ISSN 1518-3548

BANCO CENTRAL DO BRASIL

Working Paper Series 53

Inflation Targeting in Brazil: Lessons and Challenges

André Minella, Paulo Springer de Freitas, Ilan Goldfajn and Marcelo Kfoury Muinhos

November, 2002

ISSN 1518-3548
CGC 00.038.166/0001-05

Working Paper Series	Brasília	n. 53	Nov	2002	p. 1 – 47

Working Paper Series

Edited by:

Research Department (Depep)

(e-mail: workingpaper@bcb.gov.br)

Reproduction permitted only if source is stated as follows: Working Paper Series n. 53

Authorized by Ilan Goldfajn (Deputy Governor for Economic Policy).

General Control of Subscription:

Banco Central do Brasil
Demap/Disud/Subip
SBS – Quadra 3 – Bloco B – Edifício-Sede – 2º subsolo
70074-900 - Brasília (DF)
Telefone: (61) 414-1392
Fax: (61) 414-3165

Number printed: 450 copies

Banco Central do Brasil Information Bureau

Address:	Secre/Surel/Dinfo
	Edifício-Sede, 2º subsolo
	SBS – Quadra 3, Zona Central
	70074-900 Brasília (DF)
Phones:	(5561) 414 (....) 2401, 2402, 2403, 2404, 2405, 2406
DDG:	0800 992345
FAX:	(5561) 321 9453
Internet:	http://www.bcb.gov.br
E-mails:	cap.secre@bcb.gov.br
	dinfo.secre@bcb.gov.br

Inflation Targeting in Brazil: Lessons and Challenges[*]

André Minella[**]

Paulo Springer de Freitas[**]

Ilan Goldfajn[***]

Marcelo Kfoury Muinhos[**]

Abstract

This paper assesses the first three years of the inflation-targeting regime in Brazil adopted in July 1999. The inflation-targeting framework has shown to be highly important for the macroeconomic stabilization. We stress three important challenges: construction of credibility, change in relative prices, and exchange rate volatility. The estimations indicate the following results: i) the inflation targets have worked as an important coordinator of expectations; ii) the Central Bank has reacted strongly to inflation expectations; iii) there has been a reduction in the degree of persistence in inflation and in the volatility of inflation and output; iv) the exchange rate pass-through for "administered or monitored" prices is more than two times higher than for "market" prices. We also describe the methodology the Central Bank has developed to deal with inflationary shocks, which quantifies the sources of inflation, and examine some issues involved in the institutional design of inflation targeting.

Keywords: inflation targeting, Brazil, monetary policy

JEL Classification: E31, E52, E58

[*] We thank the participants in the Autumn 2002 Central Bank Economists' Meeting at the Bank for International Settlements (BIS) and in a seminar at the Central Bank of Brazil for their comments, Richard Clarida for comments in a workshop, and Thaís P. Ferreira for her contributions. We are also grateful to Luis A. Pelicioni and Marcileide A. da Silva for assistance with data. The views expressed are those of the authors and not necessarily those of the Central Bank of Brazil.

[**] Research Department, Central Bank of Brazil. E-mail addresses: andre.minella@bcb.gov.br, paulo.freitas@bcb.gov.br, and marcelo.kfoury@bcb.gov.br

[***] Deputy Governor for Economic Policy, Central Bank of Brazil, and Pontifical Catholic University of Rio de Janeiro (PUC-RJ). E-mail address: ilan.goldfajn@bcb.gov.br

1. Introduction

This paper assesses the inflation-targeting regime in Brazil adopted in July 1999, examining the challenges faced in its first three years. The inflation-targeting mechanism has shown to be highly important for the macroeconomic stabilization. In spite of different inflationary pressures, the inflation rate has been maintained at a low level in the context of a floating exchange rate regime and inflationary shocks. We stress three important challenges that are also common in other emerging markets economies: construction of credibility, change in relative prices, and exchange rate volatility. Moreover, we describe the methodology used to deal with inflationary shocks, and examine some issues involved in the institutional design of inflation targeting, such as the use of core inflation measures, escape clauses, tolerance intervals, establishment of targets, and target horizon.

We show that the inflation expectations of the private sector have not been departing significantly from the targets even when facing inflationary shocks. Other evidences also support the view that the established inflation targets have worked as an important coordinator of expectations. The estimated reaction function of the Central Bank shows that monetary policy has been reacting strongly to inflationary pressures. In particular, the Central Bank reacts to inflation expectations, giving evidence that the monetary policy is conducted on a forward-looking basis. We also find some evidence of change in the inflation rate dynamics, basically the reduction in the degree of persistence in the inflation. The volatility of output and inflation has also decreased in the inflation-targeting period.

We also stress the significant inflationary pressures stemming from the change in relative prices in the economy ("administered or monitored" versus "market" prices) and from the exchange rate volatility in the last years. We estimate the pass-through from exchange rate to inflation rate using a VAR estimation, showing the higher pass-through for "administered or monitored" prices.

The Central Bank has developed a methodology to estimate the inflationary effects of change in relative prices, exchange rate depreciation, and inflation inertia. The corresponding results help the conduct of monetary policy as it quantifies the sources of inflation.

The following section presents an overview of the first three years of inflation targeting. Section 3 assesses the different challenges for the inflation-targeting regime.

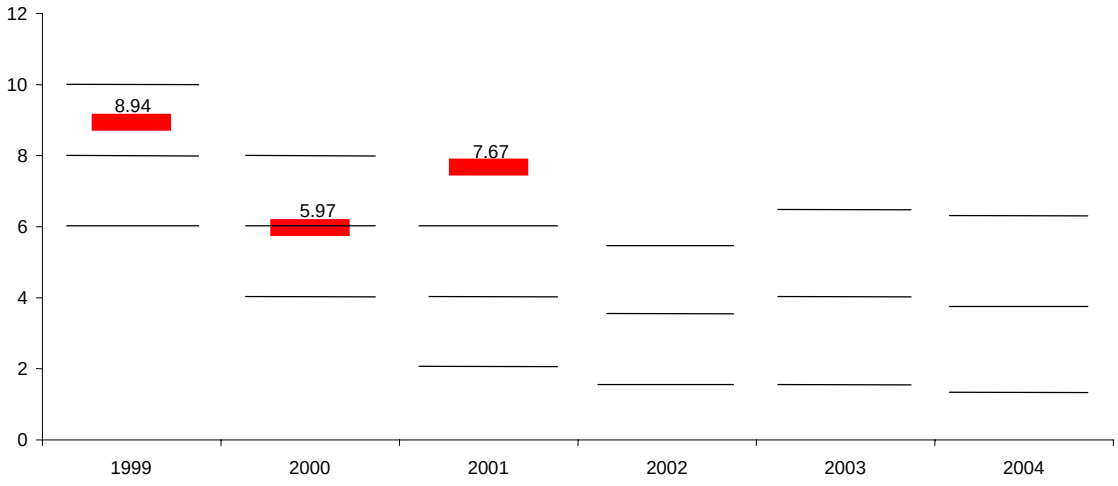
Section 4 presents the methodology used to deal with shocks, and Section 5 examines some issues involved in the institutional design of inflation targeting. A final section concludes the paper.

2. Overview of the first three years of inflation targeting

The current inflation-targeting regime was adopted in mid-1999, after the floating of the currency in January of the same year. In the first two years, the inflation rates were kept on target, having absorbed the initial impact of the exchange rate depreciation in 1999. The successful transition was supported by a considerable fiscal improvement, a shift from the primary surplus of 0.01% of GDP in 1998 to 3.23% in 1999, 3.51% in 2000, 3.68% in 2001, and 3.54% in the last 12 months up to August 2002. The macroeconomic policy has three basic elements: floating exchange rate regime, change in the fiscal regime, and inflation targeting.

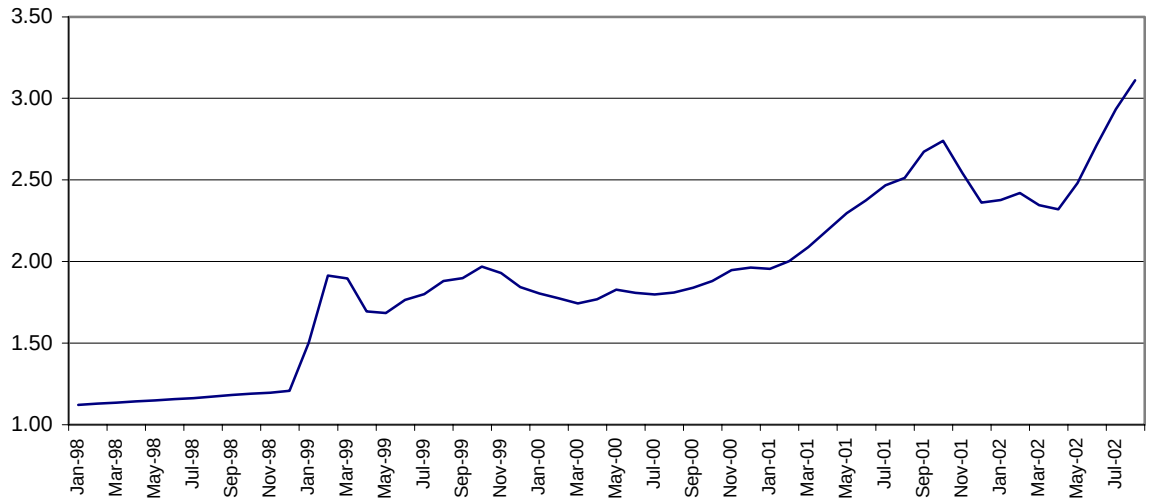
The targets are established in June year *t* for calendar year inflation at *t+2*, except for 1999 and 2000, when both targets were set in June 1999. The inflation rate is measured by a consumer price index, IPCA, produced by IBGE. Figure 1 shows the targets for 1999-2004, and actual inflation for 1999-2001. Up to 2002, the tolerance intervals were 2 percentage points above and below the central target, and as of 2003 the intervals were enlarged to 2.5 percentage points. The inflation rate was 8.9% and 6.0% for targets of 8% and 6% for 1999 and 2000, respectively.

Figure 1
Inflation Targets (upper limit, central target, and lower limit) and Inflation Rate (% p.a.)



However, in 2001 and 2002, several external and domestic shocks hit the Brazilian economy with significant impact on inflation. The inflation rate reached 7.7% in 2001, 1.7 p.p. above the upper limit of the inflation target,[1] and is expected to be above the upper limit in 2002 as well. The energy crisis, the desaceleration of world economy, the September 11 attacks to the United States, and the Argentine crisis generated strong pressure for the depreciation of the Real in 2001. In October, the average exchange rate had increased by 39.6% (a depreciation of domestic currency of 28.3%) when compared to the average of December 2001. Figure 2 shows the exchange rate level since 1998. In 2002, the shocks included increased risk aversion in capital markets, and uncertainties related to the future Brazilian macroeconomic policies under the upcoming government, leading to a new wave of depreciation.

Figure 2
Exchange Rate Level (R$/US$) - 1998:01- 2002:08 (Monthly Average)



The change in relative prices in the economy affected the inflation rate significantly as well. The administered by contract or monitored prices – administered prices, for short – rose well above the other prices – market prices, for short. The administered prices are defined as the ones little affected by domestic demand and supply conditions or that are in someway regulated by some public agency. The group was defined by Monetary Policy Committee (Copom) in July 2001, and includes, among others, oil by-products, fixed telephone, residential electricity, and public

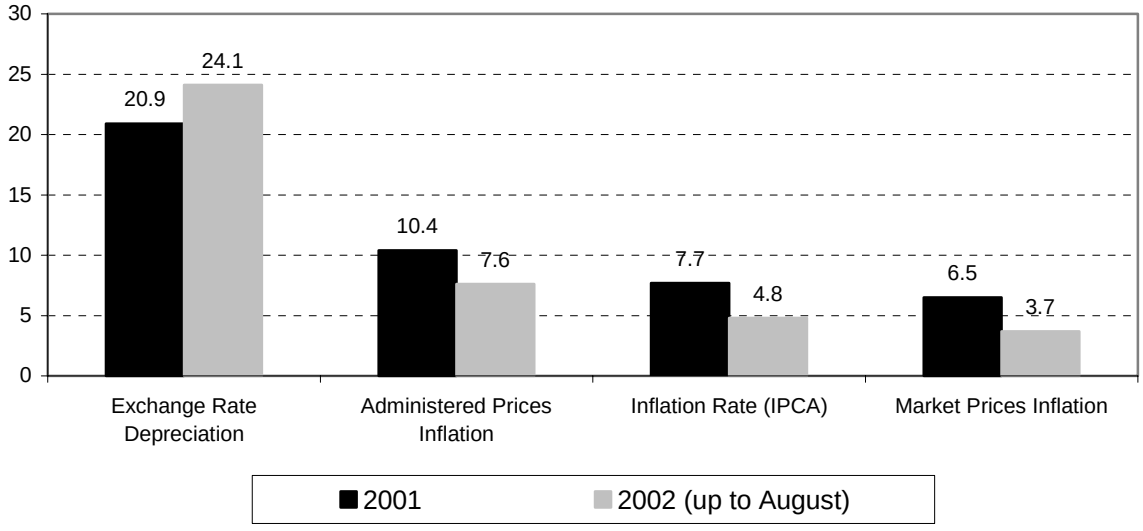
[1] The reasons for the non-fulfillment of the target in 2001 were explained in an open letter of the Governor of the Central Bank of Brazil to the Minister of Finance, available at www.bcb.gov.br.

transportation. Its weight in the IPCA was 30.8% in June 2002. Furthermore, the energy crisis, from 2001 to the beginning of 2002, and the deregulation of oil by-product markets also led to inflationary pressures.

