

**FOR
AGENDA**

SM/07/245

July 10, 2007

To: Members of the Executive Board
From: The Secretary
Subject: **Brazil—Selected Issues**

This paper provides background information to the staff report on the 2007 Article IV consultation discussions with Brazil (SM/07/244, 7/10/07), which is tentatively scheduled for discussion on **Monday, July 30, 2007**. At the time of circulation of this paper to the Board, the Secretary's Department has not received a communication from the authorities of Brazil indicating whether or not they consent to the Fund's publication of this paper; such communication may be received after the authorities have had an opportunity to read the paper.

Questions may be referred to Mr. Terrier (ext. 35498), Mr. Estevao (ext. 36038), and Mr. Goyal (ext. 36875) in WHD.

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BRAZIL

Selected Issues

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Approved by the Western Hemisphere Department

July 10, 2007

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I. CHOOSING AN INFLATION TARGET FOR EMERGING MARKET COUNTRIES¹

While most aspects of inflation targeting can be shared across countries, key parameters, including the target band, depend on country-specific factors. Targets should be set taking into account each country's sensitivity to relative price shocks, nominal rigidities, the speed of productivity catch-up and nominal exchange rate flexibility, measurement errors in the consumer price index, and the level of inflation at the time of target setting. Even though higher inflation targets in Latin America have been justified by higher volatility, increased economic stability validates reducing the targets further. Experience elsewhere suggests that in Brazil, as the economy becomes less sensitive to external and domestic shocks, the 4.5 percent mid-range target could be reduced and the tolerance band narrowed. However, changes in the target range will need to be gradual as the country cements its new stability phase, and structural reforms progressively eliminate existing rigidities.

A. Introduction

1. ***Inflation targeting has proven to be an effective monetary policy framework, not only to maintain low inflation but also to bring about disinflation.*** Indeed, while some countries adopted the system during a period of low inflation (e.g., Australia, the United Kingdom, and Finland), others incorporated inflation targeting as part of their disinflation strategy (e.g., Israel and Chile).
2. ***The Brazilian experience straddles both cases.*** Very high and volatile inflation was brought to an end by the *Real Plan* in the mid-1990s, which used a crawling peg to the U.S. dollar as a nominal anchor. However, when, in early 1999, the exchange rate parity could not be sustained, the Brazilian central bank floated the currency and subsequently proceeded to adopt a full-fledged inflation target system. The rapid adoption of an inflation target regime aimed not only at creating a nominal anchor for the medium-term but also at curbing any immediate inflationary threats. Since then, the framework has dictated monetary policy actions, including after a large depreciation of the currency in 2002 that boosted inflation beyond the upper range of the target band. In the process, the Brazilian authorities have calibrated their targets to help bring about disinflation while building strong credibility in the fight against inflation. In the recent period, inflation has been close to the lower end of the target range.
3. ***This chapter discusses the economic reasoning behind inflation target setting across different types of countries, with an emphasis on the Brazilian case.*** Based on a broad review of the economic literature and new econometric evidence, this chapter argues that the level of inflation ultimately pursued by emerging market countries depends on how volatile relative price shocks are and how fast the productivity catch up is. That is, if trend growth is to be preserved in the presence of nominal wage and price rigidities, the higher

¹ Prepared by Marcello Estevão.

volatility and trend appreciation of the currency in real terms resulting from a rapid productivity catch up in the tradable goods sector (Balassa-Samuelson effect) would need to be accommodated through higher inflation. In addition, inflation measures in emerging economies may have a stronger upward bias than in industrial countries, where statistical institutes generally correct inflation figures more systematically for price index biases, including changes in the quality of goods.

4. ***While assessing the factors underlying the choice for an optimal inflation target in Brazil would require further research, the experience of other emerging economies provides useful benchmarks for the future.*** This chapter discusses the experience of Chile and Israel in particular, as they have used inflation targeting for significantly longer periods, and with lower targets, than Brazil. Given the convergence between inflation levels and volatility in these countries and in Brazil, the authorities may consider gradually lowering the mid-range target for inflation and narrowing the tolerance band around it.

B. Inflation and Growth

5. ***While the costs of inflation are well known, there may also be some benefits associated with a positive, but relatively low, rate of inflation.*** The costs of inflation are numerous, as it: (i) diverts resources from the production of goods and services toward inflation-protecting activities; (ii) obscures the identification of real changes in relative wages and prices, thus hampering an optimal allocation of resources in the economy; (iii) raises uncertainty about future inflation and interest rates, which curbs investment, prevents the development of markets for long-term bonds, and increases inflation premia on interest rates; and (iv) promotes an income redistribution which generally hurts the poor.² On the other hand, a positive, but relatively low, rate of inflation may present some benefits, because it helps addressing or preventing a number of problems, including: (i) the presence of downward nominal wage and price rigidities; (ii) macroeconomic volatility; (iii) the desirability of achieving negative interest rates in real terms during periods of recession; (iv) positive biases in inflation measurement; and (v) the existence of an underground economy.³

6. ***Ultimately, the costs and benefits of inflation on economic growth depend on the level of inflation.*** Empirical work has shown that, above certain thresholds, the costs overwhelm the benefits of inflation and economic growth begins to suffer. Evidence for this link has appeared in the literature in the 1990s, at a time when cross-country databases with sufficiently long time-series information became available. Among the key studies in this

² In Brazil, for instance, high inflation uncertainty curbed the development of market for pre-fixed long-term government bonds and mortgage lending at fixed rates until the last few years, when a new era of low and declining inflation sparked an incipient demand for these financial instruments.

³ For a deeper discussion on the costs and benefits of inflation, see Appendix I.

area are Barro (1991), Fischer (1993), Bruno and Easterly (1998), and Sbordone and Kuttner (1994).

7. ***However, the question of how low inflation should be is far from settled.*** Some empirical papers have actually shown that low inflation is either not related to growth or affects it positively. Sarel (1996) followed Fischer's (1993) suggestion that such nonlinearity could be relevant, and found a significant structural break at an annual rate of inflation of 8 percent. Using a larger sample than Sarel, Ghosh and Phillips (1998) find a lower break, at 2½-5 percent, and a positive relationship between inflation and growth at rates below 3 percent. They also identify substantial costs of rapid disinflation at rates below 6 percent. However, these results are based on a wide sample of countries, each of them at a different stage of development. To address this issue, Khan and Senhadji (2001) studied two separate groups of countries: (a) industrial countries, for which they identified inflation thresholds of 1-3 percent; and (b) developing countries, with thresholds of 11-12 percent. They also report evidence of a positive correlation between inflation and growth below these thresholds. Christoffersen and Doyle (1998) estimate the threshold level at 13 percent for transition economies.

8. ***The literature points to country-specific optimal levels of inflation, with somewhat higher figures for emerging market economies than for industrialized countries.*** Empirical estimates suggest that the threshold above which inflation hurts growth is higher for developing countries than for industrial economies, but practical lessons for emerging market economies are still vague. Higher thresholds for developing economies may reflect highly volatile supply shocks which, as shown in Appendix I, need not be addressed by tight monetary policy. A long history of inflation in many of these countries may have led them to adopt widespread indexation systems. In such a case, stabilization policies in a context of de-indexation mechanisms would likely enhance growth in the short run, as a by-product of the removal of indexation. In Brazil, such a development was observed under the *Real Plan*.

C. Inflation Targets in Emerging Market Economies

9. ***When compared to industrial countries, emerging markets tend to measure inflation more imprecisely, grow faster, and face more volatile supply shocks.*** As discussed detail below, these factors suggest that emerging markets should target higher inflation rates.

CPI Mismeasurement

10. ***In industrialized countries, CPI weights are frequently updated, with raw data adjusted for quality changes under complex and expensive methodologies.*** These adjustments usually use goods' characteristics and econometric models to estimate how prices evolved holding goods' quality unchanged (hedonic regressions). Even after adjustments, the CPI biases in the United States and in the Euro area have been estimated at

around 1 percentage point (Appendix I). In most emerging market economies, the CPI biases are altogether left unaddressed, suggesting higher measured CPI inflation in these countries. CPI biases may be even higher in countries undergoing rapid structural changes.

The Balassa-Samuelson Effect

11. ***Income catch up also generates a wedge between inflation in emerging markets and in industrial countries.*** In general, increases in capital-labor ratios and in total factor productivity are the driving forces behind the process of catching-up to higher income levels. These gains are usually particularly fast in the tradable goods sector—which attracts a large share of technology-intensive foreign direct investment. In that context, if wage setting is normalized across sectors, lower productivity gains in the production of nontradables also implies higher inflation in that sector. Thus, the real exchange rate tends to appreciate in rapidly-growing countries (Balassa-Samuelson—BS, effect), either through a higher overall inflation rate or through nominal exchange rate appreciation. As discussed in Mishkin and Schmidt-Hebbel (2001), it may, thus, be appropriate for rapidly-growing emerging market countries to aim at an inflation rate above industrial country level, as is the case in Chile.⁴

12. ***However, productivity in the Brazilian tradable goods sector has lagged.*** Labor productivity growth in tradables has grown by only 7½ percent in Brazil since the early-1980s while in the United States productivity grew by 135 percent over the same period (Table 1). The gap vis-à-vis nontradables productivity growth was positive in both countries but much larger in the United States, suggesting that the BS effect cannot be used to justify higher inflation rates in Brazil.

Table 1. Brazil and the U.S.: Sectoral Labor Productivity Growth, 1981 to 2006

(In percent)

	Brazil			U.S.			Brazil - U.S.		
	Tradables (1)	Non-tradables (2)	(3)=(1)-(2)	Tradables (4)	Non-tradables (5)	(6)=(4)-(5)	Tradables (1)-(4)	Non-tradables (2)-(5)	(3)-(6)
1981-1995	-1.3	-19.5	18.2	49.7	5.5	44.2	-51.0	-25.0	-26.0
1995-2006	8.8	-9.3	18.2	57.1	21.2	35.9	-48.2	-30.5	-17.7
1981-2006	7.5	-27.0	34.4	135.1	27.9	107.2	-127.7	-54.9	-72.8

Source: IBGE, BEA, and authors' calculation. For Brazil, revised data beginning in 1995 were spliced with older vintages for 1981-1995.

Note: Productivity = real sectoral value added / sectoral employment. "Tradables" = agriculture + industry. "Non-tradables" = services.

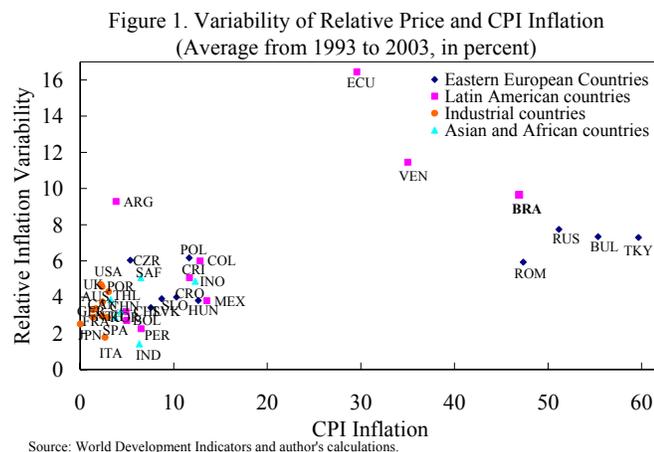
⁴ Schadler et al (2005) report estimates of the BS effect in transition economies of Eastern Europe of 1-2 percent a year.

Relative Price Shocks and Inflation

13. ***Emerging market countries are generally characterized by stronger and more volatile supply shocks.*** Variations in commodity prices, which account for large shares of consumption and exports of emerging market economies, are a case in point, in some cases exacerbated by possible constraints to exchange rate adjustment. Also, changes in domestic policies in emerging market economies or other sources of internal instability can affect country-risk premia, possibly causing large movements in tradable goods prices. Droughts and other real shocks may also have stronger effects in emerging markets, where insurance is less readily available. These factors would generate spikes in sectoral prices and fighting them could, thus, create permanent output losses.

14. ***The effect of sectoral supply shocks on emerging markets inflation depends on how rigid wages and prices are in these economies.*** The paucity of cross-country studies comparing labor and product market rigidities in emerging and industrialized economies does not allow a general conclusion on this issue. However, available evidence suggests that nominal wage rigidities are important in some emerging economies. For Brazil, Estevão (2007) shows that institutions created to protect workers have interfered with labor market functioning, raising wage rigidity and the equilibrium unemployment rate. Using micro data covering the whole country, the paper shows that tighter labor regulations at the end of the 1980s led to a lower sensitivity of real wages to changes in the unemployment rate, although there are indications that wage rigidity has diminished during the 2000s.

15. ***The impact of relative price shocks on inflation in emerging economies has still not been comprehensively assessed.*** Empirical estimates of the relationship between relative price variability and inflation have mostly focused on industrial countries. The work in this area (surveyed in Debelles and Lamont, 1997) presents strong evidence of a positive correlation between the volatility across disaggregated items of the inflation index and average inflation in the United States, the Netherlands, Germany and, in a more aggregated study, a cross-section of European countries. Blejer (1983) reports some evidence for Argentina in the mid-1980s.



16. ***In a panel of countries at different stages of development, sectoral price volatility is indeed quite correlated to inflation.*** Figure 1 shows positive correlation between the volatility of inflation across economic sectors (agriculture, industry, and services) and

consumer prices inflation. The sample includes 37 countries from different income groups, which can be subdivided into four groups: industrial countries, Latin America, Eastern European countries, and some African and Asian countries (Appendix II). The volatility of relative prices in country i is calculated as the average of the standard deviation of inflation across sectors $j=1,2,3$, (agriculture, industry, and services) at time t , π_{jt}^i , as follows:

$$\sigma_{\pi}^i = \sum_t \sum_j \frac{(\pi_{j,t}^i - \bar{\pi}_t^i)^2}{TN} \quad (1)$$

Where T is the number of years and N the number of sectors in the sample. This relationship varies across country groups. At the same time, all industrial countries are characterized by small variations in relative prices together with low inflation rates.

17. ***The positive correlation between inflation and relative price volatility is somewhat difficult to explain.*** Differences in inflation across countries could be explained by differences in the conduct of monetary policies or other macroeconomic indicators that jointly affect volatility and inflation.⁵ A panel data analysis can be used to extricate the relationship between *real* relative price shocks from these macroeconomic influences by first estimating the dependence of *nominal* relative price changes for every sector j on a set of monetary policy indicators, Mp_t^i , with D_t and D_i representing year and country-specific dummies:

$$\pi_{j,t}^i - \pi_t^i = D_t + D_i + a_j Mp_t^i + e_{jr,t}^i \quad (2)$$

Then, the cross-sector standard deviation of the residuals $e_{jr,t}^i$ would measure *real* volatility,

$$\sigma_{er,t}^i = \sqrt{\sum_{j=1}^N \frac{(e_{jr,t}^i - \bar{e}_{r,t}^i)^2}{N}},$$

or all the remaining volatility once either proactive or reactive macro shocks are taken into account.⁶ The measure can then be used to estimate equation (3):

$$\pi_t^i = D_t + D_i + \rho \pi_{t-1}^i + \alpha Mp_t^i + b \sigma_{er,t}^i + \varepsilon_t^i \quad (3)$$

18. ***Estimates suggest a stronger relationship between sectoral price volatility and inflation in Latin American countries than in industrial economies.*** Estimates of equation

⁵ Debelle and Lamont (1997) control for monetary policy effects by using city level data within the United States to calculate deviations of relative price variability and inflation with respect to national values. They show that real sector price variability is positively and robustly related to inflation.

