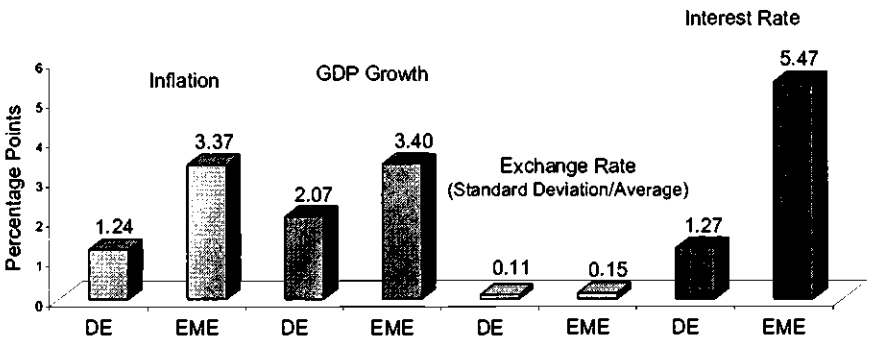
	Volatility of basic variables				*Average*	
Countries	Inflation	Exchange rate*	GDP growth†	Interest rate	GDP growth	Inflation
Developed economies						
Australia	2.05	0.13	1.96	0.58	4.78	5.89
Canada	0.83	0.04	1.30	1.14	3.57	1.96
Iceland	2.45	0.15	3.13	3.02	4.17	4.05
New Zealand	1.21	0.16	3.61	1.47	3.09	1.65
Norway	0.77	0.10	2.25	1.46	2.66	2.44
Sweden	1.11	0.12	2.41	0.44	2.58	1.24
Switzerland	0.54	0.08	1.14	0.92	1.79	0.85
United Kingdom	0.92	0.06	0.79	1.13	2.61	2.46
Average	**1.24**	**0.11**	**2.07**	**1.27**	**3.16**	**2.57**
Median	**1.02**	**0.11**	**2.11**	**1.13**	**2.88**	**2.20**
Emerging market economies						
Brazil	2.09	0.15‡	2.06	7.06	1.81	5.89
Chile	1.30	0.17	3.25	—	3.11	3.88
Colombia	5.43	0.25	3.38	10.02	0.81	12.51
Czech Republic	3.46	0.09	2.73	5.81	1.81	5.31
Hungary	4.09	0.16	—	1.13	—	11.21
Israel	3.18	0.10	3.36	3.34	2.98	4.35
Mexico	5.98	0.07	3.17	7.26	4.05	11.72
Peru	3.04	0.11	3.45	5.50	2.11	3.89
Poland	4.13	0.11	2.40	4.14	3.85	8.40
South Africa	2.13	0.26	1.11	3.65	2.26	6.51
South Korea	2.36	0.14	6.38	5.52	4.31	3.73
Thailand	3.25	0.14	6.13	6.72	0.08	2.88
Average	**3.37**	**0.15**	**3.40**	**5.47**	**2.41**	**6.69**
Median	**3.22**	**0.14**	**3.25**	**5.52**	**2.26**	**5.60**

Data source: International Financial Statistics, IMF (quarterly data).
* The coefficient of variation (standard deviation/average).
† Growth rate measured comparing the current quarter to the quarter of the previous year.
‡The period 1999:1–2002:2. For 1997:1–2002:2, the value is 0.31.

emerging and developed economies. The number of inflation targeters among developing and developed economies amounts to 12 and 8, respectively. Most of the developed countries adopted inflation targeting between 1990 and 1993, whereas the majority of the developing countries adopted it from 1998 onward.

We consider two samples. The first refers to the period after the adoption of inflation targeting in each country. The objective is to compare countries with the same regime. Because the periods across countries are different, however, the world macroeconomic environment is

Figure 2 VOLATILITIES OF SELECTED VARIABLES OF THE PERIOD 1997–2002 (AVERAGE OF STANDARD DEVIATION)



DE = developed economies.
EME = emerging market economies.

different as well. Then we consider a second sample that refers to a recent period, which includes Asian, Brazilian, and Russian crises: 1997 to mid-2002, which we refer to as a fixed sample. In this case, some countries are inflation targeters in the whole sample, whereas others are just in part of it. Table 2 and Figure 2 record the data for the second sample.[4]

In both samples, the data indicate that, in comparison to developed economies, the volatilities of all variables (inflation, the exchange rate,[5] output, and the interest rate) and the inflation level are higher in EMEs. The more challenging trade-off faced by EMEs is illustrated in Figure 3, which shows the combination of the variability of output growth and inflation for each country for 1997:1 to 2002:2.

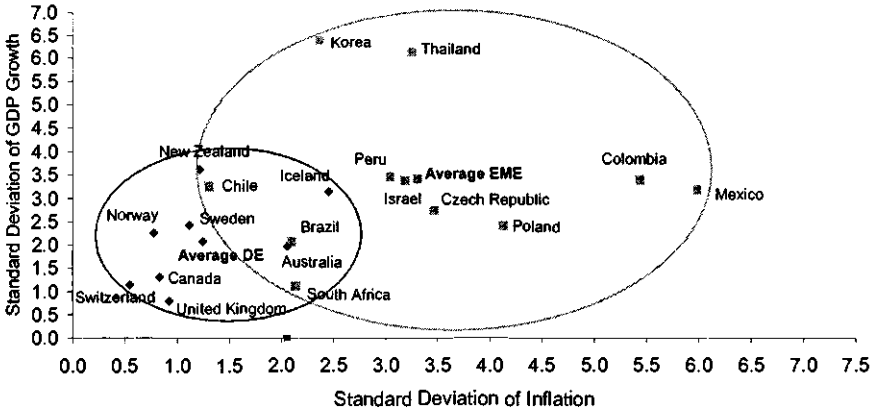
3. *Model*

We develop a small open economy model to illustrate the main points raised in the paper. The objective is to simulate the effects of some shocks and changes in inflation targets. The model combines features of Batini, Harrison, and Millard's (2003) and McCallum and Nelson's (2000) formulations.

Imports enter as intermediate goods, in contrast to most of the open economy literature, which typically uses a model with imports as consumption goods. As stressed by McCallum and Nelson (2000), a

4. The data referring to the first sample is available on request to the authors.
5. For the inflation-targeting sample, the measured exchange-rate volatility is similar.

Figure 3 TRADE-OFF VOLATILITIES OF OUTPUT AND INFLATION (1997:1–2002:2)



DE = developed economies.
EME = emerging market economies.

specification where imports are entered as intermediate goods captures better the features of the data. In comparison to models where imports enter as consumption goods, such as in Galí and Monacelli (2002), McCallum and Nelson's (2000) model generates a lower and more delayed correlation between exchange-rate changes and the inflation rate, closer to that observed in the data. Furthermore, intermediate goods are the major items in imports. Table 3 records the share in imports of goods classified by use for five countries. On average, consumption goods represent only 21.3% of the total imports, whereas capital and intermediate goods shares are 29.5% and 46.2%, respectively. Because no imported consumption goods are included in the model, there is no distinction between domestic and consumer price index (CPI) inflation, which is different from Svensson (2000) and Galí and Monacelli (2002).

The model is derived from the optimization of infinitely lived households and firms. We present directly the log approximation of the variables around the nonstochastic flexible-price steady state. Lowercase variables represent log-deviations from their steady-state values.[6] We present here only the most important equations of the model.[7] The economy is

6. $x_t = \log(X_t) - \log(X_t^{SS})$, where X_t^{SS} is the steady-state value for X_t, and log is the natural logarithm. Because $\log(1 + r_t) \approx r_t$, the lowercase variables represent percentage deviations from the steady state.
7. The derivation of the model from the optimization of households and firms, and all the equations resulting from the log-linearization are available on request to the authors.

comprised of households, firms (owned by the households), and government. Firms produce differentiated consumption goods using a Cobb-Douglas production function:

$$y_t = a_t + \alpha n_t + (1 - \alpha) m_t \tag{1}$$

where y_t is output, a_t represents a stochastic productivity factor, n_t is (domestic) labor, and m_t is imported goods.

Production is either consumed by domestic households or exported (therefore, the economy exports consumption goods and imports intermediate ones):

$$y_t = s_c c_t + s_x x_t \tag{2}$$

where c_t is domestic consumption, x_t is exports, $s_c = (1 - X^{SS}/Y^{SS})$, and $s_x = X^{SS}/Y^{SS}$.

The aggregate demand equations are:

$$c_t = E_t c_{t+1} - \frac{1}{\gamma_c}(i_t - E_t \pi_{t+1}) + \varepsilon_{ct} \tag{3}$$

$$x_t = \eta q_t + y_t^* \tag{4}$$

where i_t is the nominal interest rate; E_t is the expectations operator; inflation is $\pi_t = p_t - p_{t-1}$; p_t is the price level; γ_c is the inverse of the intertemporal elasticity of substitution for consumption; ε_{ct} is a shock to preferences; η is the elasticity of substitution between domestic and foreign goods; q_t is the real exchange rate, defined as $q_t = s_t + p_t^* - p_t$; s_t is the nominal exchange rate, defined as the price in domestic currency of a unit of foreign currency; p_t^* is the foreign price level; and y_t^* is the output of the rest

Table 3 IMPORTS CLASSIFIED BY USE (2001)

Countries	*Consumption*	*Capital*	*Intermediate (including fuel)*	*Total*
Australia	30.2 %	21.3 %	48.5 %	100.0 %
Brazil	12.8 %	26.6 %	60.6 %	100.0 %
Chile	19.8 %	21.0 %	59.3 %	100.0 %
Mexico	19.8 %	57.7 %	22.5 %	100.0 %
New Zealand*	24 %	21 %	40 %	85 %
Simple Average	21.3 %	29.5 %	46.2 %	

*1999. Part of imports not classified by use.
Data source: Central banks and national institutes of statistics.

of the world. The asterisk (*) indicates a variable of the rest of the world. All variables of the rest of the world are treated as exogenous in the model.

The model has domestic and foreign bonds, both private. Domestic bonds are denominated in domestic currency and are held only by domestic residents. Foreign bonds are denominated in foreign currency, and their prices include a stochastic country risk premium. The derived uncovered interest rate parity condition (UIP) is presented below:

$$i_t - i_t^* = E_t s_{t+1} - s_t + \zeta_t \tag{5}$$

where i_t^* is the interest rate in the rest of the world, and ζ_t is the country risk premium.

Firms maximize the difference between expected marginal revenue and unit cost. There is price rigidity: only a fraction of the firms are allowed to adjust prices each period. The choice of the optimum price for the firm yields $\pi_t = \beta E_t \pi_{t+1} + \lambda v_t$, where β is a discount factor, and v_t is the real unit cost given by:[8]

$$v_t = \alpha w_t + (1-\alpha) p_{Mt} - a_t - p_t \tag{6}$$

where w_t is wage, and p_{Mt} is the price of imports in domestic currency, defined as $p_{Mt} = s_t + p_{Mt}^*$ (p_{Mt}^* is the price of imports in foreign currency). Note that inflation is affected by the exchange rate via the price of intermediate goods.

Nevertheless, this formulation of the Phillips curve delivers some counterfactual results, as stressed in Galí and Gertler (1999) and Fuhrer (1997). It implies that current changes in inflation are negatively related to the lagged output gap; that is, a positive output gap would lead to a reduction in the inflation rate in the following period. In contrast, the empirical evidence is that a positive output gap is followed by an increase in the inflation rate over the cycle. Moreover this formulation implies that, with perfectly credible announcements, a disinflation is costless.

These empirical results have motivated some authors to work with a hybrid Phillips curve: besides the expected inflation term, the equation also contains a lagged term for inflation. In this paper, we do not have a special concern about the specific derivation for the persistence in

8. $\lambda = \frac{(1-\theta)(1-\beta\theta)}{\theta}$ where θ is the probability of the firm not adjusting its price in period t.

inflation.[9] As in Galí and Gertler (1999), one possibility is to consider that there is a fraction of backward-looking firms.[10]

In addition, we can also postulate a cost-push shock. This term could reflect changes in the markup resulting from movements in the price elasticity of demand over the cycle or in tax rates. It could also be used as a proxy for the case of change in relative prices across sectors.[11] The resulting aggregate supply equation is:

$$\pi_t = \gamma_f E_t \pi_{t+1} + \lambda w_t + \gamma_b \pi_{t-1} + \mu_t \tag{7}$$

where $\gamma_b + \gamma_f = 1$.

We assume that the shocks follow stationary univariate autoregressive processes of an order of 1.

