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Publisher: Routledge

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International Review of Applied Economics

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/cira20>

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Published online: 18 Mar 2008.

To cite this article: Nelson H. Barbosa-Filho (2008) Inflation targeting in Brazil: 1999-2006, International Review of Applied Economics, 22:2, 187-200, DOI: [10.1080/02692170701880684](https://doi.org/10.1080/02692170701880684)

To link to this article: <http://dx.doi.org/10.1080/02692170701880684>

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Inflation targeting in Brazil: 1999–2006

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This paper describes the Brazilian experience with inflation targeting in 1999–2006. The data presented in the paper show that inflation targeting managed to reduce inflation in Brazil after its 1999 and 2002 currency crises, with a substantial help of exchange-rate appreciation. The data also show that economic growth was slow under inflation targeting than during exchange-rate targeting in Brazil, but with a smaller volatility and an apparent upward trend during inflation targeting than during exchange-rate targeting. The paper also shows that inflation targeting reduced the real interest rate of the economy, which nevertheless remained well above international standards and more than three times higher than the Brazilian gross domestic product growth rate.

Keywords: Brazil; inflation targeting; monetary policy; exchange rate

JEL classifications: E000, N160, O230

Brazil adopted inflation targeting after a brief period of exchange-rate targeting that ended up in a major currency crisis. More specifically, in 1994–1998 the Brazilian Government used high domestic interest rates and privatization to attract foreign capital and sustain an appreciated exchange rate peg. The main objective of the Brazilian economic policy at that time was to reduce inflation and the main side effect of exchange-rate appreciation was a substantial increase in the country's current account deficit and net public debt. Similar to what happened in Mexico and Argentina during the 1990s, the Brazilian macroeconomic stabilization strategy was heavily dependent on the continuous inflow of foreign capital and, as a result, the international financial position of Brazil became increasingly fragile after the contagion effects from the East Asian currency crises of 1997 and the Russian currency crisis of 1998. In fact, by the end of 1998 Brazil's current-account deficit reached 4.5% of gross domestic product (GDP) and the low stock of foreign reserves of the Brazilian Central Bank did not allow a defense of the Brazilian currency, the *real*, in case another speculative attack hit the country.

The inevitable currency crisis came in the beginning of 1999 and resulted in a 'maxi-devaluation' of the *real*. In numbers the Brazilian *real*/US dollar exchange rate rose 57% in just two months, that is, from 1.21 in December 1998 to 1.90 in February 1999. After that the exchange rate dropped a little and then remained around 1.84 during the rest of 1999, that is, the exchange rate stabilized at a level 52% higher than before the crisis. The initial response of the Brazilian Central Bank (BCB) to such an abrupt devaluation of the *real* was a substantial increase in its base interest rate to stop the capital flight from Brazil and to reduce the pass-through of exchange-rate depreciation to inflation.¹ Then, after the exchange rate stabilized at a higher level, in mid 1999, the Government announced that it would start to target inflation. At that time the basic justification for such a move was that the Government needed to substitute a price target for

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the former exchange-rate target in order to coordinate market expectations and control inflation in a context of floating exchange rates.

In terms of the classic policy ‘trilemma’ of open economies, the option for inflation targeting meant that Brazil chose to have an independent monetary policy, free capital flows, and a floating exchange rate. In practice the situation was obviously different because the exchange rate was an important determinant of the Brazilian inflation rate during the period under analysis. On the one hand, the change in the domestic price of tradable goods in Brazil was (and it continues to be) basically determined by foreign inflation and exchange-rate variations. On the other hand, the prices of some key non-tradable goods in Brazil were also tied to the exchange rate because, during the privatizations of the 1990s, the government allowed the price of some public utilities (basically in the telecommunication and energy sectors) to follow a price index that is heavily influenced by the exchange rate. The inevitable result was that a major part of the Brazilian inflation rate was linked to the exchange rate in 1999–2006.²

Given the centrality of the exchange rate for Brazilian inflation, it is no surprise that inflation targeting resulted in a disguised and loose exchange-rate targeting by the BCB in 1999–2006. In theory the exchange rate was free to float, but in practice the country ended up with an asymmetric dirty floating regime, that is, a regime in which the BCB had to fight devaluations but to tolerate revaluations in order to meet the inflation targets set by the Brazilian Government. As a result, the interaction between the international financial conditions on the one side and the Brazilian interest rates on the other side explains most of the behavior of the exchange rate in Brazil in 1999–2006, which in its turn explain most of the successes and failures of inflation targeting during that period. The objective of this paper is to describe and analyze this experience.³

The Brazilian inflation-targeting regime

The institutional basis of the Brazilian inflation targeting system can be described as follows:

- The National Monetary Council (*Conselho Monetário Nacional* or CMN), formed by the Minister of Finance, the Minister of Planning and the President of the BCB, establishes the inflation targets based on the recommendations of the Finance Minister. All three members are appointed by the President and do not have fixed mandates.
- In June of every year, the CMN establishes the inflation targets, and their corresponding intervals of tolerance, for the next two years. The target consists of the desired variation of a consumer price index (the IPCA index) estimated by the government’s statistical branch (the *Instituto Brasileiro de Geografia e Estatística* or IBGE).
- The BCB is responsible for achieving the target, but no specific instrument or strategy is specified.⁴
- The Monetary Policy Committee (*Comitê de Política Monetária* or Copom), formed by the President and the Directors of the BCB, decides the level of the Central Bank’s base interest rate, known as the SELIC rate, needed to achieve the inflation target. Occasionally, additional actions such as changes in the banks’ reserve requirements can be taken.⁵
- The target is considered met whenever the observed accumulated inflation during each calendar year falls within the interval of tolerance specified by the CMN.
- If the targets are not met, the President of the BCB has to issue an open letter to the Minister of Finance explaining the causes of the failure, the measures to be adopted to ensure that inflation returns to the target level, and the period of time needed for this to happen.