⁶ Relative price volatility is assessed once the effect of macro variables, including the reaction of monetary and fiscal authorities to the underlying shocks, is taken into account. Alternative specifications using only lagged macro variables (i.e., excluding the possible contemporaneous reaction of policy to relative price shocks) generated a stronger role for relative price shocks in explaining inflation.

(3) for 1995-2003 are shown in Table 2, which controls for money growth, interest rates and the share of the primary deficit to GDP.⁷ The results suggest that country groups are quite heterogeneous. When all countries are included in the estimation, the volatility effect cannot be detected (column 4). Group-specific estimates show that relative price volatility is relevant to explain inflation in Latin American and industrial countries, but not in Eastern Europe. For industrial countries, real relative price variability has a small, but statistically significant, effect on inflation, while this effect is much larger in Latin American countries.⁸ Further research is needed to unveil causal relationships from relative price shocks to inflation, as Table 2 only shows conditional correlations. In addition, it would be useful to test different macroeconomic theories for a possible link between sectoral price volatility and inflation across different groups of countries.

Table 2. Real Relative Price Volatility and Inflation

	Dependent variable: CPI inflation				
	Industrial Countries	Latin American	Eastern European	All countries	All but Eastern European Countries
Real Volatility	0.057* (0.035)	0.473*** (0.175)	1.110 (1.237)	-0.417 (0.285)	0.411*** (0.097)
Money Growth	-0.0003 (0.004)	0.099 (0.072)	1.795*** (0.088)	1.451*** (0.061)	0.061* (0.032)
Interest Rate	0.200** (0.089)	-0.0004 (0.047)	-0.302 (0.230)	0.033 (0.111)	0.048 (0.030)
Deficit/GDP	0.017 (0.070)	-1.972*** (0.606)	3.873** (1.618)	0.001 (0.001)	-1.488*** (0.302)
Lagged Inflation	0.223** (0.112)	0.027*** (0.006)	0.017 (0.043)	0.029 (0.034)	0.028*** (0.004)
R ²	0.763	0.735	0.918	0.781	0.720
Number of observations	84	90	88	316	228

Note: 1) Data are at annual frequency. Standard errors in parenthesis. * significant at 10% level, ** - significant at 5% level, *** - significant at 1% level

2) Estimation includes year and country specific dummy variables. The estimates of real volatility effect were robust to the choice of error structure and dummy variables. The real volatility variable is the standard deviation of the error terms from sector-specific regressions (9).

D. Stability and Convergence: The Experience of Chile, Israel, and Brazil

19. *Given that past volatility helps explain higher inflation rates in emerging markets, the issue is whether increased economic stability would imply lower inflation targets in the future.* The previous discussion serves as a description of past behavior and conditions, and gives a benchmark on how to set inflation targets. However, results based on past data do not necessarily serve as a good guideline for the future. Country-specific analysis focusing on

⁷ The regression starts in 1995 because many developing countries, including Brazil, experienced abrupt structural changes up to that year. The end-year, 2003, is due to data availability. Alternative methods to extract the monetary component from relative price shocks yielded similar results.

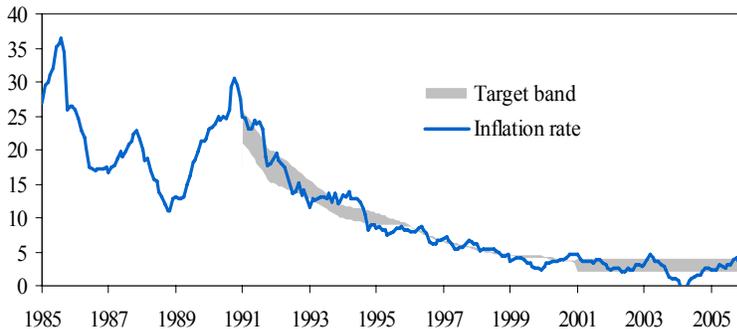
⁸ Monetary and control variables tend to have different effects in each country group, but in general, money growth and the level of the interest rates are positively related to inflation while the public primary deficit as a ratio to GDP has a negative sign. Deeper econometric methods and theoretical modeling, beyond the scope of this paper, would help pinpoint the true effect of these control variables on inflation in a panel of countries.

cases in which high and volatile inflation were brought down may be more useful. In particular, these cases shed light on the dynamics of inflation-target setting during a disinflation process, when the central bank is also cementing its credibility. Chile, Israel, and Brazil have in common the fact that the authorities have been targeting inflation during both periods of high and low inflation.⁹

20. ***In Chile, inflation-target setting and an exchange-rate anchor both played a critical role in the disinflation process*** (Figure 2). A few months after the enactment of a

new central bank law, the authorities announced an inflation target in September 1990, making Chile the first emerging market country to adopt an hybrid version of the regime. At the time, and until mid-1999, announcing inflation targets was viewed as a supplement to a crawling exchange-rate band. The

Figure 2. Chile: Target-Setting and Inflation Convergence
(Twelve-month percent change in the CPI)



Source: Chilean authorities and author's calculations.

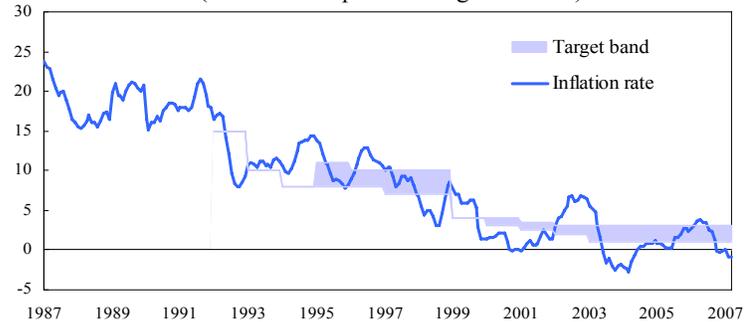
combination of both policies was deemed necessary, as pure exchange-rate management had failed in the 1980s, while pure inflation targeting was still in its infancy. The combination of slowly declining inflation targets, which at times took the form of point targets, and exchange rate management brought inflation down from 27 percent at end-1990 to about 3 percent in September 1999, when the crawling-peg band was abandoned and a target band of 2-4 percent was instituted for an indefinite horizon starting in 2001. As inflation converged to the mid-range of the target band, the government changed the definition as a 3 percent target with a band of ± 1 percent around it.

21. ***Fiscal austerity, which was maintained in Chile throughout 1990s, was enshrined in the 2000 fiscal rule and supported monetary policy.*** The main objectives of the rule are as follows: (i) annual budgets are prepared with a view to producing a structural surplus for the central government of about 1 percent of GDP; and (ii) cyclical surprises in tax collections and in copper revenues are saved. Strong commitment to market-friendly policies has also enhanced the ability of Chile's economy to adapt to shocks without generating much inflation.

⁹ This section draws in part from Schaechter et al (2000).

22. *In Israel, inflation-targeting was also introduced alongside a crawling peg regime, in an effort to curb high inflation* (Figure 3). Inflation targeting and a crawling peg (with an initial band of ± 5 percent) were announced simultaneously at the end of 1991, at a time when 12-month inflation was close to 20 percent.¹⁰ As in Chile, the operational details evolved over time, with point targets used initially to help anchor inflation expectations. The inflation target and the speed of the crawl were initially coordinated, but, gradually, the focus of monetary policy shifted toward inflation targeting.¹¹ Inflationary episodes in late-1994, the first half of 1996, and late-1998 tested the system. In particular, decisive monetary contraction in 1994 to counteract a significant target

Figure 3. Israel: Target-Setting and Inflation Convergence
(Twelve-month percent change in the CPI)

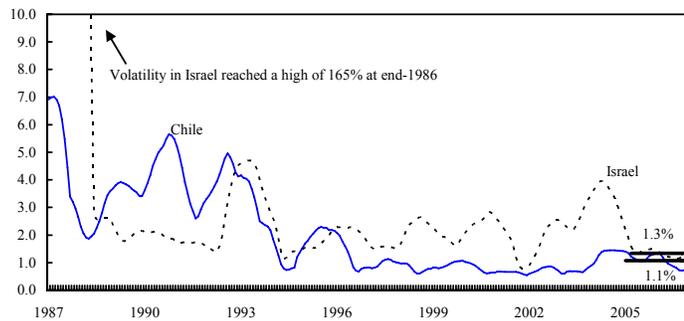


Source: Israeli authorities and author's calculations.

miss was key to the success of the framework (Bernanke et al, 1999). At that time, the Bank of Israel also stated that the inflation target would take precedence over the exchange rate peg in case of conflict, which helped lower inflation expectations. Similar to Chile, the trend disinflation path has been aided by improvements in productivity, reflecting in part immigration and structural reforms, as well as a program of fiscal consolidation.

23. *The disinflation process in both countries, which mirrored reduced economic volatility, was guided by gradual reductions in the inflation target.* However, different from Chile, the Israeli disinflation path produced larger oscillations in inflation, including two bouts of deflation after mid-2003 (Figures 3 and 4). This outcome may reflect the importance of exchange rate

Figure 4. Chile and Israel: Inflation Volatility, 1987-2006
(Two-year std. deviation in 12-month inflation, in percent)



Source: National authorities and author's calculations.

fluctuations and abrupt changes in policy interest rates. Output growth has also been more volatile in Israel, although the volatility of the early 2000s seems to have abated (Figure 5).

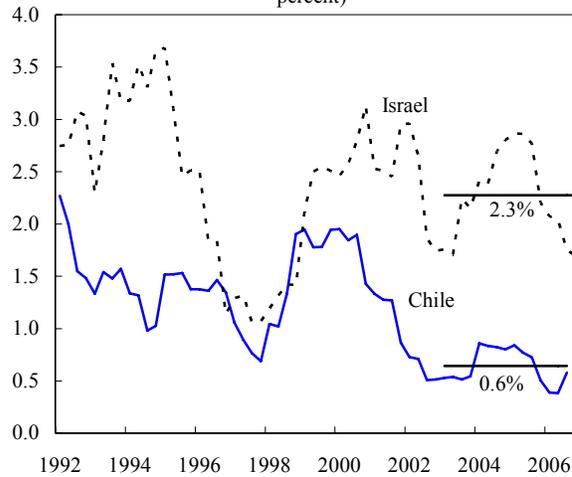
¹⁰ As a result of the two oil price shocks in 1973/1974 and 1979, inflation had escalated to very high levels up to the mid-1980s because widespread price and wage indexation transmitted these relative price shocks to the whole economy. Stability efforts reduced the very high rate to about 20 percent in the second half of the 1980s.

¹¹ Leiderman and Bar-Or (2000) discuss Israel's inflation-targeting experience in the 1990s.

During disinflation and low-inflation stability in both countries, output growth was higher than in Brazil (Figure 6).

Figure 5. Chile and Israel: GDP Volatility, 1992-2006

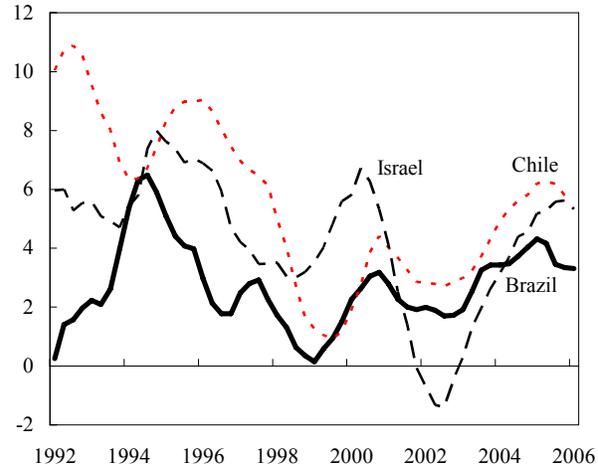
(Two-year standard deviation in quarterly growth, in percent)



Source: National authorities and author's calculations.

Figure 6. Brazil, Chile, and Israel: GDP Growth, 1992-2006

(Two-year moving average of four-quarter growth, in percent)



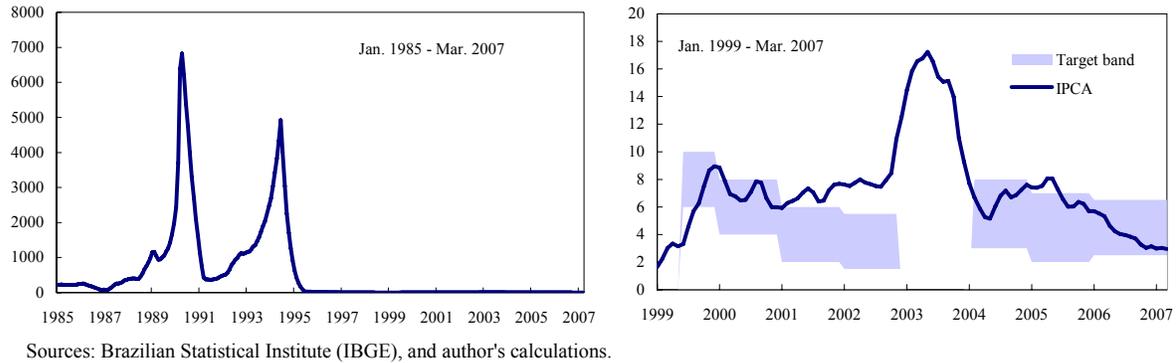
Source: National authorities and author's calculations.

24. ***Brazil's inflation-target regime, which has a shorter history, has led to a strong process of disinflation, during which important institutional reforms were made.***

Following two decades of high and, at times extremely high, inflation, the authorities brought inflation down to low single-digit levels under the *Real Plan*. Introduced in mid-1994, this plan used a crawling exchange-rate peg as a nominal anchor and introduced de-indexation mechanisms. Following severe pressures on the exchange rate, the crawling peg was abandoned in early 1999 and, in June 1999, Brazil adopted inflation targeting as its monetary policy framework.¹² The Fiscal Responsibility Law of 2000—which, among other things, limits the indebtedness of all levels of government—significantly strengthened the fiscal pillar of the macroeconomic framework. Since 2000, subnational governments have reversed their history of chronic fiscal deficits and helped the government achieve ambitious primary fiscal surpluses. In that context, twelve-month inflation has dropped just above 3 percent, well below the 4.5 percent mid-range target (Figure 7). Twelve-month ahead expectations are currently firmly anchored at around 3.5 percent.