The interest rate is the policy instrument. Monetary policy is given by a Taylor-type simple rule or by optimal simple rules. In the latter, the optimal coefficients are obtained by the minimization of the standard central bank's intertemporal loss function that penalizes deviations of the output gap ($\tilde{y}_t$) and inflation from their targets:

$$\frac{1}{2} E_t \left\{ \sum_{i=0}^{\infty} \beta^i \left[w_y \left(\tilde{y}_{t+i} \right)^2 + \left(\pi_{t+i} - \pi_{t+i}^T \right) \right] \right\} \tag{8}$$

where w_y is related negatively to the aversion to inflation variability,[12] π_t^T is the inflation target, and $\tilde{y}_t = y_t - \bar{y}_t$ ($\bar{y}_t$ is the potential output, defined as the output that would prevail in the case of full price flexibility). The

9. Fuhrer and Moore (1995) have generated inflation persistence assuming that agents care about relative wages over the life of the wage contract. Roberts (1997, 1998) has found some empirical evidence that expectations are less than perfectly rational: a fraction of the agents would have adaptive expectations or there would be a partial adjustment of expectations (these would adjust only gradually to the fully rational value). Galí and Gertler (1999) have found that the fraction of backward-looking firms is statistically significant, although not quantitatively important.
10. For simplification, we are assuming that λ is not affected by the presence of the backward-looking term.
11. For example, in the case of Brazil, there has been an important change in relative prices in the last years that is only partially related to the exchange rate and the movement of international prices.
12. In the simulations, we have considered different values for w_y. We are not concerned about the derivation of this parameter based on microfoundations. This objective function can be derived from a household utility function in the presence of price rigidity (Rotemberg, and Woodford, 1999; Woodford, 2003). Woodford (2003) has also derived the objective function in the case where prices are indexed to a lagged price index between the occasions on which they are reoptimized. The objective function includes a quasi-differenced inflation rate term rather than the inflation rate itself. We have used the usual objective function based on the following grounds: (1) the objective function is used only to get an idea of the optimal coefficients in the central bank's reaction function; (2) in practice, this objective function seems to be used more often by central banks.

interest rate is restricted to react to selected variables. We use the algorithm in Dennis (2002) to estimate the optimal simple rule.[13]

4. *Explaining the Higher Volatility*

The conduct of monetary policy in EMEs faces at least three major challenges: (1) building credibility; (2) reducing the level of inflation; and (3) dealing with fiscal, financial, and external dominance. The presence of low credibility, inflation levels greater than the long-term goal, and large shocks results in higher volatility of output, inflation, and the interest rate. Fiscal and financial dominance issues also have implications for these variables. In this section, we show how all these elements can help explain the stylized facts presented previously. The explanation for the different performance of EMEs relies on the presence of more fragile institutions and imperfect credibility, on the necessity of reducing inflation levels, and on the nature and magnitude of the shocks that hit these economies.

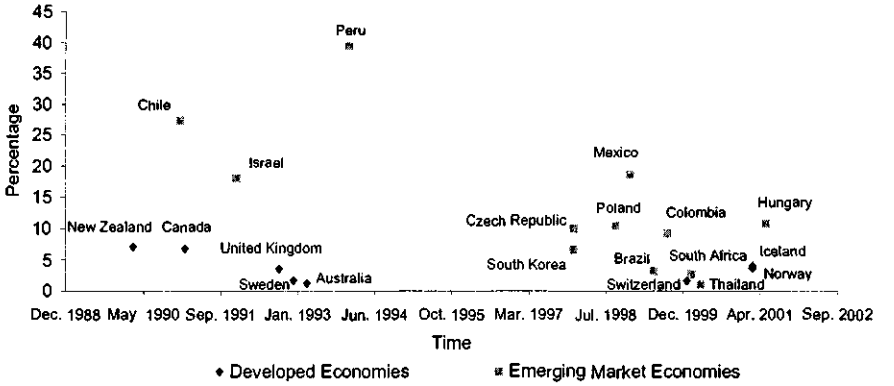
4.1 BUILDING CREDIBILITY AND REDUCING INFLATION RATE LEVELS

Institutions in emerging economies tend to be weaker than those in developed economies. Central banks are no exception. In this context, the adoption of inflation targeting represents an effort to enhance the credibility of the monetary authority as committed to price stability.

Nevertheless, building credibility takes time. During this transition period, the central bank's actions not only have to be consistent with the inflation-targeting framework, but they also have to take into account that private agents do not fully trust that the central bank will act accordingly. Private agents have concerns about the commitment of the central bank to the target itself and to its reaction to shocks. In the first case, given the history of low credibility, private agents assign some positive probability that the central bank will renege on its commitment to the targets. As a result, the expected inflation and consequently the actual inflation tend to be higher than with a perfectly credible monetary authority. Similarly, when the economy is hit by an inflationary shock, private agents do not trust completely that the central bank will react strongly. As a consequence, the central bank incurs a cost of trust building because it has to react to curb the inflationary pressures stemming from low credibility and has to prove that it is committed to the new regime. During some period, the volatility of the interest rate and output will be higher and, because the central bank also takes into account output costs, the inflation volatility also tends to be higher when compared to a situation of full credibility.

13. The explanation of the calibration of the model is available on request to the authors.

Figure 4 12-MONTH INFLATION RIGHT BEFORE IT ADOPTION



Imperfect credibility concerning the fulfillment of the targets becomes more important when we consider that the role of inflation targeting in emerging economies goes beyond assuring that inflation is kept at approximately its long-term level. It must first assure that inflation converges to low levels. In fact, emerging market countries have had to face much higher initial inflation rates than have developed countries. Table 1 showed the inflation around the moment of adoption of inflation targeting (right before and after), and the initial targets. When inflation targeting was adopted, the average inflation in the developed countries was 3.7%, whereas in the EMEs, it was 13.1%.[14] The values are also shown in Figure 4. Half of the developing economies had a two-digit inflation rate when implementing inflation targeting. In the case of Peru, Chile, Israel, and Mexico, the inflation rate was 39.5%, 27.3%, 18.0%, and 18.6%, respectively.

The differences are even clearer when we consider the first targets that were established (Figure 5). In developed economies, the maximum upper bound for the target was 6%, with an average of 2.8% for the central target. For developing economies, however, the highest upper bound reached 20%, and the average was 10.3%.

Because inflation was higher than the long-term goal, the targets were decreasing in time. Figure 6 shows the evolution of the central target average for both country groups. They are relatively stable for developed economies, and they are decreasing for EMEs.

If inflation targeting is adopted in an economy with an inflation rate significantly higher than the long-term goal, the central bank has to con-

14. The low inflation rate in Brazil that prevailed prior to the adoption of inflation targeting was partly a result of an overvalued exchange rate.

duct an active policy to bring inflation down that leads to output costs. The reduction in inflation faces two obstacles, which result in costly disinflation and higher volatility of inflation and output: (1) the already mentioned imperfect credibility, and (2) the presence of some degree of inflation persistence, resulting from some backward-looking behavior in price setting. The presence of backward-looking behavior may be due to factors such as indexed wage contracts, and adaptive expectations. In particular, in Brazil, the adjustment of regulated prices such as electricity and telephone service follows a contractual rule that implies a high degree of persistence.

Figure 5 FIRST CENTRAL TARGET ADOPTED

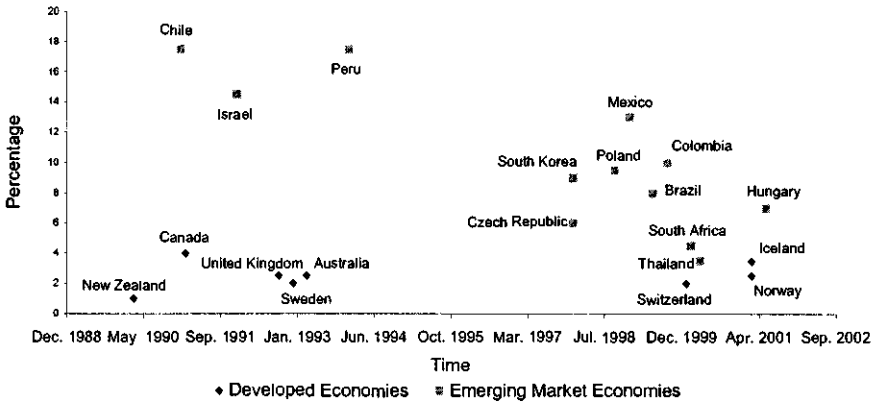
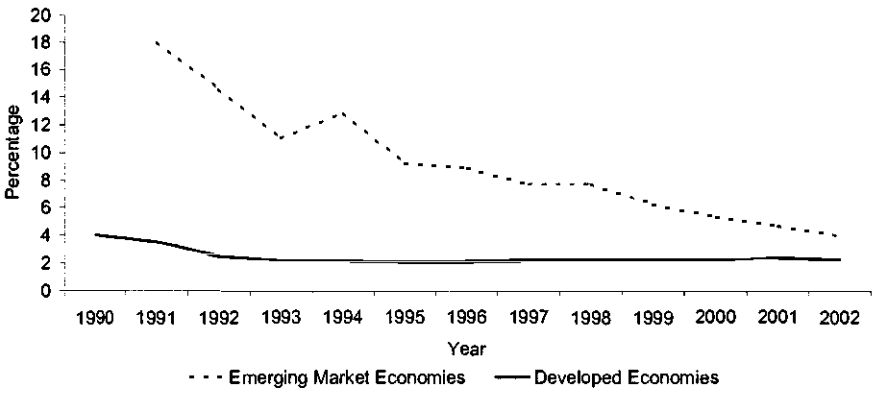


Figure 6 INFLATION TARGET AVERAGES—CENTRAL POINTS



Decreasing targets are a source of possible nonfulfillment of targets because it is difficult to assess the current backward-looking behavior and the speed of future convergence of inflation expectations. The higher deviations from the targets in EMEs may then be related to the variability of shocks as well as to the fact that inflation targeting was typically adopted when inflation was significantly higher than the long-term goal.

To have some indication of the speed of inflation convergence and of the output costs involved, we have simulated the case of a reduction in the inflation targets with imperfect credibility. To focus on this issue, we have used the closed economy version of the model previously presented ($\alpha = 1$, $s_c = 1$). The result is a standard model. The aggregate supply curve without the backward-looking term can be written as:

$$\pi_t = \beta E_t \pi_{t+1} + \lambda^* \tilde{y}_t$$

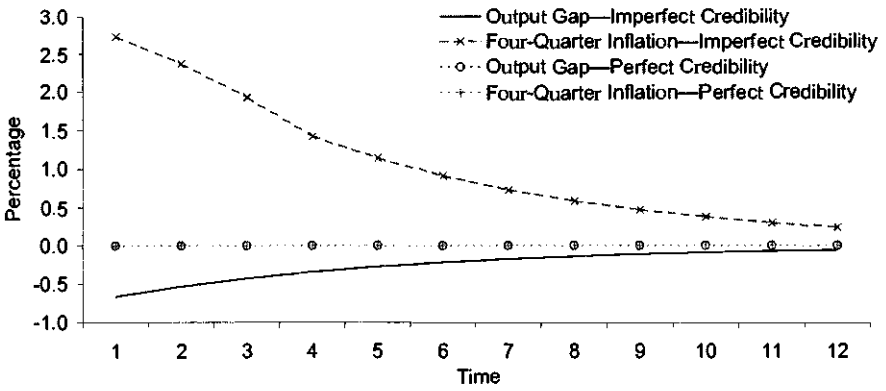
where $\lambda^* \equiv \lambda(\gamma_c + \gamma_n)$. The central bank announces a reduction in the inflation rate target from π^{To} to π^{Tn} as of the current quarter, but private agents do not fully believe that this change is permanent. They assign a probability b_t that, at the following quarter, the central bank reneges on its announcement and returns to π^{To}. Therefore, the expected inflation rate target is given by $E_t\pi^T_{t+1} = b_t\,\pi^{To} + (1 - b_t)\pi^{Tn}$. We have considered the case of an optimal monetary policy under discretion.[15] The central bank is allowed to reoptimize every period. We have assumed that if the central bank maintains the new target, the probability of reneging on its announcement declines over time. We have used a simple law of motion: $b_{t+1} = \rho_b\, b_t$, where $0 \leq \rho_b < 1$.[16]

Figure 7 shows the impulse responses of the output gap and inflation to a reduction of 3 percentage points in the inflation target for the cases of imperfect and perfect credibility. If we compare the first announced targets to the inflation in the previous twelve months (Table 1), we verify that many countries had initial targets more than 3 percentage points lower than the previous inflation. We have assumed that the initial probability of reneging is 0.8, and $\rho_b = 0.8$. Because we are considering quarterly data, the latter implies that, at the end of the year, $b_t = 0.41$. The inflation rate refers to the four-quarter accumulated inflation above the new target. We assume that inflation was stable at the old target before the announcement. At the end of the first year, in the case of imperfect credibility, the

15. We have not shown the results under commitment because it is less reasonable to assume that private agents believe the central bank is committed and, at the same time, does not keep its commitment.

16. The derivation is available on request to the authors.

Figure 7 IMPERFECT CREDIBILITY: IMPULSE RESPONSES TO A 3 PERCENTAGE POINT INFLATION TARGET REDUCTION



inflation rate is still 1.42 percentage points above the new target, and the output gap presented a reduction of 0.49%, on average.[17] Therefore, even assuming a relatively rapid reduction in the degree of imperfect credibility, the inflation rate converges only gradually to the new target. In the case of perfect credibility, inflation expectations converge automatically to the new target. As a result, inflation also converges immediately to the new target, and this movement does not require any output gap reduction.

Similar reasoning is applied when the economy is hit by an inflationary shock. The possibility that the central bank will not be tough for enough time increases inflation expectations, thus requiring a higher output reduction. The result is a higher volatility of inflation, output, and the interest rate.

As stressed by Svensson (2002), the economy incurs higher output variability at the beginning of the regime to gain credibility, but it benefits later from an improved trade-off with lower output and inflation variability, and the central bank can then be a more flexible inflation targeter. In the case of Brazil, the construction of credibility has been a process that combines reactions to inflationary pressures and increased transparency to the public. The Banco Central do Brasil has reacted to inflation expectations in a way that is consistent with the inflation-targeting framework. Minella, Freitas, Goldfajn, and Muinhos (2003)[18] have estimated

17. In this simulation, we are assuming that the relative output weight in the objective function is equal to 0.3. If we increase it to 1.0, the effect is significant on the output response but low on the inflation path: the inflation rate is 1.45, and the output gap has a reduction of 0.15% on average.