Since the BCB is not independent and its penalty for not meeting the inflation target is just to explain why that happened, we can conclude that the Brazilian inflation-targeting regime is

basically a loose way for the federal government to assure society, especially financial markets, that it will not let inflation run out of control.

Macroeconomic performance

The macroeconomic performance of Brazil since the adoption of inflation targeting has been mixed. First, considering inflation itself, the Government's targets were met when the international financial conditions allowed it, that is, inflation targeting was successful when the exchange-rate dynamics helped the BCB efforts to control inflation. Second, when compared with the period of exchange-rate targeting, inflation targeting brought a reduction in the base domestic real interest rate, but the Brazilian rate remained well above the international standards because the country needed to appreciate the exchange rate in order to meet its inflation targets. Third, the high real interest rate put an expansionary pressure on the net public debt and this had to be compensated by an increase in the government's primary surplus, that is, the government budget surplus excluding net interest payments. Fourth, the growth performance of the economy under inflation targeting did not improve much when compared with the previous period of exchange-rate targeting, and this happened even though the international environment was much more favorable for economic growth in 1999–2006 than in 1994–1998.⁶ To facilitate the analysis, we will deal with each one of these issues separately below.

Starting with inflation itself, Table 1 presents the annual inflation targets set by the CMN and the effective rates of inflation and exchange-rate variation in 1999–2006. If we consider the whole period the inflation targets were met in five out of eight years, which on a first look seems to be a very good starting performance of inflation targeting in Brazil. However, when we look closer the real story cannot be considered that successful because the inflation targets were frequently changed according to the shocks that hit the Brazilian economy and, most importantly, disinflation was obtained mostly through exchange-rate appreciation. In fact, if we exclude 1999 from the analysis, the inflation targets were met only when the exchange-rate appreciated in nominal terms. To illustrate this point, Figure 1 shows that in 2000, 2004, 2005 and 2006 the target was met and the exchange-rate appreciated, in 2001 and 2002 the target was not met and the exchange rate depreciated, and in 2003 the target was not met and the exchange rate appreciated.

Now, before we move to the real interest rate, let us make a brief pause to present some of the history behind the numbers shown in Table 1. First, since the Brazilian inflation-targeting regime started immediately after a currency crisis, there was a 7.2 percentage point (pp for short) increase in inflation in 1999 when compared with 1998.⁷ Despite such acceleration, the Government inflation target for 1999 was met for two idiosyncratic reasons: first, the 1999 target was set in June of that year, when the government authorities already knew half of the annual inflation rate of 1999 and, second, the target for 1999 was not ambitiously low in order not to undermine the credibility of the new policy regime.⁸

Continuing with our inflation story, in 2000 the Brazilian exchange rate stabilized at a new and higher level, both in real and nominal terms, and this helped the BCB to reduce inflation and meet the inflation target set for that year. Then, in 2001, Brazil was hit by two major shocks that made the 6.0% inflation target unfeasible. First, because of an unexpected drought, there was a shortage in the supply of electricity from hydro-electric plants during 2001 and, because most of Brazil's electrical power comes from this source, the adverse energy shock pushed inflation upwards. Second and most important, the 2001 currency crisis in Argentina resulted in capital flight from and exchange-rate depreciation in Brazil, pushing the domestic price of tradable goods up. Altogether the final result of these two adverse shocks was a 1.7 pp increase in the Brazilian inflation rate in 2001, when compared with 2000.⁹

Table 1. Inflation, exchange rates, GDP growth and interest rates in Brazil (all figures in %).

	1998	1999	2000	2001	2002	2003	2004	2005	2006
<i>Effective inflation rate</i>									
End of the period	1.7	8.9	6.0	7.7	12.5	9.3	7.6	5.7	3.1
Average of the period	3.2	4.9	7.0	6.8	8.4	14.7	6.6	6.9	4.2
<i>Target inflation rate (end of the period)</i>									
Initial target	NA	8.00	6.00	4.00	3.50	4.00	5.50	4.50	4.50
Ceiling	NA	10.00	8.00	6.00	5.50	6.50	8.00	7.00	6.50
Floor	NA	6.00	4.00	2.00	1.50	1.50	3.00	2.00	2.50
Was the target revised?	NA	NO	NO	NO	NO	YES	NO	YES	NO
Revised target						8.5		5.1	
Was the target met?	NA	YES	YES	NO	NO	NO	YES	YES	YES
<i>Nominal exchange-rate variation</i>									
End of the period	8.3	36.7	-2.2	16.0	35.1	-15.3	-4.8	-20.5	-1.3
Average of the period	7.7	56.4	0.9	28.4	24.3	5.4	-4.9	-16.8	-10.6
GDP growth rate	0.0	0.3	4.3	1.3	2.7	1.1	5.7	2.9	3.7
<i>Base interest rate</i>									
Nominal base interest rate	28.8	25.6	17.4	17.3	19.2	23.3	16.2	19.1	15.1
Real base interest rate	26.6	15.3	10.8	8.9	6.0	12.8	8.0	12.7	11.6

Source: Brazilian Central Bank (www.bcb.gov.br) and author's calculation.

Notes: The inflation targets are the targets set at least one year in advance. The exception is 1999, when the target was set in June of that year. The revised target is the target set in the corresponding year. The exchange-rate variation refers to the Brazilian real/US dollar exchange rate, and the base interest rate is the SELIC interest rate, set by the Central Bank of Brazil, and cumulated over the year. The real interest rate was obtained by deflating the nominal interest rate by the inflation rate cumulated over the year, according to the IPCA index. NA= Not applicable

The macroeconomic turmoil of 2001 was followed by more instability in 2002, this time because of the Brazilian political cycle and the speculative international capital flows associated with it. More specifically, in 2002 Brazil had its presidential election and the looming victory of a leftist candidate, Lula, resulted in massive capital outflows and an unprecedented cut in Brazil's access to foreign lines of credit. The exchange-rate shot up as a result of this move, reaching its highest level in real terms since the debt crisis of the early 1980s. The Brazilian inflation rate followed soon after and reached double-digit levels at the end of 2002. In fact, the exchange-rate depreciation and inflation acceleration were so sharp and fast that they even made the Brazilian monthly base interest rate temporarily negative at the end of 2002. Altogether the inflation rate increased another 4.8 pp in 2002, when compared with 2001.