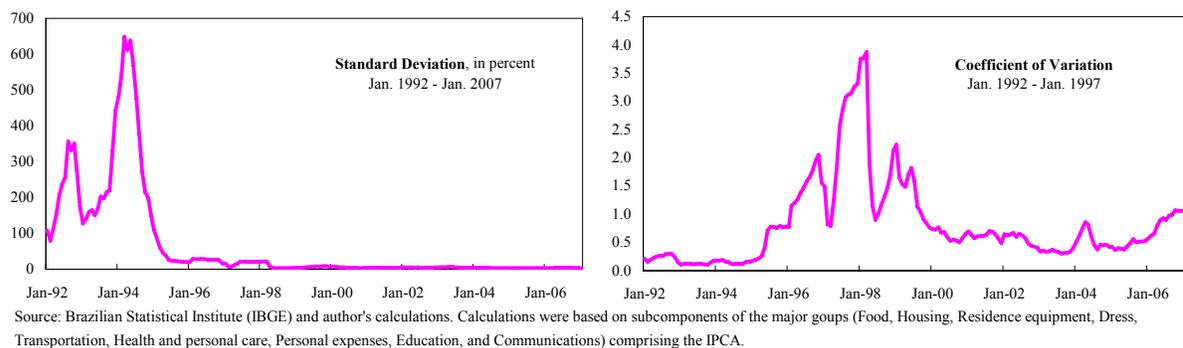
¹² After abandoning the crawling-peg, the central bank hiked up interest rates and announced its goal to introduce inflation target in June 1999 to achieve single-digit inflation by end-1999. Together with an IMF financial package, these measures stabilized the currency, reduced inflation expectations, and underpinned the achievement of the end-year inflation target. In a few months, the central bank created a research department, put together a bare-bone inflation model, and prepared for the publication of an inflation report. The IMF and other inflation-targeting central banks provided technical assistance in the process. For a description of these developments, see Fraga (2000).

Figure 7. Brazil: Target Setting and Inflation Convergence
(Twelve-month CPI inflation, in percent)



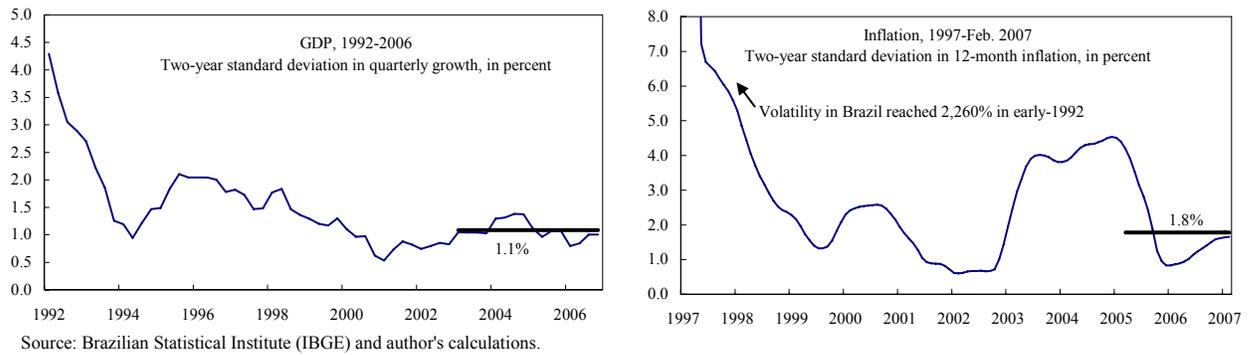
25. **Relative price volatility has also declined significantly in Brazil.** Since the high volatility of the early 1990s, the standard deviation of changes in consumer price components has fallen dramatically (Figure 8). Underlying volatility, as measured by the coefficient of variation (i.e., the standard deviation of CPI components divided by headline inflation) tends to decline with a lag, as the effect of reduced average inflation only gradually trickles down to every single component. For instance, while the standard deviation of inflation across CPI components peaked in June 1994, the peak of the coefficient of variation was in March 1998. The same happened when 12-month inflation rates declined from about 17 percent in mid-2003 to the current low levels. This lag, quite noticeable in periods of rapid disinflation, highlights the time needed for corrections in relative price adjustments to take place.

Figure 8. Brazil: Dispersion of Items Comprising CPI Inflation, 1992-2007
(Standard deviation of 12-month percent changes in CPI components and coefficient of variation)



26. **Although inflation and output volatility have diminished substantially in Brazil, they remain above the Chilean levels.** Even after converging to very low inflation levels, inflation targeters may continue to face significant output volatility. Figure 9 and Tables 3 and 4 depict the large reduction in inflation and output volatility in Brazil. However, GDP growth and inflation remains more volatile in Brazil than in Chile, notwithstanding the remarkable convergence between the two countries in the past several years. Brazilian inflation volatility is currently at similar levels as in Israel.

Figure 9. Brazil: Growth and Inflation Volatility

**Table 3. Brazil, Chile and Israel: Output Volatility, 1992-2006**

(Std. deviation of GDP growth in previous 8 quarters, period average, in percent)

	Brazil	Chile	Israel
1992-1997	1.8	1.4	2.5
1998-1999	1.4	1.6	1.9
2000-2005	1.0	0.9	2.5
2006	0.9	0.5	1.9

Source: Country authorities, and author's calculation.

Table 4. Brazil, Chile, and Israel: Inflation Volatility, 1983-2007

(Std. deviation of inflation in previous 24 months, period average, in percent)

	Brazil	Chile	Israel
1983-1986	24.0	–	84.2
1987-1996	928.8	3.2	13.5
1997-1999	9.0	0.9	1.9
2000-2005	2.5	0.9	2.3
2006-Feb. 2007	1.3	0.9	1.3

Source: Country authorities, and author's calculation.

27. *The similar convergence path to lower volatility levels in all three countries suggests that Brazil could start reducing its inflation target range toward Chilean levels.* The description of each country's experience with inflation-targeting shows that Brazil is still at an earlier stage in the convergence process and, in particular, that lingering relative price pressures (attested by the high coefficient of variation of inflation in IPCA components in Figure 8) begs caution. Against this backdrop, some small reductions in the mid-target range (from 4½ percent at present to, say, 4 percent) and a tightening in the target range (from the current range of ± 2 percent to, say, $\pm 1\frac{1}{2}$ percent) would seem possible. Over the medium-term, the authorities could aim at even lower and longer-term inflation target bands, as in Chile. The precise level for this long-term target band would need to take into account GDP and productivity growth in Brazil, and possible future Balassa-Samuelson effects.

E. Conclusion

28. ***Inflation targeting has proven to be a credible and flexible framework to conduct monetary policy, but country differences should underpin differences in key parameters, including the level and width of the inflation target range.*** Among these differences, the sensitivity to relative price shocks (in conjunction to how nominal wages and prices respond to these shocks), the speed of productivity catch up (in conjunction to how flexible nominal exchange rates are), the extent of CPI mismeasurement, and the level of inflation at the time of target setting are critical factors to take into consideration.

29. ***There is some evidence of a tight link between relative price changes and inflation in Latin American countries.*** Higher price volatility in the Latin American region could justify higher inflation targets than in industrial countries, to avoid the welfare losses resulting from nominal wage and price rigidities. More research in this area would help understand better the linkages between relative price variability and optimal inflation target in these economies.

30. ***Improvements in economic stability in Brazil would seem to justify a further gradual reduction in the inflation target.*** In recent years, steady institutional and macroeconomic improvements have helped reduce vulnerabilities and lower inflation to low single digit levels. Looking ahead, these improvements should also help boost economic growth. The same institutional and macroeconomic improvements were observed earlier in other emerging economies, which used gradual reductions in their inflation targets to help entrench lower inflation and economic volatility. A recent study by the Central Bank of Brazil (Bevilaqua et al, 2007) suggests that inflation expectations in Brazil are now more guided by the inflation target itself, implying that further target reductions may help lower inflation expectations and, in turn, the nominal interest rate consistent with potential growth. There might thus be gains in reducing the mid-range target while narrowing the confidence band.

Appendix I. The Costs and Benefits of Inflation: A Critical Survey

31. The idea of an “equilibrium” inflation rate, in which costs and benefits of inflation are balanced out, is key to the notion of an “optimal” inflation target. The process of balancing out these costs and benefits relies on contrasting inflation’s economic effects (may be measured in terms of output gains and losses) based on societal subjective preferences. This appendix lists some factors in the making of such an “equilibrium” inflation rate.

A. The Costs of Inflation

32. *It has long been argued that inflation is costly because of its effect on the behavior of economic agents, on the amount of information carried in isolated price changes, and on prospects of future inflation.* Milton Friedman argued in the 1960s that because money does not pay interest, individuals re-direct a larger portion of their time away from productive activities and into defending the value of their money in periods of high inflation. That includes increasing the frequency of visits to the bank to withdraw non-interest bearing cash. Friedman’s main example is less relevant today because of the many technological improvements, including the rise of electronic transactions, but the message that inflation robs effort away from the production of goods and services remains valid.

33. *It has been shown that inflation raises relative price variability, thus weakening the signals from real relative price shocks.* Thus, sectoral price changes cannot be easily interpreted as real business opportunities, creating uncertainty for investment decisions and misallocating resources. Consumers incur higher search costs as nonsynchronized retail price changes widen the outlet price differential for the same product, raising incentives for more non-production activity as individuals search for the lowest available price. The labor market is also more inefficient when inflation is higher because equivalent workers may earn different wages at the same point in time; this is the so-called “sand” effect on labor market allocation.

34. *The level of current inflation is also related to uncertainty about future inflation.* As discussed in Golob (1994), high-inflation countries lack an anchor for future inflation, which raises uncertainties directly and indirectly through uncertainty on future interest rates. Higher uncertainty distorts savings and investment decisions—including by shortening their planning horizon—limits the market for long-term securities, and hurts the public accounts, as the required inflation volatility premium raises interest payments.

B. The Benefits (or Inevitability) of Some Inflation

35. *Because of the many costs of inflation, some economists have defended a long-run inflation goal of zero percent.* For instance, Feldstein (1997) argued that an inflation goal above zero could undermine the credibility of the central bank. However, experience has

shown that low inflation rates (below 3 percent, according to Bernanke et al, 1999) have not damaged central bank credibility in industrial economies. In addition, market and statistical imperfections may raise the optimal inflation target above zero. Among the possible reasons for having long-term inflation above zero are downward nominal wage rigidities and the high costs of disinflating an economy all the way to zero,¹³ macroeconomic volatility, the central bank's aversion to deflation and the possibility of a liquidity trap at zero nominal interest rates, the desirability of negative interest rates in recessions, a positive bias in inflation measurement, and the underground economy.¹⁴

36. ***The existence of nominal rigidities may call for positive optimal inflation.*** For instance, workers may resist pay cuts because they would lead to a lower standard of living or because they are perceived as demeaning. When combined with money illusion, resisting lower real wages translates into downward nominal wage rigidity, which could impede the smooth adjustment of real wages to adverse shocks. As argued by Tobin (1972), higher inflation thus would, thus, improve labor-market efficiency by increasing the range of real wage cuts acceptable to workers, implying lower equilibrium unemployment. An inflation rate set too low would prevent this adjustment. This “grease” role of inflation would need to be compared to the “sand” role mentioned above, and, as discussed in Groshen and Schweitzer (1996), the net effect could be uncertain. There is some division in the profession on the importance of nominal wage rigidities with some authors denying their existence in the United States and the United Kingdom while others defending their importance to explain the transmission of shocks through the economy.¹⁵

37. ***Large relative price shocks (even in the presence of only mild nominal rigidities) may generate inflation that should not necessarily be resisted by the central bank.*** Indeed, a large part of the academic work on the subject has focused on the relationship between inflation, and supply uncertainties and shocks. Ball and Mankiw (1994) link supply uncertainties with the volatility and asymmetry of sectoral relative price shocks. Productivity shocks are another type of aggregate supply shock discussed in the literature. Cukierman and Gerlach (2003) suggest that the volatility/inflation nexus can actually be caused by the central bank reaction function to shocks and not by the volatility of the underlying shocks nor their asymmetry. In any case, it may be best for central banks not to fight relative price shocks until supply conditions have returned to an equilibrium to avoid output losses. In the process, second-round effects from the initial real shock should be resisted to deter widespread inflation.

¹³ King (1994) disagrees with the argument, pointing that for costs to exceed benefits, agents' discount rate has to be unreasonably high. Akerlof, Dickens and Perry (1996) estimate the losses of maintaining price stability in the presence of downward wage rigidities as ranging between 1 percent and 3 percent of GDP per year.

¹⁴ Inflation would be a tax on the informal economy, whose transactions are usually based on paper money.

¹⁵ For a quick survey of this literature see Lebow, Saks and Wilson (2003).

38. ***An equilibrium inflation rate above zero could also reduce the probability of deflationary episodes.*** As discussed in Mishkin and Schmidt-Hebbel (2001), central banks are averse to deflation because of its link to periods of financial instability in industrial economies. Indeed, long-term contracts are common in these countries and deflation would cause balance-sheet losses for debtors, which could trigger a cycle of financial distress: decreased debtors' net worth would raise adverse selection and moral hazard problems leading lenders to cut credit further. In a related point, zero or negative inflation rates could hamper monetary policy functioning, as interest rates would hit a floor at zero, leaving no room for negative ex ante real interest rates. Recently, researchers have played down the floor to nominal interest rate as a major hindrance to produce negative ex ante real rates and fight recession during deflation. A similar (albeit less direct) effect could be achieved through "quantitative easing" or other forms of commitment to future inflation.¹⁶

39. ***A positive bias in inflation measures, associated with fears of having inflation too close to zero, also raises measures of optimal inflation.*** These biases arise for many reasons. For instance, consumers' buying patterns change frequently while surveys do not. Thus, as consumption moves away from more expensive to less expensive goods, unchanged basket weights would overestimate actual inflation ("substitution bias"). Also, changes in the quality of goods and services (i.e. a higher value for an item at a given shelf price), as well as the arrival of new goods in the market, create upward biases in measured inflation if not accounted for by statistical agencies. Lebow and Rudd (2003) provide an estimate for the bias in the U.S. consumer price index (CPI) of about 0.9 percentage point with a confidence interval ranging from 0.3 to 1.4 percentage points. Cecchetti and Wynne (2003) provide a rough estimate for the bias in euro area's consumer prices of about 1 percentage point.

¹⁶ See the discussion in Eggertsson and Woodford (2004).

Appendix II. Sample of Countries, Data Description, and Inflation Volatility

Table A1. The Sample of Countries Used in the Econometric Analysis

Industrial countries	Latin American countries	Eastern European countries	Other countries
Australia	Argentina	Bulgaria	China
Canada	Bolivia	Croatia	India
France	Brazil	Czech Republic	Indonesia
Germany	Chile	Hungary	Korea
Italy	Colombia	Poland	South Africa
Japan	Costa Rica	Slovak Republic	Thailand
Netherlands	Ecuador	Slovenia	
Portugal	Mexico	Romania	
Spain	Peru	Russia	
UK	Venezuela	Turkey	
USA			

Databases and indicators used in the empirical work:

40. World Development Indicators Database (World Bank):

- CPI Inflation;
- Relative prices in agriculture, industry and services are the ratios of nominal value added in local currency to the value added in constant prices;
- Nominal GDP at market value (for calculation of deficit-to-GDP ratio).

41. IMF/IFS Statistics:

- Growth in monetary aggregate, M1 growth;
- Interest rates (either the treasury bill rate or money market rate were used as a proxy for interest rates, depending on data availability).

42. IMF/World Economic Outlook Database:

- Public deficit measured as the general government primary balance.

Table A.2 shows the mean and standard deviation for 1993-2003 of relative inflation in agriculture, industry, and services in a number of countries. Sectoral inflation paths diverge, with, on average, service sector prices growing quicker than the CPI. Also, relative inflation volatility differs across countries and sectors. Sector-level inflation is much more volatile in emerging markets than in industrial countries.

