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INFLATION TARGETING IN BRAZIL, CHILE, AND MEXICO: PERFORMANCE, CREDIBILITY, AND THE EXCHANGE RATE

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Resumen

Latinoamérica es parte de la tendencia mundial que ha llevado a un número creciente de países a adoptar un esquema de metas de inflación (MI). Este trabajo utiliza un marco empírico común para analizar la experiencia de Brasil, Chile y México bajo este esquema. El estudio muestra cómo el comportamiento de la inflación y de sus costos reales asociados tras la adopción de MI se comparan, para estos países, de manera favorable con un grupo de control formado por otros países. Además el trabajo presenta hechos que reflejan el aumento en credibilidad monetaria asociado a este régimen: el impacto significativo de las metas sobre la inflación esperada y efectiva, el bajo impacto de los shocks de inflación sobre la inflación subyacente y la caída en los errores de predicción de la inflación. ¿Ha estado el esquema de política en estos tres países asociados a un temor a la flotación cambiaria? No, considerando la volatilidad cambiaria relativamente alta y el nivel de reservas moderado observado en ellos. No, considerando la fuerte caída en el traspaso de devaluaciones a inflación y la poca evidencia de una respuesta significativa de la política monetaria a shocks cambiarios. Sí, considerando la frecuencia e intensidad de las intervenciones cambiarias esterilizadas en comparación a otros países con MI que mantienen una flotación más limpia.

Abstract

Inflation targeting (IT) has been adopted by a growing number of countries and Latin America has been part of this world trend. This paper reviews the recent IT experiences of Brazil, Chile, and Mexico, applying a common empirical framework to the three country cases. Inflation performance under IT and its associated output costs are reported and compared favorably to a control group of other countries. The paper analyzes ways by which IT has contributed to strengthen credibility: the effect of targets on inflation expectations and on actual inflation, the low influence of inflation shocks on core inflation, and the decline in inflation forecast errors. Do the three inflation targeters exhibit fear of floating? No, considering their relatively large exchange rate volatility and moderate international reserve holdings. No, considering strongly declining inflation-to-devaluation passthrough coefficients and little evidence for monetary policy reaction to exchange rate shocks. Yes, considering the frequency and intensity of sterilized exchange interventions in comparison to other inflation targeters that float more cleanly.

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Introduction

Inflation targeting is the new kid on the block of monetary regimes. Since New Zealand first adopted the regime in 1990, a growing number of industrial and developing countries have followed suit. To date, nineteen countries have anchored their monetary policy to explicit quantitative inflation goals. Even the Federal Reserve has suggested introducing inflation targeting in the United States, and academics have urged the Bank of Japan to adopt inflation targeting in an effort to jumpstart the Japanese economy.[1] The European Central Bank has adopted a two-pillar system based on both inflation and monetary targets, but many observers argue that in practice it is very close to a pure inflation targeting regime.

Latin America is part of this world trend. After recording the highest inflation in the world in the 1980s, the region implemented a substantial departure from past policies starting in 1990. The results have been dramatic. In the 1980s four countries recorded average inflation rates above 200 percent a year, and the average regional inflation rate stood at 145 percent. In contrast, most Latin American economies currently maintain low, single-digit inflation rates close to industrial-country levels. Price stabilization has been achieved in the region under different monetary and exchange regimes, ranging from exchange-rate-based stabilization and dollarization to inflation targeting in combination with floating exchange rates. In fact, Latin America's recent experience strongly confirms the two-corner hypothesis regarding the choice of monetary and exchanges rate regimes.[2] Most countries are strengthening their national currencies by adopting inflation targeting combined with a float, while some economies are giving up monetary policy and national currencies by evolving toward dollarization. Even currency boards seem to be part of the broad range of intermediate arrangements that are on their way out, as suggested by the current crisis in Argentina.

Inflation targeting has been adopted by Chile (in 1990), Peru (1994), Mexico (1999), Brazil (1999), and Colombia (1999). In all cases, the monetary authority implemented inflation targeting when inflation rates were well above long-term stationary levels, applying the regime to allow for less costly convergence toward low stationary inflation. Moreover, four of the five Latin American cases pursued an evolutionary approach in adopting inflation targeting, only gradually putting in place the bells and whistles of a formal inflation targeting framework. The exception was Brazil, which adopted inflation targeting with a revolutionary big- bang, establishing most inflation targeting features from the very beginning.

Does the adoption of inflation targeting make a difference? Inflation targeting countries have certainly reduced their inflation levels, but careful evidence provides a more cautious picture. Bernanke and others show that the adoption of inflation targeting did not make a difference in the cost or speed of price stabilization.[3] Cecchetti and Ehrmann present evidence that, on average, inflation targeting countries exhibit degrees of inflation aversion that are not higher than those of nontargeters.[4] Mishkin and Schmidt-Hebbel indicate that countries under

1. On the United States, see Meyer (2001); on Japan, see Svensson (2001).
2. Fischer (2001).
3. Bernanke and others (1999).
4. Cecchetti and Ehrmann (2002).

inflation targeting exhibit some structural differences with countries under alternative monetary frameworks.[5] Corbo, Landerretche, and Schmidt-Hebbel, who empirically evaluate ten years of inflation targeting experience in the world, arrive at the more positive conclusion that inflation targeting has succeeded in reducing output costs of stabilization and strengthening policy credibility.[6] Finally, Corbo and Schmidt-Hebbel compare inflation targeting in five Latin American countries to other inflation targeting experiences in the world.[7]

Various questions on inflation targeting experiences in Latin America have yet to be addressed. For example, how does the performance record of monetary policy under inflation targeting in these countries compare with a control group of other inflation targeting experiences? Four important issues arise regarding the possible contribution of inflation targeting to strengthening credibility. Do inflation targets influence inflation expectations? Do inflation targets affect inflation? Has inflation targeting helped reduce the effect of volatile inflation on core inflation? Has inflation targeting helped reduce inflation forecast errors?

All Latin American inflation targeters are open economies that employ floating exchange rate regimes of the dirty sort. They are subject to large external shocks and significant exchange rate volatility, and the exchange rate may therefore play an important role in the conduct of monetary policy under inflation targeting. Do they exhibit fear of floating? Is devaluation to inflation pass-through high? Does monetary policy react to exchange rate shocks? Why do these countries hold international reserves, and how and why do they intervene in foreign exchange rate markets?

We address these specific questions in this paper, focusing on the experience of Brazil, Chile, and Mexico under inflation targeting. The next section discusses the implementation of inflation targeting in Brazil, Chile, and Mexico. We report descriptive statistics on the success of targeting and its associated output costs are reported and compare them with those of a control group of other inflation targeting countries. The following section analyzes four ways in which inflation targeting may have contributed to strengthening credibility: the effect of targets on inflation expectations, their effect on actual inflation, the influence of inflation shocks on core inflation, and the dynamics of inflation forecast errors. We subsequently assess the role of the exchange rate on the conduct of monetary policy. We start by measuring the fear of floating within an international comparison and then report empirical results on the pass-through of devaluation to inflation and on Taylor rules. We also discuss the role of international reserves in emerging-country inflation targeters and the extent of currency interventions in the three countries. A final section concludes.

Implementation of Inflation Targeting in Brazil, Chile, and Mexico

Brazil, Chile, and Mexico have followed three different paths toward full-fledged inflation targeting. This section describes their different experiences and then assesses their performance in reducing inflation, meeting

5. Mishkin and Schmidt-Hebbel (2002).
6. Corbo, Landerretche, and Schmidt-Hebbel (2002).
7. Corbo and Schmidt-Hebbel (2001).

their targets, and lowering disinflation costs, in comparison with a control group of other inflation targeting countries.

Three Alternative Paths toward Inflation Targeting

Brazil, Chile, and Mexico have adopted inflation targeting to strengthen their monetary policy and achieve convergence of inflation toward low, stationary levels. The timing and implementation of inflation targeting vary considerably among the three countries, with a very early gradualist adoption in Chile, a later gradual adoption in Mexico, and a recent abrupt implementation in Brazil. All three countries have recently converged to inflation targeting standards prevalent in the more advanced inflation targeters, including Canada, New Zealand, and the United Kingdom. Brazil, Chile, and Mexico allow their exchange rates to float, but the central banks intervene in exchange markets—at times heavily, as discussed in section 4.

Gradual convergence toward full-fledged inflation targeting in Chile: 1990–1999

When the Central Bank of Chile adopted inflation targeting in September 1990, it was in its first year of full legal, operational, and goal independence—free from fiscal dominance and free to adopt the monetary and exchange rate regime of its choice.[8] In addition to the new inflation target, however, the Bank also pursued an exchange rate target from 1984 through 1999. The Bank frequently modified the rules and features of the exchange rate band in response to changing market pressures, and it also engaged in heavy intramarginal exchange rate interventions. The inflation target was dominant in Chile’s dual nominal anchor system throughout the 1990s: whenever a conflict arose between the inflation target and the exchange rate target (or the current account objective), the Bank decided in favor of the inflation target. This is evident from the frequent changes in the features of the exchange rate band and the decade-long record of inflation outcomes close to the Bank’s target levels (see figure 1).

Inflation targeting was actively used as a device to influence inflation expectations by committing the Bank to reducing inflation, which fell from well above 20 percent in 1990 to low, stationary levels in the late 1990s. The announcement of inflation targets backed by appropriate monetary policy action was an important device for strengthening forward-looking inflation expectations and hence reducing the role of the backward-looking indexation mechanisms that are prevalent in Chile’s highly indexed economy. This strategy lowered the costs of convergence to low inflation in the 1990s.[9]

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8. However, the Bank set annual inflation targets in close consultation with the Ministry of Finance.
9. Corbo, Landerretche, and Klaus Schmidt-Hebbel (2002).

On the road to stationary inflation, the Central Bank announced annual inflation targets—either as points or ranges—in September of each year for the following calendar year, until 1998. In September 1999 the Bank announced one more annual target for 2000 and an indefinite target range of 2–4 percent starting in 2001.

In 1999–2000 the Bank upgraded its monetary framework to full-fledged inflation targeting. This included disposing of the exchange rate band by adopting a dirty float, developing the Bank's modeling and forecasting capability, and adopting a comprehensive communications strategy to enhance policy transparency and credibility. The latter comprises publication of the schedule and minutes of monetary policy meetings (the latter with a three-month lag) and a regular inflation report with inflation and growth projections.

Evolution of monetary policy toward inflation targeting in Mexico: 1995–2001

The twin balance-of-payments and financial crises that hit Mexico in 1994–95 forced the Bank of Mexico to abandon a narrow exchange rate band and adopt a dirty float, as did Brazil some years later. The peso devaluation and subsequent inflation surge severely damaged the Bank's credibility. Public criticism focused on the lack of transparency regarding the conduct of the monetary policy, the dissemination of information, and the monetary laxity before, during, and immediately after the crisis.

The Bank responded to this credibility crisis in 1995 by adopting a monetary growth target as its nominal anchor, defined as a growth ceiling on net domestic credit. In the face of large uncertainty, the Bank established borrowed reserves as its instrument of monetary policy, letting markets determine both the exchange rate and the interest rate. As in preceding years, the Bank established an annual inflation target of 42 percent for 1995, 20.5 percent for 1996, and 15 percent for 1997. This monetary policy framework was maintained in 1996 and 1997. Inflation fell from 52 percent in 1995 to 16 percent in 1997. While the inflation targets were not attained in 1995 and 1996, inflation approached the target in 1997 (see figure 2).

In 1998, the monetary policy framework began a gradual transition toward an explicit full-fledged inflation targeting regime, reinforcing the role of the inflation target and raising policy transparency. The monetary base became less relevant and the inflation target more important in the conduct of policy. The Bank defined a series of annual inflation targets in 1999, aimed at converging to the inflation level prevalent in Mexico's main trading partners: the target ceiling started at 13 percent for 1999 and then dropped to 10 percent for 2000, 6.5 percent for 2001, and 4.5 percent for 2002, with the final goal of a stationary annual inflation target of 3 percent for 2003. Since 1999 inflation has been below the ceilings. The Bank started publication of its quarterly inflation report in 2000, which analyzes inflation prospects, the conduct of monetary policy, and the balance of risks for future inflation.

Mexico's transition to inflation targeting has thus been gradual, like Chile's. Mexico currently has in place the main components of a full-fledged inflation targeting framework, including a floating exchange rate, an independent monetary authority that sets inflation as the main goal of policy, the absence of other nominal anchors and of fiscal dominance, and implementation of monetary policy within a transparent framework in which communication with the public plays a key role. A future challenge is to consider substituting a more traditional interest rate instrument for the current quantitative instrument of monetary policy (the borrowed reserves target, or *corto).*

Big-bang adoption of inflation targeting in Brazil: 1999–2001

Brazil followed a different approach to the earlier gradualist implementation of inflation targeting in Chile and Mexico. After the 1998 balance-of-payments crisis and the subsequent depreciation of the Brazilian real, the new board of the Central Bank of Brazil, which took office in March 1999, focused on two tasks. First, it aimed at containing the pass-through from devaluation to inflation and restraining inflation expectations by imposing a restrictive monetary stance. Second, the Bank adopted a monetary framework based on inflation targeting, combined with a dirty float of the exchange rate.

Brazil modeled its full-fledged inflation targeting on the British and Swedish experience. The adoption of the technical and institutional infrastructure required for full implementation of inflation targeting was achieved in a very short time span of four months, which allowed the Bank to announce and implement inflation targeting in July 1999. Among the regime's main features were the choice of the headline broad consumer price index (the IPCA) as the target index and the announcement of multi-year annual inflation targets set at 8 percent, 6 percent, and 4 percent for 1999, 2000 and 2001, respectively, with a 2 percent tolerance band. Aiming at high policy transparency, the Bank started regular publication of an inflation report (including fan charts for quantitative projections of inflation and output), the schedule of its future monetary policy meetings, and the minutes of the meetings with a brief lag of one week. With regard to policy accountability, if a target is breached, the Governor must present an open letter to the Minister of Finance addressing the reasons behind the breach and the measures taken to reverse the deviation.

The Bank's inflation targets were attained in 1999 and 2000, with a low pass-through from the 1999 real devaluation to inflation (see figure 3). The target was breached in 2001, however, when headline inflation reached 7.7 percent. The Governor's letter to the Minister of Finance in January 2002 identified the 2001 exchange rate devaluation and the rise in government-set prices as the two main causes of the breach and discussed the measures taken to achieve the 3.5 percent target level set for 2002, within the specified 2 percent range.[10]

10. See information published by Banco Central do Brasil.

Performance under Inflation Targeting

How successful have Brazil, Chile, and Mexico been in reducing inflation and meeting their targets under inflation targeting? How costly has disinflation been? This section addresses these questions by using descriptive statistics to compare the three countries' performance under inflation targeting to the performance of a control group of eleven other inflation targeting economies.[11] We measure inflation targeting success along three simple dimensions: the reduction of inflation shortly before and after the adoption of inflation targeting, the speed at which stationary inflation was attained, and the average deviation of inflation outcomes from target levels.[12]

A general feature of inflation targeting is that countries prepare for the new regime by lowering inflation around the date of adoption (noted as year t in table 1). This pattern is observed in both industrial and emerging inflation targeters. While Mexico sharply reduced inflation in all the periods analyzed, Brazil only shows a reduction in inflation (of 8.7 percent) in the period that ranges from three years before to one year after the adoption of inflation targeting. In contrast, Chile made its strongest effort between the years $t - 1$ and $t + 1$, reducing inflation by 10.6 percent in that period. Depending on the selected period, the control group of eleven inflation targeters reduced inflation, on average, by rates that range from 7.3 percent (between years $t - 3$ and $t + 1$) to 3.9 percent (between years $t - 1$ and $t + 1$).