18. That paper is an updated and shorter version of Minella, Freitas, Goldfajn, and Muinhos (2002).

a reaction function for the BCB for the first three-and-a-half years of inflation targeting. It relates the interest rate to deviations of the 12-month ahead expected inflation from the target, allowing also for some interest-rate smoothing and reaction to the output gap.[19] Table 4 shows the estimations using the inflation forecast of the BCB and of private agents.[20] The point estimates of the coefficient on inflation expectations are greater than 1 and significantly different from 0 in all specifications. In most of the specifications, the coefficient is statistically greater than 1.[21] Therefore, we can conclude that the BCB conducts monetary policy on a forward-looking basis and responds to inflationary pressures.

We also simulate the case of reduction in the inflation targets in the presence of a backward-looking component in the aggregate supply curve equal to 0.4 (therefore, $\gamma_f = 0.6$). We use the open economy version of the model. The central bank reacts according to a simple expectational rule: $i_t = 1.5\ E_t\pi_{t+1}$. The optimal coefficients found using two different weights on the output gap in the objective function, $w_y = 0.3$ and $w_y = 1.0$, are 1.79 and 1.34, respectively.[22] As in the case of imperfect credibility, inflation decreases slowly to the new target, and the optimal output gap is negative. With a 3 percentage point reduction in the inflation target, inflation is 0.78 percentage point above the target at the fourth quarter, and the output gap reduction is 0.55% on average in the first year. In the case of a purely forward-looking aggregate supply curve, inflation converges automatically to the new target.

Because the inflation-targeting regime is supposed to affect inflation expectations, we can consider the possibility that the backward-looking component in the price adjustment becomes less important as credibility increases. The share of backward-looking firms could become smaller and/or firms could give less consideration to past inflation when adjusting prices. Either situation would reduce the degree of persistence in

19. They have estimated the equation $i_t = \alpha_1\, i_{t-1} + (1 - \alpha_1)(\alpha_0 + \alpha_2\,(E_t\pi_{t+j} - \pi_{t+j}) + \alpha_3\, y_{t-1})$, where i_t is the Selic rate decided by the monetary policy committee (Copom), $E_t\ \pi_{t+j}$ equals inflation expectations, and π^*_{t+j} is the inflation target, where j = 12, and y_t is the output gap.
20. Private agents' expectations are obtained from a survey that the Investors Relation Group (Gerin) of the BCB conducts among banks and non-financial companies. (Available at www.bcb.gov.br. Market Readout and Market Expectations Time Series of Investor Relations Section).
21. The point estimates vary, however, across specifications. Using private agents' expectations (sample 2000:1–2002:12), the point estimates are around 2.1 to 2.3, whereas with BCB expectations (sample 1999:6–2002:12), they are 3.5 and 5.7. The p-values for the test that the coefficient is equal to 1 are 0.150, 0.101, 0.012, and 0.040 in specifications I, II, III, and IV, respectively.
22. Cecchetti and Ehrmann (1999) have found a value between 0.32 and 0.41 for inflation-targeting countries. Batini, Harrison, and Millard (2003) have used 1.0 (including also a term for the interest rate in the objective function).

Table 4 ESTIMATION OF REACTION FUNCTION OF THE BANCO CENTRAL DO BRASIL: DEPENDENT VARIABLE: TARGET FOR THE NOMINAL SELIC INTEREST RATE (MONTHLY DATA)[1]

	Using central bank inflation expectations (1999:7–2002:12)		*Using market inflation expectations (2000:1–2002:12)*	
Regressors	I	II	III	IV
Constant	1.65	3.06*	4.58***	5.38**
	(1.08)	(1.59)	(1.52)	(2.07)
Interest rate (t–1)	0.90***	0.82***	0.71***	0.67***
	(0.06)	(0.09)	(0.09)	(0.12)
Inflation expectations (deviations from the target)	5.70*	3.54**	2.32***	2.09***
	(3.20)	(1.51)	(0.53)	(0.53)
Output gap(t–1)		–0.36*		–0.10
		(0.21)		(0.15)
R^2	0.9129	0.9160	0.9205	0.9214
Adjusted R^2	0.9084	0.9094	0.9157	0.9140
LM test for autocorrelation of residuals (p-values)				
1 lag	0.7853	0.7210	0.6586	0.6411
4 lags	0.6831	0.5298	0.5362	0.3991

1. Standard error in parentheses. *, ** and *** indicate the coefficient is significant at the 10%, 5%, and 1% levels, respectively.
Source: Minella, Freitas, Goldfajn, and Muinhos (2003).

inflation. Minella, Freitas, Goldfajn, and Muinhos (2003) have estimated a simple aggregate supply curve for the low inflation period in Brazil to assess if the inflation-targeting regime was accompanied by some structural change.[23] They regress inflation rate on its own lags, the unemployment rate (lagged one period), and the exchange-rate change in 12 months (lagged one period).

Table 5 records the results when including only one lag for inflation and when including two. The regression also includes dummy variables that multiply the constant and lagged inflation for the inflation-targeting period,[24] and a dummy that assumes the value of 1 for the last three months of 2002. Without adding this last dummy, the residuals in both specifications present serial correlation. Actually, the end of 2002 is a peculiar period, one that does not fit a simple Phillips curve. The authors find that the backward-looking term has decreased. The point estimate of the autoregressive coefficient decreases from 0.56 to 0.10 in

23. The procedure is similar to the one in Kuttner and Posen (1999).
24. Dummies for the inflation-targeting period that multiply unemployment and the exchange rate do not enter significantly; therefore, they were excluded from the estimation.

Table 5 ESTIMATION OF AGGREGATE SUPPLY CURVE: DEPENDENT VARIABLE: MONTHLY INFLATION RATE (1995:08–2002:12)[1]

Regressors	*I*	*II*
Constant	0.65*	0.70*
	(0.36)	(0.36)
Dummy constant[†]	0.34***	0.51***
	(0.12)	(0.14)
Inflation rate (t–1)	0.56***	0.62***
	(0.11)	(0.15)
Inflation rate (t–2)		–0.09
		(0.14)
Dummy inflation rate (t–1)[†]	–0.46***	–0.43*
	(0.17)	(0.19)
Dummy inflation rate (t–2)[†]		–0.35*
		(0.20)
Unemployment (t–1)	–0.08	–0.09*
	(0.05)	(0.05)
Exchange rate change (t–1) (12-month average)	0.08*	0.09**
	(0.04)	(0.04)
Dummy 2002Q4[‡]	1.42***	1.47***
	(0.26)	(0.25)
R^2	0.5593	0.6022
Adjusted R^2	0.5271	0.5624
LM test for autocorrelation of residuals (p-values)		
1 lag	0.6646	0.7022
4 lags	0.2218	0.3599

1. Standard error in parentheses. *, ** and *** indicate the coefficient is significant at the 10%, 5%, and 1% level, respectively. Since exchange rate change refers to the 12-month change, the sample starts in 1995:08 to avoid the inclusion of data of the period before the stabilization.

[†]Dummy has value 1 in the inflation-targeting period (1999:06–2002:12), and 0 otherwise. It multiplies the associated variable.

[‡]Dummy has value 1 in 2002:10–2002:12, and 0 otherwise.

Source: Minella, Freitas, Goldfajn, and Muinhos (2003).

the inflation-targeting period when compared to the previous period of low inflation (specification I).[25]

4.2 DOMINANCE ISSUES: FISCAL, FINANCIAL, AND EXTERNAL

We deal here with three elements that seem to be potential features of EMEs: weak fiscal regimes, the risks associated with poorly regulated financial systems, and large external shocks. Each of these problems can lead to a form of dominance: fiscal, financial, or external. In the case of fiscal and financial dominance, the problems that arise on the monetary policy front are quite

25. This result is in line with the findings in Kuttner and Posen (2001). Using a broad dataset of 191 monetary frameworks from 41 countries, they found that inflation targeting reduces inflation persistence.

similar: the fear that one or both regimes will break down increases the probability that the government will inflate in the future, and therefore increases expected inflation. This in turn increases the challenge of establishing a solid monetary anchor. The external dominance refers to the vulnerability to external shocks, which results in higher macroeconomic volatility.

4.2.1 *Fiscal Dominance* The success of inflation targeting or any other monetary regime requires the absence of fiscal dominance. Therefore, implementation of inflation targeting must be accompanied by a strong fiscal regime. But even with that, in the case of past weaknesses, it takes time for government to gain the full confidence of private agents. This fear of fiscal dominance affects inflation expectations, requiring a tighter monetary policy, which in turn negatively affects the fiscal balance.

The challenge, therefore, is to build fiscal and monetary regimes that reinforce one another. The evidence we have thus far on this issue is promising, but it may be too early to celebrate. Schaechter, Stone, and Zelmer (2000) show that the fiscal imbalance at the time inflation targeting was adopted was lower in developing countries.

4.2.2 *Financial Dominance* A problem for the conduct of monetary policy can arise when there is fear that a tightening may lead to a financial crisis. This may come as a consequence of a weak and/or overleveraged financial system and may bring about the expectation that monetary policy will not be conducted with the goal of defending the nominal anchor of the economy. This problem can be characterized as a form of dominance, which we can name financial dominance. For example, Goldfajn and Gupta (2003) have found that, in the aftermath of currency crises, an economy that faces a banking crisis (1) has a lower probability of choosing a tight policy, and (2) when tight monetary policy is adopted, the probability of a successful recovery is lower.[26]

Banking sector weaknesses, and financial vulnerabilities in general, played a key role in the Asian crisis of 1997. This type of fragility may also be an issue when the financial system exhibits a significant presence of government-owned banks, either because these banks may themselves be weak or because the government may use its banks unwisely. Just as in the case of fiscal dominance, it is necessary to work toward a strong fiscal regime; in the case of financial dominance, care must be taken to make sure the regulation and supervision of the financial system is sound and permanent.

26. They have used a dataset of currency crises in 80 countries for the period 1980–1998.

Another issue is the predominance of short-term financial contracts and lower financial depth in EMEs, which tend to weaken the monetary policy transmission mechanisms.[27] According to Schaechter, Stone, and Zelmer (2000), the ratio of liquid liabilities to GDP was on average 51.0% in EMEs and 72.0% in developed countries in 1997. The ratio of private credit to GDP was 63.9% and 81.0%, respectively. As Taylor (2000) stresses, without longer-term markets, short-term interest rates will have to move more quickly. Therefore, we tend to observe higher interest-rate volatility.

4.2.3 *External Dominance: Sudden Stops* Another possible explanation for the volatility shown in Section 2 is the existence of larger shocks in EMEs. External shocks tend to play a more important role in EMEs than they do in developed countries. EMEs are subject to sudden stops in capital inflows. These shocks significantly affect the exchange rate, and consequently the inflation rate, leading to higher interest rates to curb the inflationary pressures. As a result, these economies tend to present a higher volatility of interest rates and exchange rates.

Of course, sudden stops themselves may reflect weaker fundamentals, which translate into lower credit ratings, among other problems. On the other hand, the presence of large and frequent external shocks generates greater instability in the economy and may jeopardize the fulfillment of the targets, which in turn may negatively affect the credibility of the regime. This may be seen as a form of external dominance. It must be addressed through the strengthening of the fundamentals of the economy, such as, in the case of inflation targeting, a fairly clean exchange-rate float (by that, we mean the absence of an exchange-rate target) and in general a sufficient degree of openness and flexibility.

The data presented in Table 2 confirmed the higher volatility of the interest rate in EMEs. For the exchange rate, the data is less clear but points to a higher volatility. The coefficient of variation (the ratio of the standard deviation to the average) is 0.15 in EMEs and 0.11 in developed economies. There are some differences, however, within the group of developing economies. Brazil, Chile, Hungary, Peru, and South Africa presented significantly greater exchange-rate volatility. The average of the coefficient of variation of the five countries is 0.22.

To try to measure the importance of external shocks, we have run vector autoregression (VAR) estimations for selected countries. We have used monthly and quarterly data of four variables: industrial production (or GDP), the consumer price index, the interest rate, and the exchange rate.

27. Actually, there are two opposite effects in the case of short-term contracts: the wealth effect of change in the interest rates is lower, but changes in the interest rates affect the cost of outstanding debt more quickly.

We have used a Cholesky decomposition with the order mentioned. We have considered two specifications: (1) all variables in log level, and (2) the price and exchange rate in first log-difference. We have estimated for three periods: a large period (which varies across countries but in general starts in the 1980s), the period before the adoption of inflation targeting, and the inflation-targeting period. (All of them end in mid-2002.) Table 6 records the values for the variance error decomposition of the interest rate and price level (or inflation rate), considering a 12-month or 4-quarter horizon, for the inflation-targeting period. In particular, we show the percentage of the forecast error of the interest rate and prices (or inflation) that is explained by shocks to the exchange rate. In Brazil and South Africa, shocks to the exchange rate explain a significant part of the forecast error of interest rate and prices. In Brazil, they explain 49% of the interest rate forecast errors and 18% of the price forecast error (this figure is not statistically significant though). South Korea has similar results using monthly data, mainly for the interest rate. On the other hand, for the developed economies and for Mexico, the estimations indicate that the exchange rate does not play an important role.