Figure 3 shows the exchange rate depreciation, the increase in administered and market prices, and inflation rate for 2001 and 2002 (up to August). The administered prices rose 10.4% in 2001 and 7.6% in January-August 2002, whereas market prices increased by 6.5% and 3.7%, respectively (the values for 2002 are not annualized).

Using the structural model of the Central Bank[2] and information concerning the mechanisms for the adjustment of administered prices, it is possible to estimate the contribution for the inflation rate stemming from exchange rate pass-through, inflation inertia from the previous year, and inflation of administered prices and market prices that is not explained by the exchange rate pass-through and the mentioned inertia. Figures 4 and 5 show the values for 2001 and January-August 2002. The values in the inner part of the charts are the percentage point contributions for the inflation rate, and, in the outer part, the corresponding proportion. In 2001, 38% of the inflation rate can be explained by the exchange rate depreciation, whereas for January-August 2002 the contribution of exchange rate reaches 48%.

Figure 3
Exchange Rate Depreciation and Inflation in 2001 and Jan.-Aug./2002 (%)



[2] For an overview of the structural model, see Bogdanski *et. al*. (2000). Using the aggregate supply curve, which relates the current inflation of market prices to the expected and past headline inflation, output gap, and exchange rate change, we estimate the contributions of the exchange rate pass-through and of the inertia from the previous year for the market prices. For the administered prices, the estimation depends on the criteria used for the price adjustment of specific items.

Figure 4
Contributions to the Inflation in 2001
Percentage of the Total and Percentage Variation in the Period (values within the chart)

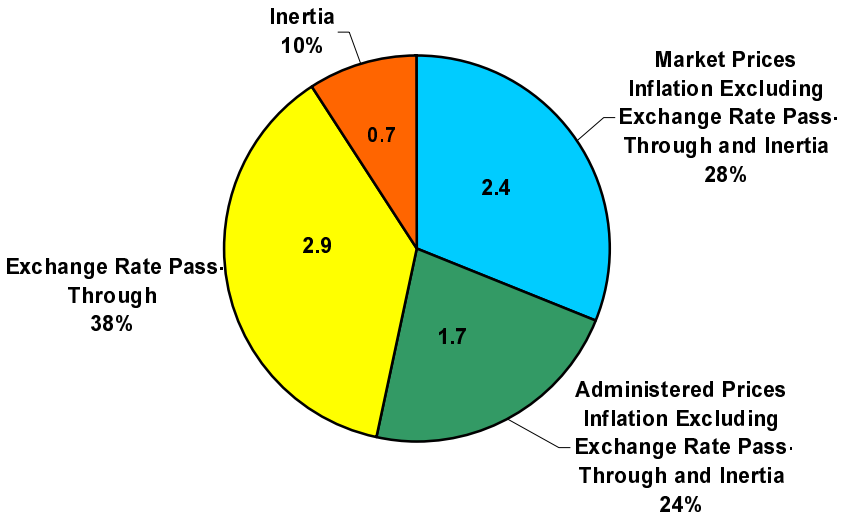
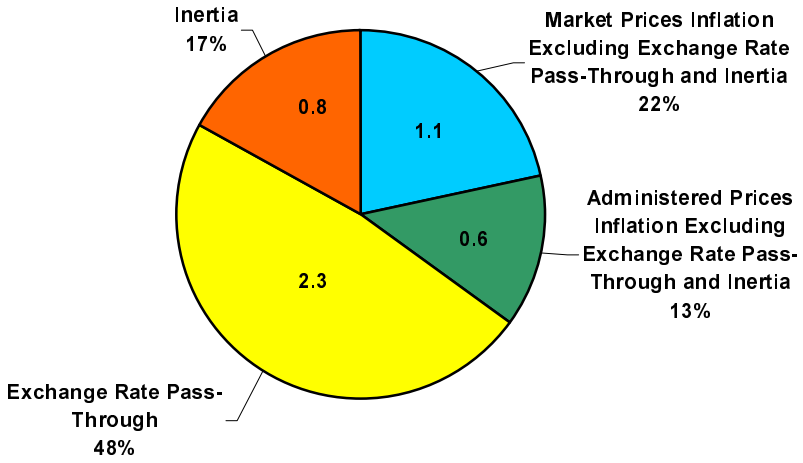


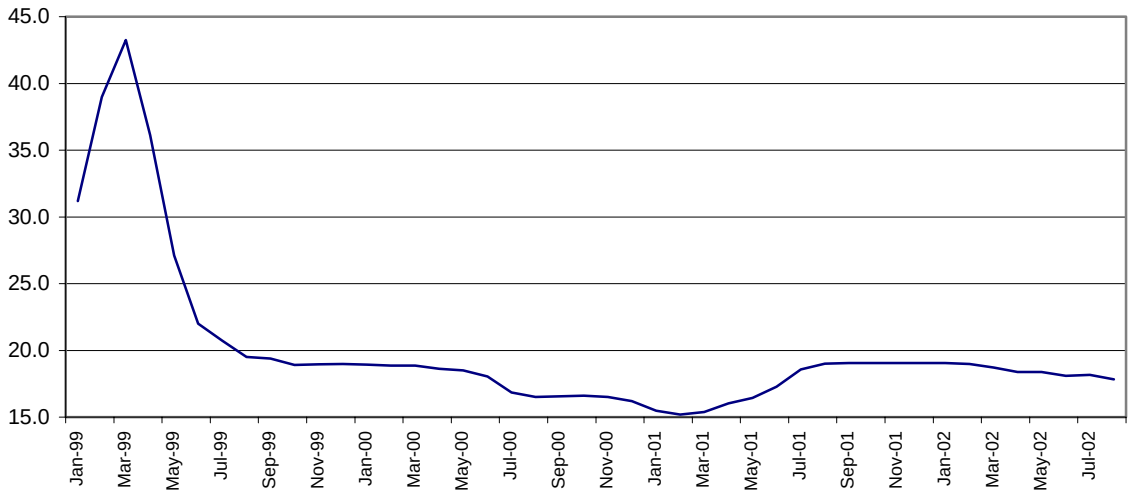
Figure 5
Contributions to the Inflation in Jan.-Aug. 2002
Percentage of the Total and Percentage Variation in the Period (values within the chart)



In 2001 and 2002, the Central Bank acted preemptively, aiming at minimizing the potential inflationary effects of the different shocks, mainly the exchange rate depreciation and the increase in administered prices. The main guideline of monetary

policy was to limit the propagation of the shocks to the other prices of the economy. Figure 6 presents the path of the basic interest rate – the Selic rate – controlled by the Central Bank. Between March and July 2001, the Central Bank raised the interest rate significantly (375 b.p.), interrupting the downward trend observed previously. Some improvement in the macroeconomic context at the beginning of 2002 allowed some reduction of the interest rate, interrupted by the inflationary pressure coming from the exchange rate depreciation. If the Central Bank had not acted preemptively, inflation would have been higher than the one actually observed, and the adjustment in the real exchange rate would have taken place in an environment of greater uncertainty. In view of the intensity and magnitude of shocks that hit the Brazilian economy in 2001 and 2002, the cost in terms of output losses of a policy aimed at offsetting completely these shocks and keeping inflation within the tolerance intervals would have been significantly higher.

Figure 6
Interest Rate (over Selic) - 1999:01 - 2002:08 (%p.a. - monthly average)



We can also verify that there has a gain in terms of variability of inflation rate, output, and interest rate. Table 1 reports the average, standard error and coefficient of variation (ratio of standard error to average). It compares the first three years of inflation targeting with the Real Plan period before the adoption of inflation targeting. For this last period, the table also reports the figures for a shorter sample, which excludes the first quarters of the Real Plan, characterized by a transition to stabilization. The inflation rate is measured by IPCA, output by seasonally adjusted GDP, and

(nominal) interest rate by the Selic rate. We use quarterly data. In the case of GDP, we use the annualized quarter over quarter growth rates. The variability of output, inflation, and inflation rate is smaller in the inflation-targeting period. This does not imply necessarily that there have been gains in terms of trade-off between output and inflation because this result also depends on the magnitude and variability of the shocks that hit the economy. In terms of average, the output growth is higher and the interest rate is lower in the inflation-targeting period. The inflation rate is smaller if we compare to the whole period before inflation targeting. In the case of the 1996:01-1999:02 period, the smaller average of the inflation rate is to a large extent a consequence of the pegged exchange rate regime, which turned out to be unsustainable in the medium run.

Table 1
Average, Standard Deviation and Coefficient of Variation for Inflation Rate, GDP and Interest Rate
Different Periods (Quarterly Data)

Period	Inflation Rate			GDP Growth			Interest Rate		
	Average (per year)	Standard Deviation	Coefficient of Variation	Average (per year)	Standard Deviation	Coefficient of Variation	Average (per year)	Standard Deviation	Coefficient of Variation
Real Plan Before Inflation Targeting									
1994:04 - 1999:02	10.3	9.2	0.89	2.0	6.3	3.16	35.4	14.1	0.40
1996:01 - 1999:02	5.8	4.8	0.84	2.0	5.2	2.55	28.2	6.0	0.21
Inflation Targeting									
1999:03 - 2002:02	7.1	3.0	0.42	2.4	3.5	1.46	18.0	1.4	0.08

3. Challenges in the inflation targeting

We stress three important challenges in the first three years of inflation targeting in Brazil: construction of credibility, change in relative prices, and exchange rate volatility.

3.1. Constructing Credibility

Inflation targeting is, to a large extent, a credibility issue. The Central Bank should act and communicate in a way to convince the market that inflation will be under control. This section shows the estimates of different specifications for Central Bank Taylor-type rules and discusses if the Central Bank has been effective in controlling inflation expectations. We show that the Central Bank has been reacting strongly to deviations of expected inflation from the target, and that, despite the failure in achieving

the target in 2001, inflation expectations remain under control. Furthermore, we present some indications of change in the inflation rate dynamics. We conclude that the Central Bank of Brazil has gained credibility in the conduct of monetary policy. The credibility, however, is still under construction as it takes time to achieve it. Besides, the absence of central bank independence in the legal framework is an obstacle to achieve higher levels of credibility.

3.1.1. The reaction function of the Central Bank

We estimate a reaction function of the Central Bank of Brazil that relates interest rate to expected inflation and to output gap, allowing also for some interest-rate smoothing:

$$i_t = \alpha_1 i_{t-1} + (1-\alpha_1)(\alpha_0 + \alpha_2 y_{t-1} + \alpha_3 (E_t \pi_{t+j} - \pi^*_{t+j})), \qquad (1)$$

where i_t is interest rate, y_t is the output gap, $E_t\pi_{t+j}$ is inflation expectations and π^*_{t+j} is the inflation target, both referring to some period in the future, as it will be explained below.[3] The sample consists of monthly data between July 1999, when the regime was formally introduced,[4] and June 2002.

We use two different definitions of interest rate. The first one is the base rate (Selic rate) decided by the Monetary Policy Committee (Copom) in their meetings. The second definition is the interest rate gap, defined as the difference between the Selic rate and its trend, estimated by a HP-filter.[5] The motivation to use the gap is to have some idea of how the Central Bank deviates the interest rate from equilibrium when faced by an increase in inflation expectations. This is particularly important for Brazil because, when inflation targeting was introduced, real interest rates were considerably high.[6] Therefore, a convergence to steady-state equilibrium would require a downward trend for interest rates. As Bogdansky *et al.* (2001) discuss, in the first two years of the

[3] Clarida, Galí, and Gertler (1998, 2000) estimate forward-looking reaction functions for the U.S., Germany, Japan, U.K., France, and Italy. Instead of using central bank or survey expectations, they employ a Generalized Method of Moments (GMM) estimation. It is basically a forward-looking version of the backward-looking reaction function proposed by Taylor (1993).

[4] Decree 3088, of June 21, 1999 established inflation targeting in Brazil. Therefore, the July Copom meeting of that year was the first one under a formal inflation-targeting regime.

[5] The Hodrick-Prescott filter was passed on the monthly data series between September 1994 (two months after the introduction of the Real) and June 2002.