Now let's consider the speed of convergence to stationary inflation among inflation targeters. Among the fourteen inflation targeters, Chile had the longest transition period (thirty-six quarters), which is partly explained by its high initial inflation rate. Brazil and Mexico have not yet attained stationary inflation levels: inflation is still around 7 percent in Brazil and 5 percent in Mexico. All three countries exhibit longer transition periods than those observed in the control group (six quarters, on average).

Inflation targeters have been successful in meeting their inflation targets, as measured by the average relative deviation of actual annual inflation from target inflation through 2000 (table 2). Among the fourteen Inflation targeters, Brazil and Chile have been closest to their targets (with 0 and 0.06 percent inflation deviations, respectively), and they are positioned well below the control group's average (0.85 percent inflation deviation). Brazil's and Chile's superior performances are confirmed on examining average absolute inflation deviations. Mexico's average target deviations are closer to those of the control group. To control for large country differences in inflation levels during the transition to stationary inflation, we scale relative and absolute deviations to annual inflation rates. This alternative measure indicates that all three countries have been significantly more on target than the eleven-country control group.

To calculate the outputs costs of disinflation under inflation targeting, we compute unconditional sacrifice ratios, that is, the percentage output loss per percentage point of inflation reduction. We then compare the

11. Comparing the performance of our three sample countries with that of the control group is demanding for our three countries because the control group comprises economies that, on average, are stable and perform well: Australia, Canada, Colombia, Finland, Israel, Korea, New Zealand, South Africa, Spain, Sweden, and the United Kingdom.
12. Calculations for Brazil start in 1996 in order to exclude the period of high inflation.

sacrifice ratios calculated for disinflation periods to sacrifice ratios before the adoption of inflation targeting (table 3). The results for Brazil and Mexico are not conclusive owing to insufficient data since inflation targeting was adopted. Average sacrifice ratios based on gross domestic product (GDP) declined strongly in Chile, from 0.37 before inflation targeting was adopted to –0.70 thereafter. However, no difference emerges between periods in Chile when we use sacrifice ratios based on quarterly industrial output data.

The control group exhibits some deterioration in GDP-based sacrifice ratios, from an average of –0.32 before to an average of 0.19 after the adoption of inflation targeting. However, measures based on industrial output indicate that the countries in the control group achieved a major reduction in sacrifice ratios after adopting inflation targeting. We therefore conclude that the establishment of inflation targeting was generally contemporaneous with a reduction in the output costs of disinflation, both in the control group and in Chile. It is likely that inflation targeting contributed to this outcome by strengthening the conduct of monetary policy and raising policy credibility, a hypothesis that we address more closely below.

Finally, the volatility of industrial output fell substantially in Brazil (from 2.8 to 1.8), Chile (from 6.2 to 3.1), and Mexico (from 3.9 to 1.7) after the adoption of inflation targeting.[13] In Chile and Mexico, the reduction in the standard deviation of industrial output was significant at the 1 percent level. The post-adoption output volatility in these three countries is similar to the average output volatility observed in the control group, which fell from 3.1 to 2.9.

Inflation Targeting and Credibility

Strengthening the public credibility of monetary policy and official inflation forecasts is presumably one of the main benefits of inflation targeting. The central bank’s announcement of an explicit inflation target is potentially a strong commitment and verification device, especially in comparison with those offered by alternative monetary frameworks. If the central bank is able to back its explicit commitment with the policy actions required to attain its target, then inflation targets could contribute to raising the credibility of monetary policy and central bank inflation forecasts.

In this section we test for the potential credibility enhancement stemming from inflation targeting by checking whether publicly announced targets have affected inflation expectations and actual headline and core inflation in the three case studies. We also test for the effect of noncore inflation (that is, inflation of volatile consumer expenditure items) on core inflation and for the magnitude of inflation forecast errors. The tests are based on country-by-country econometric estimation of structural equations and derivation of dynamic impulse responses from estimated vector autoregression (VAR) models.

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13. We calculated volatility as the standard deviation of industrial output (deviation from a trend estimated using a Hodrick-Prescott filter).

The Effect of Inflation Targets on Inflation Expectations

One way to address the role of inflation targets in raising the credibility of monetary policy is to test whether the inflation target affects inflation expectations. When inflation targeting policy is credible, the adoption of a new numerical target should alter public expectations of inflation. However, announcement of a new target would not affect market expectations of future inflation under a noncredible target and an accommodative monetary policy.

We present empirical evidence for Brazil, Chile, and Mexico on the relation between inflation expectations and inflation targets, controlling for other determinants of expectations. The equation for expected inflation includes as regressors the nominal exchange rate depreciation, the deviation of inflation from expected inflation, the deviation of the target from expected inflation, and the deviation of headline inflation from core inflation. Definitions and sources for the data used in the estimations reported here and below are discussed in the appendix.

Table 4 reports ordinary least squares (OLS) estimations for the three countries. The nominal exchange rate depreciation is significant in determining inflation expectations only in Mexico. The deviation of inflation from expected inflation is significant in Chile and Mexico but not in Brazil, and its magnitude is only important in Mexico. The difference between headline consumer price index (CPI) inflation and core inflation is not significant in any country. Deviation of the target from expected inflation is significant and has the correct sign in all countries. The effect of a positive deviation of the target from inflation expectations on expectations is large in Brazil and Chile and smaller in Mexico. Deviations of the target from expected inflation are thus both statistically and quantitatively important in explaining the dynamics of expected inflation. This result suggests that inflation targets exert a credible, strong influence on private sector expectations and reactions to the conduct of monetary policy.[14]

Figures 4, 5, and 6 depict estimation coefficients from rolling regressions for this equation for Brazil, Chile, and Mexico, respectively. The coefficient associated with the rate of depreciation in Chile is very small throughout the sample period, although it increases somewhat with the peso devaluation that started in 1998. For Brazil and Mexico, this coefficient declines steadily over time. The influence of devaluation on inflation expectations has thus been either very small or strongly declining in our three-country sample. The coefficient of the inflation target is positive, large, statistically significant, and relatively stable in the three countries.

Finally, the coefficient of unanticipated inflation is close to zero in Brazil and declining toward zero in the other two countries. This result confirms that inflation targeting has been helpful in isolating inflation

14. As a complement to the latter estimations, we conducted five event studies for Mexico (one for each year in the period 1997–2001) to test whether market inflation expectations changed after the announcement of inflation targets. The results show that the target announcements for 1997, 1999, 2000, and 2001 had positive but not significant effects on analysts' inflation expectations. Their statistical significance increased over time, however, becoming significant at the 10 percent level in 2001. Similar event studies could not be performed for Brazil and Chile owing to the lack of a long data series on market inflation expectations.

expectations from transitory inflation shocks. We reach the same conclusion with regard to the coefficient of the difference between headline CPI and core inflation.

The Effect of Inflation Targets on Inflation

We approach the question of whether inflation targets affect inflation in two ways. First, we conduct Granger causality tests for inflation targets and headline inflation. We then estimate impulse responses of headline and core inflation to inflation target shocks, based on VAR model estimations for each country.

There are two views on causality between inflation and the inflation target. According to the first view, the target should determine and therefore anticipate actual inflation when the target is credible. The opposite occurs under an accommodative monetary policy and a noncredible target: past inflation determines the setting of current target levels. The second view is that target setting is different during convergence to low stationary inflation than at the steady state. During convergence—as observed in the three countries—inflation targets are lowered each year at a pace that takes into account past inflation. Therefore, causality from inflation to targets should be expected during convergence, even under conditions of high policy credibility. Regarding the opposite causality, one should expect that targets would Granger-cause inflation during convergence to low inflation if policy is credible and effective. Under steady state and a credible policy, however, the inflation target is basically unchanged, such that neither type of causality should be expected.

We conducted Granger causality tests for headline CPI inflation and inflation targets for each country. The results for Brazil show that neither CPI inflation causing the inflation target nor the opposite causality is observed. This may result from the short sample period or from the fact that Brazil already featured low inflation rates when it started targeting inflation in 1999. In Chile and Mexico, sample periods and convergence to low stationary inflation are much longer, and the results are more differentiated. In the case of Chile, we cannot rejected the hypothesis that CPI inflation Granger-caused the setting of inflation targets for the full inflation targeting period (1990–2001). Such causality is rejected, however, during the last four and two years. This result is consistent with the view that the Central Bank of Chile was conservative in setting its target by considering past inflation during much of the 1990s. When Chile approached convergence to low inflation in the last two to four years of the sample period, target setting became independent of past inflation shocks. With regard to the opposite causality, inflation targets did Granger-cause inflation during most of the 1990s, but not in 1999–2001.

In the case of Mexico, inflation did not Granger-cause the inflation target (or inflation projections) in the early 1990s or during the last two years of the sample. However, there is evidence of this causality for the period encompassing the last four years of the sample, suggesting that the setting of targets responded to past inflation three and four years ago. There is evidence of the opposite causality from targets to inflation during the full 1990–2001 period, but not in the last two to four years.

We conclude that causality in both directions tends to be more strongly observed when convergence to low inflation starts at relatively high initial inflation rates and takes a long time, as observed in Chile and Mexico but not in Brazil. We interpret the causality from inflation to target setting observed in early convergence not as a credibility problem, but as evidence of gradualism in target setting. As the inflation targeting regimes were consolidated and the three countries approached steady-state inflation, both causalities tended to disappear as a result of convergence to stationary low inflation levels and inflation targets.

We now turn to VAR-based impulse responses of inflation to innovations in target inflation.[15] Our VARs are estimated using standard variables considered in previous empirical work: the real interest policy rate, the inflation target, core inflation, output growth, money growth, and the real exchange rate. In the line of Christiano, Eichenbaum, and Evans, the identifying assumption relies on a central bank policy function, in which the monetary policy interest rate is able to affect all nonpolicy variables except inflation contemporaneously.[16] The VARs thus incorporate three categories of endogenous variables: nonpolicy variables that the central bank is unable to affect contemporaneously (core inflation), policy variables (inflation target, policy interest rate, money growth), and nonpolicy variables that the central bank can affect contemporaneously (real exchange rate depreciation, real output). The VARs also include four exogenous variables: the percentage change in external terms of trade, the London interbank offered rate (LIBOR), a time trend, and a constant. We used two alternative inflation measures (headline and core inflation), but we only report on core inflation because of the similarity in results.

The VARs and their corresponding impulse responses are estimated dynamically, that is, by presenting results for recursive estimation periods. This methodology allows us to check whether the potential effects have changed over time in the expected direction, as a result of sudden or gradual implementation of inflation targeting in the three countries. The VARs and their impulse responses are generated for periods that cover significant samples before and after the date on which each country adopted inflation targeting. In the absence of inflation target data for periods before the adoption of inflation targeting, we use market inflation expectations data for Brazil, implicit inflation expectations data for Chile, and government and central bank inflation projections for Mexico. When those figures are not available, effective annual average inflation rates are used.

The VAR estimations are based on monthly data from January 1995 to October 2001 for Brazil and quarterly data spanning the first quarter of 1986 to the first quarter of 2001 for Chile and Mexico. The first exercises involve VAR estimations for January 1995 to October 1997 for Brazil, 1986:1 to 1991:1 for Chile, and 1986:1 to 1995:1 for Mexico. These subperiods are selected to cover a significant sample period that ends shortly before or at the start of inflation targeting. For each subsequent recursive VAR estimation, twelve months of data are added for Brazil and eight quarters of data are added for Chile and Mexico. This generates five VARs for Brazil, six for Chile, and four for Mexico, covering the full period before and after the adoption of inflation targeting. We then generate impulse responses for the dynamic effects of an innovation in the inflation target on headline inflation.

15. Recent monetary policy VARs for Chile include Valdés (1997); Morandé and Schmidt-Hebbel (1997); Calvo and Mendoza (1998); Cabrera and Lagos (2000); Parrado (2001); García (2001). For Mexico, see Schwartz and Torres (2000).
16. Christiano, Eichenbaum, and Evans (1997).

The recursive dynamic impulse responses for the effects of inflation target innovations on core inflation are depicted separately for each country. In Brazil, an innovation in the inflation target (inflation expectations before 1999) had no significant effect on core inflation during the three subperiods up to October 1999, shortly after the adoption of inflation targeting (see figure 7). When the sample is extended through October 2000 and October 2001, however, target innovations affect core inflation significantly and persistently. The size of the effect is large: a one-standard deviation in the inflation target raises core inflation by a maximum of 0.3, attained after a two-month lag. The impulse response is significant for roughly one year after the target shock takes place.

Similarly, a target innovation in Chile had no significant effect on inflation until the period that extends to 1993:1, two years after the adoption of inflation targeting (figure 8). Subsequently, the effect of the target increased in significance and persistence. The magnitude of the impulse response is still very low in the full 1986–2001 sample (a one-standard deviation in the inflation target raises core inflation by a maximum of 0.007), but it is significant for ten quarters.

In Mexico, an inflation target innovation has a significant effect starting in 1996–97 (figure 9). For the full sample extending through 2001:3, the impulse response peaks at 0.04 and is statistically significant only for the third through fifth quarters. Similar results are obtained for headline inflation measures for the three countries (not reported owing to space limitations).

The reported results show that inflation targets have a large, quick, positive, and significant influence on inflation in Brazil. The corresponding effects are very small and develop more slowly in Chile and Mexico. The response of inflation to target innovations is likely to occur because of the influence of the central bank's target announcements on inflation expectations and hence on the public's spending and portfolio decisions.

Inflation Targeting and the Effect of Volatile Inflation on Core Inflation

Headline inflation is typically decomposed into core inflation and the inflation of volatile and other noncore items, which may include perishables, oil products, consumer taxes, and interest payments. Even in countries that officially target headline inflation, monetary policy is significantly determined by past performance and future forecasts of core inflation. This reflects the view that noncore inflation shocks are frequent but temporary, and monetary policy is therefore not very effective in controlling noncore inflation. While the central banks of Chile, Brazil, and Mexico are fully aware of this drawback to using headline inflation as the official target index, they have all selected to do so because of larger public confidence in the headline inflation measure and its dominant use in indexation clauses and contracts.

This trend raises the question of the possible influence that inflation targeting has on the effects of noncore inflation shocks on core inflation, taking into account the policy reaction of the central bank, policy credibility, and the prevalence of widespread indexation mechanisms. The following representation summarizes the expected effects of noncore inflation innovations on core inflation.

Expected Effects of Positive Noncore Inflation Shocks on Core Inflation

	In countries that target core inflation	In countries that target headline inflation
Low indexation and high credibility	Zero	Zero or negative
High indexation and low credibility	Positive	Positive or zero

If Brazil, Chile, and Mexico were strict headline inflation targeters, they would react to positive noncore inflation shocks by adopting a contractionary policy stance, in order to reduce core inflation and thus meet the headline inflation target. In contrast, if they were strict core inflation targeters, they would tolerate noncore inflation shocks without reacting to them. The latter stance assumes that policy credibility is high and indexation mechanisms are not widespread. If credibility is low (or indexation mechanisms widespread), then inflation expectations are quickly revised in response to noncore inflation shocks, and noncore inflation is more likely to spread into core inflation, for a given monetary policy reaction.

We conduct an indirect test of credibility (and the possible prevalence of indexation mechanisms) by testing for the effects of noncore shocks on core inflation. This involves reestimating our recursive country VARs by adding noncore inflation and then estimating the corresponding impulse responses. The three results depicted for Brazil show that innovations in noncore inflation have a large, positive effect on core inflation, which is significant in the first six months after the shock (see figure 10). This suggests that backward indexation is still relatively important in Brazil, that credibility is still not very high, or that monetary policy does not react to volatile inflation shocks.