Lula was elected president in 2002 and his first term in office started with a sharp monetary and fiscal crunch in order to reduce inflation and restore the country's access to foreign finance. Lula's move and the very own overshooting associated the speculative attack to the Brazilian currency in 2002 quickly resulted in a return to normality, that is, a return to capital inflows and exchange-rate appreciation. Inflation decelerated to one-digit levels in 2003, with a reduction of 3.2 pp in relation to 2002. Despite this disinflation, the inflation target for 2003 was not met, even after the Lula administration revised it upwards because of the exchange-rate depreciation of 2002.¹⁰

After the failure in 2001–2003, the Brazilian inflation target regime started to perform well again in 2004–2006. Most of this success can be credited to the exchange-rate appreciation during these three years, which in its turn resulted from both the high domestic interest rates of Brazil

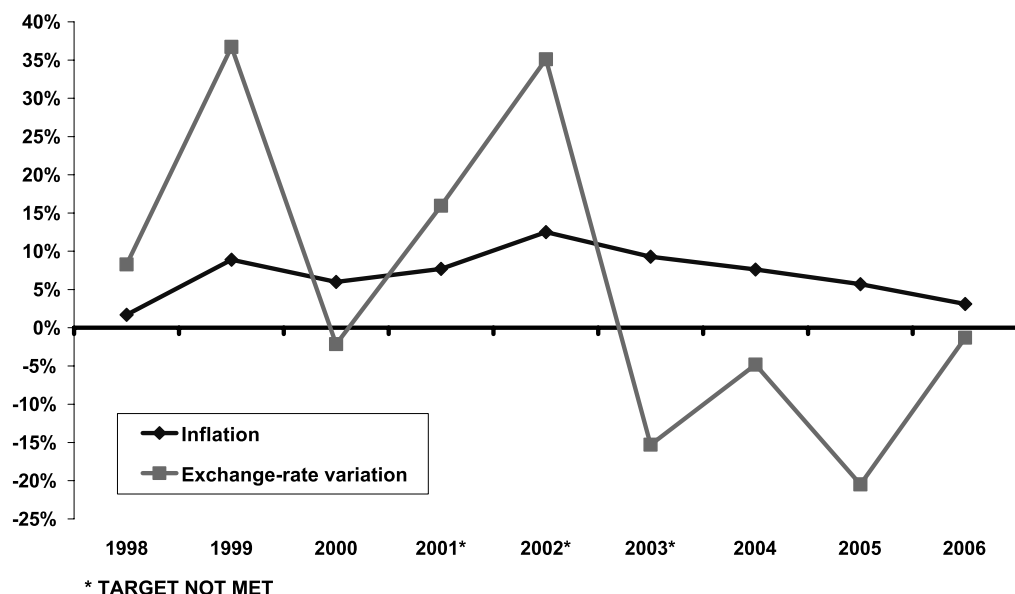


Figure 1. Consumer inflation rate and exchange-rate variation in Brazil.

Source: Brazilian Central Bank (www.bcb.gov.br). Note: The inflation rate is the variation in the IPCA index, December over December, and the exchange-rate variation in the rate of change in the Brazilian *real*/US dollar exchange rate, also December over December.

and the favorable international trade and financial conditions in the rest of the world. More specifically, on the one hand the BCB continued to practice high real interest rates in 2004–2006 and this resulted in a gradual appreciation of the Brazilian exchange-rate, in nominal and in real terms, as shown in Figures 2 and 3.¹¹ On the other hand, the exchange-rate appreciation of 2004–2006 was also driven by the boom in Brazilian exports, pulled by the rise in the world demand for commodities, which in their turn increased the country's trade and current-account surpluses. It should be noted that the improvement in the Brazilian balance of payments happened despite the exchange-rate appreciation for two reasons: first, the increase in international prices offset the reduction in the exchange rate for many sectors and, second, the depreciation in 2001 and 2002 was so intense that only at the end of 2005 did the Brazilian real exchange rate return to the level reached in 1999.

Altogether the inflation-targeting performance of Brazil in 1999–2006 can be divided into three phases: (i) *implementation*, in 1999–2000, when the favorable international conditions and the modest inflation targets proved to be very successful; (ii) *crisis*, in 2001–2003, when a combination of adverse supply shocks and financial crises made the ambitiously low inflation targets infeasible; and (iii) *consolidation*, in 2004–2006, when the very favorable international conditions and the high real domestic interest rates resulted in a quick reduction in inflation. Let us now turn to the evolution of the Brazilian base real interest rate throughout this process.

Figure 4 shows the real base interest rate of Brazil since 1994 in order to allow a comparison between the exchange-rate targeting and the inflation targeting regimes. The first thing that draws one's attention is the very high real interest rate of Brazil during its exchange-rate targeting regime and the substantial reduction brought by inflation targeting. In numbers, the average annual real base interest rate of Brazil was 21.9% in 1994–1998, and 10.7% in 1999–2006.¹² Despite such a substantial reduction in the real interest rate, it should also be noted that during the