Exchange-rate fluctuations do not always reflect the pressure of the external shocks because of policy responses, which include interest-rate changes and direct intervention in the exchange-rate market. Some emerging markets opt not to allow the exchange rate to reflect the extent of the external shocks. Some of the arguments are related to fear of floating (Calvo and Reinhart, 2002).[28] In addition to inflationary pressures, significant exchange-rate fluctuations have other implications for the economy, such as uncertainty concerning prices and the value of dollar-denominated liabilities and assets. Huge depreciations of the domestic currency may affect the financial solvency of firms and financial institutions. In this case, the central bank may have additional goals in its objective function. According to Amato and Gerlach (2002), several reasons may make it appropriate for EMEs to give importance to the exchange rate beyond that related to its inflationary effects: (1) with less developed foreign exchange markets, large shocks or capital flows cause significant volatility in the exchange rate if they are neglected by policies; (2) in economies with a poor history of monetary stability, the exchange rate tends to be a focal point for inflationary expectations; (3) exchange-rate fluctuations may have a large impact on the relative profitability of firms across sectors; and (4) foreign currency borrowing may be significant.

28. Reinhart and Rogoff (2002) have developed a system of reclassifying historical exchange-rate regimes. They have found that regimes that were officially classified as floating in reality use a form of de facto peg.

Therefore, it is worth examining the spread over treasuries of the foreign currency denominated debt of the country as another indicator of external shocks. Table 7 shows the average and volatility of the spread of the emerging market bond index plus (EMBI+) over the U.S. Treasury for Brazil, Colombia, Mexico, Peru, Poland, and South Korea. Except for Poland, the standard deviation is always higher than 118 basis points. In the case of Brazil, it reaches 377 basis points in the inflation-targeting period.

Table 6 VARIANCE ERROR DECOMPOSITION AFTER ADOPTION OF INFLATION TARGETING (12-MONTH OR 4-QUARTER HORIZON) (PERCENTAGE); VAR WITH FOUR VARIABLES: INDUSTRIAL PRODUCTION (GDP), CPI, INTEREST RATE, AND EXCHANGE RATE

	Estimation in levels for price and exchange rate		*Estimation in first difference for price and exchange rate*	
	Shocks to the exchange rate explaining the forecast error for the interest rate	Shocks to the exchange rate explaining the forecast error for inflation	Shocks to the exchange rate explaining the forecast error for the interest rate	Shocks to the exchange rate explaining the forecast error for inflation
Monthly Data†				
Developed Economies				
Canada	1	0	1	1
Sweden	2	8	4	6
United Kingdom	0	17	10	5
Emerging Market Economies				
Brazil	49*	18	8	29*
Mexico	2	1	0	0
South Africa	36*	25*	36*	25
South Korea	26*	7	32	9
Quarterly Data‡				
Developed Economies				
Australia	12	3	1	11
Canada	0	1	2	2
New Zealand	11	3	4	3
Sweden	4	1	4	10
United Kingdom	0	0	1	1
Emerging Market Economies				
Brazil	57*	35	10	20
Mexico	1	0	1	12
South Korea	3	3	5	8

*Indicates that the value is significant at the 5% level.
†New Zealand and Australia do not have cpi and industrial production on a monthly basis.
‡The sample for South Africa is too short.

As a result of these external pressures, we tend to observe a higher volatility of output, interest rates, and the exchange rate, and the possibility of nonfulfillment of targets tends to be higher. In the case of Brazil, the significant depreciation of the domestic currency was the main factor behind the nonfulfillment of the inflation targets in 2001 and 2002. The nominal exchange rate in Brazil accumulated an increase of 84.7% during 2001 and 2002 (a depreciation of the domestic currency of 45.9%), representing a real depreciation of 44.6%.

We use the model to simulate the effects of a shock to the real exchange rate of 45%, but instead of using the UIP condition, we use an autoregressive process for the real exchange rate (with an autoregressive coefficient equal to 0.5). As before, the central bank reacts according to a simple expectational rule: $i_t = 1.5E_t\,\pi_{t+1}$, and the coefficient on lagged inflation is 0.4.

Figure 8 shows the impulse responses. At the end of the fourth quarter, the four-quarter accumulated inflation reaches 5.16%, and the output gap reduction is on average 6.80% in the first year. Therefore, even with a significant output gap reduction, any existing inflation target would be breached. If we consider the inflation target for Brazil in 2002 of 4%, then with this simulation, the inflation rate would reach 9.7%, distant even from the upper bound of 6.5%.

The existence of this possibility of breaching the targets due to large shocks leads us to analyze important issues in the design of inflation targeting in emerging markets. The next section explores how to deal with higher volatility in an inflation-targeting regime.

Table 7 EMBI+ (BASED ON MONTHLY AVERAGE)

	*1997:01–2002:12**			*After IT adoption until 2002:12†*		
Country	Average	Standard deviation	Coefficient of variation (s.d./ average)	Average	Standard Deviation	Coefficient of variation (s.d./ average)
Brazil	879.35	389.07	0.44	987.14	377.82	0.38
Colombia	651.18	118.48	0.18	648.04	123.83	0.19
Mexico	443.40	150.03	0.34	408.37	130.19	0.32
Peru	601.75	120.64	0.20	601.75	120.64	0.20
Poland	233.03	38.17	0.16	232.65	35.88	0.15
South Korea	236.37	145.39	0.62	236.37	145.39	0.62

*Colombia: 1999:05–2002:12. Peru: 1998:01–2002:12. Poland: 1998:01–2002:12. South Korea: 1998:05–2002:12. For Brazil and Mexico, the data for 1997 refers to EMBI.
†South Korea: 1998:05–2002:12.

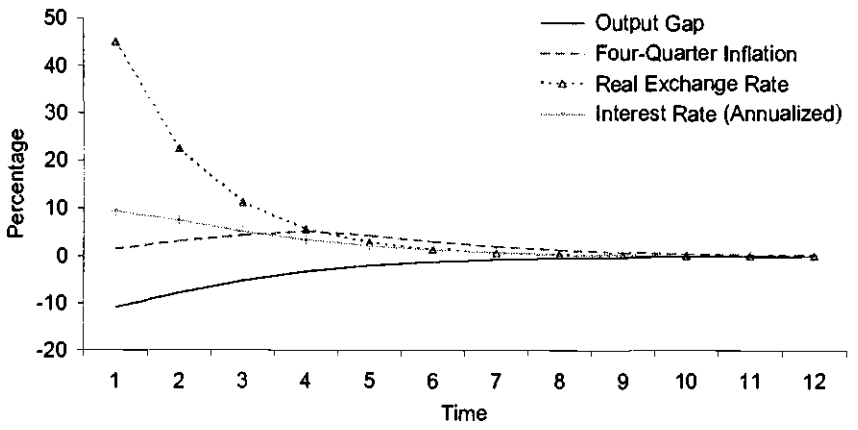
5. *How to Deal with Higher Volatility?*

The central element of the inflation-targeting regime is the public announcement of a numerical target for inflation. As Mishkin (2002) stresses, however, inflation targeting comprises much more than that. It also involves (1) an institutional commitment to price stability as the primary goal of monetary policy, to which other goals are subordinated; (2) the use of many variables for the instrument policy decision; (3) increased transparency of monetary policy strategy; and (4) an increased accountability of the central bank.

The issues presented in the previous section imply important challenges for monetary policy. The key aspect is how to build credibility in the conduct of monetary policy and in the inflation-targeting regime itself, and at the same time remain flexible enough to avoid unnecessary output costs that could lead to a perception that the regime is too costly. Communication and transparency become crucial.

One of the most appealing features of inflation targeting is the flexibility it allows monetary policy when the economy is confronted with shocks. For instance, in dealing with a supply shock, the professional consensus among academic economists and central bankers is that a central bank should accommodate the direct price-level impact of the shock while calibrating monetary policy to avoid further rounds of price increases. In practice, however, this approach may come at a cost. The central bank's commitment to low inflation may be questioned if the nature of the shock and the appropriateness of the policy response are not clear

Figure 8 IMPULSE RESPONSES TO A 45 PERCENTAGE POINT REAL EXCHANGE RATE SHOCK



to most observers. The solution to this conundrum is to provide enough information to the public to clarify that the policy response is the right answer to a well-understood problem.

In general, the optimal response depends on the nature of the shock, on several economic parameters and elasticities, and on the preferences of society relative to the inflation versus output gap volatility trade-off. At a basic level, it is crucial therefore that the central bank make an effort to identify the size and nature of the shocks, focusing in particular on whether one is dealing with supply or demand shocks, temporary or permanent shocks, and the size and inflationary impact of the shocks. Once the shocks are identified, the central bank can choose a monetary policy response that will deliver the chosen feasible pair of inflation and output gap paths.

Inflation-targeting central banks have developed several tools to deal with these issues. They involve the inflation-targeting design, transparency, adjusted targets, and a change in the IMF conditionality.

5.1 TARGET BANDS, HORIZONS, AND PERSISTENCE OF SHOCKS

The possibility that large shocks may cause target breaches leads to an important feature in the design of the inflation-targeting regime: the size of the band around the central point of the target. Tighter bands tend to signal a preference for lower inflation volatility relative to lower output volatility. The band is typically seen as a barrier not to be broken.

In a world of perfect information, however, where all shocks are precisely identified, there is no role for bands around the inflation target. Deviations from the point target would occur as an optimal response to shocks, given the parameters of the economy and the inflation aversion of society. An optimal response to a very large shock may demand large deviations from the central point of the target, sometimes beyond the upper bound of the target. The same holds for the horizon over which inflation is allowed to deviate from the target when the economy is hit by shocks. This horizon should also be determined according to the type, size, and persistence of the shock as well as the parameters mentioned above.

So why do countries opt to include target bands? While some countries may treat the band limit as a strict barrier not to be broken, in our view the bands should be treated mainly as a communications device. The bands should be considered mainly as checkpoints, with the central bank explaining clearly the reasons for the nonfulfillment of the targets. This discussion is not easily translated, however, into operational guidelines that can be implemented by the central bank. As a result, it is necessary that the assumptions underlying the decisionmaking process of the central

bank be communicated clearly. This approach means being explicit about a fairly precise path of inflation on the way back to the targeted level to avoid losing the confidence of economic agents. Transparency therefore plays the key role of imposing enough discipline on the central bank to avoid the temptations depicted in the time-consistency literature.[29]

In practice, the size of the bands varies across countries: 1 percentage point in Australia and Israel; 3 percentage points in South Africa; 3.5 in Iceland; and 4 in Brazil for 2002, and 5 for 2003 and 2004. What should be the size of the bands? One possibility would be to keep them large enough to allow the inflation rate within the bands in most of the circumstances if monetary policy is conducted efficiently. Given some variability of shocks in the economy, inflation should be inside the bands in most, say, 90%, of the cases. Using the model, and assuming some variance for the shocks, we obtain the standard deviation of inflation (given some optimal rule). If we assume that the random shocks are normally distributed, we would find a band size corresponding to 1.65 standard deviations of inflation.

The recurrent presence of larger shocks may also recommend higher central targets. As shown in Figure 6, the difference between the targets of EMEs and developed countries has decreased, but it is still positive. In 2002, the central point target for EMEs was 3.7%, whereas for developed countries it was 2.2%. The higher target reflects not only higher past inflation but also the greater vulnerability to external shocks. One possible reason is the asymmetric effects of supply shocks. Given greater downward price rigidity, deflationary shocks tend to have a lower effect in inflation than do inflationary shocks. As a consequence, with higher shocks, this bias tends to be higher.

The issue of the magnitude of the response to shocks leads us also to the discussion of the horizon to be used in the inflation-targeting framework. As emphasized by Svensson (2002), in practice, flexible inflation targeting (where some weight is given to output stabilization) means aiming to achieve the inflation target at a somewhat longer horizon. Because EMEs are more subject to larger shocks, their target horizon should naturally be longer. A danger here, of course, is that if the central bank is still building credibility, longer horizons could be interpreted as lenience, thus affecting the central bank's reputation.

In practice, there is no magic number for the horizon that a central bank should use to guide its reaction to supply shocks. It should be long

29. It seems these days that the important lesson of the time-consistency literature has reached most central banks. In fact, one finds a substantial number of central bankers around the world who seem to act like the inflation-averse central bankers in Rogoff (1985).

enough to allow the workings of the monetary policy transmission mechanisms and some degree of smoothing of the effects of the shock. On the other hand, it should be short enough to neutralize part of its inflationary effect and allow convergence of inflation expectations to the target. At any rate, it is crucial that the central bank's response be clearly explained to avoid reputational risk. Section 5.3 presents the procedure adopted by the BCB in dealing with a series of large shocks during the years 2001 and 2002.

5.2 MONETARY POLICY COMMITTEES, MEETING MINUTES, AND AN INFLATION REPORT

To stress the importance of the existence of a monetary policy committee (MPC) may sound unnecessary to most observers in more advanced economies, but it is not a trivial matter in the EMEs. Until one such committee was created in Brazil, for example, monetary policy decisions were made on an ad-hoc basis, typically at the end of a board meeting, at the end of the day, when everyone was already quite exhausted, and often without the benefit of proper preparation and analysis. An MPC that meets regularly, on a monthly basis, has created a proper environment for what, after all, is the key role of a central bank: to run monetary policy. The MPC meetings have become a ritual that provides those responsible for setting policy with a well-informed decisionmaking environment. It moves board members away from their otherwise hectic day-to-day schedules of meetings and phone calls and allows them to focus on the task at hand.

A crucial aspect of inflation targeting is the ability to enhance the credibility of the policymaking process and, as a result, to achieve the desired goals with minimum costs. The timely publication of the detailed minutes of MPC meetings is a key ingredient for an effective communications strategy. In emerging economies, where credibility is typically lower than one would like, the benefits of publishing this information can be substantial.