[6] During the pegged exchange rate regime, which ended in January 1999, the Selic rate needed to be at high levels in order to avoid large outflow of reserves. In the first months following the Real floatation, the Selic rate needed to be kept at high levels to prevent inflation-exchange rate depreciation spiral.

inflation-targeting regime, several shocks hit the Brazilian economy and, in many cases, the Copom decision was to leave interest rate constant. This would be equivalent to an increase in interest rate if we consider that the equilibrium interest rate was falling.

Monthly industrial production (seasonally adjusted), as measured by IBGE, is the proxy for output. The output gap was obtained by the difference between the actual and the HP-filtered series.[7]

We use two sources for inflation expectations. The first one is the inflation forecasts of the Central Bank of Brazil presented in the quarterly *Inflation Report*. The advantage of this source is that Copom should take interest rate decisions based on its own inflation forecasts. The forecasts in the *Inflation Report* are made assuming a constant interest rate equal to the one decided in the previous Copom meeting. Therefore, they signal if the Central Bank should change the interest rate. However, public information about Copom's inflation forecasts is available only on a quarterly basis. In order to obtain monthly figures, it was necessary to interpolate the data. The second source is obtained by a daily survey that the Central Bank collects among financial institutions and consulting firms.[8] The survey asks what firms expect for year-end inflation in the current and in the following years.[9] This expectation, however, is made jointly with an expectation for the interest rate (not necessarily constant).

The Brazilian inflation-targeting regime sets year-end inflation targets for the current and the following two years. Since it is necessary to have a single measurement of inflation deviation from the target, it was necessary to create a new variable, weighting the expected deviations from target in different years. The variable chosen was

$$D_j = (12 - j)(E_j \pi_t - \pi_t^*) + j(E_j \pi_{t+1} - \pi_{t+1}^*) \ , \qquad (2)$$

where D_t is the measure of expected deviation of inflation from the target, j indexes the month, and t indexes the year. Therefore, D_t is a weighted average of current year and following year expected deviation of inflation from the target, where the weights are

[7] Estimations using output growth and output gap obtained by extraction of a linear trend were also performed. The results were similar and are not reported in this paper.

[8] This survey is available at the Central Bank of Brazil website (www.bcb.gov.br). In this estimation, we use the inflation expectations collected on the eve of Copom meetings, avoiding possible endogeneity problems.

[9] In November 2001 the survey started collecting expectations for the following 12 months as well.

inversely proportional to the number of months remaining in the year.[10] Observe that D_t does not contain inflation expectations referring to two years in advance, despite the existence of target for such period. Given the shorter lags in the transmission mechanism of monetary policy estimated for the Brazilian economy and the higher uncertainty associated with the forecasts, it is reasonable to assume the Copom concentrates on current and following year forecasts to take the interest rate decisions.

Table 2 and 3 report the estimations using the Selic interest rate and the gap of Selic interest rate as dependent variable, respectively. Each table presents the estimations with inflation forecasts of the Central Bank (sample 1999:06-2002:06) and of the market (sample 2000:01-2002:06).[11] The estimations using only one lag for the interest rate usually present serial correlation of the residuals, but this problem is solved using two lags.[12] There has been a high degree of interest-rate smoothing. The sum of the coefficients on the two lags is 0.8 or above. The coefficient on output gap is usually not statistically significant when using market expectations or presents the wrong sign when using inflation expectations presented in the *Inflation Reports*. We have also tested for the inclusion of exchange rate change in the reaction function, but this variable is not statistically significant.

Most importantly, the coefficient on inflation expectation is greater than one and significantly different from zero. Employing the *Inflation Report*'s expectations, the coefficient is 1.84[13] and 4.25 using Selic rate and the gap of Selic, respectively. Therefore, we can conclude that the Central Bank has been reacting strongly to expected inflation. It conducts monetary policy on a forward-looking basis, and responds to inflationary pressures.

[10] It is not necessary to have a single measure of inflation deviation. If there were enough data, it would be possible to use expected inflation for the current and the following years (and possibly more years ahead) in the reaction function. But it would then be necessary to introduce dummy variables for the months since it is reasonable to assume that the weight given for current year inflation should decrease along the year.

[11] The data on IPCA expectations are available only as of January 2000.

[12] In this case, the equation is $i_t = \alpha_1 i_{t-1} + \alpha_4 i_{t-2} + (1-\alpha_1-\alpha_4)(\alpha_0 + \alpha_2 y_{t-1} + \alpha_3 (E_t \pi_{t+j} - \pi^*_{t+j}))$.

[13] In this case, the p-value is 0.13, but we have to consider the small size of the sample.

Table 2
Estimation of Reaction Function of Central Bank
Dependent Variable: Selic Interest Rate (Monthly Average)

Regressors	Coefficients and standard errors			
	With Inflation Report Inflation Expectations		With Market Inflation Expectations	
Constant	17.50***	17.57***	16.49***	16.68***
	(0.36)	(0.48)	(0.63)	(0.69)
Interest Rate (t-1)	0.76***	1.04***	0.72***	1.36***
	(0.07)	(0.13)	(0.08)	(0.18)
Interest Rate (t-2)		-0.20**		-0.56***
		(0.08)		(0.15)
Deviation of Expected Inflation Rate from Target	1.78**	1.84	1.74**	1.42*
	(0.84)	(1.19)	(0.66)	(0.72)
Output Gap (t-1)	-0.44***	-0.47***	-0.25*	-0.13
	(0.11)	(0.16)	(0.13)	(0.17)
R-squared	0.9287	0.9418	0.9272	0.9539
Adjusted R-squared	0.9220	0.9342	0.9188	0.9465
LM Test for Autocorrelation of Residuals (p-values)				
1 lag	0.0357	0.5186	0.0059	0.7408
4 lags	0.2165	0.6766	0.0757	0.5612

Notes: Standard error in parantheses. *, **, and *** indicate the coefficient is significant at 10%, 5%, and 1% level, respectively.

It is interesting to note that such coefficients are around 1.4-1.8 when the dependent variable is the Selic rate,[14] and above 3.6 when the dependent variable is the gap of the Selic rate. This result supports the view that, given a downward trend for interest rates, Copom decisions of leaving the interest rate constant may be interpreted as a tightening of monetary policy. Moreover, in the case of the gap of Selic rate, the coefficients are significantly different from one in all specifications.

[14] Favero and Giavazzi (2002) also estimated a similar reaction function using the market expectations, and found similar results (coefficient equal to 1.78). Silva and Portugal (2002) used a different specification, and found different results.

Table 3
Estimation of Reaction Function of Central Bank
Dependent Variable: Gap of Selic Interest Rate (Monthly Average)

Regressors	Coefficients and standard errors			
	With Inflation Report Inflation Expectations		With Market Inflation Expectations	
Constant	-1.51***	-1.28***	-3.28***	-3.53***
	(0.36)	(0.36)	(0.54)	(0.65)
Gap of Interest Rate (t-1)	0.81***	1.08***	0.71***	1.34***
	(0.06)	(0.09)	(0.08)	(0.19)
Gap of Interest Rate (t-2)		-0.25***		-0.54***
		(0.06)		(0.15)
Deviation of Expected Inflation Rate from Target	5.01***	4.25***	3.70***	3.63***
	(0.92)	(0.77)	(0.58)	(0.68)
Output Gap (t-1)	-0.38**	-0.43***	-0.05	0.08
	(0.15)	(0.13)	(0.13)	(0.17)
R-squared	0.9653	0.9768	0.9694	0.9797
Adjusted R-squared	0.9620	0.9738	0.9658	0.9765
LM Test for Autocorrelation of Residuals (p-values)				
1 lag	0.1254	0.4020	0.0080	0.4255
4 lags	0.0796	0.4754	0.0461	0.4356

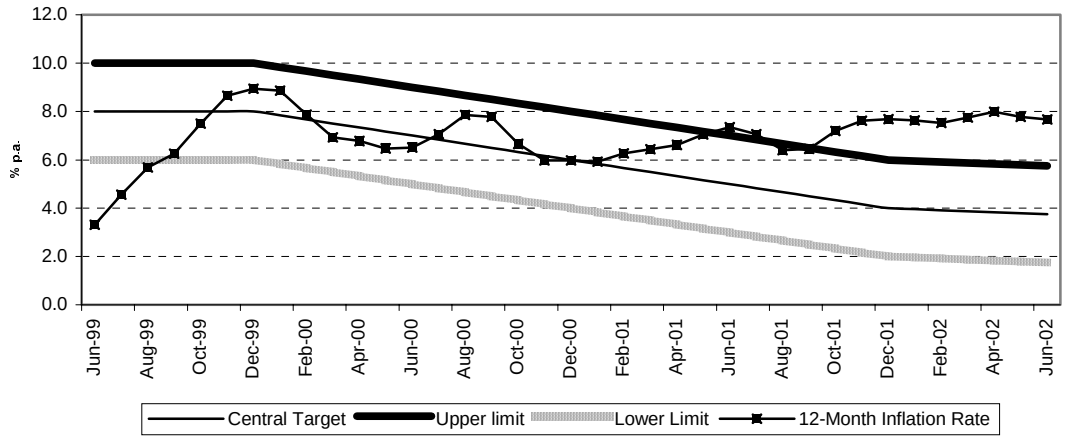
Notes: Standard error in parantheses. *, **, and *** indicate the coefficient is significant at 10%, 5%, and 1% level, respectively.

3.1.2. Inflation expectations and the role of the targets

A naive analysis of the inflation-targeting regime in Brazil might say that this regime has not been successful in controlling inflation. As Figure 7 shows, since mid-2001, 12-month inflation has been above the upper limit of the tolerance interval.[15] Nevertheless, inflation outcomes are not a sufficient statistic to evaluate the performance of the Central Bank. The evolution of inflation expectations, and the role of the target should be more relevant variables to assess the credibility of the Central Bank. Furthermore, it is necessary to take into account the shocks that hit the economy.

[15] There are established targets only for year-end inflation. Therefore it was necessary to impute a target to the other months of the year, which was done by linear interpolation.

Figure 7
12-Month Actual Inflation Rate and Inflation Target -
1999:06 - 2002:06 (% p.a.)



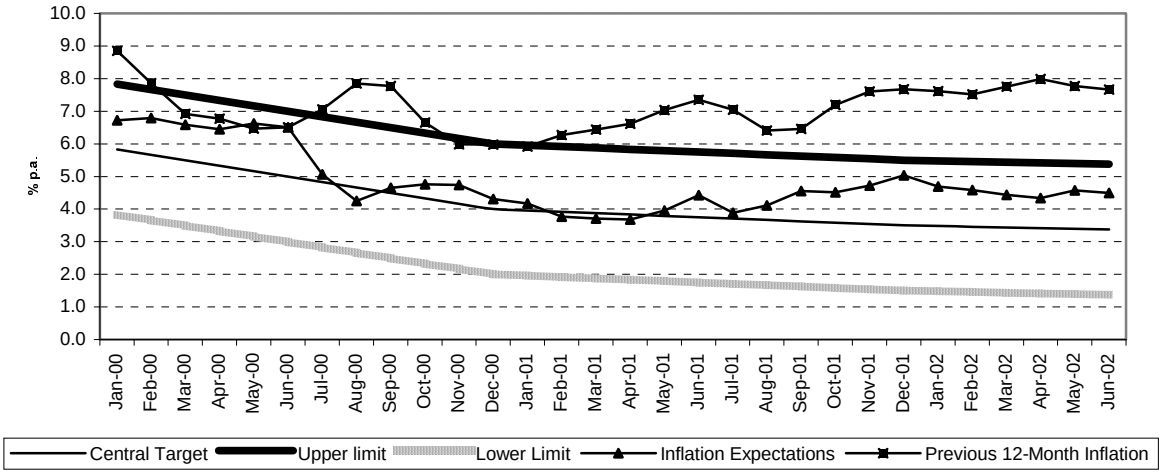
Since the introduction of the inflation-targeting regime in Brazil, the economy has been hit by inflationary shocks, notably by supply and cost-push shocks. As of 2001, shocks like the energy crisis, the readjustments of administered prices and the exchange rate depreciation have forced the Central Bank to reassess the trade-off between inflation and output variability. Since then and, in a more systematic way, since January 2002, the conduct of monetary policy has been based on accommodating the first-round effects of supply and cost-push shocks. This means monetary policy will allow relative price movements to affect inflation, but will neutralize the second-round effects.

As long as the market understands the objectives of the Central Bank, and its conduct is credible, inflation expectations should be contained and, except for unforeseen new inflationary shocks, inflation should gravitate around the target. Two conditions are necessary to guarantee inflation expectations will remain controlled. The first one is a clear communication with the market. The market needs to understand why actual inflation was above the target and how monetary policy is being conducted in order to make inflation return to the target. The Central Bank of Brazil communicates with the market via informal speeches or formal documents, like the minutes of the Copom meetings, which are released one week after the meetings, and the *Inflation Report*, which is published on a quarterly basis. The second condition for controlling

expectations is that the conduct of monetary policy should be consistent with the main guidelines expressed by the Copom. In this sense, the reaction function estimated in the previous subsection shows that the Central Bank has been acting consistently with the inflation-targeting framework.