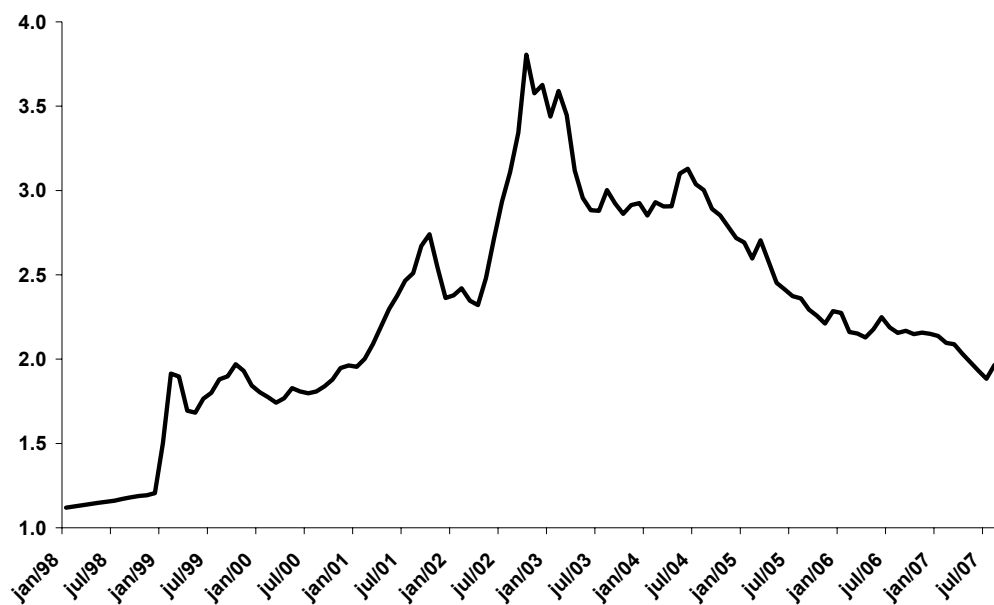


Figure 2. Nominal exchange rate in Brazil – Brazilian *real* per US dollar.
Source: IPEADATA (www.ipeadata.gov.br).

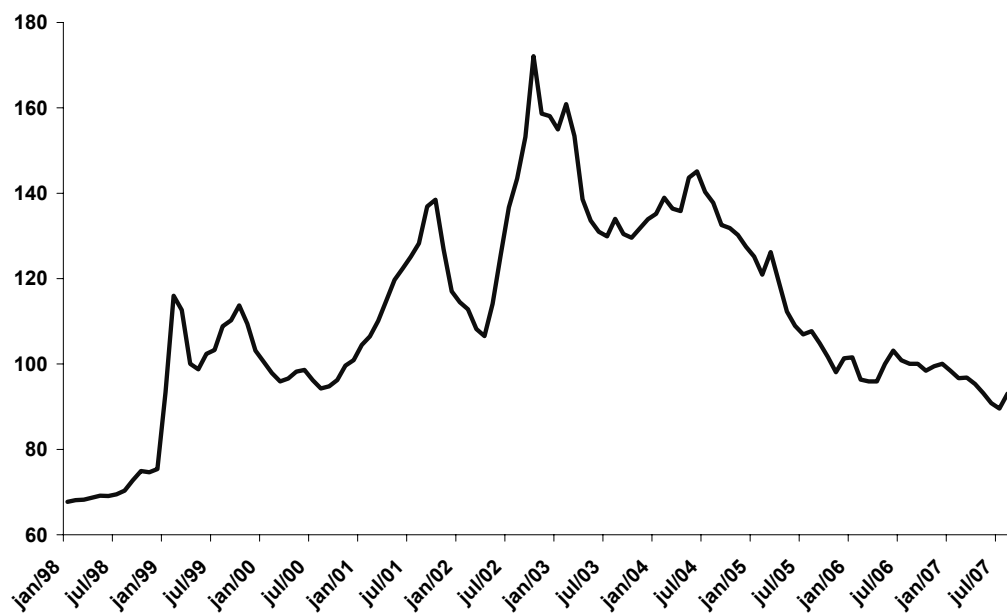


Figure 3. Index of the real effective exchange rate of Brazil (1992=100).
Source: Central Bank of Brazil (www.bcb.gov.br).

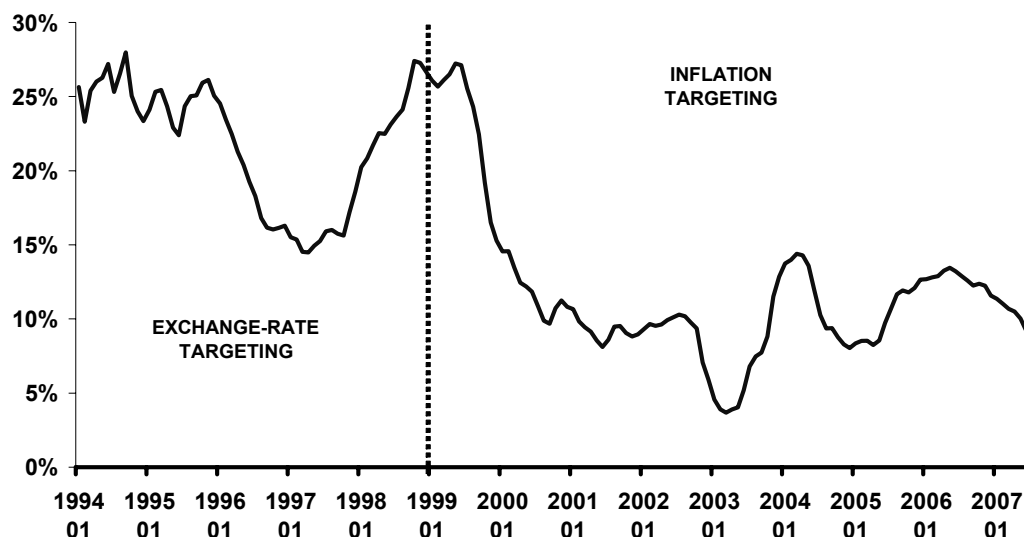


Figure 4. Real annual base interest rate in Brazil.

Source: Central Bank of Brazil and author's calculation. Note: The real interest rate is the SELIC interest rate, set by the Brazilian Central Bank, cumulated over the previous 12 months, deflated by the consumer inflation rate also cumulated over the previous 12 months, measured by the IPCA index.

inflation-targeting regime the Brazilian rate continued to be extremely high by international standards and, more important, the Brazilian real interest rate was extremely high when compared with the average GDP growth rate of the economy in 1999–2006: 2.7%.