In addition to monthly meeting minutes, most inflation-targeting central banks also publish a quarterly inflation report where their views on economic prospects and, in particular, on inflation trends are presented in detail.[30] Again, for EMEs, these reports play a key role, serving the purpose of minimizing uncertainty about the central bank's analysis and goals. Inflation reports are appropriate vehicles for the central bank to present its views on complex issues such as the degree of exchange-rate

30. For an assessment of inflation reports by inflation-targeting central banks, see Fracasso, Genberg, and Wyplosz (2003).

pass-through, the degree of inflationary persistence, the workings of the transmission mechanism, and so on.

5.3 SHOCKS AND ADJUSTED TARGETS

The recent experience of Brazil with inflation targeting during turbulent times serves to illustrate the practical application of the general guidelines and principles discussed above. This section summarizes the methodology currently used in Brazil. It calculates the inflationary impact of current supply shocks as well as the secondary impact of past shocks (due to inertia in the inflation process). The idea is simply to accommodate the direct impact of current shocks and to choose a horizon to weed out the secondary impact of past shocks.

When facing shocks, the BCB initially considers the nature and persistence of the shock. Then it builds different inflation and output trajectories associated with different interest-rate paths. Based on its aversion to inflation variability, it chooses the optimal path for output and inflation. Banco Central do Brasil (2003) has published this path and also the outcome of different paths. This is in line with Svensson's (2002) recommendations.[31]

If shocks are large and/or persistent, however, their inflationary effects may last one year or more. The optimal inflation path may imply a 12-month ahead inflation superior to the previous annual target. Therefore, in this situation, because the BCB would not be targeting the previous inflation target, it uses an adjusted target. More specifically, the target is adjusted to take into account primary effects of change in relative prices and of past inertia that will be accommodated. The new target is publicly announced. Although there is a credibility loss stemming from the target change itself, the gains in terms of transparency and communication are more significant. Private agents know the target pursued by the BCB. Keeping the old target would affect the credibility of the BCB because it could be considered unattainable. In the concept of the adjusted target, the primary effect of the shock to regulated-price inflation, and the inflation inertia inherited from the previous year to be accommodated in the current year, are added to the target previously set by the government. Facing cost shocks, such as the increase of regulated prices above the inflation of the other prices of the economy, monetary policy should be calibrated to accommodate the direct impact of shocks on the price level but to fight their secondary effects. Furthermore, because the BCB also takes into account output costs, the inertial impacts of the previous year's inflation should not necessarily be fought completely.

31. Svensson's (2002) recommendations also involve publishing the corresponding instrument-rate plan.

Indeed, significant shocks, such as increases in the price of regulated utilities and the exchange rate, have been one of the main challenges faced by the BCB. Since the implementation of the Real Plan in July 1994, regulated-price inflation has been well above the market-price inflation for various reasons. Since the start of the inflation-targeting period, the ratio of regulated prices to market prices rose 31.4% (1999:7–2003:2). As long as there is some downward rigidity in prices, changes in relative prices are usually translated into higher inflation. If these increases are treated as a supply shock, monetary policy should be oriented toward eliminating only their secondary impact on inflation while preserving the initial realignment of relative prices. Therefore, the efforts of the BCB to quantify the first-order inflationary impact of the regulated-price inflation have become particularly important because they help to implement monetary policy in a flexible manner, without losing sight of the larger objective of achieving the inflation targets.

The first-order inflationary impact of the shock to regulated items is defined as the variation in regulated prices exceeding the target for the inflation rate, weighted by the share of regulated prices in the IPCA (consumer price index) and excluding the effects of the inflation inertia from the previous year and of variations in the exchange rate:

$$ShA = (\pi_{adm} - \pi^*) * \omega_{adm} - (IA + CaA) \tag{9}$$

where ShA = first-order inflationary impact of regulated prices
π_{adm} = inflation of regulated prices
π^* = target for the inflation
ω_{adm} = weight of regulated prices in the IPCA
IA = effect of inertia in the previous year on the evolution of regulated prices
CaA = effect of the exchange-rate variation on the evolution of regulated prices

The effect of inflation inertia is excluded because inflation propagation mechanisms should be neutralized by the monetary policy over a period deemed to be appropriate (again, based on inflation aversion and other parameters). The exchange-rate variation is excluded because it is affected by monetary policy and could reflect demand shocks. If the effect of exchange-rate changes were automatically included, monetary policy would be validating any inflationary pressure coming from the exchange rate (including demand pressures). Therefore, in defining the shock to regulated prices, only the component of relative price change that is predetermined or backward-looking, and therefore cannot be affected by monetary policy in the short run, is preserved as a first-order supply shock.

Table 8 ADJUSTED TARGETS FOR 2003 AND 2004

Itemization	*2003*	*2004*
(a) Target for inflation set by the government	4.0	3.75
(b) Regulated-price shocks[1]	1.7	1.1
(c) Inertia not to be fought in the current year[2]	2.8	0.6
Inherited inertia from the previous year (total)	4.2	1.0
of regulated prices	1.4	0.4
of market prices	2.8	0.6
(d) Adjusted targets = (a) + (b) + (c)	8.5	5.5

1. For the calculation of the shock, the effect of inertia and the exchange rate on regulated-price inflation is deducted.
2. The inertia not to be fought in the current year corresponds to ⅔ of the inertia inherited from the previous year. Source: Banco Central do Brasil (2003).

Table 8 shows how this methodology was applied to Brazil for inflation in 2003 and 2004.[32] The target established by the government for 2003 is 4%. However, the regulated-price shocks are estimated at 1.7%. This value represents the expected contribution for the overall inflation of a change in relative prices that is not related to the inflation inertia from the previous year and to the exchange-rate change. Since these first-round effects should not be neutralized, they are added to the target of the BCB, leading to an adjusted target of 5.7%.

Furthermore, the BCB also takes into account the nature and persistence of the shocks and the output costs involved in the disinflationary process (the output weight in the objective function is greater than zero). In this case, the BCB decided to fight against one-third of the inertia inherited from the previous year. This inertia is estimated at 4.2%. Therefore, we have to add 2.8% to the target, leading to an adjusted target of 8.5%, which was publicly announced.

The decision to pursue an inflation trajectory based on these adjusted targets considers that monetary policy will be able to lead inflation to converge to the target tolerance interval in two years. We should stress, however, that two years is not a magic number. It depends on the size and type of the shock. Figure 9 draws the actual and expected path for inflation (Banco Central do Brasil, 2003). The trajectory is compatible with the (end-of-year) adjusted targets.

Other trajectories with steeper decreases of inflation imply an excessive loss of output. Simulations indicate that a trajectory of inflation that reaches 6.5% in 2003, the ceiling of the target tolerance interval, would

32. See Banco Central do Brasil (2003). For a more detailed explanation of the methodology, see Freitas, Minella, and Riella (2002).

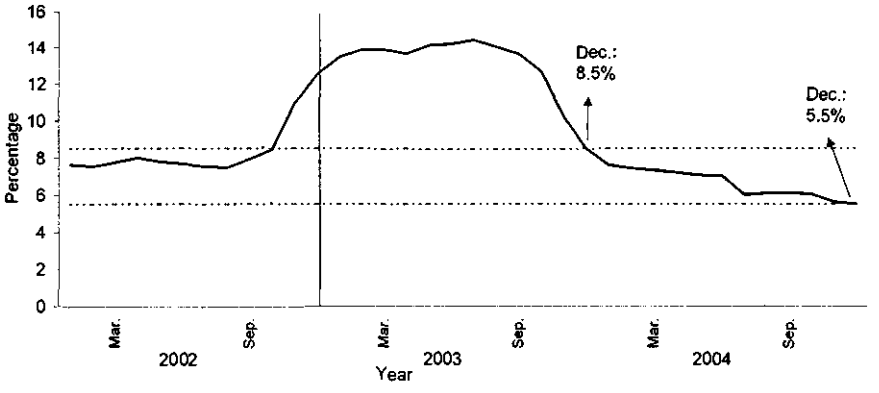
imply a 1.6% drop in GDP. A trajectory that reaches the center of the target, 4%, in 2003, would imply an even larger decline in GDP (–7.3%).

One could argue that the decision to neutralize the shock in a longer time horizon, based on an evaluation of the size and persistence of the shock, may lead to time-consistency issues: too much accommodation in the short run could lead to a loss of credibility in the long run. In fact, it is essential that the whole procedure be explained publicly in detail so that the agents can judge effectively whether the size and persistence of the shock justify the decision taken by the central bank. It is the transparency, therefore, that imposes enough discipline to avoid time-consistency issues.

In the inflation-targeting design, a core inflation measure or the establishment of escape clauses has also been used or suggested as a way of dealing with shocks and volatilities. The main argument contrary to the use of core inflation is that it is less representative of the loss of the purchasing power of money at a given point in time. Agents are concerned about the whole basket of consumption. In the case of Brazil, exclusion of the regulated price items would leave out more than 30% of the representative consumption basket. In this sense, private agents may question a monetary policy that is not concerned about the overall consumer price index.

In general, there are two advantages to the use of the adjusted target procedure. First, the core inflation measure is not necessarily isolated from the effect of shocks. For example, the large depreciation shock of the Brazilian economy in 2002 led to a core inflation—calculated by the symmetric trimmed mean method—of 8.8%, way above the inflation target. Second, the construction of the adjusted target is directly based on the idea that monetary policy should neutralize second-order effects of supply shocks and accommodate the first-round effects, and on the fact that some

Figure 9 TWELVE-MONTH INFLATION



weight to output volatility should be assigned in the objective function. Therefore, the principles under which the monetary policy is conducted become more transparent.

In the case of escape clauses, the circumstances under which the central bank can justify the nonfulfillment of the targets are set in advance. It has more similarities with the adjusted target procedure than with the use of a core inflation measure because it does not exclude items from the inflation target but defines circumstances in which the breach of targets can be justified. The main advantages of the adjusted target procedure are the following: (1) it is a forward-looking procedure, (2) it defines clearly the new target to be pursued by the central bank, and (3) it explains how the new target is measured.

5.4 IMF PROGRAMS AND CONDITIONALITY

This section focuses on the IMF conditionality in the case of a country under an inflation-targeting regime.[33] We stress two issues: (1) the diminished role of net domestic assets (NDA) conditionality, and (2) how to insert inflation performance as a criterion for the assessment of a monetary policy stance.

5.4.1 *NDA Conditionality Versus Inflation Targeting* Brazil was the first country under an inflation-targeting system to have an agreement with the IMF. From a theoretical point of view, the NDA conditionality, which is usually the one found in the agreements to evaluate the stance of monetary policy, is not adequate for an inflation-targeting regime because it harms transparency and can force the central bank to take unnecessary monetary policy actions.

Money demand is unstable, and the monetary aggregates seem to be poor predictors of inflation. Therefore, autonomous increases in the level of money demand would require, in the case of NDA ceilings or monetary base targeting, an increase in the interest rate without any inflation-targeting policy purpose. We would then observe higher volatility in the interest rate than needed. Furthermore, the imposition of an NDA ceiling can harm transparency in the sense that it would add to the inflation target another monetary policy goal. One of the main advantages of an inflation-targeting regime is the definition of a clear target for monetary policy. The existence of another target affects the credibility of the main goal of monetary policy.

5.4.2 *Inflation Performance As a Criterion for the Assessment of a Monetary Policy Stance* In place of NDA targets, inflation performance emerges as a

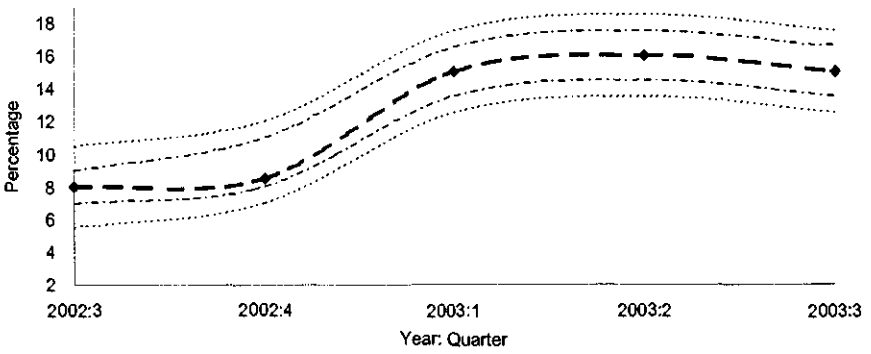
33. See also Blejer, Leone, Rabanal, and Schwartz (2002), and Bogdanski, Freitas, Goldfajn, and Tombini (2001).

natural criterion for the assessment of a monetary policy stance. Of course, because inflation targets focus on inflation forecasts, assessing inflation outcomes has to account for the shocks that hit the economy. At least two issues have to be addressed in the case of an IMF program: the frequency of the assessments (reviews), and the criteria on which to base the targets.

IMF programs have quarterly reviews, whereas in an inflation-targeting framework, inflation performance is assessed at longer horizons. The use of annualized quarterly inflation figures as targets is not recommended because they are more volatile and subject to the strong influence of temporary shocks. Brazil has used a 12-month inflation as the monetary quarterly target in the technical memorandum of understanding with the IMF. It also includes inner and outer bands of 1.0 percentage point and 2.5 percentage points, respectively, both above and below the central targets. Figure 10 shows the targets agreed to by the IMF and the BCB in the second review of Brazil's performance in March 2003. The target for the 12-month inflation of the quarter following the agreement considers the inflation verified in the three previous quarters plus an estimate for the next quarter inflation. If an important shock hits the economy in the next quarter, however, inflation may breach the target.