Figure 8 suggests that the two conditions stated above have been met. It shows the 12-month ahead inflation that is expected by the market, the 12-month ahead target, and the actual 12-month accumulated inflation. We estimate the 12-month ahead expected inflation rate using the expected inflation until the end of the current year and, for the remaining months necessary to achieve 12 months, the corresponding proportion of the following year expected inflation. The 12-month ahead target is estimated by interpolation. It is clear that inflation expectations have always been below the upper limit of the tolerance interval. This is true even since the second half of 2001, when actual inflation surpassed the tolerance interval. The correlation coefficient between the actual and expected inflation series is low (0.12). However, there are subsamples where the correlation coefficient is higher. For example, after February 2001, the correlation between the series is 0.70. Even for such subsamples, where inflation expectations tend to move closer to previous inflation, the movements of expectations tend to be smoother than the movements of actual inflation. As the graph shows, the gap between actual and expected inflation increased after mid-2001, when actual inflation surpassed the upper limit of the tolerance interval. Therefore, especially for this period, the credibility of the Central Bank seemed to be essential to keep inflation expectations under control.

Figure 8
12-Month Ahead Expected Inflation and Inflation Target, and Previous 12-Month Inflation - 2000:01 - 2002:06 (% p.a.)



Another evidence to suggest the gains in credibility of the Central Bank is to evaluate the role of the target in expectations formation. We have run OLS regressions of 12-month ahead market inflation expectations on its own lags, the 12-month ahead inflation target and the interest rate (sample 2000:01-2002:06). Table 4 reports the results. Since we find serial correlation of residuals with one lag for the expected inflation, we also estimate the model using two lags. All coefficients are statistically significant and have the expected sign. The positive coefficient on interest rate may be explained by the reaction of interest rates to inflationary pressures. When the Central Bank (and the market) foresees higher inflation, the rate of interest is increased. Most

Table 4
Estimation of Reaction Function of Inflation Expectations
Dependent Variable: Market Inflation Rate Expectations (Adjusted)

Regressors	Coefficients and standard errors			
	I	II	III	IV
Constant	-4.23*** (1.30)	-4.75*** (1.31)	-4.22*** (1.32)	-4.92*** (1.35)
Market Inflation Rate Expectations (t-1)	0.24 (0.18)	0.48** (0.19)	0.27 (0.18)	0.50** (0.19)
Market Inflation Rate Expectations (t-2)		-0.39** (0.15)		-0.40** (0.15)
Interest Rate (t-1)	0.27*** (0.07)	0.29*** (0.07)	0.25*** (0.08)	0.27*** (0.08)
Inflation Rate Target (12-Month Ahead)	0.74*** (0.22)	0.96*** (0.24)	0.70*** (0.23)	0.95*** (0.24)
12-Month Inflation Rate (t-1)			0.06 (0.10)	0.08 (0.11)
R-squared	0.8978	0.9030	0.8993	0.9053
Adjusted R-squared	0.8855	0.8861	0.8826	0.8838
LM Test for Autocorrelation of Residuals (p-values)				
1 lag	0.0663	0.5196	0.0652	0.7730
4 lags	0.0160	0.1333	0.0149	0.1316

Notes: Standard error in parantheses. *, **, and *** indicate the coefficient is significant at 10%, 5%, and 1% level, respectively.

importantly, the expected inflation reacts significantly to the inflation targets (coefficient equal to 0.96). Since this result could be a consequence of some correlation between targets and past inflation, we also include the actual 12-month inflation rate in the regression (specifications III and IV). This variable is not statistically significant. Therefore, there are indications that the expectations are forward looking, and the inflation targets play an important role.

In a summary, although the actual inflation rate has been above the upper limit of the tolerance interval in 2001 and 2002, the inflation-targeting regime has been successful in anchoring expectations. This is a consequence of the gains of credibility that the Central Bank has achieved since the implementation of the inflation-targeting regime.

3.1.3. Change in the inflation dynamics

As the inflation-targeting regime is supposed to affect the formation of inflation expectations, we can consider the possibility that the backward-looking component in the price adjustment has become less important. The share of backward-looking firms could have become smaller and/or firms could consider less the past inflation to adjust prices. This would reduce the degree of persistence in inflation. Following Kuttner and Posen (1999), we estimate a simple aggregate supply curve for the low inflation period to assess if the inflation-targeting regime was accompanied by some structural change.[16] Using monthly data, we regress the inflation rate (measured by IPCA) on its own lags, the unemployment rate[17] (lagged one period), and the exchange rate change in 12 months (lagged one period). The regression also includes dummy variables that multiply the mentioned regressors for the inflation-targeting period. The inflation rate and exchange rate change are measured in monthly terms.

Table 5 shows three different specifications. In the first, we include only one lag for inflation and do not include the exchange rate change. From the estimated coefficients on the dummy variables, we can conclude there is a statistically significant change in the constant and in the coefficient on lagged inflation in the inflation-targeting period. The autoregressive coefficient falls from 0.74 to 0.15. The coefficient

[16] It is important to stress that the Central Bank structural model used for inflation forecasting employs quarterly data, and has a different specification, for example, it includes a forward-looking term for inflation, and a term for output gap instead of unemployment rate.

[17] We use seasonally adjusted unemployment rate (criterion seven days) produced by IBGE. The results are qualitatively similar if we use the raw data or the unemployment rate estimated according to the criterion of thirty days.

Table 5
Estimation of Aggregate Supply Curve
Dependent Variable: Monthly Inflation Rate

Regressors	Coefficients and standard errors		
	First Specification	Second Specification	Third Specification
Constant	0.74**	0.81**	0.79**
	(0.36)	(0.35)	(0.32)
Dummy*Constant	0.38***	0.56***	0.39***
	(0.14)	(0.15)	(0.14)
Inflation Rate (t-1)	0.74***	0.81***	0.61***
	(0.09)	(0.12)	(0.13)
Dummy*Inflation Rate(t-1)	-0.59***	-0.58***	-0.41**
	(0.20)	(0.21)	(0.19)
Inflation Rate (t-2)		-0.12	-0.09
		(0.12)	(0.12)
Dummy*Inflation Rate (t-2)		-0.30	-0.24
		(0.20)	(0.19)
Unemployment (t-1)	-0.09*	-0.10**	-0.10**
	(0.05)	(0.05)	(0.05)
Exchange Rate Change (t-1) (Twelve-Month Average)			0.10***
			(0.04)
Dummy for 2000:07			1.08***
			(0.33)
R-squared	0.6431	0.6766	0.5537
Adjusted R-squared	0.6269	0.6538	0.5055
LM Test for Autocorrelation of Residuals (p-values)			
1 lag	0.1857	0.8353	0.5454
4 lags	0.0040	0.1693	0.1081

Notes: Standard error in parantheses. *, **, and *** indicate the coefficient is significant at 10%, 5%, and 1% level, respectively. We exclude data for inflation rate previously to 1994:09. The sample size starts in 1994:10, 1994:11 and 1995:08 (for the exchange rate we excluded data previous to 1994:06), respectively, and ends in 2002:06. Dummy refers to the inflation-targeting period, unless otherwise noticed.

on lagged unemployment is negative. In all the three specifications, there is no statistically significant change in the coefficient on lagged unemployment.[18] However,

[18] The estimations reported in Table 5 were conducted without including the terms corresponding to the inflation-targeting dummies interacting with the unemployment rate and exchange rate change.

since the residuals present serial autocorrelation, we use a second specification that adds another lag for inflation rate. The change in the coefficient of the first lag of inflation rate is still significant: from 0.81 to 0.23. The sum of the two lags before and after the inflation targeting are 0.69 and -0.19, respectively. Therefore, we can conclude that there has been a substantial reduction in the degree of inflation persistence after the inflation targeting was adopted. This implies a lower output cost to curb inflationary pressures and to reduce the average inflation.[19]

The third specification includes the lagged exchange rate change.[20] The coefficient is positive, and we could not reject the null hypothesis of no structural break for the coefficient in the inflation-targeting period. For the inflation lagged terms the results are relatively similar to those from the second specification (the first autoregressive component decreases from 0.61 to 0.20, and the sum of the two lags goes from 0.52 to -0.13). The coefficient on the lagged exchange rate is 0.10, which, considering the lagged inflation terms, generate a 12-month pass-through of 21% and 9% for the whole sample and for the inflation-targeting period, respectively. The smaller pass-through in the recent period, however, is a consequence of the lower degree of persistence in inflation. In subsection 3.3, we present some estimation for the pass-through using a VAR model and the structural model.

The coefficient on lagged unemployment is about -0.10. Therefore, a one-percentage point increase in the unemployment rate decreases the inflation rate by 1.2 percentage points when measured in annual terms. Considering the indirect effects via inflation inertia, the total effect over a year in the inflation reduction is 2.3 p.p. and 1.1 p.p. for the whole sample and for the inflation-targeting period, respectively. As before, this result is explained by the different degrees of inflation persistence.

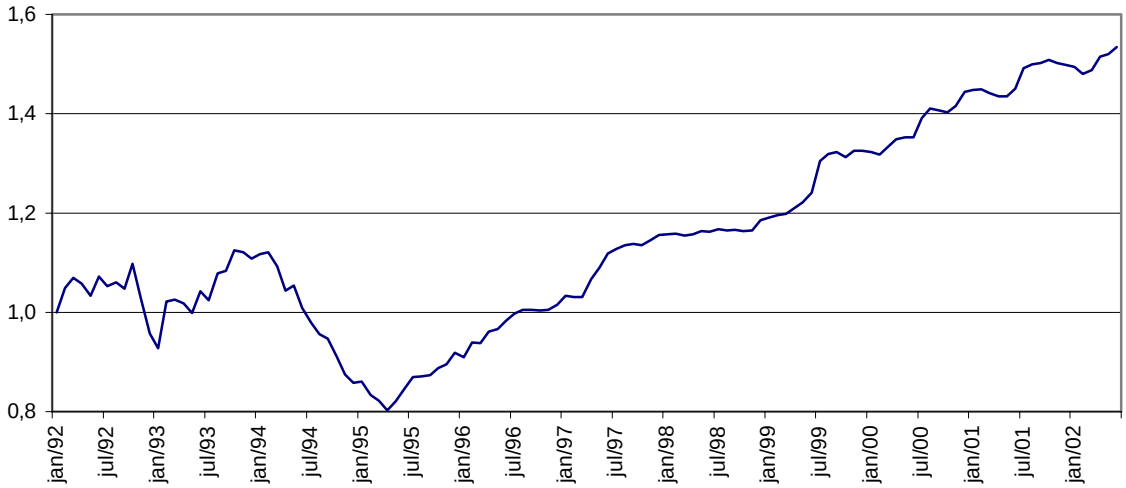
[19] Note that, although the constant in the regression is higher in the inflation-targeting period, the unconditional expected inflation (up to a constant referring to the natural unemployment rate) is equal to 2.9 and 1.3 for the periods before and after inflation-targeting adoption using the first specification; and 2.6 and 1.1 employing the second specification.

[20] We use the 12-month change; the one, three and six-month changes were not significant. To avoid the presence of autocorrelation in the residuals, we include in the third specification a dummy variable for 2000:07. After a 0.27% monthly average inflation in the first semester of 2000, inflation reached 1.6% in July, markedly above market expectations, because of the off-cropping season and a significant rise in administered prices. Including this dummy in the three specifications has no major effect on the estimated coefficients.

3.2. Change in relative prices

Monetary policy has been facing a significant change in relative prices in the economy that has markedly affected the inflation rate. Since mid-1995, administered prices have increased systematically above market prices.[21] Figure 9 shows the ratio of administered prices to market ones since January 1992. The ratio rose 23.7% in the first three years of inflation targeting (comparing June 2002 to June 1999). The weight of this group in the IPCA grew from a 17% average (from January 1991 to July 1999) to 28% in August 1999 as a result of a new household budget survey. It reached 30.8% in June 2002 because its changes were greater than those of market prices.