The opposite results are obtained for Chile and Mexico (figures 11 and 12). Here the impact of the volatile component of inflation on core inflation is not significant for most subsamples and for most periods. In Mexico, the effect of a noncore inflation innovation grows increasingly more negative over time and becomes almost significant during the first two quarters in the impulse response for the full sample, which extends through 2001. The results for Chile are similar: starting from effects that are quantitatively and statistically not different from zero, responses turn negative over time and are significantly different from zero for quarters six through eight of the last two samples, including the full sample. Volatile inflation shocks thus do not spill over into core inflation in Chile and Mexico. Furthermore, they are offset to a small degree by opposite changes in core inflation. This may reflect a significant degree of policy credibility or a weakening of indexation mechanisms based on backward inflation, supported by strong policy commitment to the headline inflation target.

Inflation Targeting and Inflation Forecast Errors

In countries that have introduced inflation targeting to converge to steady-state levels of inflation, inflation targets carry information on the monetary stance of the central bank. The announcement of the inflation target should constitute news for the market, and the target set by the bank should affect inflation expectations.

The inflation target signals how aggressive disinflation will be during the relevant period, serving as a coordination mechanism and a commitment device.

We use country VARs to generate quadratic inflation deviation forecasts for each country, based on recursive VARs estimated with quarterly data for the three countries. In contrast to the VAR models estimated above, here we have removed trends from all variables by introducing Hodrick-Prescott filters, in order to avoid positive correlation between the computed inflation forecast errors and the level of inflation.[17]

Figures 13 through 15 depict forecast errors of average quadratic inflation deviations for Brazil, Chile, and Mexico. The forecast sample for Brazil and Mexico covers 1992:1 to 2001:1, while the Chilean sample runs from 1990:1 to 2001:1.[18] Four panels of quadratic inflation forecast errors are reported for each country, at leads of one, two, four, and six quarters ahead. The results suggest a positive effect of inflation targeting on the accuracy of inflation forecasts for Chile and Mexico. We consistently observe that the accuracy of inflation forecasts has increased dramatically in both countries for various leads. The reduction of inflation forecast errors is particularly strong in Chile after 1993. In Mexico, an increase in forecast errors occurred during the spike in inflation caused by the tequila crisis, but quadratic forecast errors are close to zero after 1997, when the gradual convergence toward inflation targeting began.

The results are less clear-cut in the case of Brazil. Forecast errors rose significantly following the adoption of inflation targeting in mid-1999, when inflation increased as a result of the devaluation of early 1999. Since mid- or late 2000, however, inflation forecast errors have declined strongly to levels that are close to those observed in Chile and Mexico. We conclude that the adoption of inflation targeting has contributed to lower inflation forecast errors in all three countries, a likely bonus of strengthened credibility and lower inflation.

The Role of the Exchange Rate in the Conduct of Monetary Policy

Brazil, Chile, and Mexico currently use a dirty float. Do they exhibit fear of floating? Is the pass-through of devaluation to inflation high? Does monetary policy react to exchange rate shocks? Why do these countries hold international reserves, and how and why do they intervene in foreign exchange rate markets—and what are the costs of these policies? This section addresses these specific questions to shed light on the role of the exchange rate in the conduct of monetary policy after the adoption of inflation targeting.

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17. We use four lags in the VAR estimations, which come from the recursive estimations using the Akaike, Schwartz, and Hannan-Quinn information criteria for each country. The Kullback-Leibler distance is a measure of the distance from the maximum likelihood fit of the model; it is calculated as the sum (the integral) of the deviations of the maximum likelihood function evaluated at the estimated parameters from the true fit. This measure is usually used to evaluate the fit of a time-series model, and it is usually approximated by the Akaike information criteria (AIC). The AIC is inconsistent in that it picks larger-than-optimal lags. There are many ways to correct this, most commonly by penalizing the number of lags in the statistic. We use two such solutions: the Schwartz information criteria (SIC) and the Hannan-Quinn information criteria (HQIC).

18. The Chilean sample is two years longer to reflect its earlier adoption of inflation targeting.

Calvo and Reinhart argue that many emerging market economies that have adopted flexible exchange rates are not truly floating.[19] Their argument is based on empirical cross-country comparisons of the ratio of exchange rate volatility relative to the volatility of interest rates or international reserves, which find that relative exchange rate volatilities are lower in emerging economies than in industrial countries that float. This international comparison, based on unconditional volatility ratios, is not a sufficient basis for concluding that countries suffer fear of floating, because it does not control for the fact that countries exhibit structural differences that are likely to affect relative volatilities in key financial variables. Countries differ significantly in the type, frequency, and magnitude of the shocks they face, their financial vulnerability, trade structure and openness, and their international financial integration. A more relevant area for analysis encompasses the evolution of relative exchange rate volatility in each country, before and after the adoption of the float, to largely control for country-specific features.

The evidence for Mexico and Chile reflects large changes in relative volatilities with the adoption of floating regimes. In Mexico, a comparison of the periods 1990–93 and 1996–2000 shows that exchange rate volatility has increased dramatically, interest rate volatility has increased by less, and reserve volatility has declined (see table 5).[20] The large rise of the ratio of exchange rate volatility to international reserve volatility and interest rates volatility between both periods reflects a regime shift toward exchange rate flexibility with adoption of the float. The same structural break is observed in Chile in the last three years of the sample. In Brazil, the case for more reserve stability is not as clear-cut as in the other two countries, although the main adjusting variable was clearly shifted from the interest rate to the exchange rate following the adoption of the float in 1999.

In a cross-country comparison, the absolute volatility of exchange rates and reserves in Brazil, Chile, and Mexico is very similar to that exhibited by Australia, Canada, and New Zealand. However, interest rates are more stable in the latter three countries than in the three Latin American cases.

The role of the exchange rate as an adjustment variable has thus clearly increased since the adoption of the floating exchange rate regime, while the role of interest rates and reserve movements as shock absorbers has declined substantially. This measure of the fear of floating has declined substantially with the adoption of the floating regime, and it appears to be leveling off toward levels observed in more mature industrial floaters.

19. Calvo and Reinhart (2000).

20. The floating exchange rate regime was adopted in December 1994; we exclude the data from the crisis year (1995) to avoid biasing our results as a result of the large volatility experience that year. The trend in interest rate volatility is explained by the fact that the central bank followed an active sterilization policy during the 1990–93 period.

Monetary Policy and the Pass-through from Exchange Rate Devaluation to Inflation

The discussion of the way monetary and exchange rate policy is conducted in emerging markets and under floating exchange rate regimes has focused on two features of central bank policies.[21] First, interest rates in emerging countries have been more reactive to exchange rate movements than those in industrial countries, and second, emerging economies that float maintain a large amount of international reserves and tend to intervene more in foreign exchange rate markets than their industrial counterparts.

These key differences between emerging and industrial economies have several implications. The pass-through from exchange rate depreciation to inflation is likely to be larger in emerging market economies than in industrial countries owing to low central bank credibility, a high degree of openness, and a history of high inflation. In addition, emerging economies present large mismatches between foreign currency assets and liabilities in their corporate, banking, and public sectors; this raises the likelihood of two undesirable outcomes of adverse shocks: self-fulfilling attacks on the country's assets and the onset of bank failures, corporate bankruptcies, and domestic recession following a large exchange rate depreciation. Monetary policy in emerging economies may therefore be more sensitive to exchange rate movements both indirectly (because of pass-through effects on inflation) and directly (because the exchange rate is an additional argument in central bank objective functions, reflecting their concern for devaluation-induced bank failures and domestic recessions). To stem the impact of pass-through effects on inflation and reduce excessive exchange rate volatility, central banks resort to sterilized exchange rate interventions in response to large exchange rate shocks. Finally, to reduce the likelihood of self-fulfilling attacks, which frequently end in a bad equilibrium, emerging countries hold larger levels of international reserves than do industrial countries.

Policymakers' concern for large exchange rate pass-through, attacks on international assets, depreciation-induced bank failures and recessions, and excessive exchange rate volatility is most intense during the transition toward a flexible exchange rate regime and during the shift from moderate to stationary low inflation. Their concern declines with the strength of the fiscal stance and the health of the domestic banking system. Consequently, the fear of floating—as reflected in the holding of large reserves, monetary policy that reacts strongly to exchange rate shocks, and frequent and intense intervention in exchange rate markets—should fall over time. Our three countries reflect this trend in the rise in relative exchange rate volatility discussed above.

We now focus on the behavior of the pass-through and monetary reaction functions in Brazil, Chile, and Mexico, while the next subsection reviews central bank holdings of reserves and currency market interventions. To assess the magnitude of pass-through coefficients, we compare simple correlation coefficients between inflation and exchange rate devaluation at twelve different monthly lags, before and after the implementation of inflation targeting in Brazil, Chile, and Mexico (see table 6). The decline in the inflation-devaluation correlation coefficient is striking in Brazil and Chile, which exhibit values close to zero or negative at most lags over the last

21. For example, Hausmann, Stein, and Panizza (2001).

three years in the sample. Pass-through coefficients are still quite high in Mexico in the last three years of the sample, but they have come down substantially from previous levels, particularly at higher lags. This suggests that pass-through effects should be of much less of a concern now for policymakers in Brazil and Chile than in the past or than in Mexico. Lower pass-throughs could provide a rationale for the relatively weak reaction of monetary policy to exchange rate movements—at least for that part that reflects inflationary pressures. Beyond the latter effect, however, monetary policy rules could exhibit exchange rate sensitivity out of concern for devaluation-induced financial crises and recessions or excessive exchange rate volatility. To test for this, we define a policy reaction function for interest rates that includes the exchange rate as an additional argument in a conventional Taylor rule.[22]

We specify a simple Taylor rule for the real interest rate (R_t), dependent on the deviation of expected inflation from inflation targets $(\text{EXPINF} - \text{IT})_t$, the output gap ($\text{YGAP}_t$), the nominal exchange rate depreciation (DEP_t), and the rate of the long-term government bond denominated in foreign currency (GBOND_t):

$$R_t = b_1 + b_2 R_{t-1} + b_3 (ExpInf - IT)_t + b_4 Ygap_t + b_5 dep_t + b_6 Gbond_t$$

The estimation results for the post-adoption samples in Brazil, Chile, and Mexico and various subperiods exhibit strong policy sluggishness and varying degrees of reaction to inflation deviations from targets and output gaps (see table 7). A robust result is that the effect of exchange rate depreciations on real interest rates has not been significant. There is thus no evidence that the central banks have consistently reacted to exchange rate movements above and beyond their effects on inflation, and the latter effect has weakened considerably in the recent past.

To check for robustness, we estimate an expanded version of the preceding Taylor rule by adding the trade balance, mentioned in the case of Chile as an additional policy target in the past. The results show, surprisingly, that the trade balance absorbs the explanatory power of most other variables in each country regression (table 8). It may therefore provide a good proxy of future inflationary pressure, either through the aggregate demand channel or the exchange rate channel. However, the exchange rate is not an independent significant determinant of monetary policy.

[table 8 here]

Countries may exhibit a temporary fear of floating during particular periods or events, as evidenced in a strong reaction of interest rates to exchange rate shocks. To test this possibility, we look at the dynamic evolution of the policy functions reported in table 8. We depict twelve-month rolling coefficients for Brazil, thirty-six-month rolling coefficients for Chile, and twenty-four-month rolling coefficients for Mexico (figures 16, 17, and 18).[23] In Chile and Mexico, the coefficient of the exchange rate in the monetary policy functions exhibits a large

22. Taylor (2000).
23. Differences in window size are due to different sample sizes for each country.

increase in the subsamples that are dominated by the 1998–99 period. This indicates that the exchange rate was an important determinant of monetary policy, in central banks' response to strong market pressures observed in both countries in the aftermath of the Asian, long-term capital management, Russian, and Brazilian crises of 1997–98. After this period of strong defense of Chilean and Mexico pesos through conventional monetary policy, the sensitivity of interest rates to exchange rates vanished completely in both countries, with coefficient values falling close to zero for the last subsamples. In Brazil, the defense of the real through monetary policy arises in 2000–01, but it disappears toward the end of 2001.

International Reserves and Intervention in Foreign Exchange Markets

Several analysts claim that emerging markets with floating exchange rate regimes hold excessive foreign exchange reserves, compared with similar regimes in developed countries. This is not true in Brazil and Mexico, where ratios of international reserve to M2 or GDP are comparable to those held by Australia, Canada, and New Zealand (see table 9). Central bank holdings of reserves in today's financial environment is an insurance policy against the consequences of negative capital account shocks. Self-fulfilling runs on a country's maturing obligations are possible, which makes the economy subject to multiple equilibria. In the bad equilibrium, the currency depreciates to attain external balance. The good equilibrium with no run is welfare superior to the bad equilibrium. A sufficiently large level of reserves acts as a liquidity insurance policy and is necessary to eliminate the bad equilibrium.[24] Countries that are more vulnerable to self-fulfilling runs should hold more reserves to reduce the likelihood of a bad outcome.

With regard to the dollarization of liabilities, the fixed exchange rate regimes of the past amounted to an implicit exchange rate guarantee extended by central banks to the private sector, which therefore had the incentive to incur a large exchange rate exposure. The shift toward floating regimes in the three countries eliminates this implicit guarantee and should contribute to a gradual reduction in the balance sheet currency mismatch.[25] The demand for international reserves is likely to fall to the extent that balance sheet mismatch declines with the float, banking systems are strengthened, and other sources of vulnerabilities (including fiscal sources) diminish.[26]

All three central banks have intervened in their foreign exchange markets. We now describe briefly the intervention mechanisms used in each country and discuss their rationale.

Since the floating of the real in January 1999, the Central Bank of Brazil has intervened indirectly in the foreign exchange market by changing the composition of domestic debt. The Central Bank has increased the placement of dollar denominated debt in times of stress, thus providing exchange rate insurance to the private

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24. Goldfajn and Valdés (1997).
25. Martínez and Werner (2001) report evidence suggesting this for Mexico.
26. The reduction in international reserve holdings was relatively small during the transition to floating rates in industrial countries in the early 1970s and 1980s (Mussa, 1976; Aportela, Gallego, and García, 2001). The available evidence thus does not point to a large, quick reduction in the demand for reserves when a country—whether industrial or emerging—makes the transition from a fixed to a floating regime.

sector. The main argument in support of this policy is that even under the floating exchange rate regime, private sector foreign exchange insurance is suboptimal because the private sector does not internalize the systemic consequences of currency mismatches. In July 2001, the Central Bank of Brazil responded to the depreciation of the real by announcing that it would undertake daily sales of U.S.$50 million in the foreign exchange market, for a total of U.S.$6 billion by the end of 2001. The main goals of this strategy were to foster liquidity in the foreign exchange market and to facilitate the adjustment in domestic absorption to the sudden drop in capital inflows.

The Central Bank of Chile, in turn, eliminated its wide exchange rate band in September 1999, but it had already stopped intervening in foreign exchange markets in March 1999. The clean float continued through July 2001. In response to large exchange rate depreciation and volatility, the Central Bank announced and carried out a temporary policy of sterilized interventions between July 2001 and January 2002. The stated objectives of the interventions were to reduce excessive exchange rate volatility and provide a hedge against future devaluations, without affecting exchange rate trends. The Bank intervened by selling U.S.$800 million (less than its preannounced ceiling of U.S.$1.5 billion) and issuing the equivalent of U.S.$3 billion (as announced) in dollar-denominated peso Bank debt (to provide a hedge against future exchange rate devaluation).