Table A.2. Relative Price Inflation Volatility across Sectors from 1993 to 2003

Group 1. Industrial Countries		Australia	Canada	France	Germany	Italy	Japan	Netherlands	Portugal	Spain	UK	USA	Average
Agriculture	mean,%	0.15	0.60	-1.20	-0.97	-1.51	-0.45	-3.64	-4.16	-2.74	-2.93	-4.76	-1.00
	st. dev.,%	7.87	5.78	5.65	7.10	2.86	4.82	5.21	7.34	4.75	9.31	9.06	5.61
Industry	mean,%	-0.04	-1.61	-0.84	-0.45	-0.97	-0.97	-0.27	-0.71	-0.95	-0.65	-0.65	-0.73
	st. dev.,%	0.56	2.58	0.77	1.00	0.94	1.15	1.11	1.49	1.05	1.93	0.83	1.16
Services	mean,%	-0.06	-0.19	0.38	0.05	0.44	0.58	0.11	0.77	0.68	0.18	-0.01	0.19
	st. dev.,%	0.72	1.00	0.39	0.51	0.43	0.51	0.88	0.72	0.82	0.87	0.70	0.63
Group 2. Latin American Countries		Argentina	Bolivia	Brazil	Chile	Colombia	Costa Rica	Ecuador	Mexico	Peru	Venezuela		Average
Agriculture	mean,%	1.76	-0.77	0.62	0.83	0.82	-3.74	-0.16	-3.96	1.25	-2.33		-0.57
	st. dev.,%	30.90	3.62	13.57	8.68	14.98	8.92	30.88	5.66	3.34	11.99		13.25
Industry	mean,%	-0.28	-1.29	0.85	-1.09	-1.24	-0.15	-2.56	-0.72	1.26	-0.78		-0.60
	st. dev.,%	8.60	2.60	17.87	2.43	6.13	4.03	15.59	2.13	3.57	10.80		7.37
Services	mean,%	-0.56	0.35	-0.11	0.51	0.09	1.52	1.30	0.53	0.47	1.96		0.61
	st. dev.,%	6.43	2.01	6.87	1.47	2.50	3.57	7.44	1.16	3.83	9.57		4.49
Group 3. Transition Countries		Bulgaria	Croatia	Czech Republic	Hungary	Poland	Slovak Republic	Slovenia	Romania	Russia	Turkey		Average
Agriculture	mean,%	-5.28	-0.07	-7.28	-6.48	-4.95	-2.65	-1.97	-3.37	-8.52	-0.77		-4.13
	st. dev.,%	14.51	10.08	15.91	11.52	8.44	5.80	6.56	7.22	16.73	11.00		10.78
Industry	mean,%	-2.68	0.77	-0.30	-2.30	-4.22	0.02	-0.51	-1.90	-1.25	-2.72		-1.51
	st. dev.,%	7.11	7.58	6.57	2.65	5.56	2.10	3.82	5.98	6.31	4.59		5.23
Services	mean,%	4.37	-1.84	0.74	2.52	1.16	0.14	0.36	3.09	1.76	0.75		1.30
	st. dev.,%	12.32	6.47	7.53	3.53	4.73	1.23	3.18	11.40	9.68	2.12		6.22
Group 4. Asian and African Countries		China	India	Indonesia	Korea	South Africa	Thailand						Average
Agriculture	mean,%	0.23	0.56	0.23	-1.76	0.05	0.50						-0.03
	st. dev.,%	3.98	1.90	5.98	4.14	9.58	6.96						5.42
Industry	mean,%	-1.49	-0.23	0.11	-0.95	-0.76	-0.27						-0.60
	st. dev.,%	1.46	1.26	4.97	2.05	2.24	1.43						2.24
Services	mean,%	2.07	-0.20	-0.26	1.11	0.43	0.16						0.55
	st. dev.,%	2.26	0.75	4.77	0.69	1.79	1.75						2.00

Source: World Development Indicators database and staff calculations. Relative price inflation is defined as sectoral price inflation minus CPI inflation.

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II. FOREIGN EXCHANGE RESERVE ACCUMULATION IN BRAZIL¹

Brazil has accumulated substantial foreign exchange reserves in recent months, from US\$60 billion in mid 2006 to US\$147 billion at end-June 2007. This chapter presents measures of optimal reserve holdings and investigates empirically the impact of reserve accumulation on the exchange rate. It finds that, by most measures of optimal reserves, Brazil's reserve cushion is currently adequate. It also finds that accumulation has reduced the volatility of the exchange rate.

A. Introduction

1. *Brazil has accumulated substantial foreign exchange reserves in recent months.*

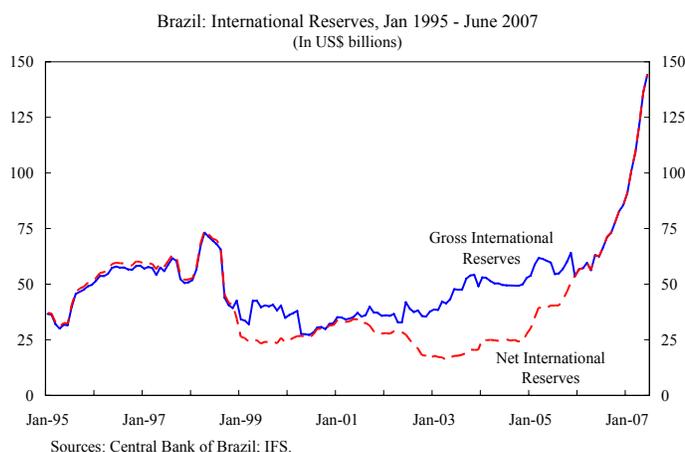
Net reserves increased by US\$32 billion in 2006, the vast majority in the second half of the year. In the first half of 2007, reserves further increased by US\$61 billion, reaching a record high of \$147 billion at end-June 2007.

2. *The authorities' policy has been to intervene opportunistically and accumulate a prudent level of reserves.*

They have frequently reaffirmed their overarching commitment to inflation targeting and flexible exchange rates. Within this framework, they have stated that they would accumulate reserves opportunistically, with a view to building a buffer for times of turbulence, reducing the risk of crises, and lowering external borrowing costs for both the government and the private sector. Their interventions are not intended to exacerbate exchange rate volatility and, at times, may serve to reduce volatility. The authorities have used different intervention strategies—intervening in the spot and forward markets, formerly pre-announcing the forward market interventions until April 2007, but no longer pre-announcing them since then.

3. *The recent rapid accumulation of reserves has taken place after the strategy of lowering external public debt had been substantially advanced.*

Against the backdrop of favorable international conditions, external current account surpluses, and robust capital inflows, the authorities repaid a large amount of external public debt, including to the IMF, in 2005 and the first half of 2006. With the bulk of these repayments completed, net capital inflows have increased and the central bank has accumulated more reserves.



¹ Prepared by Rishi Goyal and Philip Liu.

4. ***This chapter addresses two questions: What is an optimal level of reserves that the authorities could consider? What has been the impact of reserve accumulation on the exchange rate?*** The authorities have not announced a reserves target that they would deem sufficient. While there is no single optimal measure of reserves, this chapter presents several rules of thumb and the Jeanne and Ranciere (2006) model of optimal reserves calibrated for Brazil. The chapter also presents an econometric analysis of the effects of the reserve buildup on the level and volatility of the exchange rate.

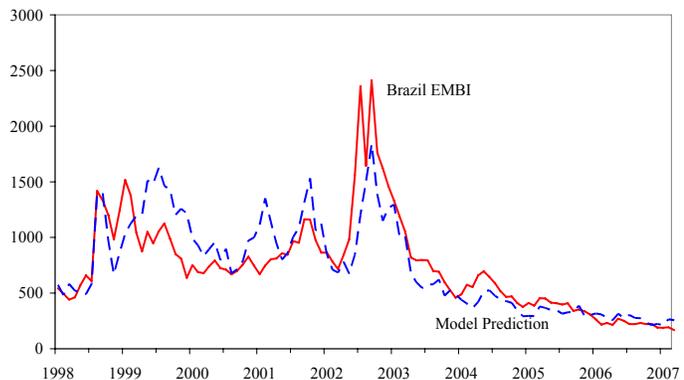
B. Benefits and Costs of Reserve Accumulation

5. ***A key benefit of reserves is to act as a buffer in times of external financing difficulties.*** Brazil has suffered balance of payments difficulties, caused by sudden stops in capital inflows, financial crises, increases in domestic political risk, contagion from other emerging markets, policy reversals, rising global risk aversion, and falling commodity prices. A large stock of reserves would mitigate the costs associated with these difficulties by making available the foreign exchange needed for the payment of imports and external debt servicing.

6. ***An adequate stock of reserves may also reduce the probability of a crisis.*** With the knowledge that reserves are available to meet financing needs during balance of payments difficulties, the probability of a crisis may be reduced.

7. ***Higher reserves have contributed to lowering country risk premia.*** Brazil's Emerging Market Bond Index (EMBI) spread has declined from over 800 basis points in May 2004 to 160 basis points in June 2007, and it is below the average EMBI spread for the first time in its history. A recent cross-country panel regression analyzed the roles of external and domestic factors in accounting for the reduction in spreads. Applied to Brazil over the 2004-07 period, the regression shows that spreads have fallen largely because of improved external debt dynamics, lower global volatility (as proxied by the S&P 500 volatility index, VIX, of the Chicago Board Options Exchange), and enhanced GDP growth prospects. Higher reserves (as a share of imports) have also helped lower spreads, but their contribution is small compared to improved external debt dynamics (IMF, 2006, and Hartelius, Kashiwase, and Kodres, forthcoming).

Brazil: Actual and Predicted EMBI Spreads, 1998 - 2007
(In basis points)



Source: Hartelius, Kashiwase, and Kodres (forthcoming).

8. ***The most easily quantifiable cost of reserve accumulation is the cost of sterilization for the Central Bank or the public sector.*** Under the inflation targeting regime, interventions are often sterilized through the issuance of domestic Treasury bills, implying relatively high costs for the government due to interest rate differentials. For 2007, the cost of sterilization is estimated at $\frac{2}{3}$ of a percentage point of GDP. Expected declines in domestic interest rates relative to the return on foreign exchange reserves will reduce the cost of sterilization.

9. ***While the cost of sterilization appears manageable, sterilization leads to higher gross public sector debt.*** Sterilization requires increasing the public debt (the central bank does not issue its own paper). At 65 percent of GDP at end-2006, Brazil's gross public debt is relatively high among large emerging markets. Should further reserve accumulation take place, it may be advisable to raise the overall balance of the public sector to help offset sterilization costs and, thus, ensure that gross public debt remains on a downward trajectory. Obviously, such a trade off would need to be assessed thoroughly.

10. ***Other potential costs include moral hazard and a restrictive monetary policy.*** Garcia and Soto (2004) stress that large reserve stocks may lead to a postponement of reforms. Furthermore, large sterilized interventions cause monetary policy stance to be more restrictive than otherwise and result in forgone domestic absorption.

C. Optimal Level of Reserves

11. ***Several measures of the optimal level of reserves have been proposed.*** Different "rules of thumb" include reserve coverage of imports, short-term external debt, and broad money. A growing model-based literature has also sought to assess whether the accumulation of reserves across emerging markets in recent years is optimal.² This section assesses Brazil's reserve adequacy according to these measures.

Import coverage

43. ***The number of months of import coverage is the traditional measure of reserve adequacy.*** It is motivated by the argument that a country should be able to meet its short-term external trading balance needs in the event of a crisis, and it provides a simple way to scale the level of reserves to reflect the size and openness of the economy to trade. The broad rule of thumb is that reserves should be sufficient to pay for 3-4 months of imports of goods and services.

² See, for instance, Aizenman and Marion (2004), Garcia and Soto (2004), and Jeanne and Ranciere (2006).

12. ***Brazil's reserve coverage of imports has ranged between 5½ and 10½ months over the past decade and reached 9 months by March 2007.*** Reserve coverage is similar to the levels in India and Argentina, above the level in Mexico, but considerably below the levels in China and Russia (Figure 1). By this measure, Brazil's reserves seem adequate.

13. ***This measure has its limitations, however.*** Chief among them is that import coverage by itself does not cover the potential demand on reserves when external financing and private capital flows are considered. Increased financial integration and liberalization of short-term capital movements have increased countries' exposure to sudden stops in capital and contagion from other emerging markets. The next measure attempts to account for coverage of such flows.

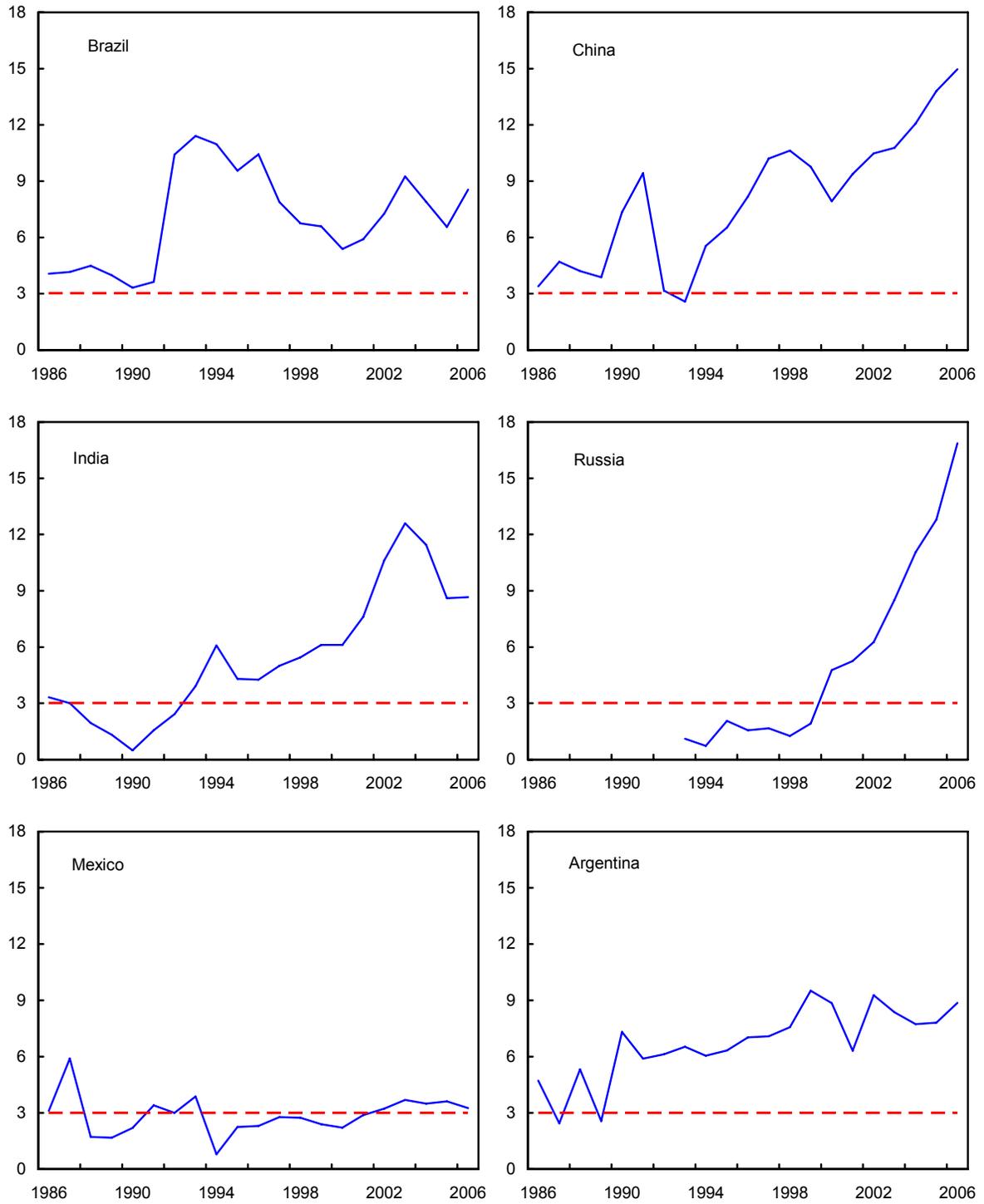
Short-term external debt coverage

14. ***The ability to finance short-term external debt is a popular measure for economies that are open to capital flows and sudden stops.*** The logic of the measure is similar to the seminal bank run model of Diamond and Dybvig (1983). Following a large negative shock, foreign investors become unwilling to rollover short-term loans and attempt to withdraw their funds from the affected country. The sudden termination of finance and capital flight forces the country to abandon potentially solvent investment projects, leading to a sharp economic downturn. Full reserve coverage of short-term external debt—the Guidotti-Greenspan rule—would alleviate concerns about the ability to finance debt falling due within the next year and, therefore, the concerns about sudden stop crises. Indeed, the reserves to short-term external debt ratio has been found by some authors to be a robust predictor of sudden stop crises.³

15. ***Brazil's reserve coverage of short-term external debt has risen steadily.*** After averaging 70 percent for most of the past decade, Brazil's reserve coverage of short-term external debt rose markedly in 2006 and exceeded 170 percent at end-March 2007, as external public debt was reduced significantly and reserves were built up (Figure 2). Brazil's reserve coverage is similar to the level observed in Mexico and above the level in Argentina, but well below the levels in China, India, and Russia.