Figure 9
Ratio of Administered Prices to Market Prices - 1992:01-2002:06 (Jan/1992=1)



The dynamics of administered prices differ from those of market prices in three aspects:

a) the dependence to international prices in the case of oil by-products;

b) a greater pass-through from exchange rate. There are three basic links: i) the price of oil by-products depends on oil prices denominated in domestic currency; ii) part of the electricity rates is linked to exchange rate variations; and iii) part of the price adjustments settled in the contracts that rule electricity and telephone rates is indexed to

[21] For more details on the behavior of administered prices, see Figueiredo (2002).

the General Price Index (IGP), which is more affected by the exchange rate than the consumer price indexes;

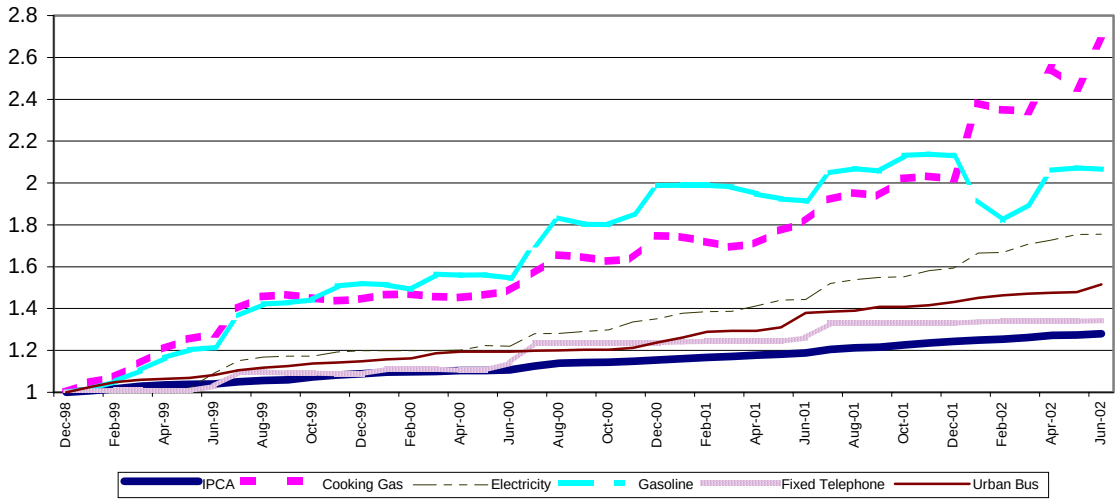
c) a stronger backward-looking behavior. Electricity and telephone rates are generally adjusted annually, and the contractual clauses usually estipulate adjustments should be based on a weighted average of the past change of IGP and of exchange rate.

The issues in the items "a" and "c" are out of control of monetary policy, and the exchange rate (item "b") is only partially affected by monetary policy. In particular, these three factors have exerted strong inflationary pressures during the inflation-targeting period. Between June 1999 and June 2002, the oil price rose 53.0% (from US$ 15.77 to US$ 24.13/barril - crude oil - Europe brent). The exchange rate increased by 53.7% at the same period, and by 125.2% if we compare to December 1998 (a depreciation of the domestic currency of 35.0% and 55.6%, respectively). The presence of a strong backward-looking component implies higher output cost and inflation rate during disinflations. First, the response of inflation to any inflationary shock is more persistent. Second, since the inflation targets for Brazil are decreasing, it is important that the price adjustments converge to the targets to reduce or avoid output costs. In the presence of a stronger backward-looking behavior, however, the adjustment is slower, implying a greater output gap reduction to meet the targets.

Moreover, the sectors of telephone, electric energy and oil by-products faced some important structural reforms that had some initial implications for the inflation rate. Fixed telephone rates had two spikes in 1996 and 1997 because the line acquisition fee had a sharp fall (not included in the price index), whereas phone rates increased. The sector of oil by-products had a deregulation at the beginning of 2002 with the end of control of its prices and of subsidies to cooking gas (whose prices rose about 18% in January 2002). In the case of electric energy, the rationing between 2001 and 2002 led to a rise in the electricity rates.

Figure 10 shows the path of price levels of gasoline, cooking gas, telephone, electricity, urban bus, and the headline IPCA level from December 1998 through June 2002. It is clear that these prices have been an important pressure on the inflation rate.

Figure 10
Level of Prices - IPCA and Selected Items - 1998:12-2002:06 (Dec./1998=1)



It is broadly known the effect of inflation rate on relative prices. In this paper, we stress the effect of change in relative prices on the inflation rate. As a measure of the dispersion of relative prices we use the standard deviation of the monthly change of the 52 items that comprise the IPCA. We then test for Granger causality between relative prices and inflation rate.[22] The results are reported in Table 6, which shows the estimation using one and three lags (selected by Schwarz and Akaike information criteria, respectively) for a sample from 1994:12 to 2002:06. We can reject the null hypothesis that relative prices do not Granger cause inflation rate. Therefore, change in relative prices conveys information about future inflation. We can also reject the null that inflation rate does not Granger cause relative prices.

Table 6
Granger Causality Test: Relative Prices and Inflation Rate (IPCA)
Sample: 1994:12 - 2002:06

Null Hypothesis	1 lag		3 lags	
	F-statistic	P-value	F-statistic	P-value
Relative Prices do not Granger Cause Inflation Rate	2.89	0.0926	3.15	0.0293
Inflation Rate does not Granger Cause Relative Prices	16.71	0.0001	5.35	0.0020

[22] We can reject that they are integrated of order one.

3.3. Exchange rate volatility

Dealing with exchange rate volatility has been one of the main challenges to inflation-targeting regime in emerging markets economies. Compared to industrialized economies, emerging markets seem to be more sensitive to the effects of financial crisis in other countries. Exchange rate market volatility generates frequent revisions of inflation rate expectations and may result in non-fulfillment of inflation targets. As a general rule, the actions of the central bank should not move the exchange rate to artificial or unsustainable levels. However, the central bank may react to exchange rate movements to curb the resulting inflationary pressures and to reduce the financial impact on dollar denominated assets and liabilities in the balance sheet of firms.

Regarding the financial problems associated with exchange rate volatility, Haussmann, Panizza and Stein (2001) argued that all countries that are not able to issue debt in their own currency are more vulnerable to the impact of currency mismatches in their balance sheets. Those mismatches are even more dramatic in a financially integrated world, where rumors of financial problems may lead to capital flight that might produce self-fulfilling crises, generating bad equilibrium. As observed by Schmidt-Hebel and Werner (2002) the level of reserve works as an insurance against the occurrence of this bad equilibrium. If all burden of the adjustment to capital outflows during financial crisis is supported by exchange rate depreciation, the country might have a backward bending exchange rate supply curve with no equilibrium being possible. They justify foreign exchange rate intervention based on the following reasons: (i) facilitate adjustment to sudden reductions in capital inflows; (ii) accumulate reserves; (iii) reduce excessive exchange rate volatility (associated with lower liquidity in foreign exchange markets); and (iv) raise the supply of exchange rate insurance.

Given the problems associated with exchange rate volatility and the pros of intervention, the Central Bank of Brazil, like other emerging markets economies, including some that also adopt inflation targeting, has actually been implementing a dirty-floating exchange rate policy.[23] Such interventions are made as transparent as possible in order to avoid the concern expressed by Mishkin (2000) that intervention may hinder the credibility of monetary policy as the public may realize that stabilizing the exchange rate takes precedence over promoting price stability as a policy objective.

[23] Calvo and Reinhart (2000) discuss the limited empirical evidence of truly free-floating countries.

In Brazil, the volatility of exchange rate has been considerable. From 1999:07 through 2002:06, the exchange rate (monthly average) increased on average 1.2% per month, with a standard error of 3.6 and a coefficient of variation (ratio of standard error to average) of 3.0. The inflationary pressures resulting from exchange rate depreciation are more related to the magnitude of the depreciation than to the pass-through coefficient[24]. According to the structural model of the Central Bank, the pass-through to market prices inflation, as a percentage of the observed depreciation, is 12% after one year of the depreciation. The pass-through to administered prices is estimated to be 25%, resulting in a pass-through of about 16% for the headline IPCA. In line with the estimates, between January 2001 and August 2002, the price of the dollar moved from R$ 1.95 to R$ 3.11, implying an increase of 59.5%. In the same period, IPCA rose 12.2%. In this sense, Brazil seems to be closer to the lower end of the estimates done by Haussmann, Panizza and Stein (2001). They estimated the pass-through accumulated in 12 months for more than 40 countries and found a value below 5% for G-7 countries, and, on the other extreme, figures above 50% for countries like Mexico, Paraguay and Poland.

We can also use a VAR estimation with monthly data to assess the pass-through and the importance of exchange rate shocks to inflation rate variability. We use two specifications. Both include output, spread of EMBI+ (Emerging Markets Bond Index Plus) over Treasury bonds,[25] exchange rate (monthly average), and interest rate (monthly average). Output is measured by industrial production, seasonally adjusted data, produced by IBGE. The inclusion of EMBI+ was necessary because it is a good indicator for financial crises, both foreign crises (Mexico, Asia, Russia, Argentina) and domestic (beginning of 1999), which have an important impact on interest rates. The interest rate is the Selic overnight rate, the basic interest rate in the economy, controlled by the Central Bank. In the first specification, we use administered and market prices as variables, whereas in the second we use the consumer price index IPCA instead. We estimate the model in levels, that is, using I(1) and I(0) regressors instead of using the error correction representation.[26] The estimation is consistent and captures possible

[24] See Goldfajn and Werlang (2000) for the reasons for the low pass-through in the Brazilian January 1999 devaluation episode.
[25] We use EMBI from Sept./1994 through Dec./1998, and EMBI+ after that.
[26] According to augmented Dickey-Fuller unit root tests, we can accept the presence of a unit root for the log-levels of IPCA, administered prices, market prices, exchange rate, interest rate, and for the level of EMBI+ spread. We reject the presence of unit root for the monthly change of those variables, and for the level of interest rate.

existing cointegration relationships (Sims, Stock, and Watson, 1990; Watson, 1994). The variables used are the log-levels of output, administered prices, market prices, IPCA and exchange rate, and the levels of EMBI+ spread and interest rate. We use a Cholesky decomposition with the following order in the first specification: output, administered prices, market prices, EMBI+, exchange rate, and interest rate. In the second specification, the consumer price index substitutes for administered and market prices. Since the financial variables react more rapidly to shocks, we include them after output and price. We also estimate using interest rate before exchange rate. The results, even numerically, are very similar. We use two samples. The first one includes all the period of the Real Plan, from September 1994 through June 2002.[27] The second sample starts with the implementation of the inflation-targeting regime (July 1999) in order to try to capture some specificities of the recent period. However, since the sample is very short, the estimation does not generate statistically significant results.

Figure 11 shows the impulse responses to a one standard deviation of exchange rate shock, using the whole sample. It presents the point estimates and the two-standard-error bands, which were estimated using a Monte Carlo experiment with 1000 draws. The values shown are percentage points. The lag length of the VAR estimations was chosen according to Schwarz criterion, but we test for the presence of serial correlation of residuals, and increase the number of lags when necessary to obtain no serial correlated residuals.[28] The responses of administered and market prices are positive and statistically significant. The increase in administered prices is greater than that of market prices (note that the scales in the graphs are different). The exchange rate increases initially 2.6%, reaching a total of 4.3% in the second month, and starts decreasing after that. The rise of both administered prices and market prices reaches a maximum in the eighth month. The values of the pass-through are presented in Table 7. We estimate the pass-through as the ratio of the price increase in a 12-month horizon to the value of the exchange rate shock. If we consider the value of the exchange shock in the first month, the pass-through is 19.7% for the administered prices, and 7.8% for the market prices. Considering the value of the exchange rate shock in the second month, the pass-through is 12.1% and 4.8%, respectively. The pass-through for the administered prices is 2.5 higher than that for the market prices. Figure 12 shows the

[27] July and August 1994 were excluded because the price indexes were still "contaminated" by the previous high inflation period. In this case, the start of the sample is adjusted according to the number of lags used.
[28] We have used four lags for both specifications.

responses in the case of the specification that includes IPCA instead of the administered and market prices.[29] The pass-through to IPCA was estimated at 14.1% and 8.4%, considering the first and second month shock, respectively.

Figure 11. Impulse Responses of Administered Prices (ADMP), Market Prices (FREEP) and Exhange Rate (ER) to an Exchange Rate Shock

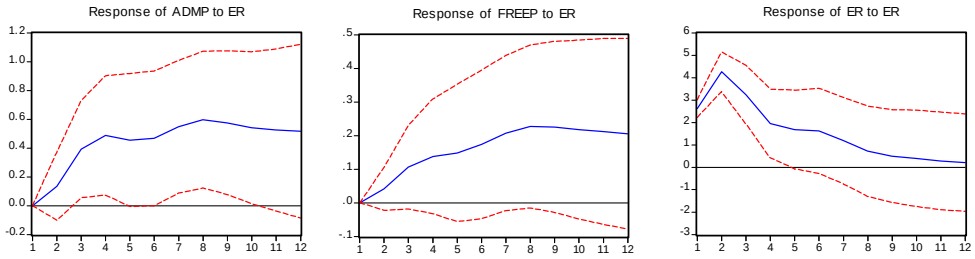
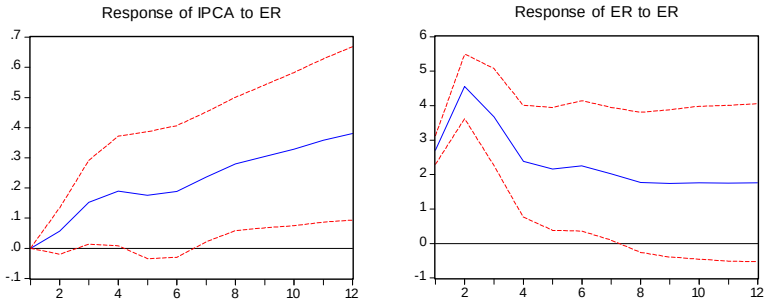


Figure 12. Impulse Responses of Price Level (IPCA) and Exchange Rate to an Exchange Rate Shock



We also consider a variance decomposition analysis, which gives the percentage of the forecast error variance of a variable that can be attributed to a shock to a specific variable. The influence of exchange rate shocks on administered prices is greater than in market prices. Considering a 12-month horizon, shocks to the exchange rate explain 24.9% of the forecast error variance of administered prices, and 16.3% of that of market prices. Using the specification with IPCA, the value is 23.0%.