Focusing our analysis on 1999–2006, Figure 4 shows that inflation targeting started with very high real interest rates in Brazil. As we mentioned earlier, the reason for this was the Brazilian 1999 currency crisis, which led the BCB to increase interest rates abruptly and substantially to stop the capital outflows from the country. Then, after inflation targeting was formally introduced, in mid 1999, the real base interest rate started to fall until it reached 9.5% at the end of 2000. After that the real interest rate fluctuated between 8% and 10% until the end of 2002, when the devaluation of the *real* associated with Lula's election and the subsequent increase in inflation made BCB's base interest rate temporarily negative. 'Normality' was quickly restored in the beginning of 2003, when the Lula administration raised the real interest rate of the economy to 14.3% in order to stop devaluation and decelerate inflation. When it became clear that such an effort was successful, in mid 2003, the real base interest rate started to fall gradually. The interest-rate cuts persisted until the end of 2004, when the acceleration of GDP growth made the BCB fear that the market's expectation for inflation would accelerate above the target set for 2005.¹³ The BCB's response to this possible threat was another interest-rate hike, which made the Brazilian real interest rate reach 13.4% in mid 2006.

The increase in the interest rate in 2005 resulted in a sharp appreciation of the *real* and a deceleration of GDP growth. By the end of 2005 it was clear that the BCB's response to the increase in the level of economic activity at the end of 2004 was exaggerated and, in addition to the huge discrepancy between Brazilian and international interest rates, this could compromise the country's fiscal stability. The BCB's response was another round of gradual interest-rate cuts, which made the base Brazilian real interest rate fall to 'just' 11.6% at the end of 2006, that is, a still abnormally high real interest rate by international standards and well above the GDP growth rate of the economy in that year, 3.7%.

Moving to fiscal policy, the main side effect of the Brazilian high real interest rates was the expansionary impact of net interest payments on public expenditures and debt. Table 2 presents the main fiscal numbers for the period, from which we can identify two distinct phases in the evolution of the net public debt of Brazil. First, in the first four years of inflation targeting most of the Government net debt was directly or indirectly tied to the exchange rate because the Brazilian Government was a net debtor in foreign currency and most of its domestic debt was formally indexed to the either the exchange rate or the interest rate.¹⁴ So, in the wake of the 1999 currency crisis and the interest-rate hike that followed it, the net interest payments by the Brazilian public sector shot up to 12.5% of GDP, and the ratio of its net public debt to GDP increased in 5.6 pp in just one year. Then, as the exchange rate stabilized at a new and higher level, the net interest payments by the public sector fell to less than 10% of GDP in 2000–2001, but the net domestic debt of the Government continued to rise gradually in relation to GDP because of the huge difference between the real interest rate on the one side, and the growth rate of the economy on the other side. The first phase of debt dynamics ended in 2002, when Brazil experienced another sharp and abrupt exchange-rate depreciation, the net interest payments by the public sector shot up to 13% of GDP, and the net public debt of the country rose to 50.5% of its GDP.

The second phase in the dynamics of public debt began in 2003, when the exchange-rate appreciation started to reduce the government net interest payments. The ratio of net public debt to GDP followed the same path in 2004–2006, when the Brazilian government was able to repay most of its foreign debt and accumulate a huge amount of foreign reserves. This movement was obviously facilitated by the favorable international trade and financial conditions of the period

Table 2. Fiscal policy in Brazil.

	1998	1999	2000	2001	2002	2003	2004	2005	2006
<i>Public debt in % of GDP</i>									
Net domestic debt	33.2	35.2	36.5	38.9	37.5	41.7	40.2	44.1	47.6
Monetary base	4.0	4.2	3.9	3.9	4.2	4.2	4.4	4.7	5.1
Non-monetary debt	29.2	31.0	32.7	34.9	33.3	37.5	35.8	39.4	42.5
Net foreign debt	5.8	9.4	9.0	9.6	13.0	10.7	6.8	2.3	−2.7
Net domestic and foreign debt	38.9	44.5	45.5	48.4	50.5	52.4	47.0	46.5	44.9
<i>Budget balance of the public sector in % of GDP</i>									
Primary deficit	0.0	−3.0	−3.3	−3.4	−3.7	−3.9	−4.2	−4.4	−3.9
Net interest payments	7.4	12.5	7.4	8.2	13.0	7.2	6.5	7.1	6.8
On foreign debt	0.3	0.9	0.8	1.1	1.2	1.1	0.9	0.7	0.3
On domestic debt	7.1	11.5	6.6	7.1	11.8	6.1	5.6	6.5	6.5
Nominal deficit	7.4	9.5	4.1	4.8	9.3	3.3	2.3	2.8	2.9
<i>Primary budget of the Federal Government in % of GDP</i>									
Revenues	15.8	16.4	16.5	17.2	17.9	17.4	18.1	18.8	19.4
Expenditures	15.1	14.5	14.7	15.6	15.7	15.1	15.6	16.4	17.2
Net error and omissions	−0.3	0.2	0.0	0.0	0.0	0.0	0.2	0.1	0.1
Balance	0.5	2.1	1.7	1.7	2.2	2.3	2.7	2.6	2.2

Source: Brazilian Central Bank (www.bcb.gov.br) and author's calculation.

Notes: The primary deficit is the government budget deficit excluding net interest payments. The nominal deficit is the total budget deficit, that is, the primary deficit plus net interest payments by the public sector. The numbers for the whole Brazilian public sector refer to the federal, state and municipal governments, and the state-owned enterprises.

and, at the end of 2006, the Brazilian government became a net creditor in foreign currency. In contrast, on the domestic front, the high real interest rate continued to increase the Brazilian net public domestic debt, which reached the unprecedented high level of 47.6% of GDP at the end of the period. Altogether, we can say that in this second phase of debt dynamics inflation targeting was characterized by an increase in the ratio of net public domestic debt to GDP and a substitution of domestic debt for foreign debt.