Finally, the Bank of Mexico has intervened on several occasions since the adoption of floating regime.

—In 1995, the central bank sought to smooth the adjustment to the fall in the demand for Mexican assets associated with the balance-of-payments and financial crisis by opening a special window for paying the amortization of TESOBONOS and commercial bank’s credit lines. The amount of dollar sales through this window amounted to U.S.$5 billion.

—The Bank of Mexico acts as the counterpart to the government in all its foreign exchange transactions, settling all of them at the market-determined daily fixed exchange rate. Because the government typically runs a surplus in foreign currency, the central bank bought US$ 50 billion in 1995–2001 through this mechanism.

—In the aftermath of the crisis, Mexican authorities aimed at raising the country’s international reserves to a suitable level to strengthen its external financial position and to improve the cost and maturity conditions of foreign financing. The central bank thus implemented a mechanism for buying foreign currency reserves in July 1996. One important aspect of this scheme was to avoid sending signals to the markets that could be interpreted as desired levels for the exchange rate.[27] This mechanism went into operation in August 1996 and was abolished in June 2001. Both theory and practice show that the accumulation of reserves through this mechanism had no noticeable effect on the volatility and trend of the exchange rate.[28] The central bank bought US$ 12.3 billion through this scheme in 1996–2001.

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27. The scheme that was adopted to reach these objectives works as follows. On the last business day of each month, the Bank of Mexico auctions rights to sell dollars to the central bank (put options) among credit institutions. These rights can be partially or completely exercised in the month following the respective auction. Holders of these rights can sell dollars to the Bank of Mexico at the interbank exchange rate published for the previous business day, if the exchange rate is not higher than the average exchange rate for the twenty business days previous to the date on which these rights are exercised. The expansion of the monetary base caused by the Bank of Mexico is completely sterilized. Consequently, the evolution of the supply of primary money is in no way affected by the aforementioned operations.
28. See Werner (1997); Werner and Milo (1998).

—Liquidity in the foreign exchange market almost dried up several times after the adoption of the float, when the domestic currency experienced sharp depreciations. Under such circumstances, small changes in the demand for foreign currency led to disproportionate peso depreciation. To moderate these extreme situations, the central bank introduced a contingent dollar sales scheme in February 1997, which was eliminated in June 2001. Under to this scheme, the Bank of Mexico auctioned U.S.$200 million daily, with a minimum price set 2 percent above the preceding day's exchange rate. This mechanism was used on several occasions to sell a total of U.S.$ 2 billion (most of the sales took place in 1998).

—Finally, the Bank of Mexico intervened with discretion and very infrequently, on occasions when the exchange rate was deemed to be depreciating excessively.

The intervention policies of Brazil, Chile, and Mexico share two important features. First, interventions have relied heavily on schemes that are announced in advance to the markets and that are complemented by ex post information on their amounts and dates. Discretionary interventions have been infrequent. This raised the transparency and public accountability of interventions, contrasting strongly with past discretionary, nondisclosed interventions both in these countries and in industrial economies. Second, all interventions have been sterilized, isolating monetary policy from their effects. This feature strengthened the conduct of monetary policy aimed at linking policy interest rates to inflation objectives, thereby avoiding the undesirable effects of nonsterilized interventions on domestic interest rates. The recent practice of sterilized interventions stands in stark contrast to past nonsterilized interventions, which had major effects on domestic interest rates (as in Chile in 1998).

We identify four main objectives motivating foreign exchange interventions in the three countries: facilitating adjustment to sudden reductions in capital inflows; accumulating reserves; reducing "excessive" exchange rate volatility (associated with lower liquidity in foreign exchange markets); and raising the supply of exchange rate insurance. The first two objectives are two sides of the same coin. On the one hand, countries accumulate international reserves to reduce the likelihood of self-fulfilling runs and, therefore, to improve their access to international capital markets. On the other hand, in times of stress triggered by a large decline in the demand for the country's assets (as in Mexico 1995 or Brazil 2001), the exchange rate that would equilibrate the market may imply a large depreciation, with the risk of a significant increase in inflation. In addition, if depreciating the exchange rate is the only available adjustment variable, then the supply of foreign exchange could conceivably become backward bending, such that no equilibrium exists.

Although the objectives pursued by the central banks imply plausible benefits of their foreign exchange interventions and international reserve holdings, these policies could be further improved with regard to transparency and the clarity of objectives, as has already been accomplished in the conduct of monetary policy. First, the determinants of optimal international reserve holdings should be more clearly identified. If current reserve levels are deemed to differ from optimal levels, the central bank should specify the mechanisms and time frame for attaining the desired levels. Second, it is advisable to provide ex ante information on the magnitude of the shocks that would trigger interventions in the foreign exchange market to facilitate adjustment to lower capital inflows. Alternatively, the central bank could consider adopting state-contingent intervention rules, such as the U.S.$200 million auction implemented in Mexico.

With regard to the third and fourth objectives listed above, the lack of formal microstructure studies of foreign exchange markets in emerging economies limits our ability to make a serious judgment on the need to intervene to provide liquidity and reduce exchange rate volatility. In addition, monetary authorities should be careful with regard to these policies because they reduce the private sector's incentive to insure itself.

Our overall assessment of the role of the exchange rate in the conduct of monetary policy in the three case studies is that the interest rate response to exchange rate movements and the analysis of the relative volatility of the exchange rate vis-à-vis reserves or interest rates do not indicate the presence of a fear of floating. Some of the results indicating a close connection between exchange rate movements and monetary policy actions were probably heavily influenced by events in 1998. However, the three countries have been less forthcoming with regard to the objectives and implementation of their foreign exchange reserve policies and their direct interventions in foreign exchange markets. Here central banks face the challenge of upgrading policies to the same level they have attained in their conduct of monetary policy.

Conclusions

Inflation targeting is being adopted by a growing number of countries, and Latin America is taking part in this world trend. This paper has reviewed the recent inflation targeting experiences of Brazil, Chile, and Mexico, applying a common empirical framework to the three cases. Major commonalties and differences are apparent in our assessment of these countries' inflation targeting experience. The three countries started from very different initial conditions and adopted strikingly different approaches to introducing inflation targeting. Chile was an early but very gradual inflation targeting adopter, taking ten years to complete its full-fledged inflation targeting framework. By contrast, it took Brazil less than six months to implement most inflation targeting features. Brazil's big-bang approach also stands in contrast to Mexico's experience, in which inflation targeting was introduced gradually and is still being perfected. Despite their different starting points, however, the three countries are evolving to a very similar monetary policy framework with all the elements of inflation targeting observed in countries like Canada, New Zealand, and the United Kingdom.

The paper reported descriptive statistics on the success of inflation targeting and the costs of inflation stabilization under inflation targeting, showing that the three countries have been successful in meeting inflation targets and attaining relatively low sacrifice ratios and output volatility levels after adopting inflation targeting. We then analyzed evidence on the contribution of inflation targeting to strengthening the credibility of monetary policy in the three countries. Broadly speaking and allowing for some country differences, inflation targeting has helped strengthen credibility in four ways: inflation targets have influenced private sector inflation expectations; they helped in the convergence toward low stationary inflation; the influence of volatile inflation shocks on core inflation was either small or negative; and inflation deviation forecast errors declined significantly following the adoption of inflation targeting.

Finally, we analyzed the central role of the exchange rate in the conduct of monetary policy and its outcome in the three country cases. Country measures to test for a fear of floating suggest that, on average, exchange rates are not less volatile and international reserves are not more volatile than what is observed in free-floating industrial countries. International reserve levels in Brazil and Mexico are of the same relative magnitude as those of mature industrial countries that float and have inflation targeting in place. This is not the case in Chile, however, which holds much larger reserves.

The fear of floating may be triggered by high devaluation-to-inflation pass-through coefficients but our evidence shows that pass-through coefficients have fallen dramatically in Brazil and Chile and moderately in Mexico in the last two to three years. Beyond pass-throughs, central bankers may fear floating because they are concerned about the real effects of large exchange rate volatility and devaluation-induced financial crises and recessions stemming from high dollar liabilities. This would lead them to set monetary policy in reaction to exchange rate shocks, beyond the effect of exchange rates on inflation. Our estimations of expanded Taylor functions show that exchange rates have no significant effect on domestic interest rates over the medium term, although contractionary monetary policies were adopted in response to exchange rate devaluation in exceptional periods (1998–99 in Chile and Mexico and 2000–01 in Brazil).

Central bankers' fear of floating can also be manifested in the frequency and intensity of their exchange rate interventions. Indeed, the three countries employ a dirty float, resorting at times to foreign exchange interventions in response to what they perceive as excessive exchange rate volatility or temporary devaluations. In contrast to past practice, current interventions are announced in advance and implemented as temporary and fully sterilized operations.

Even so, both intervention policies and the motivation for international reserve holdings are far behind monetary policy with regard to their rationale, consistency, and transparency. More openly discussed research on their costs and benefits is required. Once optimal reserve levels or their policy function is identified, central banks should specify the mechanisms and time frame for attaining the desired levels. Finally, it is advisable to provide ex ante information on the magnitude of the shocks that would trigger interventions in the foreign exchange market.

The results presented in this paper should be taken as preliminary evidence, considering that they are based on recent and relatively short experiences of inflation targeting in Brazil, Chile, and Mexico. However, in comparison with different experiences over time (the trio's dismal historical record of inflation and macroeconomic management) and across space (the yet-unsatisfactory performance of hard pegs of the sort followed by Argentina and Ecuador), the adoption of inflation targeting under a dirty float seems to be delivering the goods.

Appendix: Data Definitions and Sources

The general data sources are Banco Central do Brasil, Banco Central de Chile, and Banco de México.

Estimation of inflation expectations. Inflation expectations are defined for Chile as the difference between nominal interest rates and Unidad de Fomento (UF)–indexed (real) interest rates on three-month bank deposits. For Brazil, they are defined as the annual expected inflation, and for Mexico as the inflation expectations for the following twelve months. The series are monthly 1991–2001 for Chile, monthly 1999–2001 for Brazil, and weekly 1997–2001 for Mexico.

VAR estimations. The number of lags was selected by estimating the VAR system from 1986:1 to 2000:4. Following the Schwartz criterion, one lag was used. The ordering of variables in the country VAR systems is the following:

—Total CPI inflation (four-quarter percentage variation of CPI);

—Inflation target (Chile: expected inflation from interest rates is used prior to the adoption of the first target in 1991; Mexico: annual average inflation and annual inflation projections are used before the adoption of the first inflation target in 1995; Brazil: annual average inflation and annual inflation projections are used before the adoption of the first inflation target in 1999);

—Monetary policy rate (Brazil and Chile: central banks' monetary policy rate; Mexico: proxied by ninety-day deposit rate);

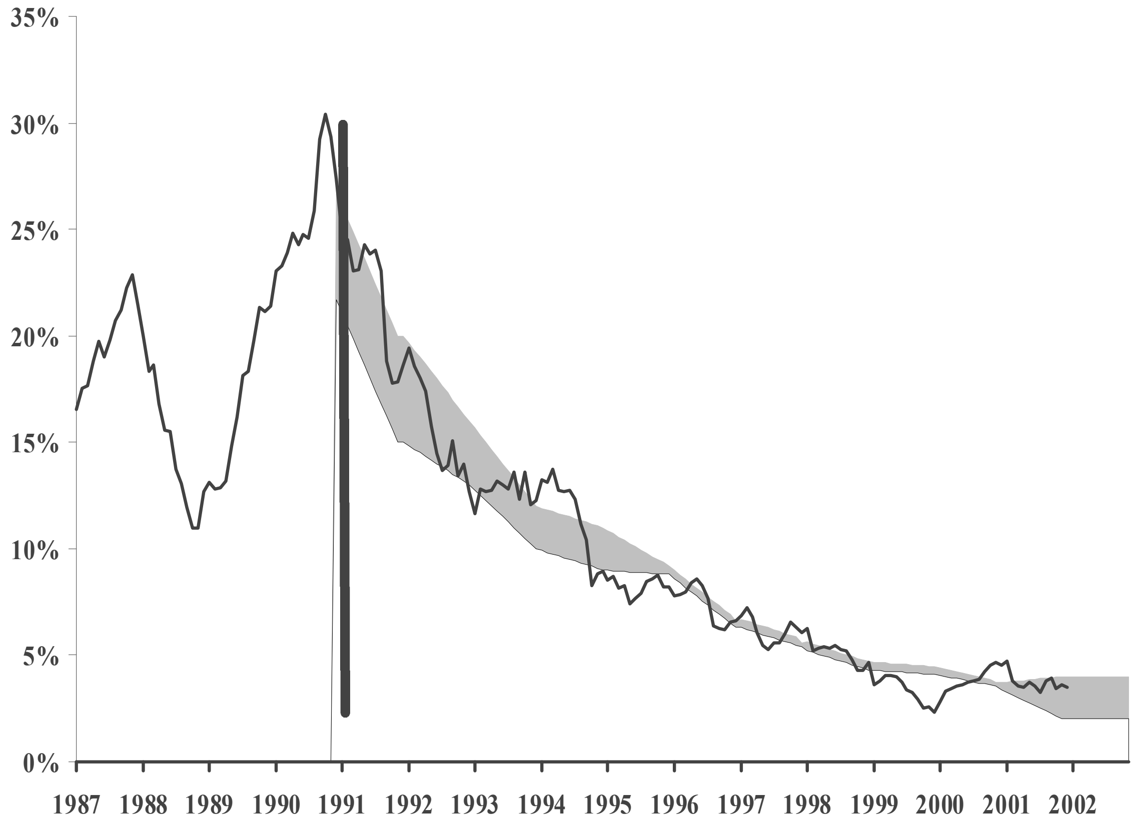
—Money growth rate (four-quarter percentage change in M1);

—Growth (four-quarter percentage change of real GDP); and

—Real exchange rate depreciation (four-quarter percentage change of the multilateral real exchange rate (Chile) and the U.S.-bilateral real exchange rate (Brazil and Mexico).

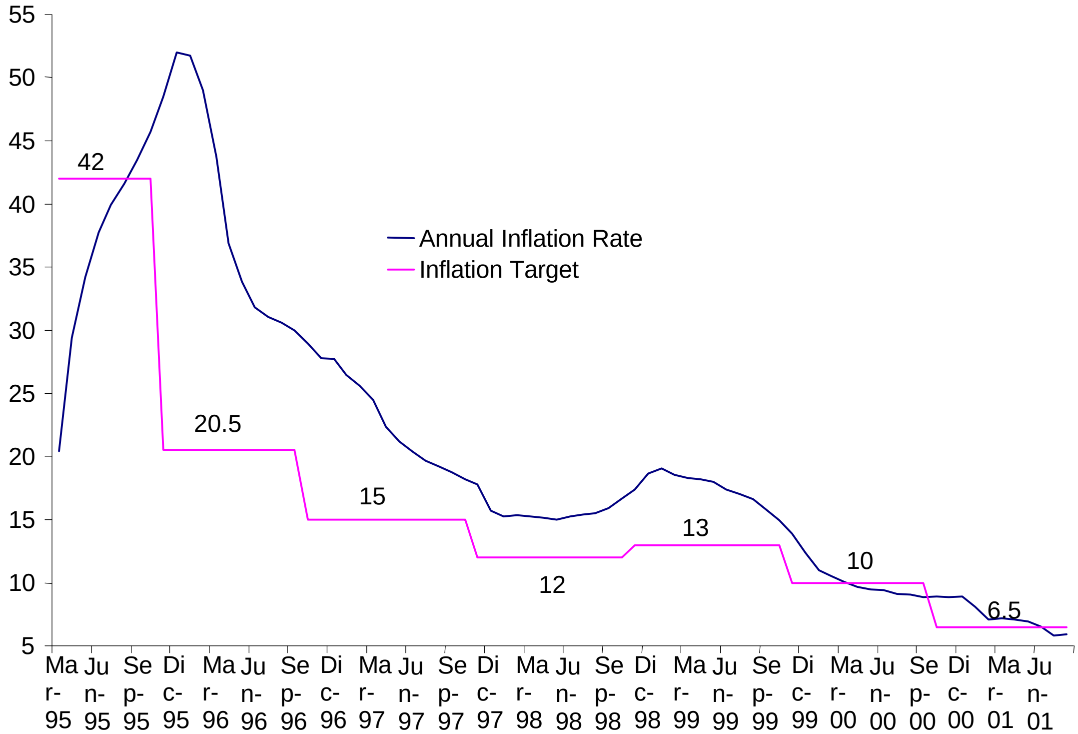
Taylor rule estimations. The data are monthly 1997–2001 series for Brazil, quarterly 1991–2001 series for Chile, and monthly 1997–2001 series for Mexico. The output gap is defined as the difference between actual and potential output, using industrial production indexes as a proxy for aggregate output. Potential output is estimated using the Hodrick-Prescott filter. The long-term interest rate is the rate of the long-term government bond denominated in foreign currency: the thirty-year treasury bill rate for Brazil and Chile and a dollar-denominated government bond (UMS26) for Mexico.