[29] The response of price level stabilizes if we consider a 24-month horizon.

Table 7
Pass-Through Considering Different Specifications:
Ratio of Price Change (12-month horizon) to an Exchange Rate Shock

Value of Exchange Rate Shock Considered	Sample					
	Real Plan Period			Inflation-Targeting Period		
	Administered Prices	Market Prices	IPCA	Administered Prices	Market Prices	IPCA
Pass-Through Using the First Month Exchange Rate Shock	19.7	7.8	14.1	18.8	8.4	12.6
Pass-Through Using the Second Month Exchange Rate Shock	12.1	4.8	8.4	11.6	5.2	7.8
Ratio of Pass-Through Administered Prices to Market Prices			2.5			2.2

Since the inflation-targeting regime may have represented a structural change in the relationships, and the exchange rate regime is different from the most part of the previous period, we estimate a VAR model for the first three years of inflation targeting (1999:07-2002:06). However, the sample size is too short, and the response of administered and market prices is positive, but not statistically significant using a two-standard-error band (they are significant in the first months if we use a one-standard-error band). To compare with the previous estimation, however, we show in Table 7 the point estimates. They are very similar to those found for the whole sample.[30] These results using a VAR model are not in line with those in Muinhos (2001), which shows a structural break in the pass-through coefficient when the exchange rate regime changed. The estimations are conducted using a linear and a non-linear Phillips curve. The pass-through in the same quarter of the exchange rate change fell from more than 50% to less than 10%.

In terms of variance decomposition, exchange rate shocks explain 23.4% and 40.2% of the forecast error variance of administered and market prices, respectively, in a 12-month horizon (the first value is almost statistically significant, and the second is significant). Therefore, in this estimation, the contribution of exchange rate shocks was

[30] We have used two lags in both specifications. With IPCA and three lags, however, the values are smaller for the pass-through: 9.6% and 4.8%.

greater for the market prices than for the administered one. For the case of IPCA, the exchange rate shocks explain 32.8% of the forecast error variance of prices.

Therefore, exchange rate volatility is an important source of inflation variability. The design of the inflation-targeting framework has to take into account this issue to avoid that a possible non-fulfillment of inflation targets as a result of exchange rate volatility decrease the credibility of the central bank.

4. Methodology for calculating the inflation inertia and the effects of the shock to administered prices

The interest rate should react to inflationary shocks. However, the conduct of monetary policy has to consider several issues concerning the shocks: nature (demand or supply shocks), degree of persistence (temporary or permanent), size and their inflationary impact. In the case of supply shocks, there is a trade-off between output gap and inflation.[31] The optimal response of the interest rate depends on the degree of inflation aversion, on the response of inflation to output gap, and on the degree of persistence of the shock. Monetary policy should react less, and even we can consider that it may not react, when supply shocks are temporary or have a small size. Likewise, the greater the time horizon of the inflation target, the lower is the reaction of the central bank.

As discussed in previous sections, change in relative prices has been one of the main challenges faced by the Central Bank of Brazil. Since the implementation of the Real Plan, in July 1994, the administered prices inflation has been well above the market prices inflation. As long as there is some downward rigidity in prices, change in relative prices is usually translated into higher inflation. However, monetary policy should be oriented towards eliminating only the secondary effect of supply shocks on the inflation rate while preserving the initial realignment of relative prices. Therefore, the efforts of the Central Bank to quantify the first-order inflationary impact of the administered price inflation have become particularly important, since it helps to implement monetary policy in a flexible manner and without losing sight of the larger objective of achieving the inflation targets set by the National Monetary Council.

[31] See Clarida, Galí, and Gertler (1999).

First-order inflationary impact of the shock to administered items is defined as the variation in administered prices exceeding the target for the inflation rate, weighted by the share of administered prices in the IPCA and excluding the effects of the inflation inertia from the previous year and of variations in the exchange rate. The effect of the inflation inertia is excluded because inflation propagation mechanisms should be neutralized by the monetary policy, which has to consider the appropriate period. As a rule of thumb, the Central Bank considers 18 months an adequate period to offset the inertial effects of higher inflation. The exchange rate variation is excluded because this variable is affected by the monetary policy and could reflect demand shocks. Therefore, in defining the shock to administered prices, only the component of relative price change that has no relation with the activities of the Central Bank of Brazil is preserved as a first-order supply shock.

This section summarizes the methodology that has been currently used to separate the effect, via inertia, of the inflation in the previous year on the inflation in the current year, and the inflationary impact brought about by the shock to administered prices.[32] In this summary, it is assumed that the inertial effects and the pass-through from exchange rate to prices are the same for all goods in the economy.

4.1. Calculating the primary effect of the shock to administered prices

The first-order inflationary impact or primary effect of readjustments in administered prices is calculated by the difference between the inflation of administered prices and the inflation target for the year (weighted by the influence of administered prices on the IPCA), excluding the effects of inflationary inertia and of the exchange rate variation on administered prices:

$$ShA = \left(\pi_{adm} - \pi^{*}\right) * \omega_{adm} - (IA + CaA), \qquad (3)$$

where ShA = first-order inflationary impact of administered prices;

π_{adm} = inflation of administered prices;

π^{*} = target for the inflation;

ω_{adm} = weight of administered prices in the IPCA;

[32] See Freitas, Minella, and Riella (2002) for a more detailed description of the methodology.

IA = effect of the inertia in the previous year on the evolution of administered prices;

CaA = effect of the exchange rate variation on the evolution of administered prices.

The following subsection shows the calculation of the IA and CaA components.

4.1.1. Calculating the effect of the inflation inertia and exchange rate pass-through on administered prices

The model adopted by the Central Bank of Brazil assumes that the inflation in a given quarter depends on the inflation registered in the previous quarter, which in turn depends on the inflation in the quarter before and so on. The inertia inherited in a given year results from the inflation registered in the last quarter of the previous year, and its calculation is based on the inflation that exceeded the target. The inertia inherited from the last quarter of the previous year impacts the inflation in each quarter of the current year according to the following formula:

$$I_{j,y_t} = (\pi_{j=4,y_{t-1}} - \pi^*_{j=4,y_{t-1}}) * C^j_{inertia} * \omega_{group}\,, \qquad (4)$$

where I_{j,y_t} = effect of the inflation inertia in the previous year (y_{t-1}) on the inflation of the jth quarter of the current year (y_t);

$\pi_{j=4,y_{t-1}}$ = inflation in the last quarter ($j=4$) of the previous year (y_{t-1});

$\pi^*_{j=4,y_{t-1}}$ = target for the inflation in the last quarter of the previous year, approximated by ¼ of the target set for that year;

$C_{inertia}$ = coefficient that measures the pass-through of the inflation in the previous quarter to the current quarter, according to Central Bank estimates. This coefficient is raised to the jth power;

ω_{group} = weight of the group (market or administered prices) in the IPCA.

The total impact of previous year inflation on current year inflation via inertia is obtained by adding the effects estimated for each quarter:

$$I_{y_t} = \prod_{j=1}^{4}(1+I_{j,y_t}) - 1, \qquad (5)$$

where Π represents the productory symbol. In this paper, we assume, for simplicity, that $I = IA$, that is, the inertia estimated for the administered prices is the same as that for the market prices.

The formula below shows how to measure the influence of exchange rate variation on the primary impact of the shock to administered prices:

$$CaC_t = (e_t - e_{t-k}) * \alpha_2 * \omega, \qquad (6)$$

where CaC_t = effect of the exchange rate variation on the price adjustment of utility C in month *t*;

$(e_{t-1} - e_{t-k})$ = exchange rate variation accumulated from *t-k* to *t*. The value of *k* depends on the specific good one is analyzing. There are utilities whose price adjustments depend on the 12-month exchange rate variation, while for other goods, like gasoline, price adjustments is based on the evolution of exchange rate in the previous month. As stated before, for simplicity, we assume all goods follow the same rule;

α_2 = pass-through of the exchange rate variation to the prices;

ω = weight of the specific good in the IPCA. In this paper, it corresponds to the whole group of administered prices.

4.2. An example

Table 8 shows a hypothetical example on how the primary effect of the shock to administered prices and the inertia inherited from the previous year could be useful in a monetary policy decision. This example was built assuming the target for inflation is 4% and the expected inflation is 5%.

According to this example, inflation is expected to be 1 p.p. above the target for that year. Cookbook recipe would suggest Copom to raise interest rate[33]. However, Copom should adjust the target, adding the impact of inertia to be tolerated in that year (line c) and the primary effect of the shock to administered prices (line h). Observe that

[33] Even if the projected deviation from the target would be caused only by demand shocks, the optimal response of the Central Bank would not necessarily be to raise interest rates. It would depend on the effectiveness of monetary policy to reduce inflation in that year, the inflation forecasts for the following years, the expected duration of the shock, etc.

Copom interprets as a shock not the whole increase of administrative prices, but only the increase that is not explained by inertia and exchange rate change.

The target adjusted by the above-mentioned effects rises to 4.9%, which is close to the inflation forecast of 5%. Hence, in this case, the optimal policy would be to leave interest rates unchanged. There are, however, other points to be taken into consideration. The most important one is the trade-off between credibility and flexibility that arises when the forecast for inflation approaches the upper limit of the tolerance interval, while the forecast excluding the inertia and administered price shocks remains around the target. There is no clear answer for solving this trade-off, but, as a general guideline, the Central Bank should be more flexible the higher credibility it has, the better it can communicate with the market, and the stronger is the output loss involved if inflation is brought back to the target. In this sense, the bands should be considered mainly as checkpoints, with the Central Bank explaining clearly the reasons for the non-fulfillment of the targets.

Table 8

Example of Calculation of the Target Adjusted for Inertia Effect from Previous Year and for the Primary Effect of the Shock to Admnistered Prices

Item	%
(a) Target for year t	4.0
(b) Contribution of year t-1 inertia to inflation in year t	0.8
(c) Inertia from year t-1 to be accomodated in year t (= b/2)	0.4
(d) Administered price inflation forecast for year t	8.0
(e) Contribution of admintered price inflation above the target (= ((d) - p^{target})w_{adm})	1.2
(f) Inertia effects of year t-1 on year t administered price inflation	0.2
(g) Exchange rate impact on administered price inflation	0.5
(h) Primary effect of the shock to administered prices (= e - f - g)	0.5
(i) Target adjusted for inertia effect from previous year and for the primary effect of the shocks to administered prices (= a + c + h)	4.9
(j) Inflation forecast for year t	5.0

5. Institutional design of inflation targeting

The inflation-targeting framework has to be designed in such way that the conduct of monetary policy be oriented consistently towards the fulfillment of the targets, but at the same time take into account the limits for this achievement. The inflation is not totally under control of the monetary authority, and output costs have to be considered. There exist various sources for the non-fulfillment of targets. The first refers to the models used by central banks: model misspecification, uncertainty concerning the estimated coefficients, possible structural breaks, existence of variables that are difficult to model, etc. The second is the presence of unexpected shocks in the economy. The third is the presence of lags in the effects of monetary policy.

We stress four issues involved in the institutional design of inflation targeting: i) choice of price index used (core versus headline inflation), ii) the inclusion or not of escape clauses, iii) the size of the tolerance intervals (bands), and iv) horizon and criteria used for the targets.[34] Besides those issues, it is important to note the current gap in the Brazilian institutional framework represented by the absence of central bank independence. Central bank independence has been implemented in several countries, and is an important element to consolidate a policy oriented towards price stability.

5.1. "To core or not to core"

The use of some measure of core inflation has been justified on the grounds that is necessary a measure of inflation that is less sensitive to temporary price movements and more reflective of the long-term trend. Monetary policy should not target a variable that is subject to temporary movements. A core inflation measure is also justified based on the argument that is necessary a measure of inflation that is less sensitive to supply shocks, such as oil prices shocks.