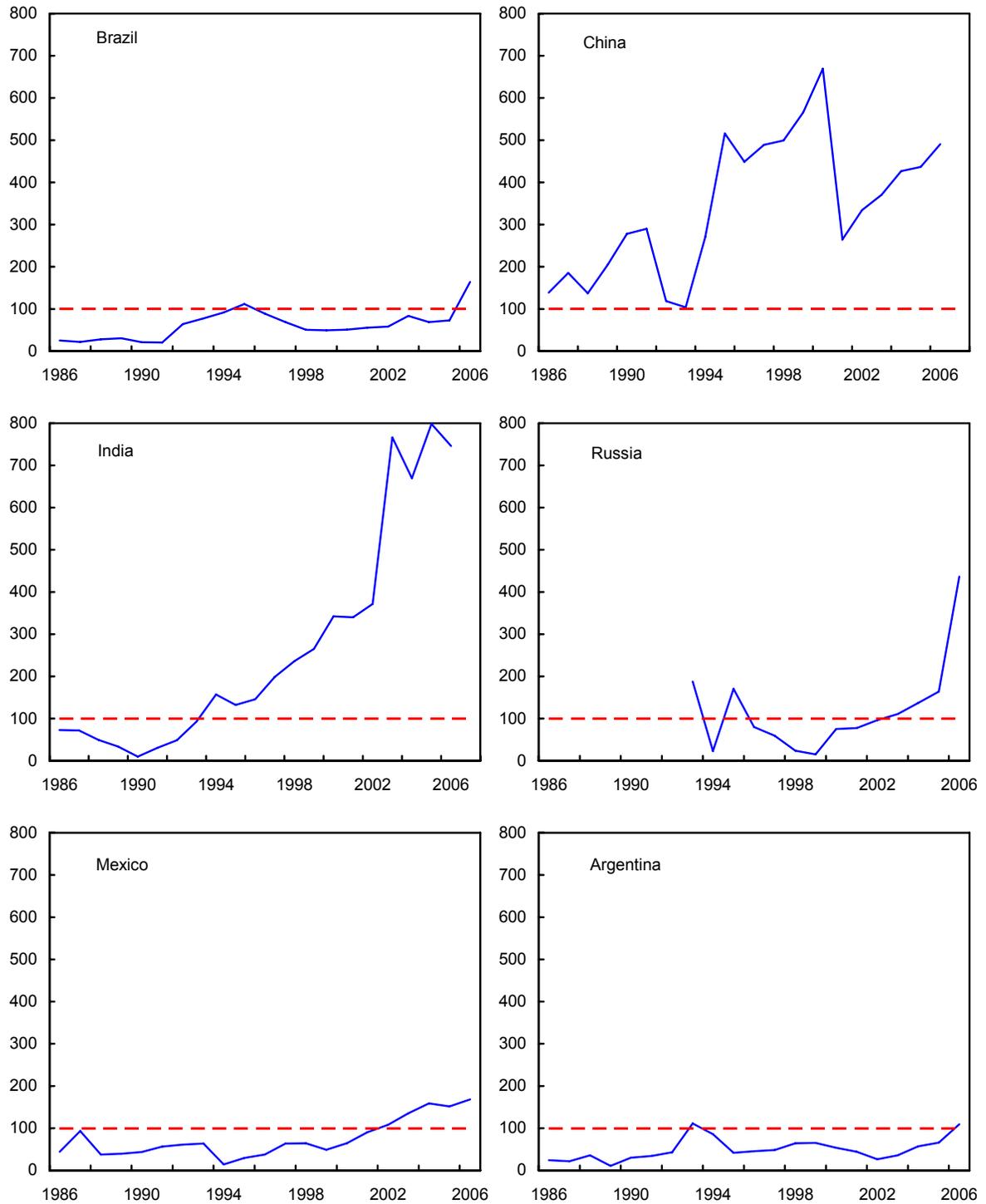
³ See Rodrik and Velasco (2000), Dadush et al. (2000), IMF (2000), Willet et al. (2004), and Garcia and Soto (2004).

Figure 1. Emerging Markets: Reserve Coverage of Imports, 1986 - 2006
(In months of imports)



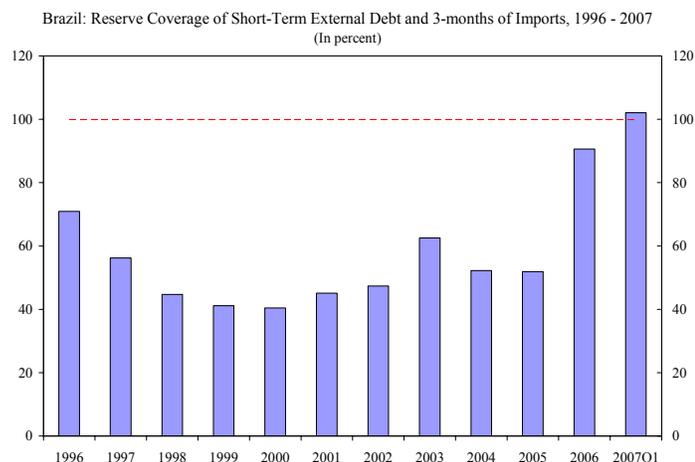
Sources: *World Economic Outlook, International Financial Statistics.*

Figure 2. Emerging Markets: Reserve Coverage of Short-Term External Debt, 1986 - 2006
(In percent of short-term external debt)



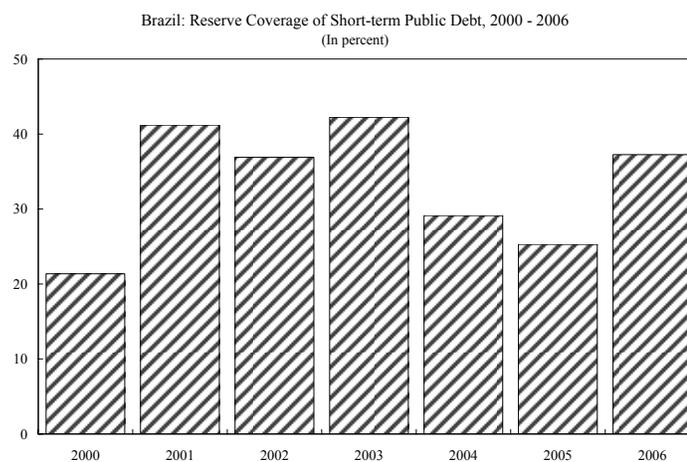
Sources: *World Economic Outlook*, *International Financial Statistics*.

16. **Reserve coverage of both short-term external debt and imports provides an indication of the vulnerability to an “external drain”.** A benchmark of 3 months of imports plus 100 percent of short-term external debt provides a more comprehensive measure of the foreign exchange resources needed in the event of a crisis. By this measure, Brazil’s reserve coverage has averaged slightly over 50 percent over the past decade, but has risen over the past year to over 100 percent, suggesting that Brazil has a sufficient buffer. However, this measure does not capture pressures arising from “internal drain” associated with capital flight by residents. With an open capital account, domestic residents could shift resources abroad during times of stress.



Coverage of short-term public debt

17. **One potential source of internal drain is the large fraction of short-term government debt.** About one-third of government paper is short term. Financial institutions hold about 60 percent of government paper and, during a crisis, they or their clients may not rollover government debt and may move funds abroad. If the risk of rollover and capital flight is deemed to be high, then further accumulation of reserves would be needed. Assuming, for instance, that 10 percent of the domestic short-term debt were not rolled over, with the corresponding resources channeled abroad, an additional reserve coverage of 2 percent of GDP would be advisable.



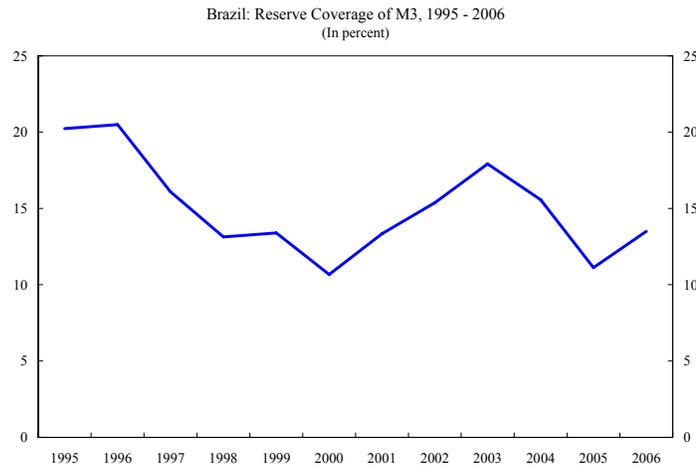
Coverage of broad money

18. **A second potential source of pressure on reserves is from monetary liabilities.** Calvo (1996) highlighted the importance of volatile monetary aggregates in explaining currency crises and the need for reserve coverage of money. Coverage of money is especially

relevant for countries where deposit flight is a risk. In Brazil, M2 has remained broadly stable at about 25 percent of GDP over the past decade, while rapid growth in financial investment funds has resulted in an increase in the M3-to-GDP ratio from about 30 percent in 1995 to 60 percent in 2006.

19. ***Reserve coverage of M2 has increased gradually, while coverage of M3 has remained broadly stable.***

Reserve coverage of M2 in Brazil is similar to China, India, and Mexico, but is below the levels in Russia and Argentina (Figure 3). Brazil's reserve coverage of M3 has averaged 14 percent over the past decade.



20. ***So, while the rules of thumb for external drain suggest that Brazil's reserve cushion is broadly adequate, those of internal drain suggest scope for further increases.***

While lower than in the other BRIC economies, Brazil's reserve cushion appears adequate to meet both short-term external debt and import needs, but not large enough in case of significant capital flight associated with rollover risk of public debt or drops in demand for M3.

A model-based measure of optimal reserves

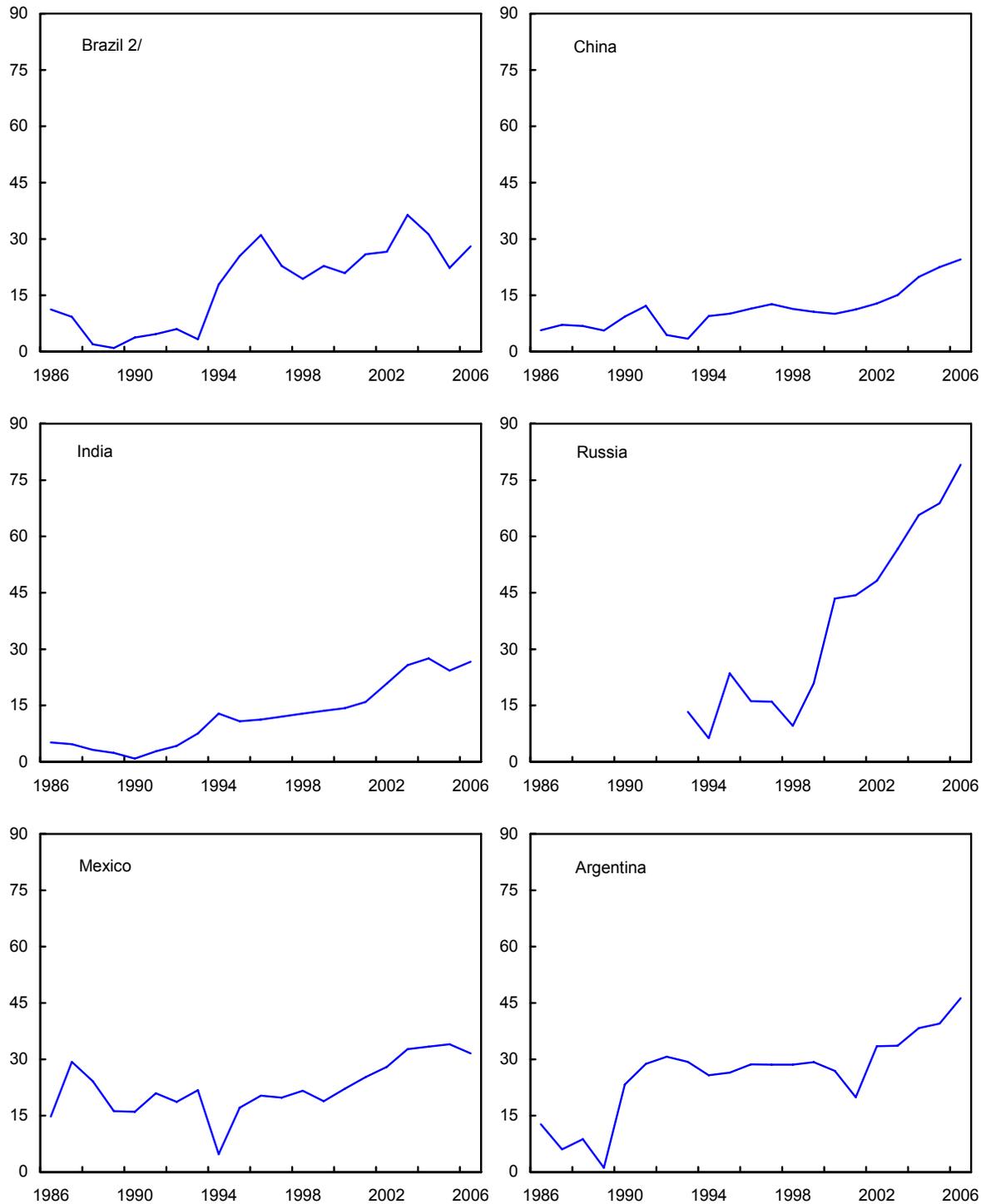
21. ***To complement the rules of thumb analysis, this section presents a model-based measure of optimal reserves calibrated to the Brazilian economy.*** Jeanne and Ranciere (2006) derive a simple and intuitive formula for optimal reserves trading off the benefits—the ability to smooth consumption during a sudden stop—with the opportunity cost. In their model, optimal reserves increase one-for-one with short-term external obligations and output loss during a sudden stop, and decrease with the opportunity cost.⁴

22. ***In a baseline calibration, Brazil's level of reserves appears adequate.*** Short-term external obligations plus 3 months of imports are equivalent to close to 10 percent of GDP, with short-term external debt of close to 7 percent of GDP (over \$70 billion in March 2007)

⁴ The optimal reserve to GDP ratio, ρ , is given by:
$$\rho = \lambda + \gamma - \frac{p^{1/\sigma} - 1}{1 + (p^{1/\sigma} - 1)(1 - \delta - \pi)} \left(1 - \frac{r - g}{1 + g} \lambda - (\delta + \pi)(\lambda + \gamma) \right)$$
, where

λ is short-term external claims during a sudden stop (as a percent of GDP), γ output loss due to a sudden stop, p a measure of the liquidity premium generated by a sudden stop, π the probability of a sudden stop, δ the opportunity cost of reserves, r the risk-free rate, g the potential growth rate, and σ the degree of risk aversion. The last term on the right-hand side of the equation is the risk-adjusted opportunity cost of holding reserves.