Figure 1. Inflation Targets and Actual Inflation in Chile, 1990–2001
Annual rate, in percent



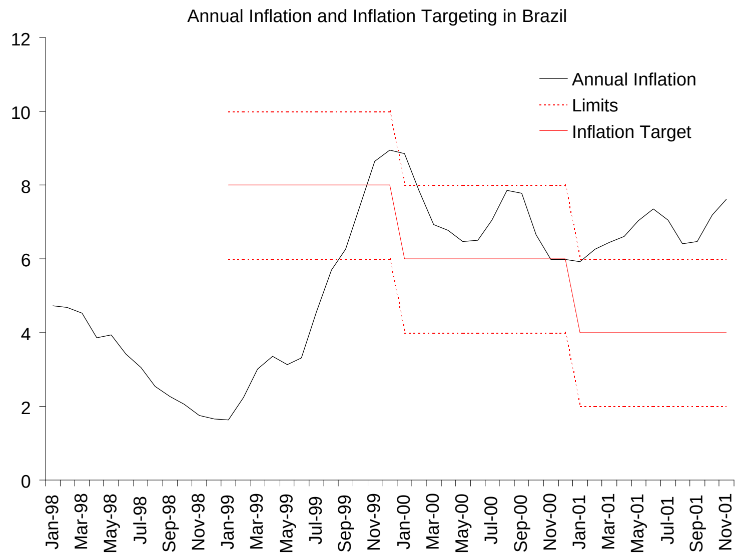
Source: Banco Central de Chile.

Figure 2. Inflation Targets and Actual Inflation in Mexico, 1995–2001
Annual rate, in percent



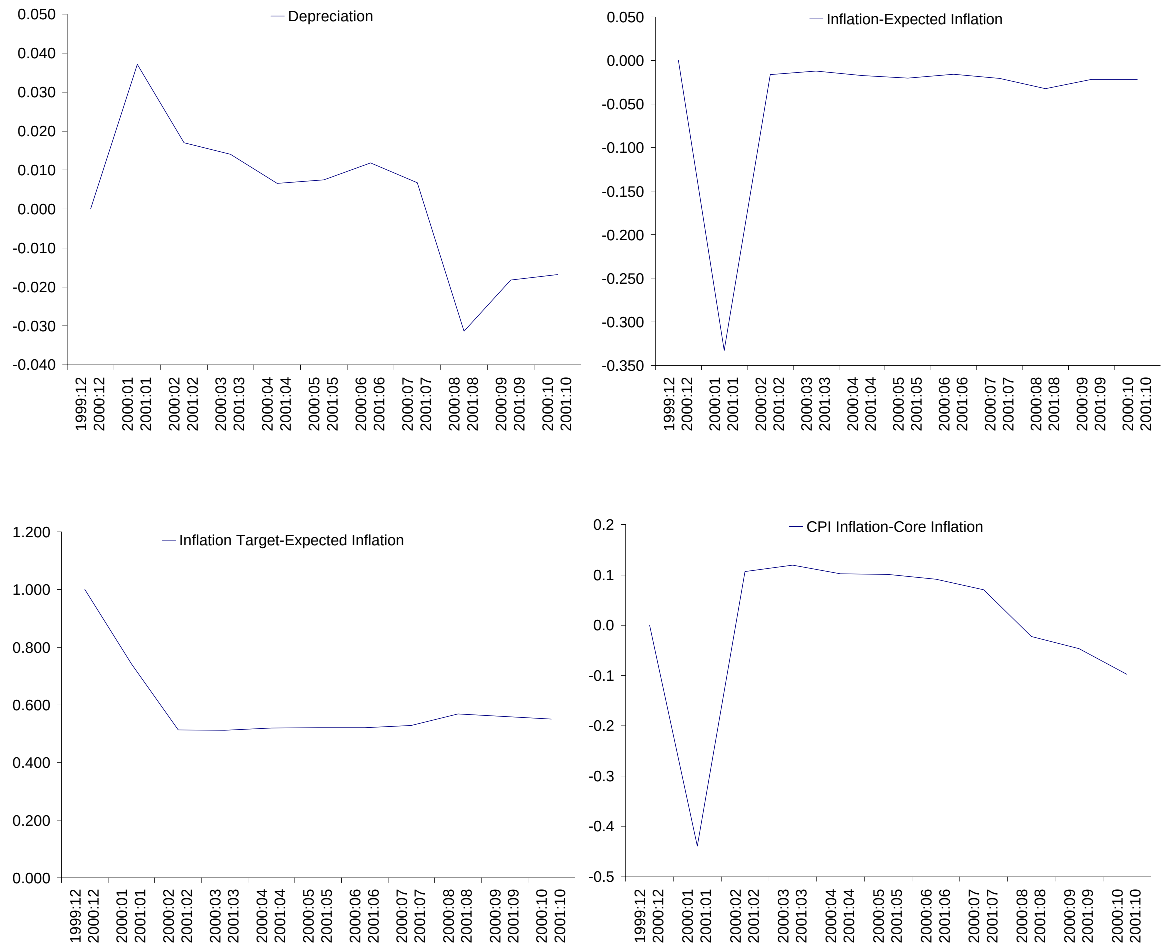
Source: Banco de México.

Figure 3. Inflation Targets and Actual Inflation in Brazil, 1998–2001
Annual rate, in percent



Source: Banco Central do Brasil.

Figure 4. Regression Coefficients for Inflation Expectations from Rolling Regressions: Brazil

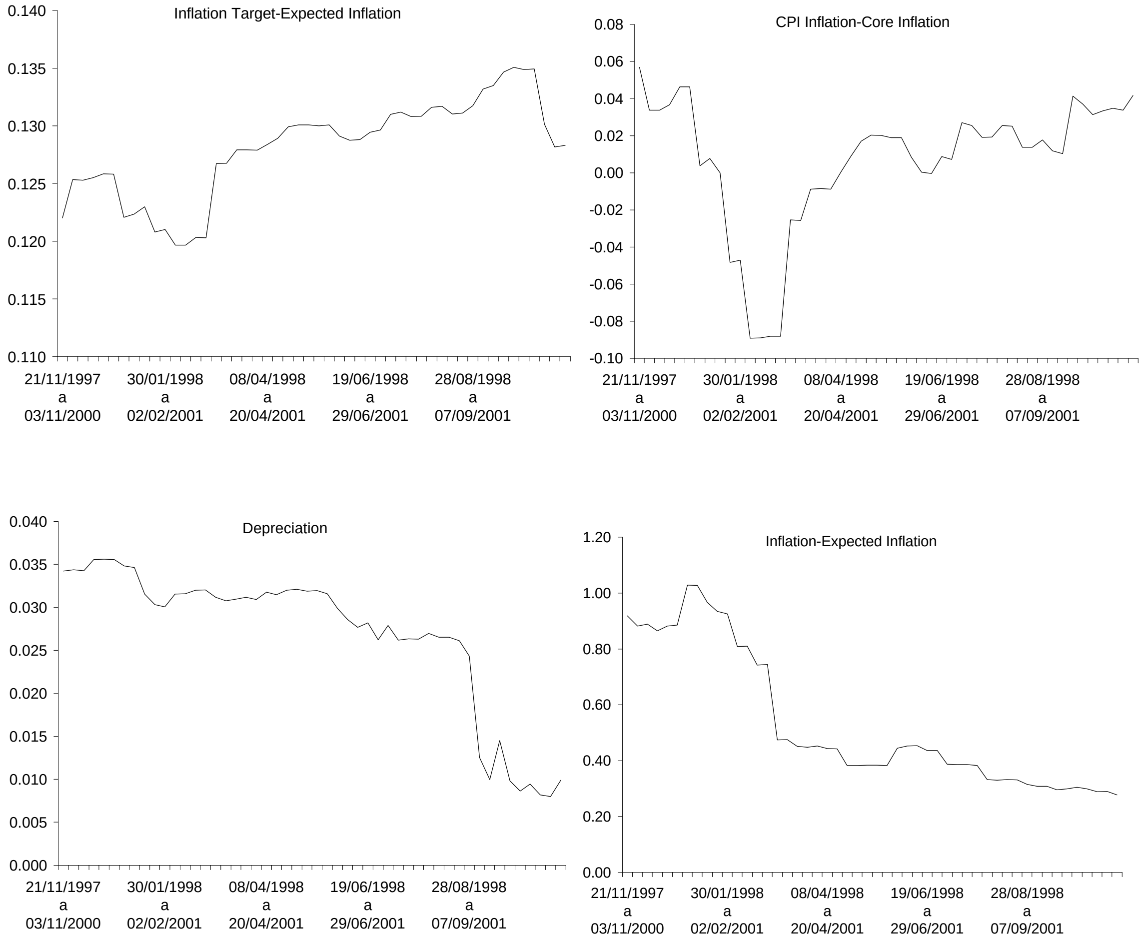


Source: Authors' calculations, based on data from IFS and country sources.

Figure 5. Regression Coefficients for Inflation Expectations from Rolling Regressions: Chile

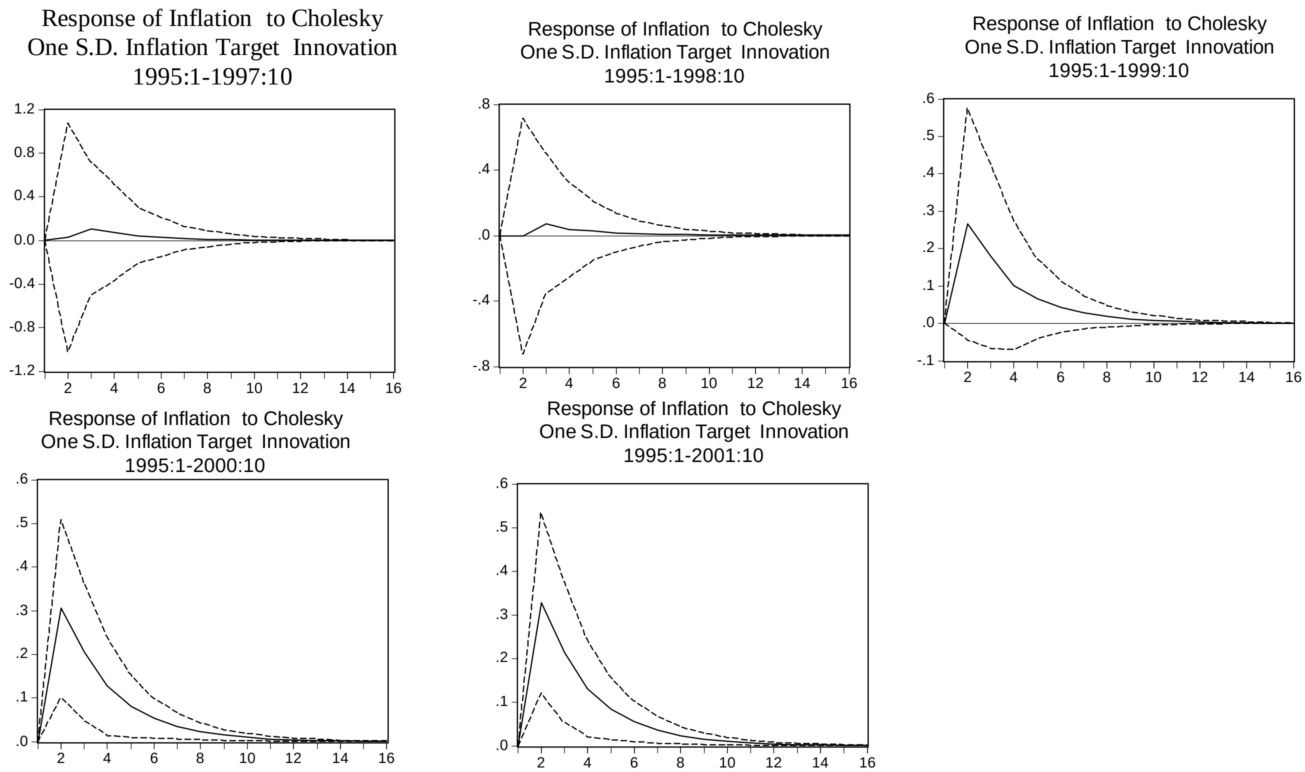
Source: Authors' calculations, based on data from IFS and country sources.

Figure 6. Regression Coefficients for Inflation Expectations from Rolling Regressions: Mexico



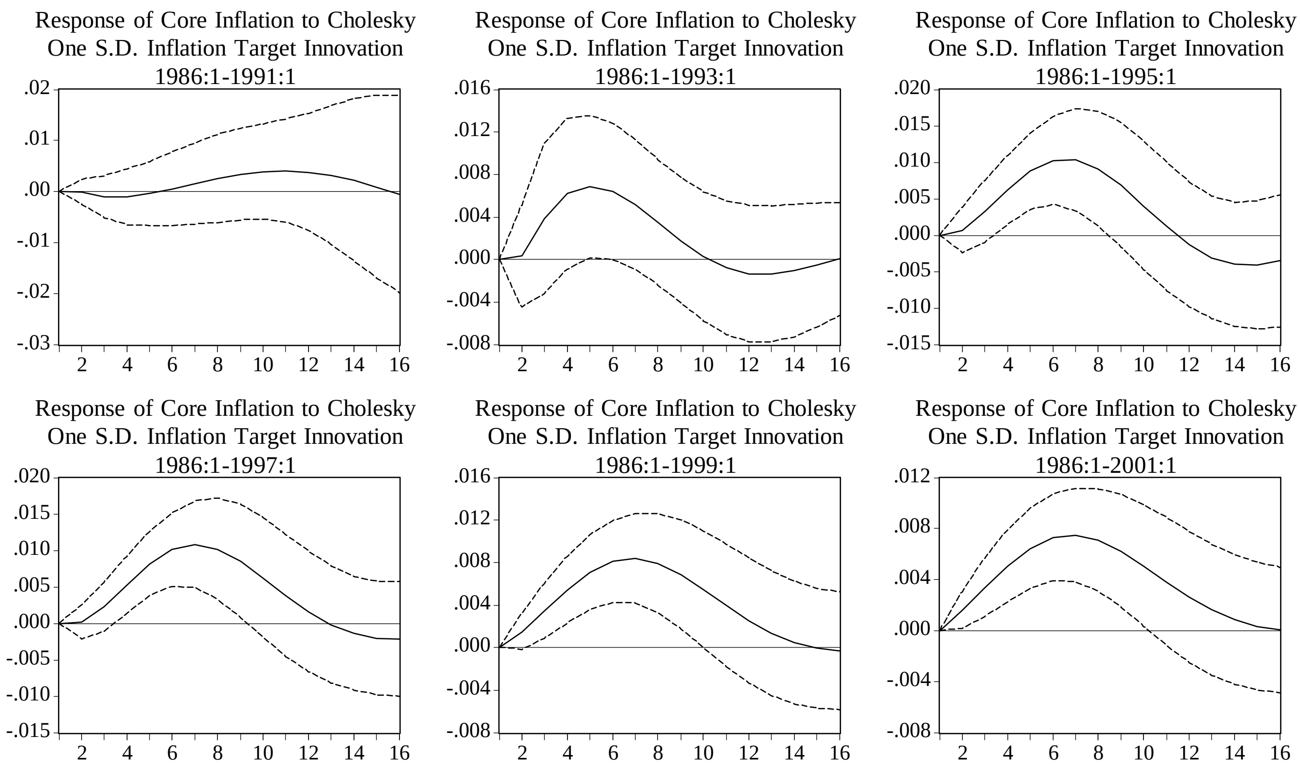
Source: Authors' calculations, based on data from IFS and country sources.