There are different measures of core inflation. The most common methodologies are the exclusion method, and the trimmed mean method. The first one usually excludes some items such as food, oil by-products, and other energy prices because these prices present high seasonality and are often subject to supply shocks. The symmetric trimmed mean core excludes the items that presented the higher and the lowest change in the

[34] For different international experiences in terms of these four items, see Ferreira and Petrassi (2002), and Mishkin and Schmidt-Hebbel (2002).

period. The items are ordered according to their change. The items excluded are those whose accumulated weight from the top of the list reaches some threshold, say, 20% or 30%, and those following the same criterion from the bottom of the list.[35]

In Brazil, the change in relative prices has motivated the discussion of adoption of a core inflation measure, in particular, a measure that would exclude the administered prices. Nowadays, only a few countries target a core inflation measure, such as Canada and Thailand, which use core by exclusion. We do not include in this group countries like United Kingdom and South Africa, which use an inflation measure that excludes only mortgage interest rates. In this case, the motivation for the adoption of an exclusion index is different: increases in the interest rates, via mortgage rates, affect positively the headline inflation rate. Actually, the international experience has pointed to the use of headline indexes: Australia, New Zealand, and Czech Republic abandoned the use of core inflation measures in 1998, 1999, and 2002, respectively. Other countries, such as Colombia, Island, Israel, Mexico, Peru, Poland, Sweden, and Switzerland also use headline inflation (Ferreira and Petrassi, 2002).

The main argument contrary to the use of core inflation is that it is less representative of the loss of the purchasing power of money. The agents are concerned about the whole basket of consumption. In the Brazilian case, exclusion of the administered items would imply to leave out more than 30% of the representative consumption basket. In this sense, private agents may question a monetary policy that is not concerned about the overall consumer price index.

Furthermore, in the Brazilian case, in some occasions during the 1970s and 1980s, the government excluded some items from the headline index on an ad hoc basis in order to reduce the official inflation rate, or even changed the official index. As a result, the agents in Brazil tend to be reluctant to accept an index that excludes some items because it reminds them of these changes in the past.

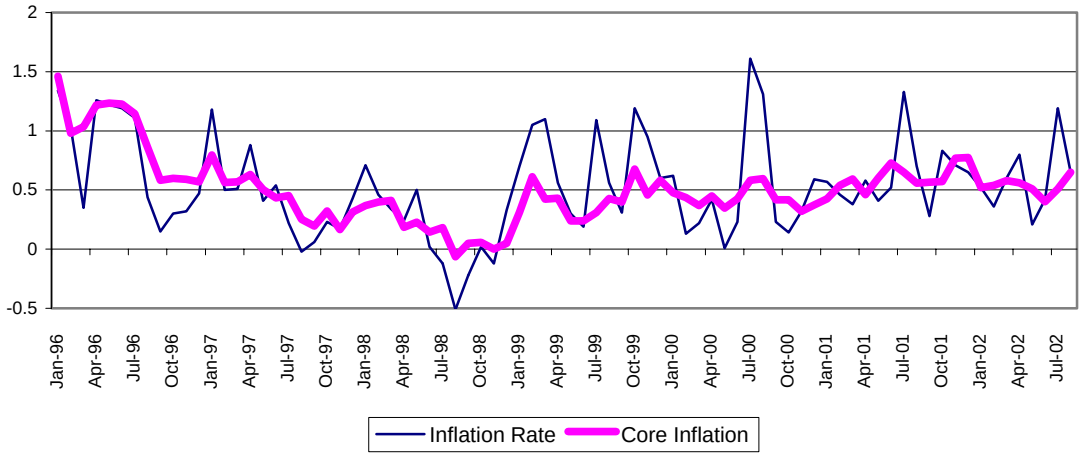
The adoption of a trimmed mean core in turn would imply a great loss in terms of communicability. The basket that comprises the index is not known *a priori*: it depends on the evolution of prices. Furthermore, the choice of the threshold is not

[35] The sample of the variations of the inflation rate components is ordered $\{x_1, \ldots, x_n\}$ with their respective weights $\{w_1, \ldots, w_n\}$. The symmetric trimmed mean is obtained from $\bar{x}_\alpha = (1/(1-\frac{2\alpha}{100}))\sum_{i \in I_\alpha} w_i x_i$, where α is the threshold, $I_\alpha = \left\{ i \mid \frac{\alpha}{100} < W_i < (1-\frac{\alpha}{100}) \right\}$, I_α is the set of the components to be considered in the computation of the trimmed mean with $\alpha\%$, and W_i is the accumulated weight up to *i*-th component (Figueiredo, 2001).

trivial, and is necessary to smooth some prices whose adjustments take place only from time to time.[36] The Central Bank of Brazil uses a 20% symmetric trimmed mean core that includes the smoothing of eight items.[37] Figure 13 presents the monthly inflation rate and core inflation. The core measure is considerably less volatile than the headline. The standard deviation of the core inflation is 0.28 and of the inflation rate is 0.42 (sample 1996:01-2002:08).

Nevertheless, the trimmed mean core has shown to play an important role as predictor of inflation trend. Table 9 shows Granger causality tests between core inflation and inflation rate (IPCA).[38] We find that core inflation Granger causes inflation rate, that is, core inflation conveys information about future inflation (beyond that contained in past inflation), and inflation rate does not Granger cause core inflation. Therefore, core inflation can be used as a useful source of information about future inflation.

Figure 13
Inflation Rate and Core Inflation
1996:01 - 2002:08 (% p.m.)



[36] The discontinuous adjustments tend to be larger than the average. Therefore, in the absence of smoothing, these items would be systematically excluded.
[37] See Figueiredo (2001) for an evaluation of different core measures for Brazil.
[38] See also Figueiredo and Staub (2002). Figueiredo (2001) found that the core measure has the "attractor" property as well.

Table 9
Granger Causality Test: Core Inflation and Inflation Rate (IPCA)
Sample: 1996:01 - 2002:06

Null Hypothesis	1 lag		2 lags	
	F-statistic	P-value	F-statistic	P-value
Core Inflation does not Granger Cause Inflation Rate	4.83	0.0311	7.14	0.0015
Inflation Rate does not Granger Cause Core Inflation	0.04	0.8479	0.98	0.3797

5.2. Escape clauses

Since the inflation rate is subject to several factors that are out of the control of monetary policy, the success of the conduct of monetary policy should not be judged exclusively by the fulfillment or not of the inflation targets. Under some circumstances, like significant supply shocks, the central bank cannot avoid the inflationary impact of the shock because of the presence of lags in the effects of monetary policy or should not avoid it because of the associated output costs.

In the case of escape clauses included in the inflation-targeting framework, it is set in advance the circumstances under which the central bank can justify the non-fulfillment of the targets. The inflation target design in New Zealand, South Africa, Czech Republic, and Switzerland includes escape clauses (Ferreira and Petrassi, 2002). In New Zealand, they can be invoked in the case of unpredictable events that can affect inflation rate, such as natural disasters, and change in commodity prices and indirect tax rates. In South Africa, escape clauses include significant change in terms of trade, natural disasters, and interruption of external capital flows. Besides significant changes in international prices and agricultural production, natural disasters, and change in indirect tax rates, escape clauses in Czech Republic comprise changes in regulated prices that affect more than 1-1.5 percentage points the headline inflation, and large changes in exchange rate not related to domestic monetary policy. In Switzerland, escape clauses refer to change in exchange rate and some prices such as oil, and imported goods.

There is clearly a trade-off in the adoption of escape clauses in the framework. Their inclusion allows a better assessment of the conduct of central bank, and may

avoid excessive responses of monetary policy that could occur otherwise. However, their adoption may signal that the monetary authority will be lenient to some inflationary pressures, and their excessive use can affect the credibility of the regime.

In the Brazilian case, since the regime is still relatively new, and its credibility is still under construction, the adoption of escape clauses could affect negatively its credibility. Furthermore, the tolerance intervals should be enough to accommodate most of the shocks that the economy is subject to.

5.3. Tolerance intervals (bands)

The limits of the forecasting models, the possibility of unexpected shocks hitting the economy, and the presence of lags in the effects of monetary policy justify either the use of tolerance intervals for the point targets or the use of range targets in the case of absence of point targets in most of the inflation-targeting countries. The size of the bands varies across countries: it goes from 1 percentage point in Australia and Israel, to 3 percentage points in South Africa, 3.5 in Island, and 4 in Brazil for 2002, and 5 for 2003 and 2004.

The size of the bands should be large enough to allow that in most of the circumstances the inflation rate is within them, but at the same time they are not supposed to be too large to avoid a lenient conduct of monetary policy. The size of the bands has to be established according to the importance of the three factors mentioned above: it depends on the limits of the forecasting models, the frequency and magnitude of shocks that the economy is subject to, and the lag length of the effects of monetary policy. In the Brazilian economy, it is clear that the first two factors lead to a larger band size. First, other economies can use models estimated using a large sample because they have a much longer history of stability, and in many cases the inflation-targeting regime has been adopted over a larger period.[39] As a result, the forecast model can be estimated more precisely. In Brazil, the dynamics of inflation in the high inflation period are markedly different from those in the low inflation period. As a consequence, most of the estimations that model inflation have to start after June 1994. Moreover, with just three years of inflation targeting, possible structural breaks in the relationships are not easily found. Second, the Brazilian economy has been hit by

[39] Since there is a transition period of learning, possible structural changes with the new regime can be found more easily with a larger sample.

frequent and large shocks. Most of them are related to its position as an emerging market economy – high volatility of country risk premium and of exchange rate – and to some structural transformations that led to change in relative prices. The volatility of inflation rate and exchange rate in Brazil is still one of the highest in inflation targeting economies.

As we saw in previous sections, the exchange rate depreciation accounted for 38% and 48% of the inflation rate in 2001 and Jan.-Aug. 2002, respectively. Furthermore, exchange rate shocks explain 24.9% and 32.8% of the 12-month ahead forecast error variance of inflation rate considering samples for the whole period of the Real Plan and for the inflation-targeting period, respectively. The upper limit of the tolerance interval in 2001 was not enough to accommodate the shocks. Taking into account these factors that affect the band size, the National Monetary Council (CMN) has enlarged the tolerance intervals from 2 p.p. to 2.5 p.p. above and below the central targets for 2003 and 2004.

5.4. Establishment of targets and target horizon

The inflation targets have to be set taking into account both the long-term goal of price stability and the conditions for their achievement. If the actual or expected inflation rate is above the long-term goal, the targets have to be set in such way that the inflation rate converges to it. However, it is necessary to take into consideration the associated output costs, and some country specificities that may lead to a medium-term inflation rate goal above a long-term one.

The length of the target horizon has also implications for the magnitude of the response of monetary policy to shocks. The longer is the target horizon, the smaller are the effects of current shocks in the expected inflation for the target horizon. As a consequence, monetary policy tends to respond less to shocks.

The targets in Brazil are set in June by CMN for the end of the calendar year of two years ahead. The initial targets were established taking into account the domestic currency depreciation of the beginning of 1999, and aiming at reducing the inflation rate to low levels. In June 1999, the targets were established at 8%, 6%, and 4% for 1999, 2000, and 2001, respectively, and, in June 2000, at 3.5% for 2002. In principle, inflation targets should not be changed to avoid loss of credibility. Nevertheless, the continuous pursuing of targets that in advance are already perceived as having low probability of

being achievable reduces the credibility of the central bank. Taking into account this balance of risks, CMN decided in June 2002 to revise upwards the target for 2003 from 3.25% to 4%, and set the target at 3.75% for 2004. We consider that private agents in general have appraised positively the revision. Insisting on a little realistic target would have affected negatively the credibility of the monetary policy.

6. Conclusions

The inflation-targeting regime in Brazil is relatively new, but has shown to be important to achieve low levels of inflation rate even in a context of large shocks. The presence of a central bank committed to achieve preannounced inflation targets has worked as an important coordinator of expectations and generated a more stable inflation scenario. The pursuing of the goal, and the significant increase in the transparency that has marked the action of the monetary policy – including the release of the minutes of Copom meetings seven days after the event and of the quarterly *Inflation Report* – have contributed to the development of the awareness of the importance of the price stability commitment.

In this period, the regime has faced many challenges, including the construction of credibility – still under construction – the change in relative prices, and the exchange rate volatility. Dealing with them has required a large effort of the Central Bank, which itself has also learned substantially and has improved the system. The Central Bank has reacted strongly to inflation expectations, consistent with the inflation-targeting framework. The market expectations have behaved in a controlled way, even in the presence of inflationary shocks. The estimations also indicate a reduction in the degree of inflation persistence and in the volatility of output and inflation.

The increase in administered prices and the exchange rate depreciation have exerted significant inflationary pressures. The Central Bank has developed a methodology to estimate the different sources of inflation, which has been used in the conduct of monetary policy.

Several issues comprise the institutional design of the inflation-targeting framework. The conclusions appointed to the maintenance of headline inflation as the target and to the enlargement of the tolerance intervals (adopted for 2003 and 2004).

References

Bogdanski, Joel, Alexandre A. Tombini, and Sérgio R. C. Werlang (2000), "Implementing Inflation Targeting in Brazil", Working Paper Series no. 1, Central Bank of Brazil, July.

Bogdanski, Joel, Paulo S. de Freitas, Ilan Goldfajn, and Alexandre A. Tombini (2001), "Inflation Targeting in Brazil: Shocks, Backward-Looking Prices, and IMF Conditionality", Working Paper Series no. 24, Central Bank of Brazil, Aug.