Figure 3. Emerging Markets: Reserve Coverage of Broad Money, 1986 - 2006
(In percent of broad money 1/)



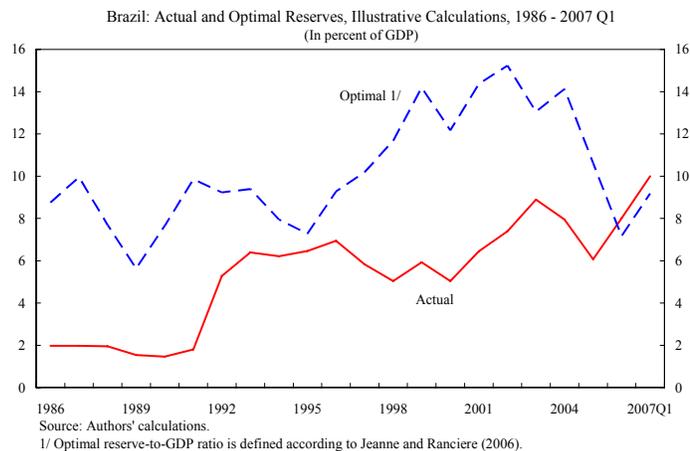
Sources: *World Economic Outlook*, *International Financial Statistics*, Brazilian Central Bank.

1/ Defined as money plus quasi money in the *International Financial Statistics*.

2/ From 1994 onwards, the authorities' definition of M2 is used.

and three months of imports equivalent to 3 percent of GDP. Potential output growth is estimated at $3\frac{3}{4}$ percent, and forgone output during a crisis is calibrated at $4\frac{1}{2}$ percent. The probability of a sudden stop is set at $12\frac{1}{2}$ percent.⁵ As in Jeanne and Ranciere (2006), the opportunity cost of reserves is the term premium, set at 1.5 percent. The risk-free rate is 5 percent and the coefficient of risk aversion is $2\frac{1}{2}$, consistent with the business cycle literature. According to this calibration, optimal reserves are about 9 percent of GDP, or US\$100-110 billion. While the calculated optimal reserves level depends on the chosen parameterization, it is robust to small changes in parameters (Figure 4).

23. ***Brazil's comfortable reserve position at present contrasts with relatively suboptimal reserve holdings during the past two decades.*** For the same parameterization as above but varying the short-term external obligations (short-term external debt + 3 months of import coverage) over time shows that actual reserves have been lower than optimal reserves during the last two decades, except in 2006-07. These calculations are only illustrative since parameters have changed. Nevertheless, the difference between the optimal and actual levels is instructive. For instance, the difference was especially large during the crisis periods of 2002, 1998–99, and the 1980s, suggesting the value of holding more reserves as mentioned in footnote 5.



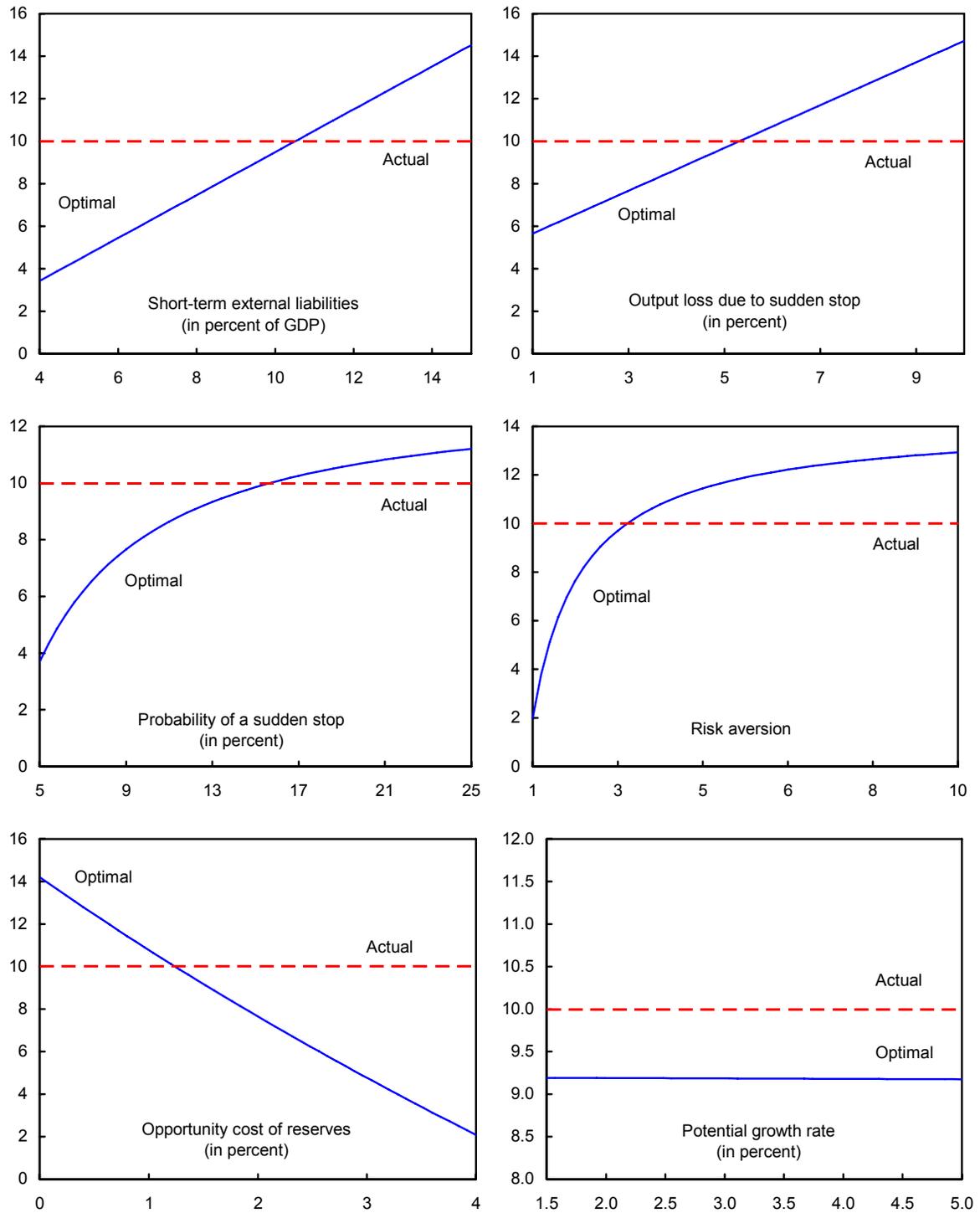
D. Reserve Accumulation and the Exchange Rate

24. ***Available high-frequency data allow for empirical tests of the impact of reserve accumulation on the exchange rate.*** Theory suggests that sterilized interventions should not affect the level of the exchange rate, which has generally been backed up by the empirical evidence.⁶ This section presents three related empirical tests for Brazil: the uncovered

⁵ The $12\frac{1}{2}$ percent probability of a crisis should be viewed as an upper bound. However, if the external environment were to deteriorate sharply, the calculated optimal level of reserves would increase, and a country attempting to maintain the optimal reserves level according to the model would need to accumulate reserves precisely when pressures on reserves are mounting.

⁶ See, for instance, the survey by Sarno and Taylor (2001).

Figure 4. Brazil: Optimal Reserves, A Sensitivity Analysis
(In percent of GDP)



Source: Authors' calculations, based on Jeanne and Ranciere (2006).

interest parity; the impact of reserve accumulation on the level of the exchange rate; and the impact of reserve accumulation on the volatility of the exchange rate.⁷

Testing interest parity

25. **Reserve accumulation from sterilized interventions could impact the exchange rate only if there are systematic deviations from uncovered interest parity.** To test for uncovered interest parity, the following equation is estimated: $\frac{S_t^e}{S_t} = \alpha + \beta \frac{1+i_{t,t+k}}{1+i_{t,t+k}^*} + \delta rp_{t,t+k} + e_t$, where S and

S^e are the spot and expected nominal exchange rates, i and i^* are the k -period yields on domestic currency and foreign currency assets, and rp is the risk premium. For uncovered interest parity to hold, $\alpha = \delta = 0$ and $\beta = 1$.

26. **Three tests of interest parity are conducted.** These tests are based on different measures of the expected exchange rate: (i) the actual spot exchange rate at $t+k$ (or the *ex post* exchange rate); (ii) the expected exchange rate at $t+k$ from the Central Bank exchange rate survey (or the *ex ante* exchange rate),⁸ and (iii) the forward contract rate for delivery at $t+k$, which is akin to a test of covered interest parity. Daily data are used from April 2000 to early March 2007 at the 1-month, 2-month, and 3-month horizons. The risk premium is approximated by the EMBI for Brazil. The results are reported in Table 1.⁹

27. **Uncovered interest parity fails to hold, implying a role for reserve accumulation in affecting the exchange rate in Brazil.** In all three specifications, the risk premium and constant terms are statistically significant and different from zero. Using the *ex post* (or realized) exchange rate, the coefficient on the interest differential is negative and significantly different from 1. This is consistent with previous studies of major world currencies, and Chinn and Meredith (2005) explain the failure of interest parity using *ex post* exchange rate changes in the short run by the endogenous behavior of monetary policy to exchange rate shocks. By contrast, the coefficient on the interest differential using the *ex ante* (or survey-based expected) exchange rate from survey data is positive and, at the 3-month horizon, statistically equal to 1. Using the forward contract rate, the coefficient on the

⁷ While others in the literature use daily intervention data, daily reserve changes are used here owing to the lack of publicly-available daily intervention data. This introduces an error in estimating the impact of intervention on the exchange rate, but correctly estimates the effect of reserve changes on the exchange rate.

⁸ Following Chinn and Frankel (2002), the survey-based expected exchange rate is verified to be an unbiased predictor of the *ex post* exchange rate at the 1-month, 2-month, and 3-month horizons. This is necessary since survey-based expectations may themselves be derived from an interest parity relationship.

⁹ Note that the use of daily data implies overlapping observations, which introduce moving average terms in the residual. To correct the standard errors, Newey-West robust standard errors and Hansen's (1982) generalized method of moments estimator are used.

interest differential is negative at the 1-month horizon and positive at the 2- and 3-month horizons, but all three estimates are significantly different from 1.

Table 1. Testing Interest Parity

		<i>Ex post</i>			<i>Ex ante</i>			<i>Forward contract</i>		
		α	β	δ	α	β	δ	α	β	δ
1 Month	Estimate	0.035	-0.432	0.372	-0.036	0.664	-0.765	0.003	0.110	-0.108
	Newey-West t stats	3.58	-15.78	3.03	-5.52	-5.22	-10.18	2.42	-101.62	-6.65
	GMM t stats (MA=21)	2.52	-11.18	2.33	-4.00	-3.82	-7.51	1.62	-75.43	-5.30
2 Months	Estimate	0.072	-0.873	0.752	-0.038	0.835	-1.022	0.005	0.198	-0.176
	Newey-West t stats	4.91	-13.84	4.65	-5.44	-2.36	-12.40	3.01	-57.84	-7.39
	GMM t stats (MA=43)	2.58	-7.44	2.60	-3.43	-1.58	-8.55	1.53	-34.42	-4.53
3 Months	Estimate	0.114	-1.309	1.075	-0.042	1.034	-1.310	0.008	0.275	-0.221
	Newey-West t stats	6.38	-13.30	4.72	-5.91	0.47	-16.72	3.67	-42.62	-7.66
	GMM t stats (MA=65)	2.87	-6.56	2.62	-3.60	0.32	-11.53	1.52	-22.38	-4.48

Note: The t-statistics are based on the hypothesis that $\alpha=0$, $\beta=1$ and $\delta=0$ respectively.

Impact of reserve accumulation on the level of the exchange rate

28. *A direct test of reserve accumulation on the level of the exchange rate is undertaken.* Following Dominguez and Frankel (1993), expected excess returns are first computed and these excess returns are then regressed on daily reserve changes. Excess returns are defined as: $return_{t,t+k} = (1 + i_{t,t+k}) - (1 + i_{t,t+k}^*) \frac{S_t^e}{S_t}$. As before, three

measures of expected excess returns are computed using the actual spot rate at $t+k$, the expected spot rate from the central bank expectations survey, and the forward contract exchange rate. The regression results are reported in Table 2.

29. *The direct test yields inconclusive results.* Negative regression coefficients imply that increases in reserves are related to an appreciation of the *real*. However, the coefficients are insignificant,¹⁰ which may have two possible explanations: daily reserve data are used rather than intervention data, which would capture that gamut of activities that may affect the exchange rate; or higher frequency data, such as intra-day data, may be needed to capture fully the effect of interventions on the exchange rate.¹¹ Insignificant coefficients suggest

¹⁰ Note that, as before, the standard errors are corrected for moving average terms in the residuals generated by overlapping observations.

¹¹ See, for instance, Dominguez (2003).

either that reserve changes are unrelated to exchange rate movements or that they significantly dampen exchange rate movements. Since both inferences are plausible, the direct test results need to be interpreted with caution. To examine further the relationship between reserve changes and exchange rates, the impact of reserve changes on exchange rate volatility is considered.

Table 2. Reserve Accumulation and the Exchange Rate Level

(Regression: $return_{t,t+k} = constant + \beta \Delta Reserves_t$)

		<u>Ex post return</u>		<u>Ex ante return</u>		<u>Forward contract return</u>	
		Constant	β	Constant	β	Constant	β
1 Day	Estimate	0.0002	0.023				
	Newey-West t stats	0.77	1.16				
	GMM t stats	0.75	1.23				
1 Month	Estimate	0.008	-0.067	0.003	-0.100	0.001	-0.007
	Newey-West t stats	2.49	-0.90	0.96	-0.85	2.79	-0.84
	GMM t stats (MA=21)	1.70	-0.94	0.62	-0.86	1.80	-0.81
2 Months	Estimate	0.017	-0.012	0.010	-0.121	0.003	-0.013
	Newey-West t stats	3.24	-0.09	2.81	-0.93	3.74	-1.01
	GMM t stats (MA=43)	1.56	-0.11	1.36	-0.97	1.73	-1.00
3 Months	Estimate	0.025	-0.024	0.017	-0.143	0.004	-0.016
	Newey-West t stats	3.56	-0.12	4.14	-0.98	4.38	-1.03
	GMM t stats (MA=65)	1.40	-0.19	1.66	-1.03	1.67	-1.09

Note: The t-statistics are based on the hypothesis that $constant = \beta = 0$.