To complete our fiscal outlook, Table 2 also shows the evolution of the federal government primary surplus and nominal budget deficit in the inflation-targeting period.¹⁵ Compared with the last year of exchange-rate targeting, most of the inflation targeting period was characterized by a gradual increase in the federal primary surplus.¹⁶ Most of this increase happened in 1999, when the Brazilian federal government cut its spending and increased its revenues in proportion to GDP in order to avoid an explosive increase in its public debt. After that the federal government's revenues and expenditures tended to grow together in relation to GDP, which in its turn had a small positive impact on economic growth through the balanced-budget multiplier. The second main fiscal crunch happened in 2003, when the federal government once more cut its spending in proportion to GDP in order to avoid an explosive increase in the country's net public debt. However, in variance to what happened in 1999, the federal government revenues also fell in proportion to GDP in 2003, which stabilized the primary surplus in terms of GDP.¹⁷ The federal government revenues and expenditures resumed growing faster than GDP in 2004–2006, and fiscal policy became expansionary at the end of the period.¹⁸

Finally, considering GDP growth, the inflation-targeting period had a slower rate of expansion than the exchange-rate period, but a smaller volatility as well. To illustrate this point, Figure 5 shows the moving-average annual GDP growth rate of Brazil in 1994–2006. In numbers, on the one hand the average GDP growth rate was 3.8% during the exchange-rate targeting period, against 2.7% during the inflation targeting period. On the other hand the maximum and minimum growth rates during exchange-rate targeting were 8.5% and zero, respectively, whereas during inflation targeting the maximum and minimum rates were 5.7% and minus 0.8%, respectively.

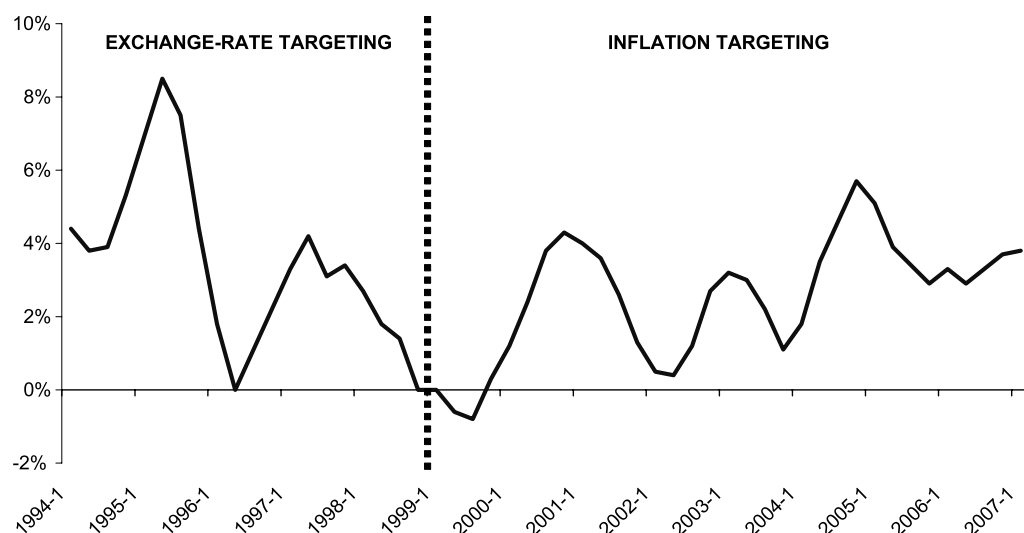


Figure 5. Moving-average of the annual GDP growth rate of Brazil.

Source: IBGE (www.ibge.gov.br) and author's calculation. Note: The growth rate is the rate of change of the average GDP during period t through $t-3$, in relation to the average GDP during period $t-4$ through $t-7$.

Finally, it should also be noted that the trend growth rate was stationary or declining during the exchange-rate targeting period, but rising during the inflation targeting period.

Figure 5 also reveals clearly the sequence of booms and busts experienced by the Brazilian economy since 1994. The downturns are usually associated with adverse shocks, and the upturns with expansionary macroeconomic policy. More specifically, the period starts with the boom brought by inflation reduction in 1994. This boom ended in 1995, when the Brazilian economy suffered the contagion effect from the Mexican crisis and the Brazilian government adopted restrictive macroeconomic measures to avoid exchange-rate depreciation and inflation acceleration. The second boom started after the Mexican crisis was absorbed by Brazil and lasted until 1997. Then, in 1997–1999, the Brazilian economy experienced another growth deceleration because of the contagion effects from the East Asian crises of 1997 and the Russian crisis of 1998, and because of the recessive impact of the very own Brazilian crisis of 1999. The economy resumed growth in 2000, but the expansion was quickly curtailed by the Argentine crisis and the Brazilian energy rationing of 2001. The Brazilian economy started another recovery in 2002, but the expansion was short-lived because of the speculative attack to the Brazilian currency during the presidential elections of that year. The exchange-rate depreciation and the restrictive macroeconomic measures adopted by the Brazilian government pushed economic growth down in 2003, and only in the beginning of 2004 did the economy start to recover. However, differently from all of the previous episodes, the 2004 expansion was cut for domestic reasons, namely: the fear of the BCB that the economy was overheating at the end of that year. As we saw earlier, interest rates were raised and economic growth decelerated by approximately 2 pp in 2005, but it still remained well above the previous troughs. Then, at the end of the period under analysis, in the second-half of 2006, the growth rate of the Brazilian economy started once again to accelerate.¹⁹

Inflation targeting, real exchange rates and potential output

Whether or not Brazil started a new growth cycle in recent years is an open question that depends, among other things, on the management of monetary policy. From the recent history of inflation targeting in Brazil, there are two main macroeconomic challenges to the Brazilian authorities that will eventually have to be addressed. First, so far the success of inflation targeting has depended heavily on a favorable behavior of the exchange rate and this cannot go on indefinitely. By definition real exchange-rate appreciation can not go on forever otherwise the country's currency will become infinitely expensive and, more important, an excessively appreciated real exchange rate can reduce the growth prospects of the economy. Second, so far inflation targeting has been characterized by slow GDP growth, both in comparison with Brazil's previous history and with the growth rate of the rest of the world. Also, because by definition any growth acceleration results in a temporary increase in the level of economic activity, it tends to create inflationary pressures and require compensatory measures by monetary policy. However, if monetary policy is too conservative in setting a low inflation target and a fast speed of convergence to it, the economy may end up locked in a slow-growth equilibrium where the central bank 'kills' any growth acceleration for fears of rising inflation. To complete our analysis of inflation targeting in Brazil, let us look at these two challenges in more detail.