Figure 7. Effects of Inflation Targets on Core Inflation: Brazil



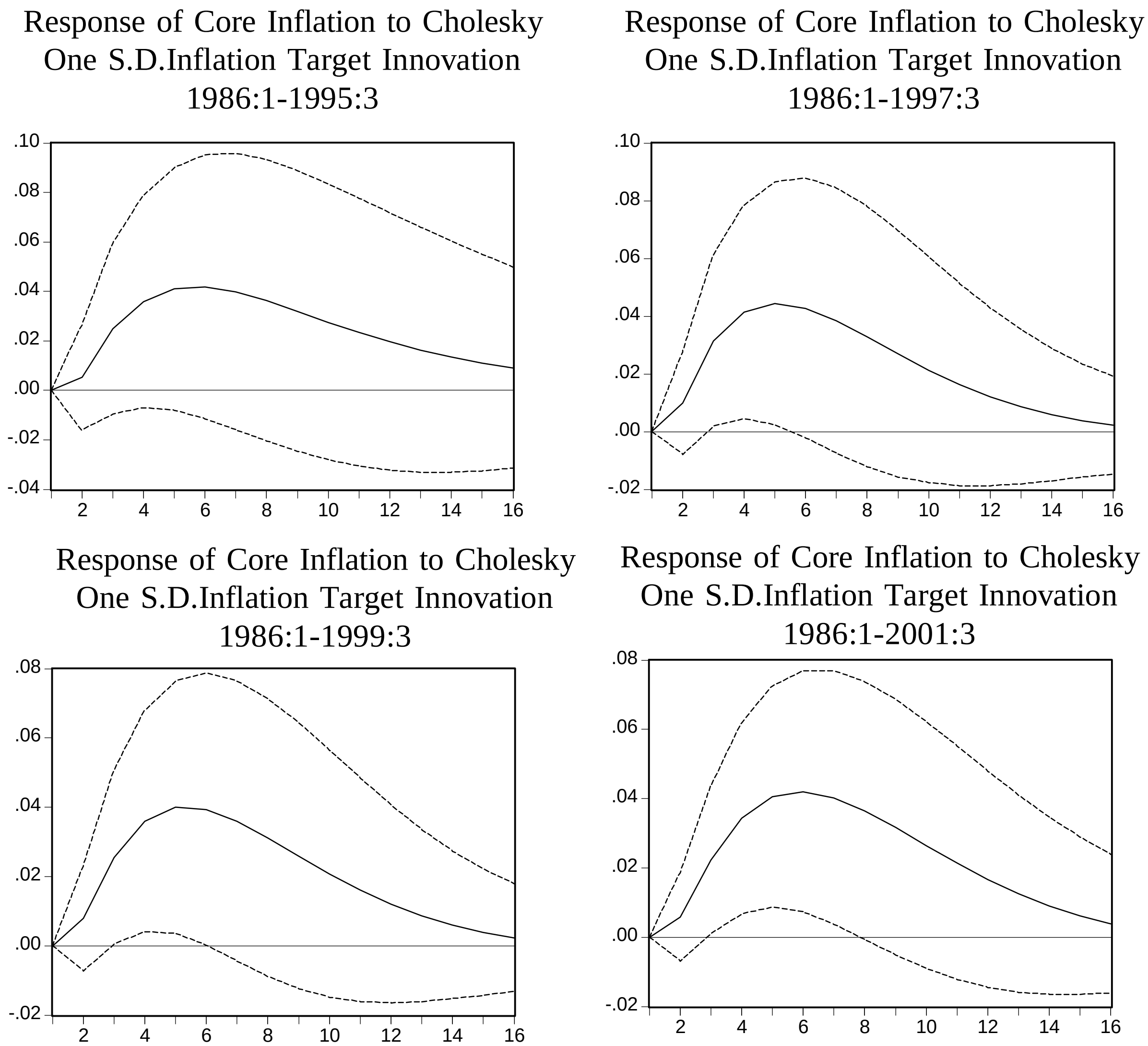
Source: Authors’ calculations, based on data from country sources.

Figure 8. Effects of Inflation Targets on Core Inflation: Chile



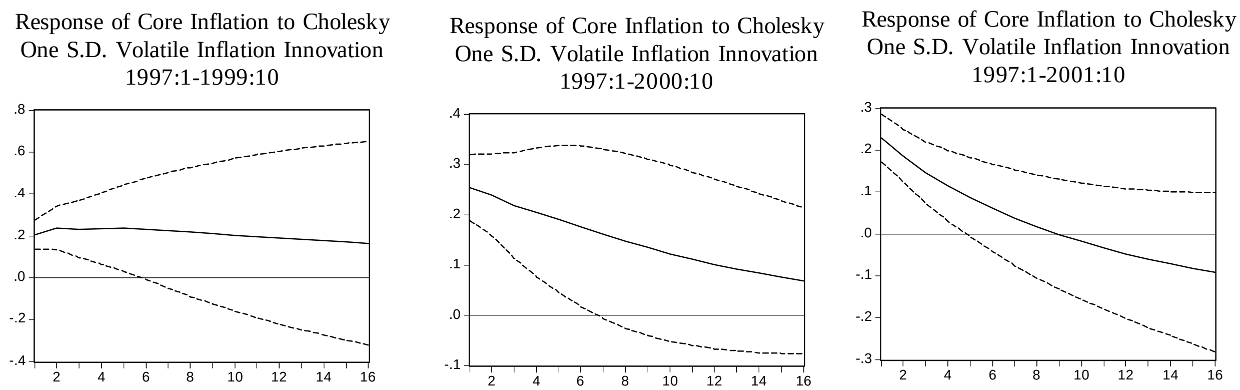
Source: Authors' calculations, based on data from IFS and country sources.

Figure 9. Effects of Inflation Targets on Core Inflation: Mexico



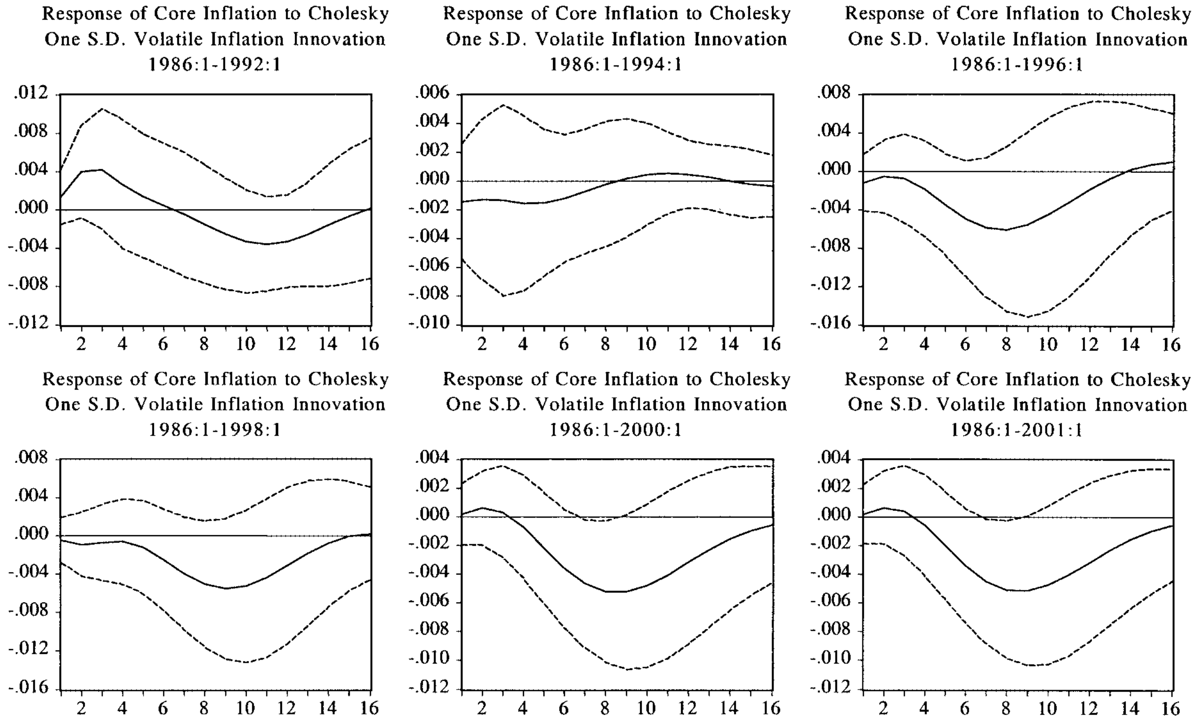
Source: Authors' calculations, based on data from IFS and country sources.

Figure 10. Effects of Volatile Inflation on Core Inflation: Brazil



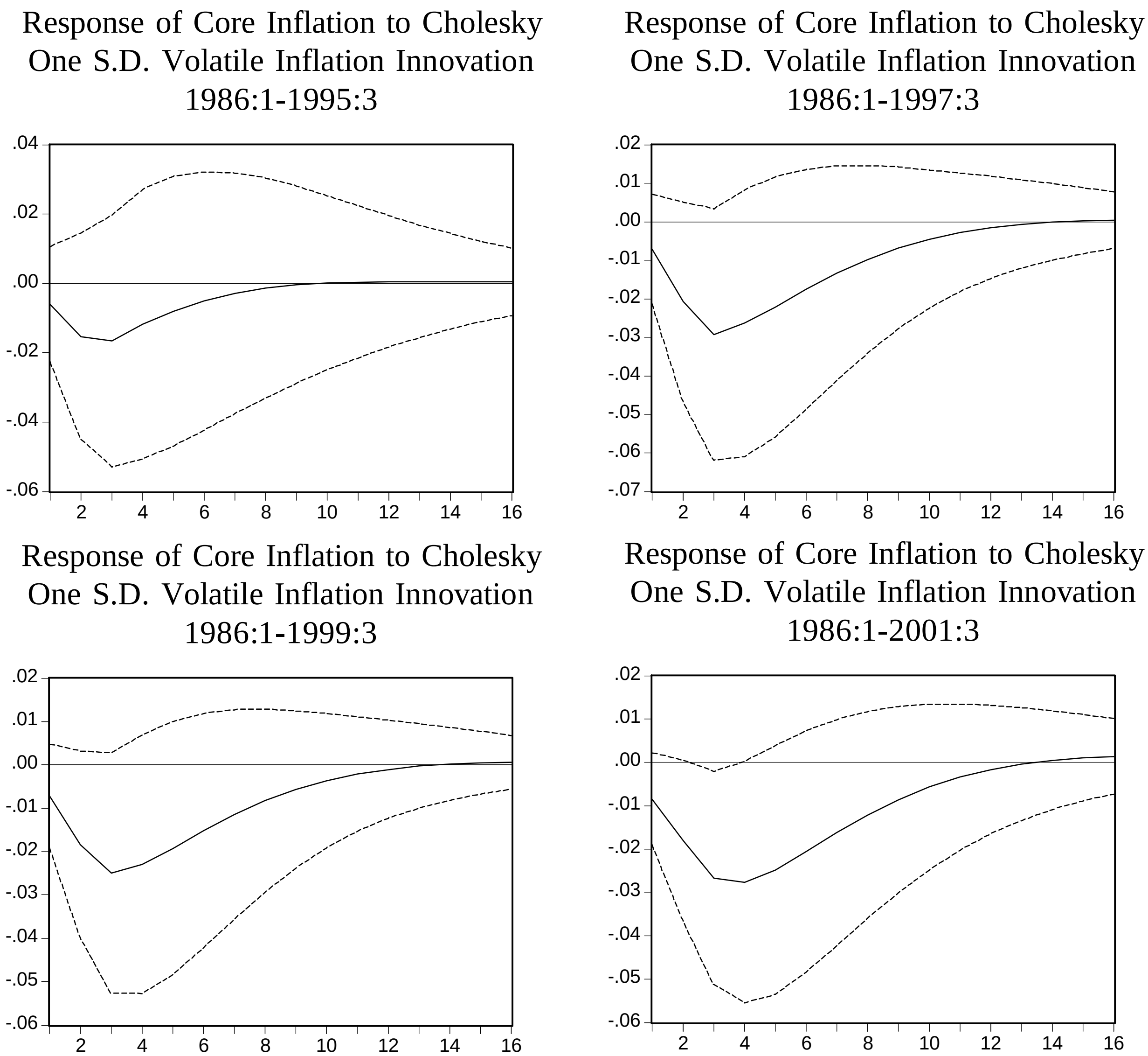
Source: Authors' calculations, based on data from IFS and country sources.

FIGURE 11. Effects of Volatile Inflation on Core Inflation: Chile



Source: Authors' calculations, based on data from IFS and country sources.

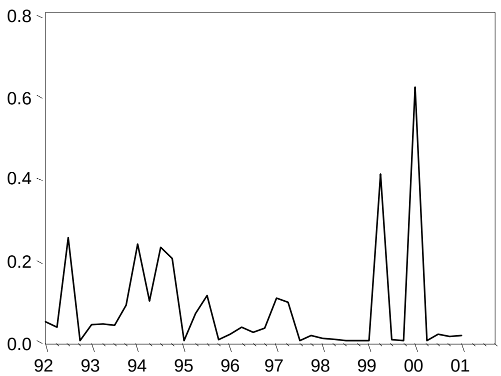
Figure 12. Effects of Volatile Inflation on Core Inflation: Mexico



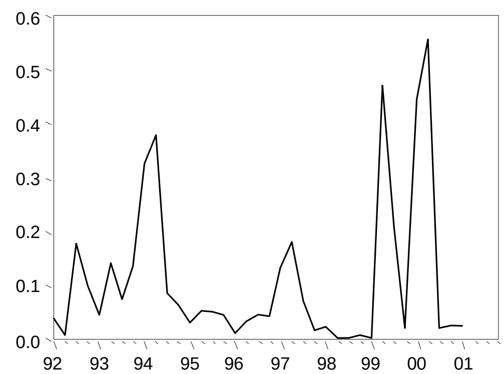
Source: Authors' calculations, based on data from IFS and country sources.