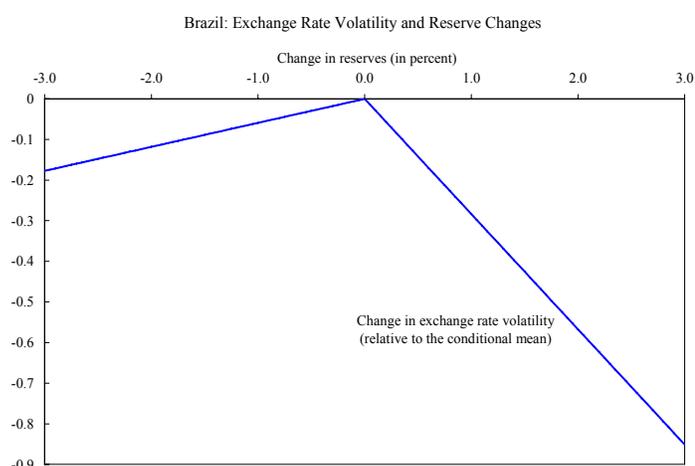
Impact of reserve accumulation on the volatility of the exchange rate

30. **Reserve changes have lowered exchange rate volatility.** A GARCH model is estimated for implied exchange rate volatility using current and lagged daily reserve changes (in percent), RESERVE_D; changes in the VIX index to control for changes in overall volatility; and absolute values of daily reserve changes, RESERVE_D_POS. The last term tests whether exchange rate volatility reacts asymmetrically to reserve increases versus decreases. The results, which are reported in Table 3, reveal that the contemporaneous and lagged changes in reserves have a negative and statistically significant effect on the implied volatility of the *real*.

Table 3. GARCH Model of Reserve Accumulation and Exchange Rate Volatility

	Coefficient	Std. error	z-stat	Prob.
C	0.00096	0.00027	3.51	0.000
RESID(-1)^2	1.19418	0.28086	4.25	0.000
GARCH(-1)	-0.26392	0.12854	-2.05	0.040
RESERVE_D_POS	-0.00017	0.00004	-4.10	0.000
RESERVE_D	-0.00011	0.00003	-3.97	0.000
RESERVE_D(-1)	-0.00031	0.00009	-3.55	0.000
RESERVE_D(-2)	-0.00027	0.00009	-2.91	0.004
LOG(VIX)-LOG(VIX(-1))	0.00041	0.00196	0.21	0.833

31. ***Increases in reserves have lowered exchange rate volatility more than decreases in reserves.*** Both reserve increases and reserve decreases have lowered the volatility of the *real*, but reserve increases have lowered *real* volatility by more than reserve decreases. The negative and statistically significant coefficient on RESERVE_D_POS implies that a 1 percent increase in reserves has lowered *real* volatility by 30 percent (relative to the conditional mean), while a 1 percent decrease lowers *real* volatility by 6 percent (relative to the conditional mean). Reserve accumulation has thus been more effective at moderating exchange rate volatility than reserve decumulation.



E. Conclusion

32. ***Brazil's reserve position is broadly adequate for prudential purposes.*** The rapid accumulation in recent months has resulted in a comfortable reserve cushion that could be used to finance temporary external imbalances. The opportunity cost, while growing, remains quite manageable. Indeed, measures of optimal reserves based on commonly-used rules of thumb and a recently-developed model calibrated to the Brazilian economy confirm the sufficiency of the current reserve position even though in comparison to other BRIC economies, Brazil's cushion is lower.

33. ***Rapid reserve accumulation may not have affected trend real appreciation, but it has reduced its volatility.*** Empirical tests show that reserve changes have not impacted the

level of the exchange rate, although this result needs to be interpreted with caution. They confirm, however, that reserve accumulation has attenuated *real* volatility, providing support to the thesis that the central bank's intervention has at least not exacerbated volatility.

34. ***Going forward, the pace of reserve accumulation could be reduced.*** The marginal benefit of continued rapid reserve accumulation is unlikely to outweigh its cost. Thus, several countries with large reserve stocks have begun seeking higher returns for their reserves by investing a fraction of reserves in relatively illiquid assets, which would lower the carrying cost of reserves. Such reserve diversification would, however, require a careful consideration of its benefits and costs.

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III. REAL INTEREST RATES IN BRAZIL¹

Real interest rates in Brazil have remained very high, notwithstanding macroeconomic stabilization and reduced vulnerabilities. This chapter explores some of the reasons for the persistently high real rates in Brazil. It finds that real rates in Brazil have declined at a pace comparable to other countries undergoing stabilization and improving public debt fundamentals. Going forward, continued sound macroeconomic policies, together with structural reforms, should help lower rates further.

A. Introduction

1. ***The persistence of high real interest rates in Brazil, particularly after macroeconomic stabilization, has been subject of substantial research and debate.*** Brazilian real interest rates have traditionally been very high. During the 1980s and until the mid-1990s, this phenomenon was accompanied by (and attributed to) substantial macroeconomic and price instability. More recently, however, despite the successful stabilization efforts, interest rates in Brazil have remained persistently high in real terms, triggering abundant debate and research on the potential causes. Given that high real interest rates inhibit the development of long-term credit markets and hamper economic growth, it is important to understand their drivers to elucidate the proper policy responses.

2. ***Studies examining the role of macroeconomic factors in the determination of real interest rates have generally been able to explain only in part the levels observed in Brazil.*** Empirical evidence tends to support the view that macroeconomic factors such as inflation levels, country risk spreads, and weak public debt fundamentals, *inter alia*, have an effect on the level of real interest rates (for example, Calhman de Miranda and Kfoury Muinhos, 2003; Favero and Giavazzi, 2002; World Bank, 2006). However, estimates based on cross-country data fail to fully account for the large real interest rate differentials observed in Brazil (Calhman de Miranda and Kfoury Muinhos, 2003; Bacha, Holland, and Goncalves, 2004).

3. ***This has motivated additional—possibly complementary—hypotheses on the drivers of the high real interest rates observed in Brazil.*** The first one points to multiple equilibria arising from feedback effects between interest rates and the perceived riskiness of public debt. In particular, high interest rates affect the fiscal accounts and the sustainability of public debt, feeding back into interest rates via a risk premium demanded by creditors. Under this approach, Brazil could have been trapped in a “bad equilibrium” since the beginning of the stabilization period. The second hypothesis highlights the potential role of institutional factors affecting the riskiness of financial contracts issued in the Brazilian jurisdiction, such as poor contract enforcement (Arida, Bacha, and Lara-Resende, 2005). Although the empirical support for this hypothesis appears to be weak (Goncalves, Holland, and Spakov, 2005), there is evidence that financial restrictions could amplify the role of

¹ Prepared by Francisco Vázquez.

macroeconomic factors in the determination of real interest rates (Bacha, Holland, and Goncalves, 2007).

4. ***This chapter provides a further look into the macroeconomic determinants of real interest rates using cross-country data.*** Using an unbalanced panel dataset of annual real interest rates in 150 countries from 1980-2007, it explores the role of selected macroeconomic factors in determining their level. It finds that countries with more volatile inflation, particularly during protracted periods, tend to display higher real interest rates. This result, which is novel to the literature, suggests that price-dilution risks have a substantial and long-lasting role in determining the level of real interest rates. The chapter also finds that countries with weak public debt fundamentals, measured by the ratio of debt to gross national income and the share of short-term debt to total debt, tend to display higher real interest rates.

5. ***The rest of the chapter is organized as follows.*** Section B provides a descriptive background on the evolution of real interest rates in Brazil and other countries since the early 1990s. Section C explores the behavior of real interest rates during stabilization periods using data from a group of countries with a history of high real interest rates, and uses the results as a reference to the Brazilian case. Section D explores the role of selected macroeconomic factors in the determination of real interest rates. Section E concludes.

B. A Cross-Country Snapshot at the Evolution of Real Interest Rates

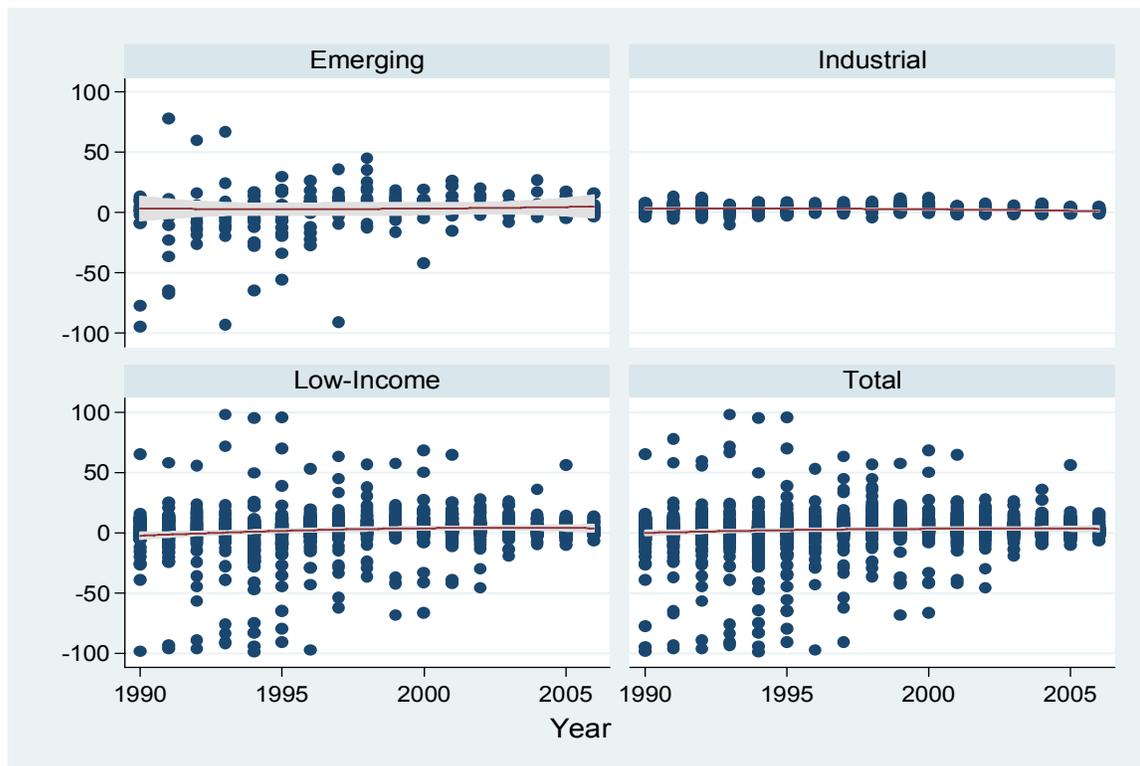
6. ***Real interest rates in Brazil have declined since the early-1990s, but their levels have remained consistently among the highest in the world.***² A broad overview at the behavior of real interest rates worldwide during the last fifteen years reveals similar patterns across countries at different stages of development (Table 1 and Figure 1). In particular, real interest rates have been falling across all country groups since the mid-1990s, reflecting inflation stabilization and abundant liquidity worldwide. The dispersion of real interest rates has also narrowed significantly across (as well as within) country groups, with minimum interest rates moving up toward positive territory and maximum rates dropping. In fact, the dispersion of real interest rates in the early 1990s was significant among low-income and emerging market countries, with many episodes of large negative rates reflecting a mix of financial repression and inflationary surprises. Brazilian real interest rates have been following a similar trend, but their levels appear to be substantially higher than those in other countries.

² In this chapter, real interest rates were measured by the ex-post money market rates (IFS line 60b), deflated by the consumer price inflation (see Appendix 1 for a more detailed discussion of the data and the use of short-term rates). Parallel exercises using discount rates (IFS line 60) produced results similar to those reported here.

Table 1. Summary Statistics of Real Interest Rates by Country Groups, 1990-2006

		Period		
		1990-95	1996-00	2001-06
Low-	Averag	-	4.0	3.
	St. Dev.	20.	11.	5.
	Mi	-	-	-
	Max	73.	56.	27.
	No.	44	46	50
Emerging	Averag	-	4.9	3.
	St. Dev.	20.	7.4	4.
	Mi	-	-	-
	Max	49.	21.	15.
	No.	10	9	11
Industrial	Averag	3.1	3.2	1.
	St. Dev.	2.6	1.9	1.
	Mi	-	-	-
	Max	7.0	7.7	5.
	No.	21	17	17
Brazi	Averag	123.	21.	15.
	St. Dev.	151.	13.	4.
	Mi	-	8.3	8.
	Max	421.	35.	20.
	No.	6	5	6

Figure 1. Evolution of Real Interest Rates by Country Groups, 1990-2006



Note: excludes years with real interest rates in excess of 100 percent.
Source: International Financial Statistics and IMF staff calculations.

C. Stabilization of Real Interest Rates: How Fast? How Far?

7. *To analyze the behavior of real interest rates around peak periods, a group of countries with a history of high real interest rates was selected.* The selection criterion was countries with a history of real interest rates surpassing an arbitrary threshold of 20 percent real rates in at least one year during 1980-2006. This criterion produced a group of 36 countries, including 27 low-income and 9 emerging market economies. Aside from Argentina during the hyperinflation in 1988-89, Brazil displayed the largest real interests in the group, with a peak in 1990, followed by Uruguay (2002), Mongolia (1993), and again Argentina (1983).³

8. *Real interest rates in Brazil around their historic maximum were substantially higher than those in comparator countries.* To compare the evolution of real interest rates in Brazil and the selected countries around peak periods, an eleven-year window was used and centered at the historic maximum of each series (labeled T0). The results (Table 2) showed a substantial and persistent dispersion of real interest rates within the group of countries analyzed, as indicated by the yearly standard deviations of real interest rates, as well as by their range. Overall, real interest rates in Brazil around the historical peak reached in 1990 were systematically (and substantially) higher than the group average, reaching the maximum values in the sample in six out of the eleven years.