First, regarding exchange rate, stable inflation requires a stable real exchange rate, but the level of the exchange rate is not determined *a priori*. There are multiple equilibria and, therefore, the real exchange rate can be stabilized at a competitive or an uncompetitive level. Thus, when the inflation target is ambitiously low and the speed of convergence to it too fast, there will be a tendency toward real exchange-rate appreciation, which in turn may end up increasing the financial fragility of the economy in the medium run, especially if appreciation is sustained by speculative capital inflows. The usual logical sequence here is that high real interest rate leads to

capital inflows and exchange-rate appreciation, which in turn leads to a reduction in the trade and current account balance of the economy, which in turn makes the economy more vulnerable to shifts in the international liquidity. So, when inflation targeting is too ambitious and financed by speculative capital inflows, the result tends to be a sequence of boom and bust, during which GDP growth fluctuates around a low rate. Another possibility is that inflation targeting stabilizes the real exchange rate at a new low level without compromising the balance of payments of the economy.²⁰ However, even in this case ambitious inflation targeting can still result in a slow growth rate because an appreciated real exchange rate does not stimulate the development of the domestic tradable sector. In other words, productivity growth is usually faster in the tradable sector and, therefore, an appreciated real exchange rate may end up reducing the overall growth rate of the economy.²¹

The natural solution to the exchange-rate challenge outlined above is to combine inflation targeting with an asymmetric dirty floating that maintains the country's real exchange rate stable and competitive in the long run. The dirty floating will have to be asymmetric because the instruments to combat appreciation are different from the ones used to combat depreciation in order to keep the real exchange rate competitive. In other words, in face of depreciation the government should use its traditional restrictive macroeconomic tools to stop the process and avoid an increase in inflation, without selling much of its foreign reserves. However, in face of appreciation, the government should buy the foreign currency to slow down the process, but with no open compromise with a specific exchange rate. The auxiliary measures to combat appreciation are obviously to increase imports and reduce domestic interest rates so that, at the end of the day, the asymmetric dirty floating ends up creating a sliding floor for the exchange rate.²²

Second, regarding growth, inflation targeting is usually aimed at stabilizing economic growth at its potential level, so that it eliminates excess demand pressures that tend to increase inflation, and insufficient demand pressures that do the opposite. The logic from the orthodox standpoint is that the long-run growth rate of the economy is given from outside of macroeconomic issues, by preferences and institutions, and the only thing a responsible central bank can do is to make the economy grow at its potential rate in the long run. So, according to the orthodox view of economic policy, attempts to grow faster than such supply-determined limits end up increasing inflation, with either no or negative permanent real effects on the economy. The main problem with such a view is that it fails to recognize that the potential output of an economy is an endogenous variable and, therefore, it can and usually is affected by macroeconomic policy itself, including monetary policy.

More specifically, potential output is an unobservable variable that is estimated from the past and expected behavior of the economy.²³ Since expectations are usually heavily influenced by the recent past, the estimates of potential output tend to extrapolate current trends to the near future and, in this way, they may create a self-fulfilling monetary policy. An example helps to illustrate the point. Suppose that a conservative central bank estimates a slow potential growth rate for the economy and, based on such a pessimistic estimate, it combats a growth acceleration for fearing that it will increase inflation above the pre-specified target. In doing so the very own actions of the central bank reduce the effective growth rate of the economy, especially of investment, and when potential output is re-estimated again *ex-post*, the data will confirm that the central bank was right not necessarily because its initial estimates were right, but because the growth deceleration produced by the central bank is automatically translated into a lower estimate of the growth potential of the economy.²⁴ In short, because the estimates of potential output are highly uncertain at the end of the sample and continuously revised every time a new observation is incorporated into the analysis, the actions of the central bank may seem to be correct *ex-post* because its very own actions produced the scenario that justified it *ex-ante*.

The endogeneity of potential output at the end of the sample is especially dangerous for an economy, such as Brazil, that aims to accelerate its growth rate. The danger here is that because the growth rate in the recent past was low, any strong growth acceleration tends to generate an apparent excessive output gap in the short run. So, if the central bank stops the process too soon, there will not be enough time for the estimates of potential output to identify the structural change in the growth prospects of the economy. The final result is either that the economy never takes off, or that it takes off very slowly. However, the endogeneity of potential output does not obviously mean that authorities live in an apparent '*Field of Dreams*', in which 'if you believe, growth will come.'²⁵ There are objective limits to the growth rate of the economy that cannot be avoided by optimistic expectations such as the maximum supply of energy, the stock of foreign reserves and a zero unemployment rate.

The endogeneity of potential output only means that there may be more than one equilibrium position for the GDP growth rate and, therefore, the speed of convergence to the inflation target is also a relevant variable for economic growth. As usually happens in economics, central banks face a trade-off in this area: on the one hand, quick disinflation may lock the economy in a slow-growth equilibrium, but on the other hand, slow disinflation may lock the economy in a high-inflation equilibrium. Even though this trade-off has yet to be emphasized by modern macroeconomic theory, it is an unavoidable matter for policy makers who deal with the real world.

Conclusion

Inflation targeting represents an improvement in relation to the previous monetary policy regime adopted by Brazil, but it can and should be improved in order to increase the growth rate of the economy. In general terms the main conclusions from the previous sections can be summarized in 10 points.