Figure 13. Average Quadratic Errors of Inflation Deviation Forecasts for Brazil, 1992:1–2001:1
Quarterly data

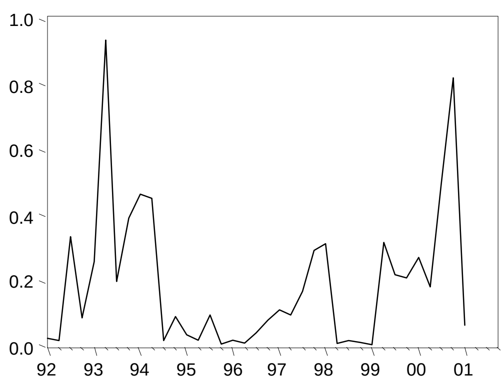
1 lead



2 leads



4 leads



6 leads

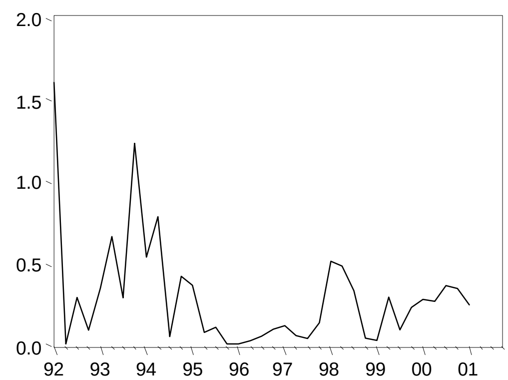
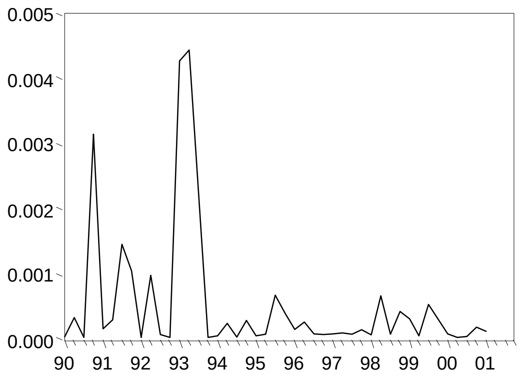
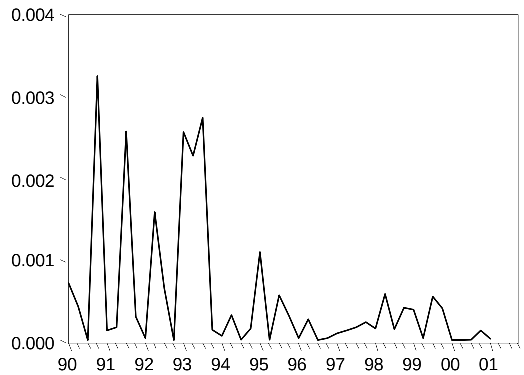


Figure 14. Average Quadratic Errors of Inflation Deviation Forecasts for Chile, 1990:1–2001:1
Quarterly data

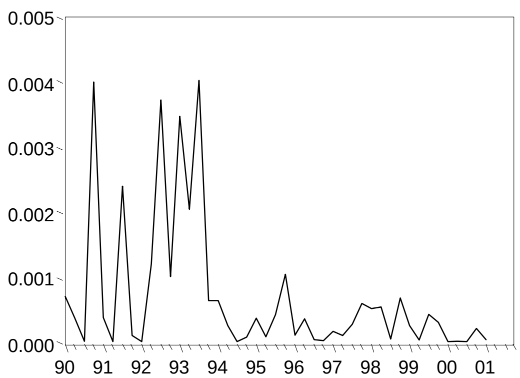
1 lead



2 leads



4 leads



6 leads

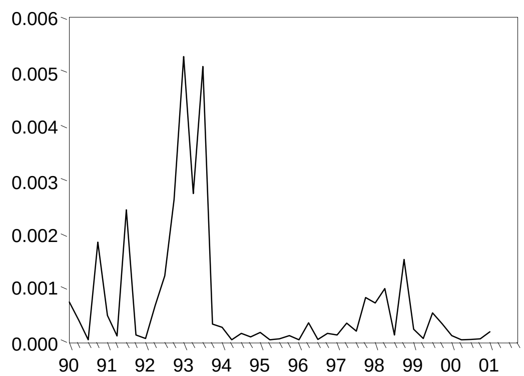
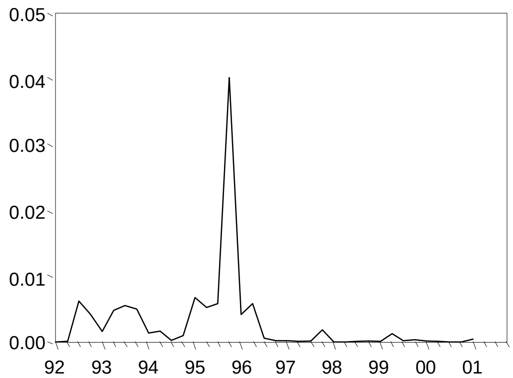


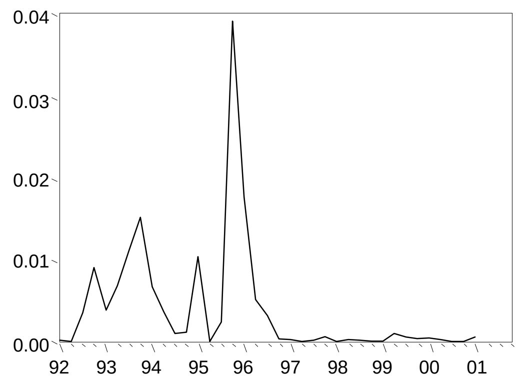
Figure 15. Average Quadratic Errors of Inflation Deviation Forecasts for Mexico: 1992:1–2001:1

Quarterly data

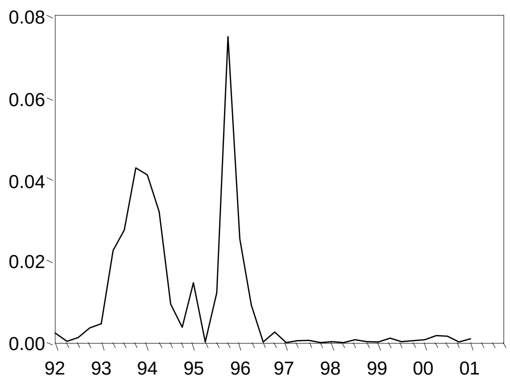
1 lead



2 leads



4 leads



6 leads

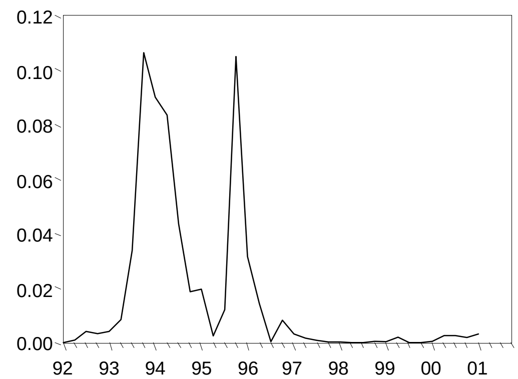
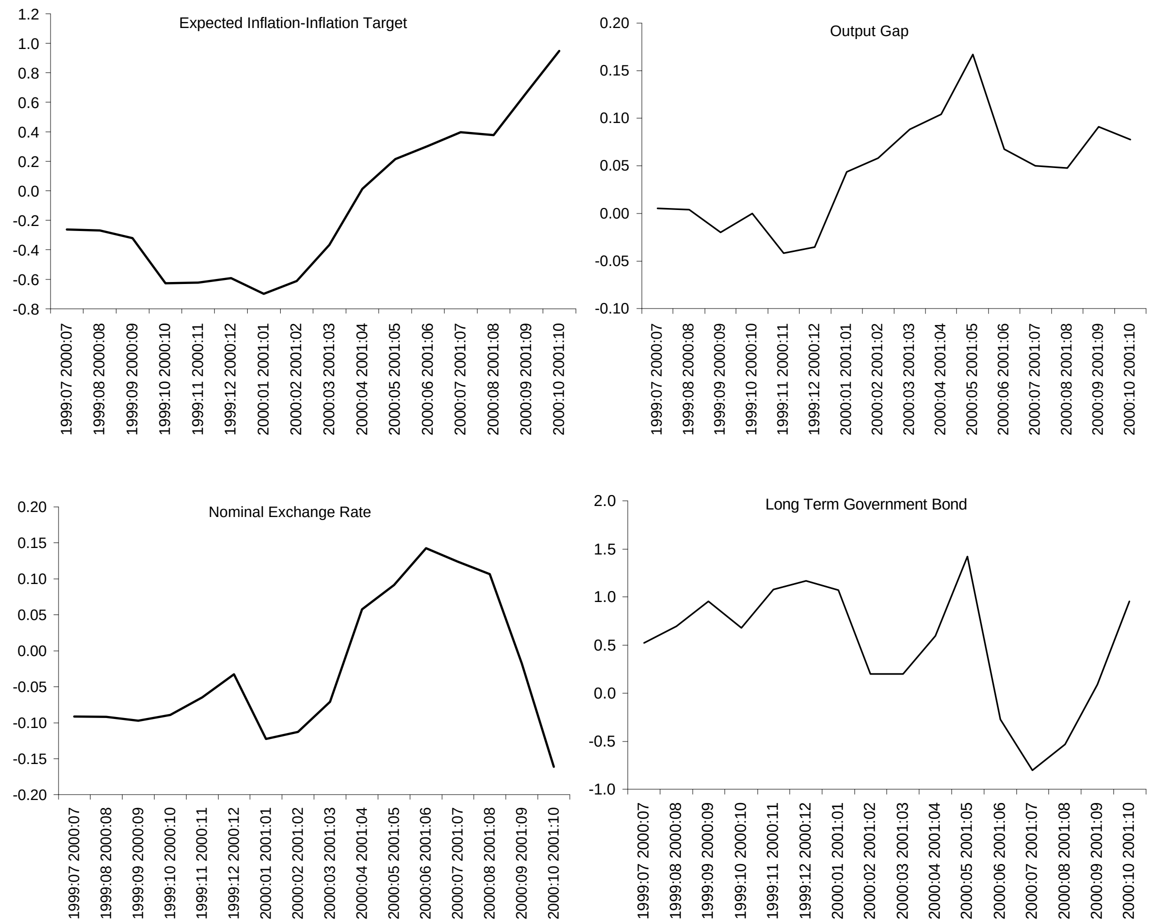
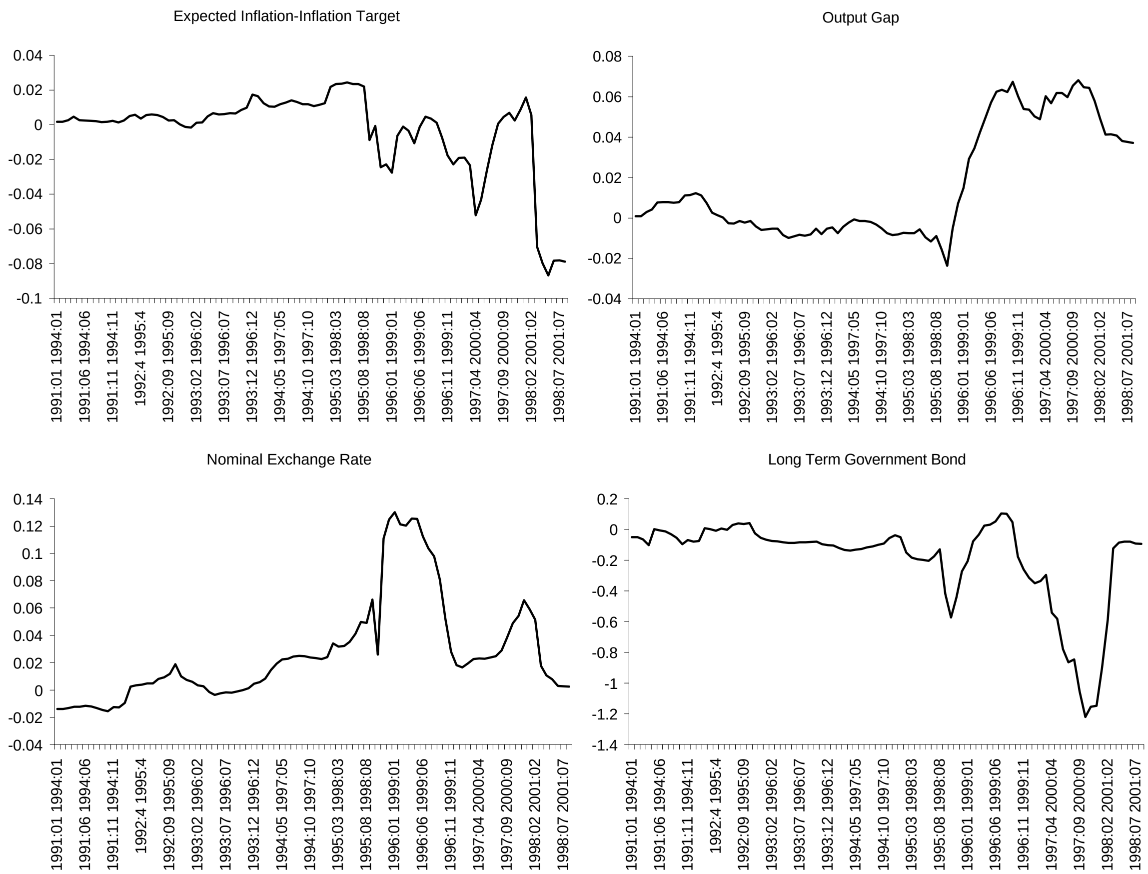


Figure 16. Regression Coefficients for Rolling Taylor Rule Estimations: Brazil



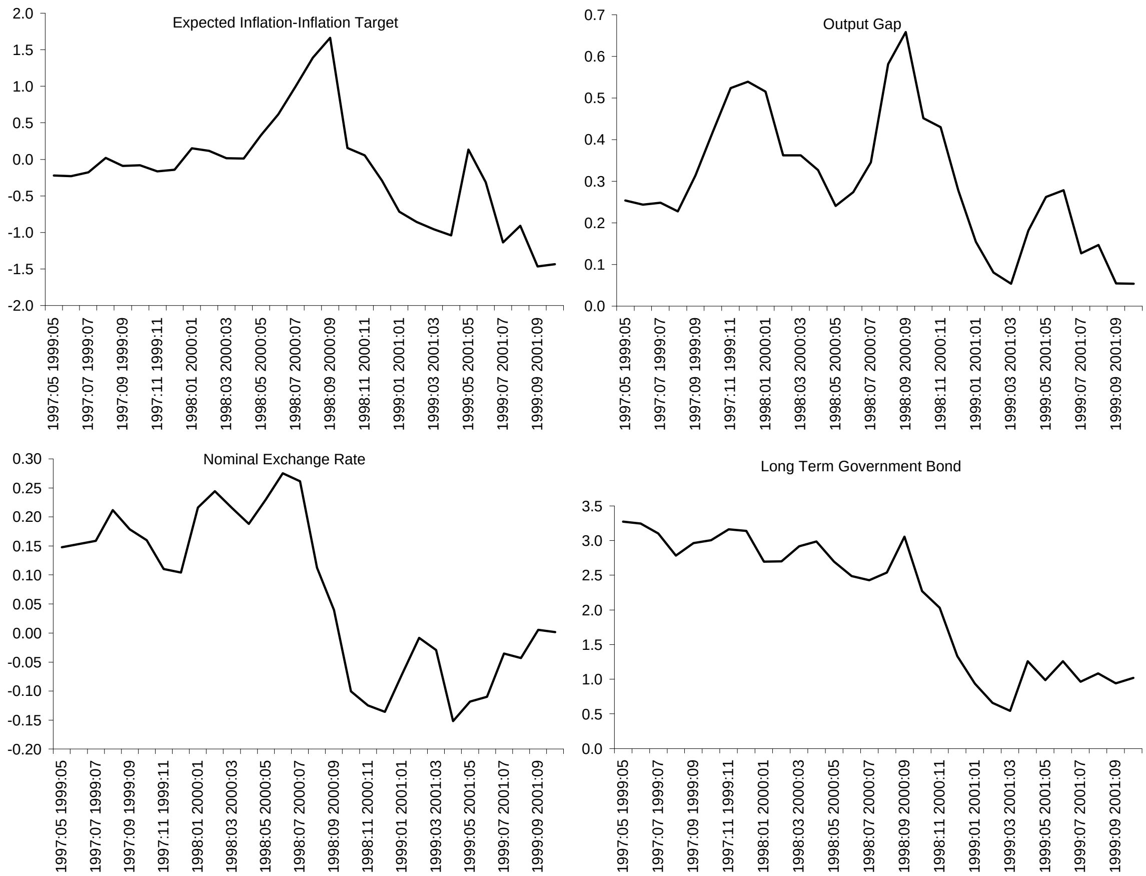
Source: Author’s calculations, based on data from country sources.