The path of the targets with the IMF should be consistent with the annual targets of the inflation-targeting regime. This approach is in line with the forward-looking or pre-emptive nature of the inflation-targeting system. At the same time, it eliminates the problem of the effect of quarterly figures because the time horizon for the inflation target could be defined as four quarters. Eventual (predicted) pickups of inflation during the year should not alter the monetary policy committee decisions, provided inflation is expected to converge to the target and provided shocks in one year keep affecting inflation in the following year, but only through the direct channel, that is, via the autoregressive component of inflation.

Figure 10 INFLATION TARGETS (CENTRAL POINT AND UPPER AND LOWER BOUNDS) AGREED WITH THE IMF



The main difficulty arises with the necessity of agreement between the IMF and the central bank concerning the model used and the associated risks, and reaching this agreement may also be time consuming. Therefore, it also involves the construction of credibility by the forecast-making process of the central bank.

In the agreements between Brazil and the IMF, the inflation forecasts made by the BCB have been used as an important criterion for the definition of the targets. However, the revisions are still made on a quarterly basis based on the actual inflation. The reasons for the nonfulfillment of targets have been explained thoroughly to the public and to the IMF.

6. *Conclusion*

Inflation targeting in EMEs has been relatively successful but has proven to be challenging. The volatility of output, inflation, the interest rate, and the exchange rate has been higher than in developed countries. Several issues have led these economies to face this less favorable trade-off. The process of building credibility, the necessity of reducing inflation levels, the dominance issues, and the larger shocks have all played an important role. To deal with this more volatile environment, we recommend (1) high levels of communication and transparency, (2) target bands treated mainly as communications devices, (3) a methodology for calculating the convergence path following a shock (adjusted targets), and (4) better IMF conditionality under inflation targeting.

REFERENCES

Amato, Jeffery D., and Stefan Gerlach. (2002). Inflation targeting in emerging market and transition economies: Lessons after a decade. *European Economic Review* 46:781–790.

Ball, Laurence, and Niamh Sheridan. (2003). Does inflation targeting matter? Cambridge, MA: National Bureau of Economic Research. NBER Working Paper No. 9577.

Banco Central do Brasil. (2003). Open-letter sent by Banco Central do Brasil's governor, Henrique de C. Meirelles, to the minister of Finance, Antonio Palocci Filho. Available at www.bcb.gov.br (accessed March 6, 2003).

Batini, Nicoletta, Richard Harrison, and Stephen P. Millard. (2003). Monetary policy rules for an open economy. *Journal of Economic Dynamics and Control* 27(11–12):2059–2094.

Bernanke, Ben S., Thomas Laubach, Frederic S. Mishkin, and Adam S. Posen. (1999). *Inflation Targeting: Lessons from the International Experience.* Princeton, NJ: Princeton University Press.

Blejer, Mario I., Alfredo M. Leone, Pau Rabanal, and Gerd Schwartz. (2002). Inflation targeting in the context of IMF-supported adjustment programs. IMF Staff Papers 49(3):313–338.

Bogdanski, Joel, Paulo S. de Freitas, Ilan Goldfajn, and Alexandre A. Tombini. (2001). Inflation targeting in Brazil: Shocks, backward-looking prices, and IMF conditionality. Central Bank of Brazil. Working Paper Series No. 24.

Calvo, Guillermo, and Carmen Reinhart. (2002). Fear of floating. *Quarterly Journal of Economics* 117(2):379–408.

Cecchetti, Stephen G., and Michael Ehrmann. (1999). Does inflation targeting increase output volatility? An international comparison of policymakers' preferences and outcomes. Cambridge, MA: National Bureau of Economic Research. NBER Working Paper No. 7426.

Corbo, Vittorio, Óscar Landerretche, and Klaus Schmidt-Hebbel. (2002). Does inflation targeting make a difference? *Inflation Targeting: Design, Performance, Challenges*, In Norman Loayza and Raimundo Soto (eds.). Santiago, Chile: Central Bank of Chile, 221–269.

Corbo, Vittorio, and Klaus Schmidt-Hebbel. (2001). Inflation targeting in Latin America. Central Bank of Chile. Working Paper No. 105.

Dennis, Richard. (2002). Solving for optimal simple rules in rational expectations models. Federal Reserve Bank of San Francisco. Mimeo, Sept. *Journal of Economic Dynamics & Control* (forthcoming).

Fracasso, Andrea, Hans Genberg, and Charles Wyplosz. (2003). How do central banks write? An evaluation of inflation reports by inflation-targeting central banks. Geneva Reports on the World Economy Special Report 2. Geneva, Switzerland: International Center for Monetary and Banking Studies (ICMB); London: Center for Economic Policy Research (CEPR).

Freitas, Paulo S. de, André Minella, and Gil Riella. (2002). Metodologia de Cálculo da Inércia Inflacionária e dos Efeitos dos Choques dos Preços Administrados. Notas Técnicas do Banco Central do Brasil No. 22. English translation in Banco Central do Brasil. (2002). *Inflation Report* 4(2):123–128.

Fuhrer, Jeffrey. (1997). The (un)importance of forward-looking behavior in price specifications. *Journal of Money, Credit, and Banking* 29(3):338–350.

Fuhrer, Jeffrey, and Georger Moore. (1995). Inflation persistence. *Quarterly Journal of Economics* 110(1):127–159.

Galí, Jordi, and Mark Gertler. (1999). Inflation dynamics: A structural econometric analysis. *Journal of Monetary Economics* 44:195–222.

Galí, Jordi, and Tommaso Monacelli. (2002). Monetary policy and exchange rate volatility in a small open economy. Cambridge, MA: National Bureau of Economic Research. NBER, Working Paper No. 8905.

Goldfajn, Ilan, and Poonam Gupta. (2003). Does monetary policy stabilize the exchange rate following a currency crisis? IMF Staff Papers 50(1):90–114.

Kuttner, Kenneth N., and Adam S. Posen. (1999). Does talk matter after all? Inflation targeting and central bank behavior. Federal Reserve Bank of New York. Staff Report No. 88.

Kuttner, Kenneth N., and Adam S. Posen. (2001). Beyond bipolar: A three-dimensional assessment of monetary frameworks. *International Journal of Finance and Economics* 6:369–387.

McCallum, Bennett T., and Edward Nelson. (2000). Monetary policy for an open economy: An alternative framework with optimizing agents and sticky prices. *Oxford Review of Economic Policy* 16(4):74–91.

Minella, André, Paulo S. de Freitas, Ilan Goldfajn, and Marcelo K. Muinhos. (2002). Inflation targeting in Brazil: Lessons and challenges. Central Bank of Brazil. Working Paper Series No. 53.

Minella, André, Paulo S. de Freitas, Ilan Goldfajn, and Marcelo K. Muinhos. (2003). Inflation targeting in Brazil: Constructing credibility under exchange rate volatility. *Journal of International Money and Finance* 22(7):1015–1040.
Mishkin, Frederic. (2000). Inflation targeting in emerging market countries. *American Economic Review* 90(2):105–109.
Mishkin, Frederic, and Klaus Schmidt-Hebbel. (2002). A decade of inflation targeting in the world: What do we know and what do we need to know? In Norman Loayza and Raimundo Soto (eds.). *Inflation Targeting: Design, Performance, Challenges*. Santiago, Chile: Central Bank of Chile, 171–219.
Reinhart, Carmen M., and Kenneth S. Rogoff. (2002). The modern history of exchange rate arrangements: A reinterpretation. Cambridge, MA: National Bureau of Economic Research. NBER Working Paper No. 8963. Quarterly Journal of Economics (forthcoming).
Roberts, John M. (1997). Is inflation sticky? *Journal of Monetary Economics* 39:173–196.
Roberts, John M. (1998). Inflation expectations and the transmission of monetary policy. Board of Governors of the Federal Reserve System. Finance and Economics Discussion Paper Series, no 98/43, October.
Rogoff, Kenneth. (1985). The optimal degree of commitment to an intermediate monetary target. *Quarterly Journal of Economics* 100(4):1169–1189.
Rotemberg, Julio J., and Michael Woodford. (1999). Interest-rate rules in an estimated sticky price model. In John B. Taylor (ed). *Monetary Policy Rules*. NBER Business Cycles Series, Vol. 31. Chicago and London: University of Chicago Press, pp. 57–119.
Schaechter, Andrea, Mark P. Stone, and Mark Zelmer. (2000). Adopting inflation targeting: Practical issues for emerging market countries. International Monetary Fund. Occasional Paper No. 202.
Schmidt-Hebbel, Klaus, and Alejandro Werner. (2002). Inflation targeting in Brazil, Chile, and Mexico: Performance, credibility and the exchange rate. Central Bank of Chile. Working Paper No. 171.
Svensson, Lars E. O. (2000). Open-economy inflation targeting. *Journal of International Economics* 50:155–183.
Svensson, Lars E. O. (2002). Monetary policy and real stabilization. Princeton University Mimeo. Paper presented at "Rethinking Stabilization Policy", a symposium sponsored by the Federal Reserve Bank of Kansas City and held at Jackson Hole, Wyoming, August 29–31, 2002.
Taylor, John B. (2000). Using monetary policy rules in emerging market economies. Stanford University. Mimeo.
Truman, Edwin M. (2003). *Inflation targeting in The World Economy*. Washington, D.C.: Institute for International Economics.
Woodford, Michael. (2003). *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton NJ: Princeton University Press.

Comment

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A nation dealing with its central bank is a leading example of principal-agent mechanism design in an imperfectly understood environment. As

this interesting paper shows, the problems are tougher in an emerging market economy such as Brazil, especially during the transition toward freer markets.

The central bank seeks to deliver low average inflation, but it will inevitably miss its inflation target at times—often for good reasons. The challenge is to design rules and incentives that achieve the general goal but do not impose unrealistic harsh penalties when an event stands in the way of the immediate achievement of the goal. Whiffs of inflation should be excused if they arise for good reasons rather than dereliction.

Flexible inflation targeting has a good reputation these days as the correct way for citizens to manage their central bank. Commitment to strict rules such as pegging the currency to another country's or a discretion-free Taylor rule has not fared well in practice, and modern analysis suggests that strict rules could never perform satisfactorily. These problems do not occur if instead, the central bank should be given an overall inflation target and be expected to achieve the target unless some extraordinary event occurs outside the bank's control; in which case, the bank should explain why it missed its target and on what path it will return to the target.

Brazil has operated under a wonderfully flexible inflation-targeting regime for several years, as we learn in this paper. The current overall target is 4% per year. Current inflation in Brazil is about 14%. Is this 1970s-style central-bank irresponsibility, or is the 10-percentage-point gap the result of an intelligent response to special circumstances?

Table 8 of the paper lays out a formula by which the citizens of Brazil can decide if 14% inflation is acceptable under the 4% target regime, shown in line (a). Line (b) gives the bank 1.7 percentage points of slack because of rising prices associated with liberalization—the removal of subsidies that kept some prices unrealistically low. Line (c) grants the bank 2.8 more percentage points of slack because of excess inflation in the previous year. Whatever excess is brought over by way of inertia from the previous year, only one-third is to be squeezed out this year. The rest will wait until future years. The logic is that erasing all inherited inflation immediately would depress real activity excessively.

Table 8 would permit 8.5% inflation, not the actual rate of 14%. The remaining 5.5 percentage points are explained in Figure 9. The target applies at the end of the year. Forecasted inflation from December 2002 to December 2003 is on target, at 8.5%, because the forecast calls for a rapid decline in inflation in the fall of 2003. By the time this volume is in print, the Brazilian public will know if the target was actually met.

The paper makes a compelling argument in favor of the flexibility of the formula underlying the Brazilian process for adjusting the target. Liberalization is creating highly desirable turbulence in the economy,

which needs to be recognized in setting inflation targets. And the instability of exchange rates in emerging market economies also differentiates them from the advanced economies, such as Britain, which have much tighter inflation targets.

The paper is equally compelling about the desirability of adjusting the target to account for special forces rather than adjusting the price index. Public acceptance of the targeting procedure is surely weakened if the products whose prices rise most rapidly are removed from the official price index. I think this argument also extends to advanced economies—the use of core or stripped inflation measures had a lot to do with the loss of control of the price level in the United States in the 1970s, for example.

The complexity and sophistication underlying Table 8 are remarkable. In the 1980s, when I dabbled in monetary policy and inflation-targeting rules, I would not have dreamt of proposing something as academic as the procedure embodied in line (c) of the table.

It's fascinating that Brazil has so far outstripped the International Monetary Fund (IMF), which is living in the deep past by trying to enforce inflation targets through limits on the growth of liquid assets. Because successful disinflations are almost always accompanied by large increases in the holdings of liquid assets, the IMF policy is perverse. I'm delighted to learn that the Brazilian team was able to talk the IMF out of this type of discredited policy.

The Brazilian public faces a difficult task in deciding if the gap between target and actual current performance is the result of diligence in following the rules or is misconduct. The public may find the logic behind Table 8 and Figure 9 a contrivance to hide bad performance. On the one hand, the process will be less subject to manipulation if the rules for granting exceptions are well established in advance—the basic logic of committed monetary policy rules. On the other hand, painful experience has demonstrated the need to keep the process flexible so that the economy can deal with the blow that comes from an utterly unexpected direction.

The authors share the enthusiasm for transparency that pervades the modern literature on monetary policy. The public needs to know what the central bank is doing now, what it plans to do in the future, and what it expects the resulting inflation rate to be. I'm impressed by this logic. But I'm also impressed by the success of the U.S. Federal Reserve in achieving desirably low inflation under a regime with almost total opacity. It appears that a small amount of actual performance substitutes for a great deal of transparency.