Calvo, Guillermo, and Carmen Reinhart (2002), "Fear of Floating", *Quarterly Journal of Economics*, 117(2): 379-408, May.

Clarida, Richard, Jordi Galí, and Mark Gertler (1998), "Monetary Policy Rules in Practice: Some International Evidence", *European Economic Review*, 42: 1033-1067.

Clarida, Richard, Jordi Galí, and Mark Gertler (1999), "The Science of Monetary Policy: a New Keynesian Perspective", *Journal of Economic Literature*, XXXVII(4): 1661-1707.

Clarida, Richard, Jordi Galí, and Mark Gertler (2000), "Monetary Policy Rules and Macroeconomic Stability: Evidence and Some Theory", *Quarterly Journal of Economics*, Feb.

Favero, Carlo A., and Francesco Giavazzi (2002), "Why are Brazil's Interest Rates so High", mimeo.

Ferreira, Thaís P., and Myrian B. S. Petrassi (2002), "Regime de Metas para a Inflação: Resenha sobre a Experiência Internacional", Central Bank of Brazil, mimeo.

Figueiredo, Francisco M. R. (2001), "Evaluating Core Inflation Measures for Brazil", Working Paper Series no. 14, Central Bank of Brazil, Mar.

Figueiredo, Francisco M. R. (2002), "Os preços administrados e a inflação medida pelo IPCA", Central Bank of Brazil, mimeo.

Figueiredo, Francisco M. R., and Roberta B. Staub (2002), "Evaluación y combinación de mediciones de inflación de base para Brasil", *Monetaria*, Cemla, 29-50, Jan.-Mar.

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

Goldfajn, Ilan, and Gino Olivares (2001), "Can Flexible Exchange Rates Still "Work" in Financially Open Economies", G-24 Discussion Paper No 8.

Goldfajn, Ilan, and Sergio R.C. Werlang (2000) "The Pass-Through from Depreciation to Inflation: A Panel Study, Banco Central do Brasil", Working Paper Series nº5, Brasília

Hausmann, Ricardo, Ugo Panizza, and Ernesto Stein (2001), "Why do Countries Float the Way They Float", Journal of Development Economics, 66(2): 387-414

Kuttner, Kenneth N., and Adam S. Posen (1999), "Does Talk Matter After All? Inflation Targeting and Central Bank Behavior", mimeo

Mishkin, Frederic (2000), “Inflation Targeting in Emerging Market Countries”, NBER Working Paper Series 7618, Cambridge MA

Mishkin, Frederic, and Klaus Schmidt-Hebbel (2002), "A Decade of Inflation Targeting in the World: What Do We Know and What Do We Need to Know?", In: Loayza, Norman, and Raimundo Soto (eds.), *Inflation Targeting: Design, Performance, Challenges*, Santiago, Chile, Central Bank of Chile, pp.171-219.

Muinhos, Marcelo K. (2001), “Inflation Targeting in an Open Financially Integrated Emerging Economy: the Case of Brasil”, Working Paper Series no.26, Central Bank of Brazil, Aug.

Schmidt-Hebel, Klaus, and Alejandro Werner (2002), "Inflation Targeting in Brazil, Chile, and Mexico: Performance, Credibility and the Exchange Rate", Working Paper no. 171, Central Bank of Chile, July

Silva, Marcelo E. A. da, and Marcelo S. Portugal (2002), "Inflation Targeting in Brazil: an Empirical Evaluation", mimeo.

Sims, Christopher A., James H. Stock, and Mark W. Watson (1990), “Inference in Linear Time Series Models with Some Unit Roots”, *Econometrica*, 58 (1): 113-144, Jan.

Taylor, John B. (1993), "Discretion versus Policy Rules in Practice", *Carnegie-Rochester Conference Series on Public Policy*, 39:195-214.

Watson, Mark W. (1994), “Vector Autoregression and Cointegration”, In: Engle, R. F. and D. L. McFadden (eds.), *Handbook of Econometrics*, vol. IV, Amsterdam, Elsevier, pp. 2844-2915.

Banco Central do Brasil

Trabalhos para Discussão

Os Trabalhos para Discussão podem ser acessados na internet, no formato PDF,
no endereço: *http://www.bc.gov.br*

Working Paper Series

Working Papers in PDF format can be downloaded from: http://www.bc.gov.br

1	**Implementing Inflation Targeting in Brazil** *Joel Bogdanski, Alexandre Antonio Tombin e Sérgio Ribeiro da Costa Werlang*	Jul/2000
2	**Política Monetária e Supervisão do Sistema Financeiro Nacional no Banco Central do Brasil** *Eduardo Lundberg*	Jul/2000
	Monetary Policy and Banking Supervision Functions on the Central Bank *Eduardo Lundberg*	Jul/2000
3	**Private Sector Participation: A Theoretical Justification of the Brazilian Position** *Sérgio Ribeiro da Costa Werlang*	Jul/2000
4	**An Information Theory Approach to the Aggregation of Log-Linear Models** *Pedro H. Albuquerque*	Jul/2000
5	**The Pass-through from Depreciation to Inflation: A Panel Study** *Ilan Goldfajn e Sérgio Ribeiro da Costa Werlang*	Jul/2000
6	**Optimal Interest Rate Rules in Inflation Targeting Frameworks** *José Alvaro Rodrigues Neto, Fabio Araújo e Marta Baltar J. Moreira*	Jul/2000
7	**Leading Indicators of Inflation for Brazil** *Marcelle Chauvet*	Set/2000
8	**The Correlation Matrix of the Brazilian Central Bank's Standard Model for Interest Rate Market Risk** *José Alvaro Rodrigues Neto*	Set/2000
9	**Estimating Exchange Market Pressure and Intervention Activity** *Emanuel-Werner Kohlscheen*	Nov/2000
10	**Análise do Financiamento Externo a Uma Pequena Economia** *Carlos Hamilton Vasconcelos Araújo e Renato Galvão Flôres Júnior*	Mar/2001
11	**A Note on the Efficient Estimation of Inflation in Brazil** *Michael F. Bryan e Stephen G. Cecchetti*	Mar/2001
12	**A Test of Competition in Brazilian Banking** *Márcio I. Nakane*	Mar/2001

13	**Modelos de Previsão de Insolvência Bancária no Brasil** *Marcio Magalhães Janot*	Mar/2001
14	**Evaluating Core Inflation Measures for Brazil** *Francisco Marcos Rodrigues Figueiredo*	Mar/2001
15	**Is It Worth Tracking Dollar/Real Implied Volatility?** *Sandro Canesso de Andrade e Benjamin Miranda Tabak*	Mar/2001
16	**Avaliação das Projeções do Modelo Estrutural do Banco Central do Brasil Para a Taxa de Variação do IPCA** *Sergio Afonso Lago Alves*	Mar/2001
	Evaluation of the Central Bank of Brazil Structural Model's Inflation Forecasts in an Inflation Targeting Framework *Sergio Afonso Lago Alves*	Jul/2001
17	**Estimando o Produto Potencial Brasileiro: Uma Abordagem de Função de Produção** *Tito Nícias Teixeira da Silva Filho*	Abr/2001
	Estimating Brazilian Potential Output: A Production Function Approach *Tito Nícias Teixeira da Silva Filho*	Ago/2002
18	**A Simple Model for Inflation Targeting in Brazil** *Paulo Springer de Freitas e Marcelo Kfoury Muinhos*	Abr/2001
19	**Uncovered Interest Parity with Fundamentals: A Brazilian Exchange Rate Forecast Model** *Marcelo Kfoury Muinhos, Paulo Springer de Freitas e Fabio Araújo*	Maio/2001
20	**Credit Channel without the LM Curve** *Victorio Y. T. Chu e Márcio I. Nakane*	Maio/2001
21	**Os Impactos Econômicos da CPMF: Teoria e Evidência** *Pedro H. Albuquerque*	Jun/2001
22	**Decentralized Portfolio Management** *Paulo Coutinho e Benjamin Miranda Tabak*	Jun/2001
23	**Os Efeitos da CPMF sobre a Intermediação Financeira** *Sérgio Mikio Koyama e Márcio I. Nakane*	Jul/2001
24	**Inflation Targeting in Brazil: Shocks, Backward-Looking Prices, and IMF Conditionality** *Joel Bogdanski, Paulo Springer de Freitas, Ilan Goldfajn e Alexandre Antonio Tombini*	Ago/2001
25	**Inflation Targeting in Brazil: Reviewing Two Years of Monetary Policy 1999/00** *Pedro Fachada*	Ago/2001
26	**Inflation Targeting in an Open Financially Integrated Emerging Economy: the case of Brazil** *Marcelo Kfoury Muinhos*	Ago/2001

27	**Complementaridade e Fungibilidade dos Fluxos de Capitais Internacionais** *Carlos Hamilton Vasconcelos Araújo e Renato Galvão Flôres Júnior*	Set/2001
28	**Regras Monetárias e Dinâmica Macroeconômica no Brasil: Uma Abordagem de Expectativas Racionais** *Marco Antonio Bonomo e Ricardo D. Brito*	Nov/2001
29	**Using a Money Demand Model to Evaluate Monetary Policies in Brazil** *Pedro H. Albuquerque e Solange Gouvêa*	Nov/2001
30	**Testing the Expectations Hypothesis in the Brazilian Term Structure of Interest Rates** *Benjamin Miranda Tabak e Sandro Canesso de Andrade*	Nov/2001
31	**Algumas Considerações Sobre a Sazonalidade no IPCA** *Francisco Marcos R. Figueiredo e Roberta Blass Staub*	Nov/2001
32	**Crises Cambiais e Ataques Especulativos no Brasil** *Mauro Costa Miranda*	Nov/2001
33	**Monetary Policy and Inflation in Brazil (1975-2000): a VAR Estimation** *André Minella*	Nov/2001
34	**Constrained Discretion and Collective Action Problems: Reflections on the Resolution of International Financial Crises** *Arminio Fraga e Daniel Luiz Gleizer*	Nov/2001
35	**Uma Definição Operacional de Estabilidade de Preços** *Tito Nícias Teixeira da Silva Filho*	Dez/2001
36	**Can Emerging Markets Float? Should They Inflation Target?** *Barry Eichengreen*	Fev/2002
37	**Monetary Policy in Brazil: Remarks on the Inflation Targeting Regime, Public Debt Management and Open Market Operations** *Luiz Fernando Figueiredo, Pedro Fachada e Sérgio Goldenstein*	Mar/2002
38	**Volatilidade Implícita e Antecipação de Eventos de Stress: um Teste para o Mercado Brasileiro** *Frederico Pechir Gomes*	Mar/2002
39	**Opções sobre Dólar Comercial e Expectativas a Respeito do Comportamento da Taxa de Câmbio** *Paulo Castor de Castro*	Mar/2002
40	**Speculative Attacks on Debts, Dollarization and Optimum Currency Areas** *Aloisio Araujo e Márcia Leon*	Abr/2002
41	**Mudanças de Regime no Câmbio Brasileiro** *Carlos Hamilton V. Araújo e Getúlio B. da Silveira Filho*	Jun/2002
42	**Modelo Estrutural com Setor Externo: Endogenização do Prêmio de Risco e do Câmbio** *Marcelo Kfoury Muinhos, Sérgio Afonso Lago Alves e Gil Riella*	Jun/2002

43	**The Effects of the Brazilian ADRs Program on Domestic Market Efficiency** *Benjamin Miranda Tabak e Eduardo José Araújo Lima*	Jun/2002
44	**Estrutura Competitiva, Produtividade Industrial e Liberação Comercial no Brasil** *Pedro Cavalcanti Ferreira e Osmani Teixeira de Carvalho Guillén*	Jun/2002
45	**Optimal Monetary Policy, Gains from Commitment, and Inflation Persistence** *André Minella*	Ago/2002
46	**The Determinants of Bank Interest Spread in Brazil** *Tarsila Segalla Afanasieff, Priscilla Maria Villa Lhacer e Márcio I. Nakane*	Ago/2002
47	**Indicadores Derivados de Agregados Monetários** *Fernando de Aquino Fonseca Neto e José Albuquerque Júnior*	Set/2002
48	**Should Government Smooth Exchange Rate Risk?** *Ilan Goldfajn e Marcos Antonio Silveira*	Set/2002
49	**Desenvolvimento do Sistema Financeiro e Crescimento Econômico no Brasil: Evidências de Causalidade** *Orlando Carneiro de Matos*	Set/2002
50	**Macroeconomic Coordination and Inflation Targeting in a Two-Country Model** *Eui Jung Chang, Marcelo Kfoury Muinhos e Joanílio Rodolpho Teixeira*	Set/2002
51	**Credit Channel with Sovereign Credit Risk: an Empirical Test** *Victorio Yi Tson Chu*	Set/2002
52	**Generalized Hyperbolic Distributions and Brazilian Data** *José Fajardo e Aquiles Farias*	Set/2002