Figure 17. Regression Coefficients for Rolling Taylor Rule Estimations: Chile



Source: Author's calculations, based on data from country sources.

Figure 18. Regression Coefficients for Rolling Taylor Rule Estimations: Mexico



Source: Author’s calculations, based on data from country sources.

Table 1. Alternative Measures of Initial Disinflation in Fourteen Inflation Targeting Countries
Percent change in annual inflation rate

	Period		
Country	*t – 1 to t + 1*	*t – 2 to t + 1*	*t – 3 to t + 1*
Brazil	3.8	0.1	–8.7
Chile	–10.6	–1.6	0.8
Mexico	–6.4	–11.1	–24.9
Average of 11 countries[a]	–3.9	–4.9	–7.3

Source: Authors' calculations, based on data from *International Financial Statistics* (IFS) and country sources.
a. Australia, Canada, Colombia, Finland, Israel, Korea, New Zealand, South Africa, Spain, Sweden, and the United Kingdom.

Table 2. Annual Average Deviation of Actual from Target Inflation under Inflation Targeting in Fourteen Countries, 1989–2000 (Various Subperiods)[a]

	Percentage points		*As a ratio to current inflation*	
Country	*Relative*	*Absolute*	*Relative*	*Absolute*
Brazil	0.00	0.00	0.00	0.00
Chile	–0.06	0.51	–0.04	0.09
Mexico	–0.60	1.32	–0.08	0.12
Average of 11 countries	–0.85	1.30	–0.17	0.73

Source: Authors' calculations, based on data from IFS, country sources, and Schaechter, Stone, and Zelmer (2000).
a. Relative (absolute) deviation: sum of relative deviations divided by number of periods. Relative (absolute) deviation as a ratio to current inflation: sum of relative (absolute) deviations as ratios to inflation divided by number of periods. The target is defined as either a range or a point depending on the inflation targeting framework,.

Table 3. Sacrifice Ratios during Inflation Stabilization in Eleven Inflation Targeting Countries, Various Subperiods[a]

	GDP		*Industrial Output*	
Country	*Before*	*After*	*Before*	*After*
Brazil	–0.16	0.00	–0.00	–1.90
Chile	0.37	–0.70	–0.49	–0.65
Mexico	–0.08	0.53	–0.64	–0.32
Average of 8 countries[(b)]	–0.32	0.19	0.63	–1.25

Source: Authors' calculations, based on data from IFS and country sources.
a. Based on annual GDP data. Sacrifice ratios calculated as the cumulative GDP variation (to a trend calculated by a Hodrick-Prescott filter) divided by inflation change in any disinflation period. Inflation targeters' sacrifice ratios are calculated before (since 1980) and after the adoption of the inflation targeting framework. Outlier observations are excluded.
b. Excluding Canada and Finland in the GDP measure.

Table 4. OLS Estimation Results for Inflation Expectations: Brazil, Chile and Mexico[a]

Explanatory variable	*Chile* *1991–2001*	*Brazil* *1999–2001*	*Mexico* *1997–2001*
Constant	–0.08	0.07	–0.03
	(–2.26)	(0.47)	(–0.73)
Nominal exchange rate depreciation	0.00	–0.01	0.03
	(0.87)	(–0.36)	(2.68)
Deviation of inflation from expected inflation	0.01	0.01	0.46
	(2.25)*	(0.86)	(3.77)*
Deviation of inflation target from expected inflation	0.99	0.64	0.12
	(16.70)*	(15.08)*	(3.35)*
CPI Inflation versus core inflation	0.35	–0.07	–0.03
	(0.93)	(–1.15)	(–0.73)
Summary statistic			
Adjusted R^2	0.97	0.90	0.15
Durbin-Watson statistic	1.88	2.26	2.00

Source: Authors’ calculations, based on data from IFS and country sources.
* Statistically significant at 5 percent.
a. Standard errors in parentheses.

Table 5. Volatility of Exchange Rates, Reserves, and Interest Rates in Six Countries, 1990–2001
Standard deviation and ratio of standard deviations

Indicator and year	*Brazil*	*Chile*	*Mexico*	*Australia*	*Canada*	*New Zealand*
Exchange rate						
1990	18.53	1.54	0.31	2.07	1.17	1.85
1991	12.61	1.49	0.15	1.45	0.61	1.22
1992	42.44	2.38	0.54	1.56	1.09	1.40
1993	3.74	1.08	0.59	2.41	0.99	1.12
1994	22.32	0.96	4.96	1.60	1.18	1.10
1995	1.82	2.37	12.35	1.41	1.14	1.44
1996	0.09	0.56	1.50	1.30	0.85	1.05
1997	0.10	1.34	1.77	2.15	0.99	1.73
1998	0.15	1.41	3.14	3.24	1.25	2.68
1999	11.05	1.91	1.78	1.46	1.16	1.94
2000	2.00	1.84	1.99	3.30	1.23	3.72
2001	1.83	2.30	1.95	3.23	1.26	3.27
International reserves						
1990	15.45	5.52	20.79	5.00	7.91	11.98
1991	11.46	2.76	7.72	2.59	5.56	2.78
1992	10.32	2.58	2.90	5.34	10.32	5.70
1993	3.95	2.23	11.89	5.24	8.68	5.20
1994	4.83	2.73	18.68	2.03	9.92	8.79
1995	9.70	2.81	38.66	4.81	5.13	4.75
1996	2.11	3.06	4.19	11.34	4.71	8.30
1997	5.45	2.66	3.98	3.56	7.60	7.87
1998	12.73	3.31	3.67	5.95	10.34	3.70
1999	12.90	4.05	1.18	8.33	4.37	7.64
2000	9.16	1.93	4.37	11.39	2.29	4.32
2001	4.13	1.19	3.82	5.21	1.66	8.44
Interest rate						
1990	48137.95	1.05	3.21	0.37	0.64	0.52
1991	516.75	0.17	1.07	0.34	0.57	0.37
1992	262.99	0.34	1.44	0.29	0.77	0.34
1993	335.20	0.16	1.18	0.16	0.42	0.83
1994	4225.16	0.09	2.47	0.30	0.49	0.67
1995	6.80	0.29	12.76	0.16	0.63	0.30
1996	1.27	0.16	4.09	0.20	0.21	0.44
1997	6.25	0.13	2.05	0.16	0.24	0.51
1998	6.20	2.32	5.81	0.07	0.37	0.68
1999	4.55	0.37	1.81	0.07	0.10	0.19
2000	0.34	0.17	1.31	0.16	0.16	0.17
2001	0.54	1.41	1.34	0.18	0.24	0.12
Exchange rate/international reserves						
1990	1.20	0.28	0.01	0.41	0.15	0.15
1991	1.10	0.54	0.02	0.56	0.11	0.44
1992	4.11	0.92	0.19	0.29	0.11	0.25
1993	0.95	0.48	0.05	0.46	0.11	0.21
1994	4.62	0.35	0.27	0.79	0.12	0.12
1995	0.19	0.84	0.32	0.29	0.22	0.30
1996	0.04	0.18	0.36	0.11	0.18	0.13
1997	0.02	0.50	0.44	0.60	0.13	0.22
1998	0.01	0.43	0.86	0.54	0.12	0.72
1999	0.86	0.47	1.51	0.18	0.27	0.25
2000	0.22	0.96	0.45	0.29	0.54	0.86
2001	0.44	1.93	0.51	0.62	0.76	0.39
Exchange rate/interest rate						
1990	0.00	1.46	0.10	5.66	1.82	3.54
1991	0.02	8.89	0.14	4.28	1.08	3.27

1992	0.16	6.95	0.37	5.40	1.41	4.08
1993	0.01	6.60	0.50	15.20	2.34	1.35
1994	0.01	10.31	2.01	5.27	2.41	1.64
1995	0.27	8.11	0.97	9.05	1.82	4.72
1996	0.07	3.50	0.37	6.62	4.02	2.38
1997	0.02	10.24	0.86	13.50	4.05	3.40
1998	0.02	0.61	0.54	49.66	3.36	3.92
1999	2.43	5.21	0.98	19.99	11.43	10.28
2000	5.80	11.02	1.52	20.80	7.82	22.34
2001	3.40	1.64	1.46	18.43	5.27	26.87

Source: Authors' calculations, based on data from IFS and country sources.

Table 6. Simple Correlation Coefficients for Annual Inflation and Nominal Exchange Rate Depreciation: Brazil, Chile, and Mexico

	Correlation coefficient between annual inflation rate and annual exchange rate depreciation								
Annual exchange	*Brazil*			*Chile*			*Mexico*		
rate depreciation	*1991–94*	*1995–98*	*1999–2001*	*1991–94*	*1995–98*	*1999–2001*	*1991–94*	*1995–98*	*1999–2001*
One-month lag	0.95	1.00	–0.16	0.37	–0.72	–0.39	0.28	0.66	0.67
Two-month lag	0.87	0.99	–0.06	0.40	–0.78	–0.41	0.32	0.79	0.71
Three-month lag	0.75	0.97	0.00	0.42	–0.82	–0.41	0.39	0.87	0.74
Four-month lag	0.62	0.94	0.06	0.44	–0.82	–0.31	0.49	0.89	0.76
Five-month lag	0.48	0.85	0.05	0.47	–0.80	–0.50	0.60	0.88	0.72
Six-month lag	0.34	0.64	0.03	0.48	–0.78	–0.63	0.69	0.86	0.71
Seven-month lag	0.20	0.61	0.05	0.49	–0.79	–0.68	0.75	0.85	0.72
Eight-month lag	0.07	0.62	0.10	0.50	–0.80	–0.67	0.80	0.84	0.70
Nine-month lag	–0.05	0.63	0.14	0.47	–0.83	–0.68	0.83	0.82	0.66
Ten-month lag	–0.15	0.64	0.14	0.44	–0.86	–0.67	0.84	0.80	0.58
Eleven-month lag	–0.24	0.66	0.13	0.39	–0.87	–0.58	0.84	0.77	0.51
Twelve-month lag	–0.33	0.69	0.13	0.33	–0.85	–0.50	0.82	0.73	0.45

Source: Authors' calculations, based on data from IFS and country sources.

Table 7. Taylor Rule Estimations for Real Interest Rates without the Trade Balance: Brazil, Chile, and Mexico[a]

	Brazil		*Chile*				*Mexico*			
Real interest rate	*1999–2001*		*1991–2001*		*1997–2001*		*1997–2001*		*1999–2001*	
Real interest rate lag	0.88	0.83	0.96	0.96	0.97	0.96	0.59	0.62	0.85	0.84
	(5.8)*	(7.3)*	(27.9)*	(29.7)*	(16.8)*	(18.8)*	(5.3)*	(5.3)*	(6.4)*	(6.7)*
Expected inflation-inflation target	0.29	0.26	0.01	0.01	0.02	0.01	0.11	1.04	–0.88	–0.24
	(2.7)*	(2.9)*	(0.77)	(0.28)	(0.31)	(0.27)	(0.2)	(2.5)*	(–0.2)	(–0.47)
Output gap	0.02	0.01	0.02	0.02	0.03	0.03	0.09	0.18	0.07	0.11
	(0.5)	(0.3)	(1.9)*	(2.0)*	(1.8)*	(1.8)*	(0.8)	(1.6)	(0.8)	(1.4)
Nominal exchange rate	0.01		–0.01		0.01		0.19		0.03	
	(0.0)		(–0.12)		(0.41)		(1.5)		(0.2)	
Long-term government bond	0.30		0.01		–0.01		1.64		0.88	
	(0.5)		(0.24)		(–0.04)		(2.9)*		(1.6)	
Summary statistic										
Adjusted R^2	0.76	0.78	0.87	0.87	0.86	0.86	0.76	0.66	0.77	0.73
Durbin-Watson statistic	1.92	1.86	1.57	1.56	1.60	1.58	1.95	1.88	1.65	1.55

Source: Author's calculations based on data from country sources.

* Statistically significant at the 5 percent level.

a. OLS estimation. Standard errors in parentheses.

Table 8. Taylor Rule Estimations for Real Interest Rates with the Trade Balance: Brazil, Chile, and Mexico[a]

	Brazil	*Chile*		*Mexico*	
Real interest rate	*1999–2001*	*1991–2001*	*1997–2001*	*1997–2001*	*1999–2001*
Real interest rate lag	0.89	0.92	0.92	0.47	0.68
	(3.88)*	(25.20)*	(14.66)*	(4.79)*	(5.45)*
Expected inflation-inflation target	0.30	0.01	0.01	0.08	–0.66
	(2.42)	(0.04)	(0.05)	(0.16)	(–1.01)
Output gap	0.02	0.01	0.02	0.11	0.08
	(0.50)	(1.56)	(1.15)	(1.34)	(1.25)
Nominal exchange rate	–0.01	–0.01	0.01	0.16	–0.03
	(–0.02)	(–0.27)	(0.41)	(1.51)	(–0.23)
Long-term government bond	0.32	0.03	0.02	1.98	1.49
	(0.51)	(0.64)	(0.09)	(4.02)*	(2.86)*
Trade deficit lag (exports-imports)	–0.01	–0.01	–0.01	–0.01	–0.01
	(–0.09)*	(–2.49)*	(–1.75)	(–3.24)*	(–2.73)*
Summary statistic					
Adjusted R^2	0.75	0.88	0.87	0.80	0.81
Durbin-Watson statistic	1.92	1.64	1.68	2.17	1.95

Source: Authors' calculations based on data from country sources.

* Statistically significant at the 5 percent level.

a. OLS estimation. Standard errors in parentheses.

Table 9. International Reserves, 1999–2000

Billions of dollars and percent

Indicator and year	*Brazil*	*Chile*	*Mexico*	*Australia*	*Canada*	*New Zealand*
Total						
1999	34.80	14. 40	31. 78	23. 46	28 .13	4 .46
2000	32.49	14. 73	35 .51	21 .80	31 .92	3 .33
Percent GDP						
1999	6.55	21.29	6.62	5.93	4.30	8.02
2000	5.46	20.88	6.18	5.76	4.50	6.54
Percent imports						
1999	70.62	103.26	22.39	35.45	12.78	34.20
2000	58.24	88.09	20.35	31.69	13.05	25.91
Percent M1						
1999	100.38	213.92	62.12	28.69	20.96	56.50
2000	79.96	224.19	59.53	27.30	21.03	45.81
Percent M2						
1999	22.92	45.72	15.07	9.14	10.80	20.52
2000	20.95	45.40	14.36	9.10	10.70	17.52

Source: IFS.

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