- (1) Inflation targeting managed to reduce inflation in Brazil after its 1999 and 2002 currency crises, with a substantial help of exchange-rate appreciation.
- (2) Economic growth was slower under inflation targeting than under exchange-rate targeting, but with a smaller volatility and with an apparent upward trend.
- (3) Inflation targeting reduced the real interest rate of the economy, which nevertheless remained well above international standards and more than three times higher than the GDP growth rate of Brazil in 1999–2006.
- (4) The high real interest rate required a substantial increase in fiscal austerity by the Brazilian government, but so far this has not been sufficient to stop the increase in the ratio of net public domestic debt to GDP.
- (5) The high domestic real interest rates and the favorable international trade and financial conditions in the rest of the world allowed the Brazilian government to accumulate foreign reserves, repay most of its foreign debt and reduce its dependence of foreign capital in 2003–2006.
- (6) Inflation targeting can be combined with an asymmetric dirty floating regime, in which the central bank combat exchange-rate depreciation with restrictive monetary policy, and accumulate foreign reserves to slow down appreciation.
- (7) The asymmetric dirty floating should aim at a stable competitive real exchange rate, in order to promote the fast growth of the domestic tradable sector, and in this way push the country's exports and imports up without increasing the foreign financial fragility of the economy.
- (8) Aggregate estimates of potential output are not good guides for the demand pressures on inflation in moments of structural growth acceleration or deceleration.

- (9) Because of the endogeneity of potential output at the end of the sample, inflation targeting should be done with moderation in order to avoid a self-fulfilling monetary policy that locks the economy in a slow-growth equilibrium.
- (10) A fast convergence to a low inflation target may produce a permanently low growth rate, but a slow convergence to a moderate inflation target can produce a permanently high inflation.

Notes

1. In this paper we define the exchange rate as the domestic price of foreign currency, so that a depreciation of the exchange rate means an increase in the exchange rate, that is, a devaluation of the domestic currency. By analogy, appreciation means a reduction in the exchange rate, that is, a revaluation of the domestic currency.
2. For instance, according to the estimates for that time (Belaïsch 2003), 23% of exchange rate variations tended to pass through to consumer prices (measured by the IPCA index) in the long run, whereas the pass-through to the general price level (measured by the IGPDI index) was 71%.
3. For a more technical analysis of inflation targeting in Brazil, see Bogdanski, Tombini and Werlang (2000), Minella et al. (2003), Tombini and Alves (2006) and Bevilaqua, Mesquita and Minella (2007).
4. According to the Brazilian Presidential Decree 3088, of 21 June 1999, it is up to the BCB 'to execute the necessary policies to meet the specified targets.'
5. In 1999–2005 the Copom met every month to determine interest rates. Starting in 2006 the Copom has been meeting eight times a year, that is, one meeting approximately every six weeks. If necessary, an extraordinary meeting can be called by the President of the BCB.
6. According to the IMF estimates, the average world GDP growth rate was 3.7% in 1994–1998 and 4.2% in 1999–2006. In its turn, the inflation-targeting period can be divided in two phases regarding the world GDP growth rate, that is, slow-growth, in 1999–2006, when the average world annual GDP growth rate was 3.5%, and fast growth, in 2003–2006, when the average annual growth rate was 4.9%.
7. Unless stated otherwise, all numbers are annual figures.
8. The inflation rate of 1999 was high when compared with 1998, but modest when compared with the magnitude of the exchange-rate depreciation verified in 1999. As we will see later in this section, most of the small pass-through of the exchange rate to domestic prices in 1999 can be credited to the high real interest rate and the abrupt fiscal crunch practiced by the Brazilian government during that year.
9. As we will also see later in this section, the high real interest rate practiced by the BCB and the particular recessive impact of the two supply shocks on the level of economic activity helped to reduce the magnitude of inflation acceleration.
10. One of the first measures of the Lula administration was to increase interest rates, cut public spending and increase the inflation target for 2003 from the 4.0% set by the previous administration to 8.5% because of the adverse 'electoral' shock of 2002. A complete analysis of Lula's economic policy is beyond the scope of this paper. The interested reader can find more information in Barbosa-Filho (2007) and Arestis, de Paula and Ferrari (2007).
11. Note that most of the real exchange-rate appreciation was concentrated in the first semester of 2003 and in 2005, which coincided with the periods of increases in the Brazilian base interest rate, as is shown later.
12. These are geometric averages and the real interest rate was calculated *ex-post*.
13. At the time there was an intense debate in the media on whether or not the economy was really overheating, because the increase in inflation at the end of 2004 also reflected an increase in an important indirect tax rate, the so-known PIS-COFINS rate.
14. Indexation to the interest rate increased the impact of exchange-rate depreciation on domestic debt because the BCB usually increased its base rate abruptly after a devaluation of the domestic currency.
15. The nominal deficit is the difference between the total government expenditures and revenues, that is, it is the net interest payments minus the primary surplus.
16. Only in 2006 did the primary surplus fall in relation to GDP, but it was still higher than the level verified in 2002.
17. Nevertheless, the combined reduction in public revenues and spending had a negative impact on economic growth in 2003 through the balanced-budget multiplier.
18. In 2003–2006 all of the increase in Government expenditures as a percentage of GDP was directed to an increase in income transfers through social security, social assistance and unemployment benefits (Barbosa-Filho 2007).

19. The expansion started in 2006 gained force in 2007, when the Brazilian GDP was expected to grow by 5.2%.
20. For a formal model of this case, see Barbosa Filho (2006).
21. For an analysis of the link between real exchange rates and development, see Frenkel and Taylor (2006).
22. This idea has been first proposed by Ros (1995) for Mexico. For a more recent analysis of inflation targeting in Mexico, see Galindo and Ros (2008).
23. For an analysis of the methods of estimation of potential output applied to Brazil, see Barbosa-Filho (2005).
24. So far most of the mainstream studies on the uncertainty associated with estimates of potential output have been focused on the reliability of forecasts based on real-time data, rather than on the implications of a self-fulfilling monetary policy. For an example of the mainstream approach, see Orphanides and van Norden (2005).
25. *Field of Dreams* is a 1989 movie in which a farmer becomes convinced by a mysterious voice that, if he constructs a baseball diamond in his corn field, the ghosts of deceased star baseball players will come to play. The voice repeatedly says to the farmer: 'If you build, he will come,' and the Hollywood story obviously ends up confirming the voice's prediction.

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