Many commentators on monetary policy have pointed to the benefit of testing monetary policy against outside forecasts of inflation. Figure 9 illustrates the potential value of these forecasts. The bank's claim that it is enti-

tled to the extra 5.5 percentage points of slack rests on the realism of the forecast. Certainly, in the United States, comparison to the consensus or to individual reputable inflation forecasts would prevent the Fed from taking an unrealistic position about future inflation should our economy find itself in the situation of the recent Brazilian economy, which suffered from simultaneous large shocks from currency depreciation and liberalization.

Comment

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The paper by Arminio Fraga, Ilan Goldfajn, and André Minella is a thoughtful and important paper on inflation targeting in emerging market economies. Not only does it add substantially to the literature on how to conduct monetary policy in these economies, but as I will argue below, it has important lessons for monetary policy in advanced economies.

Because I have so little to be critical about, my comments will focus on expanding some themes discussed in the paper. Specifically, first, I will examine why emerging market economies are so different from advanced economies and why this affects thinking about monetary policy. Then I will address several issues for inflation targeting in emerging market economies discussed in the paper: target bands, transparency and formality, response to shocks, and International Monetary Fund (IMF) conditionality.

1. Why Emerging Market Economies Are So Different from Advanced Economies

This paper, along with a recent paper I have written with Guillermo Calvo (Calvo and Mishkin, 2003), rightfully emphasizes that emerging market economies (EMEs) are fundamentally different from advanced economies, and this distinction is important in designing appropriate monetary policy regimes. EMEs have five fundamental institutional differences from advanced economies that are crucial to sound theory and policy advice:

1. Weak fiscal institutions (what the paper refers to as "fiscal dominance").
2. Weak financial institutions, including government prudential regulation and supervision (what the paper refers to as "financial dominance").

3. Low credibility of monetary institutions.
4. Liability dollarization.
5. Vulnerability to sudden stops of capital inflows (what the paper refers to as "external dominance").

Advanced countries are not immune to problems with their fiscal, financial, and monetary institutions (the first three items in the list above), but there is a major difference in the degree of the problem in EMEs. Weak fiscal, financial, and monetary institutions make emerging market countries vulnerable to high inflation and currency crises, which are not only a source of high volatility but also mean that the real value of domestic money cannot be taken for granted. As a result, EMEs have much of their debt denominated in foreign currency, usually dollars, hence leading to what is called liability dollarization. As (Mishkin, 1996) and Calvo (2001) have pointed out, liability dollarization is what leads to an entirely different impact of currency crises on the economy in emerging market versus advanced countries. In emerging market countries, a sharp real currency depreciation raises the value of liabilities in local currency, thus causing the net worth of corporations and individuals, especially those whose earnings come from the nontradables sector, to fall. This serious negative shock to corporations' and individuals' balance sheets then increases asymmetric information problems in credit markets, leading to a sharp decline in lending and an economic contraction. It should be noted, however, that not all emerging market countries (e.g., Chile, and South Africa) suffer from liability dollarization in a serious way (see Eichengreen, Hausmann, and Panizza, 2002).

A dominant phenomenon in emerging market countries is a sudden stop, a large negative change in capital inflows, which appear, as a general rule, to contain a large unanticipated component (see Calvo and Reinhart, 2000). It is more likely to hit EMEs because of their weak fiscal and financial institutions, and a sudden stop leads to a sharp contraction of investment and the aggregate economy. The effect of sudden stops on individual countries is by no means uniform and appears to have much to do with initial conditions. For example, Chile had low debt relative to Argentina and did not suffer from liability dollarization, and thus was much less affected by the sudden stop in 1997–1998 than was Argentina, which suffered a serious dislocation.

This paper illustrates that these institutional differences result in a much more complicated environment for executing monetary policy by conducting illustrative simulations using a dynamic new Keynesian model. These simulations show that low credibility of monetary institutions leads to slower convergence of inflation to targeted levels and a

higher cost of disinflation. In addition, low credibility leads to higher volatility of inflation, output, and interest rates. The simulations also show that sudden stops, as represented by an exchange-rate shock, also lead to higher volatility of inflation output and interest rates.

One conclusion from the above discussion is that institutional reforms are especially critical to successful macroeconomic performance in EMEs. Rounding up the usual suspects provides the following list: (1) improvements in prudential supervision, (2) limits on the government safety net for the financial system, (3) discouragement of currency mismatch for the economy as a whole, (4) increased trade openness, (5) improvements in fiscal relationships between the central government and the provinces and increases in fiscal transparency, and (6) public/institutional commitments to price stability and central bank independence. I will not discuss these institutional reforms here because that would take my discussion to far afield. I do want to emphasize, however, that fundamental institutional reform is far more critical to macroeconomic success than is the choice of monetary policy regime (a point emphasized in Calvo and Mishkin [2003]). Inflation targeting or other monetary policy regimes, including hard exchange rate pegs such as a currency board or dollarization, are not a panacea.

Central banks in EMEs can encourage institutional reform, and the Banco Central do Brasil has been active in this regard. A central bank in an EME can only do so much, however, and it has to take weak institutions as given in deciding how to conduct monetary policy. The bottom line is that being a central banker is much tougher in EMEs than it is in advanced economies.

2. *Issues in Inflation Targeting in EMEs*

The tougher institutional environment that central bankers in EMEs face is important in policy design with regard to four issues discussed in the paper: target bands, transparency and formality, response to shocks, and IMF conditionality.

2.1 TARGET BANDS

The paper advocates target bands for inflation targets that are wide to accommodate the higher volatility in EMEs and suggests that the bands should be seen as checkpoints. Although the paper's position on these issues is reasonable, there is a subtlety here that needs to be emphasized.

The use of target bands has a dangerous aspect. Floors and ceilings of bands can take on a life of their own in which there is too great a focus on the breach of the floor or ceiling rather than on how far away actual inflation

is from the midpoint of the target range. As discussed in Bernanke et al. (1999) and Mishkin and Schmidt-Hebbel (2002), too great a focus on breaches of the floors or ceilings can lead to the so-called instrument instability problem, in which the attempts of policymakers to keep inflation within the target range cause policy instruments, such as short-term interest rates or exchange rates, to undergo undesirably large fluctuations. A focus on avoiding short-term breaches of the bands can also lead to suboptimal setting of monetary policy and controllability problems in which the inflation target is more likely to be missed in the medium term. Both of these problems have arisen in the New Zealand inflation-targeting regime.

One solution to these problems is to use a point target rather than a target range. There is still a need, however, for a trigger mechanism to support accountability for the central bank. Indeed, this is exactly what the Bank of England has done: it has a point target for inflation of 2% and the requirement that if the inflation rate is more than 1 percentage point above or below this target, then it has to issue a public letter to the government explaining why inflation has moved so far from the target, what policy actions will be taken to deal with the situation, and what will be the expected path of inflation back to the 2% target. This procedure puts the focus on the midpoint of a target range and not too much on the edges of the target range.

Having a wide target range with the edges of the range seen as checkpoints, as advocated in the paper, can be consistent with the Bank of England procedure and can avoid the problem of too much focus on the edges of the range. However, this requires that the focus always stay on the midpoint of the range and that the edges of the bands are interpreted only as checkpoints and not hard targets that cannot be breached. I think Fraga, Goldfajn, and Minella are advocating this approach, but it is important that EMEs be aware that the use of a target range requires some sublety in the communication process to avoid instrument instability and controllability problems.

2.2 TRANSPARENCY AND FORMALITY

This paper rightfully emphasizes that the weaker credibility of monetary policy institutions in EMEs requires even more transparency and formality in the inflation-targeting regime than in advanced economies. Because the public is more skeptical of monetary authorities in EMEs, the central bank can strengthen its credibility by providing even more information to the public with measures like the following: releasing minutes of central bank deliberations quickly; publishing the central bank's forecasts; and publishing a clear and frank inflation report that outlines the goals and

limitations of monetary policy, how the numerical values of the inflation targets are determined, how the targets are to be achieved, and the reasons for deviations from the targets.

Fraga, Goldfajn, and Minella also emphasize that a formal process for monetary policy decisions with regularly scheduled meetings of a monetary policy committee (which in turn has a high level of proper preparation and economic analysis) is not only crucial to effective decisionmaking but is also crucial to establishing credibility for the central bank. This point almost seems obvious, but as the authors emphasize, many central banks in EMEs have not followed this procedure in the past.

It is important to note that the Banco Central do Brasil has been a leader in advancing transparency and formality in EMEs. Before the Brazilian central bank adopted inflation targeting, many central banks in EMEs were skeptical that they could put in place a full-fledged inflation-targeting regime with high levels of transparency and formality. This is one reason that some of these central banks engaged in a gradual approach to implementing inflation-targeting regimes, with the Bank of Mexico being a prominent example. However, in 1999, the Banco Central do Brasil, under Arminio Fraga, has paved the way for other central banks in EMEs by implementing a full-fledged inflation-targeting regime with all the bells and whistles of transparency and formality within four months of the initial announcement of inflation targeting. This achievement was extraordinary and has helped hasten the adoption of inflation targeting in many EMEs.

2.3 RESPONDING TO SHOCKS

A key theme of the paper is that EMEs face much bigger shocks than advanced economies do, which complicates the conduct of monetary policy. How should inflation-targeting central banks in EMEs respond to shocks? When shocks drive inflation away from the target, what horizon should be used for returning to the target? For Brazil, these questions have not been academic: Brazil experienced a major exchange-rate shock in 2002, prior to the election of the new president, that caused a major overshoot of its inflation target.

The discussion in the paper on how to respond to shocks gets it exactly right. The first point the paper makes is that the response to a shock and the horizon over which the central bank plans to get the inflation rate back on target depends on the nature and persistence of the shock. In other words, an optimizing framework in which output and inflation fluctuations are minimized requires that the horizon for hitting an inflation goal is shock dependent. Thus, the procedure for responding to a shock derived from an optimizing framework requires the following four steps: (1) identify the nature and persistence of the shock; (2) estimate the

first- and second-order effects of the shock, depending on the type of shock; (3) calculate the optimal response, depending on weights on inflation versus output fluctuations in the central bank's objective function; and (4) explain to the public why the particular path of inflation has been chosen.

The paper provides an excellent discussion of how the Banco Central do Brasil has responded to a large shock when it adjusted its inflation targets in early 2003. First, the central bank estimated the regulated-price shock to be 1.7%. Then taking into account the nature and the persistence of past shocks, it estimated the inertia from past shocks to be 4.2%, of which two-thirds was to be accepted, resulting in an additional adjustment of 2.8%. Then the central bank added these two numbers to the previously announced target of 4% to get an adjusted inflation target for 2003 of 8.5% (4% + 1.7% + 2.8%). The adjusted target was then announced in an open letter sent to the minister of finance in January 2003. The letter explained that getting to the nonadjusted target of 4% too quickly would entail far too high a loss of output. Specifically, the letter indicated that an attempt to achieve an inflation rate of 6.5% in 2003 was expected to entail a decline of 1.6% of gross domestic product (GDP), while trying to achieve the nonadjusted target of 4% was expected to lead to an even larger decline in GDP of 7.3%.

The procedure followed by the Banco Central do Brasil has several important advantages and is a textbook case for central bank response to shocks. First, the procedure has tremendous transparency, both in articulating why the initial inflation target was missed and also in showing how the central bank is responding to the shock and its plans to return to its longrun inflation goal. This degree of transparency helps minimize the loss of credibility from the missed target and the need to adjust the short-term inflation target. Second, the central bank recognized that not adjusting the inflation target was just not credible because the market and the public clearly recognized that inflation would overshoot the initial target. Thus, adjusting the target publicly was absolutely necessary to retain credibility for the central bank because to do otherwise would have signaled to the markets that the central bank was unwilling to be transparent. Third, by discussing alternative paths for the inflation rate and the reasons that the particular path using the adjusted target was chosen, the central bank could demonstrate that it is not what King (1996) has referred to as an inflation nutter who cares only about controlling inflation and not about output fluctuations. By its procedure of outlining that lower inflation paths would lead to large output losses, the Banco Central do Brasil demonstrated that it is not out of touch with the concerns of the public because it indeed does care about output losses, just as the public and the politicians do.

2.4 LESSONS FOR ADVANCED COUNTRIES

Although the discussion in the paper and the experience of Banco Central do Brasil in responding to shocks has important lessons for the conduct of monetary policy in other EMEs, it also has important lessons for the conduct of monetary policy in advanced economies. Inflation-targeting central banks in advanced economies have often adopted a horizon for their inflation targets of two years or so, with the Bank of England being a prominent example. This approach can give the impression that the horizon for inflation targets is fixed, which could mean that inflation targeting will not be flexible enough. After all, our models tell us that optimal monetary policy will surely adjust the target horizon for inflation depending on the nature and persistence of shocks, a key point made by the paper. Indeed, critics of inflation targeting in advanced economies have pointed to the rigidity of the inflation-targeting regimes with a fixed horizon as an important reason for not adopting inflation targeting.

Until now, the use of a specific horizon like two years has not been a problem for inflation targeting in advanced economies like the United Kingdom because inflation has not been subject to big shocks and it has remained close to the target level. In this case, having the horizon for the target equal to the policy horizon (i.e., the time it takes for monetary policy to affect inflation), which is about two years, is consistent with optimal monetary policy. As Svensson (1997) demonstrates, however, if the inflation rate is shocked away from its long-run target, then the target horizon should be longer than the policy horizon. Although this situation has not occurred yet for inflation targeters in advanced economies, one day a big shock to inflation will come (as it already has in Brazil). Then for monetary policy to minimize output and inflation fluctuations optimally, the target horizon will need to be longer than two years and to vary depending on the nature of the shock.

Central banks in advanced economies are aware of this issue. For example, in the United Kingdom, the inflation-targeting regime stipulates that if inflation is knocked more that 1 percentage point away from its target of 2%, then the Bank of England will specify the path of inflation and the length of time that it will take to get back to the 2% target. Thus, there is a provision for flexibility in which the target horizon can be varied when big shocks hit the inflation process. There are two problems that may arise, however, when a big shock hits the economy. The first is that the two-year horizon may have become so fixed in the mind of the public and/or the central bank that the central bank may not respond flexibly enough to a large shock. The second is that a big shock may occur that the central bank expects will drive inflation outside the band around the inflation target, but inflation is still within the band for

the time being. Even though inflation is not yet outside the target range, the two-year horizon for hitting the inflation targets is unlikely to remain appropriate. Instead, the central bank will need to adopt a procedure like the Banco Central do Brasil has followed to set appropriate policy instruments in which the horizon and path for inflation are adjusted depending on the nature and persistence of the shock. This kind of flexible response would be harder to accomplish if the fixed time horizon is in place when inflation at first remains within the target range.

Because EMEs like Brazil have already been subjected to large shocks that require changes in the horizon for inflation targets, they illustrate that central banks in advanced economies have to take this contingency into account when designing their inflation-targeting systems. A lesson in this paper is that to minimize output and inflation fluctuations optimally, central banks in both advanced and emerging market economies need to make it clear, even before it is necessary, that the horizon for inflation targets needs to be flexible and will vary depending on the nature and persistence of shocks, and that they will be ready to use procedures like the one the Banco Central do Brasil has followed recently.

Stating that they are ready to use a procedure like the one the Banco Central do Brasil has used has another important advantage for central banks in advanced as well as emerging market economies. A well-known conundrum for central bankers in both advanced and emerging market economies is that many of them don't like to talk about output fluctuations when discussing monetary policy. They fear that doing so encourages the public and the politicians to demand that the central bank focus on fighting declines in output, with the result that the pursuit of the price stability goal will be compromised. The problem with central banks unwillingness to discuss output fluctuations is that the public may begin to see the central bank as having different preferences than they do, which can erode support for the central bank. By acknowledging that a procedure like the one followed by the Banco Central do Brasil will be used when large shocks hit the economy, a central bank can make it clear that it does care about output fluctuations and is not an inflation nutter. This approach has the advantage that it will promote support for central bank independence and the inflation-targeting regime. It also shows that the central bank cares about output fluctuations in a forward-looking context because it highlights decisions that the central bank will make about the future path of inflation and the horizon over which inflation will return to target. It therefore clarifies that the central bank is focusing on output fluctuations in a long-term context, which is necessary for avoiding the time-inconsistency problem.

2.5 IMF CONDITIONALITY

The paper contains a brief section on IMF conditionality and I have a few comments about this topic. When a country obtains loans under an IMF program, it is subject to conditions that require evaluation of the monetary policy stance. In the past, a key element of this conditionality was ceilings on the growth rate of net domestic assets. As pointed out by Fraga, Goldfajn, and Minella, conditionality based on net domestic assets makes little sense in an inflation-targeting regime. Net domestic assets conditionality, which is derived under the IMF's financial programming framework, is based on an outdated theory: the monetary approach to the balance of payments (see Mussa and Savastano, 1999), which requires that the growth rate of monetary aggregates be closely linked to inflation. However, the linkage between monetary aggregates and inflation is almost always found to be weak when inflation rates are reasonably low, as is the case for EMEs that have adopted inflation targeting. As a result, targets for net domestic assets are likely to lead to the inappropriate setting of monetary policy instruments and are likely to decrease monetary policy transparency.

In an inflation-targeting regime, it seems natural to replace net domestic asset conditionality with assessment of the country's inflation performance. Indeed, this is what the IMF moved to in evaluating monetary policy under its program for Brazil when inflation targeting was adopted in 1999. The IMF program has conducted quarterly reviews on Brazil's performance in meeting its inflation targets, but there is still a problem that the IMF evaluation is essentially backward-looking (Blejer, Leone, Rabanal, and Schwartz, 2001). Inflation targeting is inherently forward-looking, so how can IMF conditionality be modified to be more forward-looking? One approach would be for the IMF to monitor monetary policy institutions. Specifically, the IMF conditions could focus on the degree of central bank independence, whether the central bank mandate focuses on price stability as the long-run overriding goal of monetary policy, and whether transparency and accountability of the central bank is high. As part of this monitoring, the IMF could conduct a careful assessment of central bank procedures, the legitimacy of its forecasting process and whether the central bank provides adequate explanations for misses of its inflation targets.

In a sense, this shift in approach is similar to the shift in approach that has occurred in bank supervision in recent years. In the past, bank supervision was also quite backward-looking because it focused on the current state of banks' balance sheets. However, this backward-looking approach is no longer adequate in today's world, in which financial innovation has produced new markets and instruments that make it easy for banks and

their employees to make huge bets easily and quickly. In this new financial environment, a bank that is quite healthy at a particular point in time can be driven into insolvency extremely rapidly from trading losses, as was forcefully demonstrated by the failure of Barings in 1995. Thus, bank examinations have now become far more forward-looking and now place much greater emphasis on evaluating the soundness of a bank's management processes with regard to controlling risk. Similarly, the IMF could shift its conditionality to focus on the management processes in central banks to keep inflation under control.

3. *Conclusion*

The paper by Fraga, Goldfajn, and Minella is important not only because it has useful lessons for how inflation targeting should be conducted in emerging market countries but also because it has valuable lessons for advanced countries. The Banco Central do Brasil has been a leader in developing best-practice inflation targeting for emerging market countries, sometimes under extremely difficult conditions.

This topic reminds me of an incident at the Federal Reserve Bank of Kansas City's Jackson Hole conference, where top central bankers from all over the world congregate every August. The recently departed Rudi Dornbusch, who we all miss, made the provocative statement that "there are no competent central bankers in Latin America." Of course, what Dornbusch was getting at was that the environment for conducting effective monetary policy in Latin America is difficult, to say the least. What this paper demonstrates is that, in fact, some of the most competent central bankers are in Latin America, and we have a lot to learn from them.

REFERENCES

Bernanke, Ben S., Thomas Laubach, Frederic S. Mishkin, and Adam S. Posen. (1999). *Inflation Targeting: Lessons from the International Experience*. Princeton, NJ: Princeton University Press.

Blejer, Mario I., Alfredo M. Leone, Paul Rabanal, and Gerd Schwartz. (2001). Inflation targeting in the context of IMF-supported adjustment programs. IMF Working Paper No. 01/31.

Calvo, Guillermo A. (2001). Capital markets and the exchange rate: With special reference to the dollarization debate in Latin America. *Journal of Money, Credit, and Banking* 33(2):312–334.

Calvo, Guillermo A., and Frederic S. Mishkin. (2003). The mirage of exchange rate regimes for emerging market countries. *Journal of Economic Perspectives*, 17(4):99–118.

Calvo, Guillermo A., and Carmen M. Reinhart. (2000). When capital flows come to a sudden stop: Consequences and policy. In *Reforming the International Monetary*

and Financial System, Peter B. Kenen and Alexander K. Swoboda (eds.). Washington, DC: IMF.
Eichengreen, Barry, Ricardo Hausmann, and Ugo Panizza. (2002). Original sin: The pain, the mystery, and the road to redemption. Presented at the conference Currency and Maturity Matchmaking: Redeeming Debt from Original Sin. Inter-American Development Bank. Washington, DC, November 21–22.
King, Mervyn. (1996). How should central banks reduce inflation? Conceptual issues. *Achieving Price Stability*. Federal Reserve Bank of Kansas City, 53–91.
Mishkin, Frederic S. (1996). Understanding financial crises: A developing country perspective. Annual World Bank Conference on Development Economics, World Bank 29–62.
Mishkin, Frederic S., and Klaus Schmidt-Hebbel. (2002). One decade of inflation targeting in the world: What do we know and what do we need to know? In *Inflation Targeting: Design, Performance, Challenges*, Norman Loayza and Raimundo Soto (eds.), Central Bank of Chile, Santiago 2002, 117–219.
Mussa, Michael, and Miguel Savastano. (1999). The IMF approach to economic stabilization. *NBER Macroeconomics Annual 1999*, Cambridge, MA: MIT Press, 79–121.
Svensson, Lars E. O. (1997). Inflation forecast targeting: Implementing and monitoring inflation targets. *European Economic Review* 41:1111–1146.

Discussion

A number of participants asked for clarification on the conduct of monetary policy by the Brazilian central bank. Mark Gertler noted that Alan Greenspan spent his first years in charge of monetary policy, successfully building his reputation. This situation could potentially be a problem, however, if expectations about monetary policy and the reputation of the Fed become tied to his personality. He asked whether the head of the central bank in Brazil faced similar problems. He was skeptical that the publication of details of state-contingent targets could successfully substitute for the reputation of Arminio Fraga, speculating that there might be considerable leeway for discretion within the published targets. Gertler asked whether the target paths published by the Brazilian central bank are based on specific models or on individual judgement. Arminio Fraga responded that the fact that there is room for discretion makes transparency extremely important, and thus it is important that the specific models used to generate the target paths are published. Ken Rogoff speculated that if target inflation rates in emerging markets were to reflect the size of the shocks those countries are likely to face, the target rates should be substantially higher. Arminio Fraga responded that the Brazilian central bank gave a good deal of thought to this issue. He noted that the central bank had not wanted the target to be high enough to include

expectations of a violent change in regime because this consideration might have triggered indexation clauses. Andrés Velasco suggested an alternative approach to accommodating big supply shocks in emerging markets without loss of credibility. He suggested that the central bank focus only on the element of the price level that does not depend on the exchange rate. He was curious about why the Brazilian central bank had not followed this approach. Arminio Fraga responded that the exchange rate affects all sectors of the economy and also that the exchange rate may be driven by the usual type of fundamentals as well as by supply shocks.

Arminio Fraga disagreed with the proposal in Robert Hall's discussion that the central bank explicitly announce its preferences. Among other problems, he felt that this approach still leaves open issues of time consistency and is difficult to explain to the public. However, he said that the central bank of Brazil is still trying to refine its approach and is currently thinking of explaining decisions in terms of a unit shock and how the shock will be handled over time. Rick Mishkin was also of the view that publishing the objective function of the central bank is not a sensible idea. In response to Robert Hall's discussion of external forecasts, Arminio Fraga said that outside forecasts tended to lag and that there was a lot of herding behavior. Mike Woodford was not convinced that targeting external forecasts would be better than targeting internal forecasts because outsiders' beliefs about central bank credibility affect their forecasts, while the central bank has full information about its own credibility. However, he noted that external forecasts are useful to the central bank forecasts as indicators of expected inflation. Robert Hall responded that this comment was reasonable, but that his point was that central banks shouldn't offer excuses; they should offer performance.

The difference in the challenges faced by monetary policy in developing and developed countries was discussed by several participants. Arminio Fraga noted that a history of weak institutions makes managing regime change more difficult in developing countries than it is in developed countries. In contrast to the events prior to Lula's election in Brazil, the transition from Clinton to Bush in the United States did not pose any problems for the Federal Reserve. Rick Mishkin agreed, noting that the job of the central bank is made much more difficult if the fiscal authority misbehaves. He pointed out that in the United States, the Fed benefits greatly from a stable and favorable policy environment. By contrast, central banks in developing countries have to work much harder on institutionalization and transparency because the policy environment tends to be much less favorable. Ken Rogoff remarked that Brazil's achievement in bringing inflation under control was very significant, especially in light of the fact that Brazil had experienced the second highest cumulative infla-

tion rate of any country since 1970: over 1 quadrillion percent. He speculated that, just as the Bundesbank seemed to have gained credibility from Germany's hyperinflation history, Brazil's central bank might also be able to benefit to some extent from the country's past.

A number of participants expressed the view that developed countries could learn from Brazil's experience. Ken Rogoff was of the view that the problem of credibility in monetary policy has not been solved, contrary to what a lot of people think. He noted that high productivity growth in recent years has made low inflation possible relatively painlessly. He speculated that the combination of high debt–GDP ratios and the old-age problem in Europe and Japan may incite these countries to inflate in the future. Rogoff also remarked that the ratio of science to art in central banking needs to be increased, and that the only difference between the Fed's conduct of monetary policy in the 1970s and today is in its communications strategy. Rick Mishkin noted that, although it is hard for central banks to explain technical details to the public, transparency about the effect of the output gap on the inflation target is a good idea. He observed that this topic is currently missing from the discussion of inflation targeting in advanced countries but could be crucial if a large shock does occur. Mike Woodford supported Mishkin's comment that the paper offers lessons for developed countries with low inflation. In particular, he said that a fixed horizon for achieving an inflation target is undesirable because the horizon should clearly depend on the persistence and nature of the shocks.

Carl Walsh noted that in the area of monetary economics, the interchange between policymakers and theory has been productive in the past few years. He observed that the table of state-contingent paths used by the Brazilian central bank to explain its actions can be interpreted as the optimal targeting rule from Benigno and Woodford. He noted that difficulty in explaining either the table or the rule is that the coefficients of the reaction function depend on many structural parameters, about which there is uncertainty. This situation makes it hard to be explicit or transparent about how output affects the inflation target. In response to Carl Walsh, Mike Woodford was optimistic that the Benigno and Woodford paper provides a useful framework for framing justifications for deviations from the target, particularly from the point of view of external monitoring by the International Monetary Fund (IMF).

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0-262-57221-4