Table 2. Summary Statistics of Real Interest Rates Around their Historic Peaks

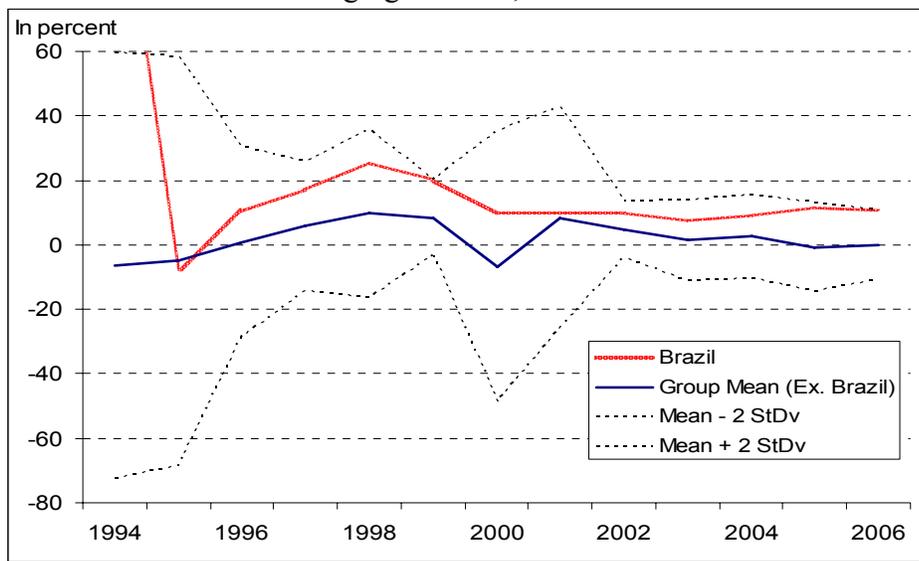
Year	Brazil	Entire Sample			
	1985-1995	Mean	St. Dev.	Min	Max
T-	17.1	-7.9	34.5	-93.0	63.2
T-	-17.0	-5.2	27.6	-64.8	56.8
T-	59.7	0.5	30.6	-94.2	59.7
T-	77.3	5.1	23.7	-40.9	77.3
T-	325.0	19.3	58.8	-21.1	325.0
T	421.0	56.0	78.9	20.2	421.0
T+	77.8	8.3	37.4	-91.6	77.8
T+	59.2	5.6	29.6	-98.5	70.1
T+	66.9	4.7	25.0	-96.2	66.9
T+	126.1	11.8	24.0	-7.0	126.1
T+	-7.6	5.7	13.6	-42.3	40.8

T0 stands for the year of the peak in real interest rates
Based on a sample of 36 countries with a history of real interest rates exceeding 20 percent at least in one year during 1980-2006.

³ Annual data from IFS are used to compute real interest rates. Although real interest rates in Brazil may be overstated for the year 1990 because of highly volatile monthly inflation rates, this methodology was used because of data constraints and to ensure uniformity of treatment across countries.

9. ***Real interest rates in Brazil after macroeconomic stabilization remained substantially higher than those in other emerging market countries.*** To analyze real interest rate dynamics after macroeconomic stabilization, Brazil's real interest rates after the launching of the 1994 Real plan were compared with the rates of a group of comparator emerging market economies. The latter included countries in which real interest rates were above 20 percent for at least one year after 1994, using the constituents of the EMBI+ index. The filtering criterion produced five countries (Argentina, Ecuador, Indonesia, Turkey, and Ukraine). The results show that real interest rates in Brazil dropped substantially immediately after the beginning of macroeconomic stabilization, but remained persistently higher than those in the comparator countries, with an average of 8.4 percentage points above the group mean during 2000-06 (Figure 2).⁴

Figure 1. Comparison of Real Interest Rates in Brazil and Selected Emerging Markets, 1994-2006

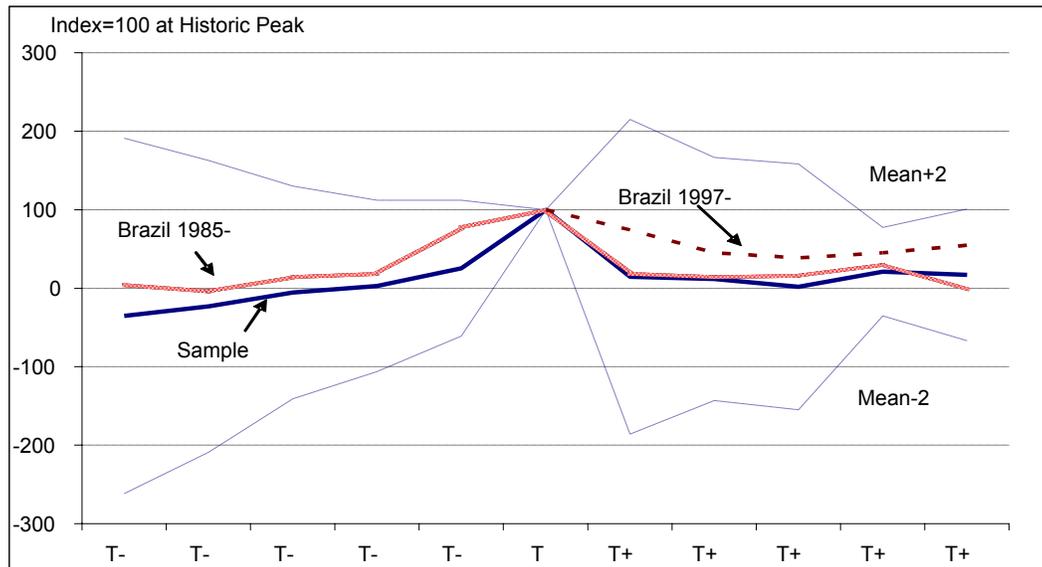


10. ***In relative terms, however, the behavior of real interest rates in Brazil was broadly comparable to that observed in comparator countries.*** To assess the relative evolution of real interest rates, the series were normalized to 100 at the peak (in T0), and a 95 percent confidence interval was constructed around the group mean. Using this metric, the relative behavior of Brazilian rates during the eleven-year window was very close to the average, with a steady increase from negative values in the years preceding the peak, a sharp drop in the year immediately after the peak, and a leveled evolution afterward (Figure 3). On average, real rates in the selected countries dropped from their peaks by a substantial 85 percent in the first year following the peak, and remained broadly unchanged afterward. In

⁴ A parallel exercise using a set of 12 emerging market economies with real interest rates surpassing at least 10 percent in at least one year after 1994 produced similar results.

recent years, the relative evolution of both money market rates and the Selic rate after the beginning of the stabilization were also broadly consistent with the behavior in other countries.

Figure 2. Comparison of Normalized Real Interest Rates Around Historic Peaks, 1980-2006



Sample of 36 emerging and developing countries with real interest rates surpassing 20 percent on at least one year during 1980-2006.

11. ***Overall, these results suggest that a key difference between real interest rates in Brazil and in comparator countries resides in the levels, rather than in their relative evolution.*** The observed pattern suggests that real interest rates may stabilize at very different levels across countries and that these levels may depend critically on the sustainability of macroeconomic policies and the implementation of institutional and structural reforms. For example, in the case of Mexico following the Tequila crisis of 1995, sound macroeconomic management was not sufficient to fully bring real interest rates down, and a sustained stabilization effort, combined with an agenda of deeper economic reforms, was needed to reduce uncertainties. Eventually, market expectations improved, allowing for a more substantial drop in real interest rates. The next section exploits cross-country data to assess the potential role of macroeconomic factors behind the levels of real interest rates.

D. Real Interest Rates and Macroeconomic Factors

12. ***Dynamic panel regressions were estimated to examine the role of selected macroeconomic factors in determining the level of real interest rates.*** All the specifications included one lag of the dependent variable to account for the strong persistence of real interest rates, country-level fixed effects, and time dummies to control for common (global)

shocks to the sampled countries. A more detailed description of the specification is presented in Appendix 1.

13. ***Baseline results indicate that real interest rates are strongly influenced by their previous levels, the history of inflation volatility, and public debt fundamentals:***

- The strong inertia of ***real interest rates*** is reflected in the autoregressive coefficients, which vary between 0.41 and 0.48 (Table 3), suggesting that, on average, more than 40 percent of a shock to real interest rates in any given year is carried to the subsequent year.

Table 3. Within-Group Regressions of Real Interests on Macroeconomic Factors
Sample: 1980-2006

	[1]	[2]	[3]	[4]	[5]
L.Real Interest Rate	0.434 [0.084]*	0.413 [0.097]*	0.407 [0.109]*	0.475 [0.049]*	0.474 [0.048]*
L. Inflation	-0.033 [0.017]	-0.035 [0.017]	-0.019 [0.014]	0.062 [0.020]	0.060 [0.021]
L2. Inflation	0.062 [0.018]*	0.059 [0.016]*	0.052 [0.019]	0.023 [0.014]	0.021 [0.013]
L3. Inflation		0.086 [0.005]**	0.061 [0.007]*	0.038 [0.002]*	0.036 [0.003]*
L4. Inflation			0.161 [0.007]**	0.142 [0.009]*	0.141 [0.009]*
L2. Public debt to Gross National Income				0.048 [0.004]*	0.048 [0.004]*
L. Short-term Debt to Total					0.090 [0.012]*
Observations	2488	2346	2206	1540	1540
Number of Countries	150	148	147	109	109
R-squared	0.22	0.20	0.20	0.25	0.25
Sum of Inflation Volatility Coefficients	0.029	0.110	0.255	0.265	0.258
Standard errors	[0.004]*	[0.012]*	[0.006]**	[0.000]**	[0.001]**
Long-term Impact on Real Interest Rates (basis points)					
Inflation	5.2	18.8	43.0	50.5	49.1
Debt to Gross-National				9.1	9.1
Short-term Debt to Total					17.1

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

- As expected, ***inflation volatility*** entered with a positive sign, indicating that real interest rates include a premium for price-dilution risks. Notably, up to four lags of inflation volatility influence real interest rates, underscoring the importance of persistent price stability. A sustained increase in inflation volatility by 1 percent a year translates into a 25.8 basis points increase in real interest rates in the short run (column 5), and a 49 basis points increase in the long run.

- Similarly, weaker *public debt fundamentals* correspond to higher real interest rates. A 1 percent increase in the ratio of public debt to gross national income translates into a 4.8 basis points increase in real interest rates in the short run and a 9.1 basis points increase in the long run, while a 1 percent increase in the share of short-term debt corresponds to a 9 basis points increase in real rates in the short run and a 17.1 increase in the long run.

14. ***Results based on GMM estimation of the model in first differences were broadly consistent with previous estimates, but suggest a stronger incidence of macroeconomic factors on real interest rates.*** A parallel set of regressions were computed using the Arellano-Bond (1991) estimator, by restating the variables in first-differences to remove the fixed-effects, and using lagged levels of the explanatory variables as instruments to take into account their potential endogeneity. The estimation was carried out on the entire sample (1980-2006) as well as on two sub-samples. The results (Table 4) were roughly consistent with those discussed previously, albeit with generally larger point estimates, suggesting a stronger impact of macroeconomic factors. Overall, the coefficients displayed in the second column, estimated with GMM on the entire sample, exceed those displayed in the first and were also more precise, as reflected in their lower standard errors.

Table 4. Alternative Regression Estimates and Robustness Check
(Varying Samples)

	Sample 1980-2006		Sample 1990-2006		Sample 1990-2006 Excluding Brazil	
	Within-Levels	GMM-Differences	Within-Levels	GMM-Differences	Within-Levels	GMM-Differences
L. Real Interest Rate	0.47 [0.048]	0.47 [0.001]**	0.45 [0.058]	0.46 [0.000]**	0.34 [0.037]	0.36 [0.001]**
L. Inflation Volatility	0.06 [0.021]	0.08 [0.001]**	0.05 [0.016]	0.09 [0.001]**	0.04 [0.005]	0.08 [0.001]**
L2. Inflation Volatility	0.02 [0.013]	0.03 [0.001]**	0.02 [0.012]	0.03 [0.001]**	0.01 [0.003]	0.03 [0.001]**
L3. Inflation Volatility	0.03 [0.003]	0.05 [0.001]**	0.03 [0.003]*	0.05 [0.001]**	0.04 [0.003]	0.04 [0.001]**
L4. Inflation Volatility	0.14 [0.009]*	0.16 [0.001]**	0.15 [0.017]	0.17 [0.000]**	0.15 [0.010]*	0.17 [0.000]**
L2. Public debt to Gross National Income	0.04 [0.004]*	0.05 [0.000]**	0.03 [0.012]	0.05 [0.000]**	0.02 [0.000]**	0.05 [0.000]**
L. Short-term Debt to Total Debt	0.09 [0.012]	0.17 [0.006]**	0.13 [0.036]	0.19 [0.005]**	0.12 [0.031]	0.24 [0.007]**
Observations	154	141	131	125	130	123
R-squared	0.2		0.2		0.1	
Number of Countries	10	10	10	10	10	10
Arellano-Bond Test for AR(1) z =		-		-		-
Arellano-Bond Test for AR(2) z =		-		-		-

Robust standard errors in brackets

* significant at 10%; ** significant at 5%; *** significant at 1%

15. ***The results were similar in regressions based on two sub-samples.*** As robustness checks, the regressions were re-computed: (i) restricting the sample period to a more recent period; and (ii) excluding Brazil from the sample. The coefficients from the post-1990 sub sample were consistent with previous estimates, providing support for parameter stability. However, some coefficients, particularly those attached to the ratio of short-term debt to total debt, were less stable on alternative partitions of the data (i.e., restricting the sample to 1995-2006). Interestingly, excluding Brazil from the sample resulted in lower point estimates for most coefficients, suggesting that the sensitivity of real interest rates to macroeconomic factors in Brazil is generally stronger than that observed in other countries.

16. ***Macroeconomic factors do not fully explain by themselves the high level of real interest rates in Brazil.*** The country's history of high and volatile inflation, together with its relatively large share of public debt at short-term maturity, provides some basis to explain higher real interest rates than in other countries. However, controlling for these macroeconomic factors does not seem sufficient to explain the observed level of real interest rates in Brazil.

17. ***Enriching the above analysis with other indicators, including of institutional quality, may help shed additional light on the level of real interest rates in Brazil.*** Weak indicators of institutional quality, such as the legal framework of contract enforcement and the business environment, tend to raise the cost of finance and, hence, contribute to high real rates of interest. However, since comprehensive and reliable data on these variables, with broad country coverage and long time series, are lacking, estimating the contribution of institutional factors is challenging.

E. Conclusion

18. ***This chapter exploited a panel database covering 150 countries between 1980-2006 to assess the role of macroeconomic factors in determining the level of real interest rates.*** The chapter also explored the behavior of real interest rates around stabilization periods. The main conclusions are as follows:

- ***Convergence in Brazil is similar to that in other countries.*** Evidence suggests that the *relative* evolution of Brazilian real interest rates around their historical peak, as well as their post-stabilization peak, has been broadly similar to that observed in other countries, with a rapid drop immediately after the peak and a more leveled behavior afterward. Thus, the persistence of high real interest rates in Brazil is not attributable to sluggish convergence from unstable periods.
- ***Macroeconomic factors play a key role.*** Chief among macroeconomic factors are inflation volatility, the level of public sector indebtedness, and the weight of short-term debt in total public debt play an important role in determining the level of real interest rates.

Going forward, the continued pursuit of strong macroeconomic policies, including stable and low inflation and the strengthening of the public debt profile, would likely contribute to further declines in real interest rates.

Appendix 1. Data and Model Specification

19. **Real interest rates.** Two alternative measures of ex-post short-term real interest rates were used. The baseline estimations used money market rates (IFS line 60b) adjusted by CPI inflation (IFS line 64).⁵ This variable has been used customarily in previous studies. It has the advantage of being homogeneous and comparable across countries, although it may also reflect the monetary policy stance. A robustness check used discount rates (IFS line 60), and produced results similar to those reported above. To reduce measurement problems originating from accelerating inflation during peak episodes, all the exercises excluded a few observations with real interest rates exceeding an arbitrary threshold of 100 percent.

20. **Samples.** An unbalanced panel of 150 countries was constructed, classified in three groups: industrial, emerging markets, and developing countries, covering the period 1980-2006. Inflation volatility was measured by the standard deviation of monthly inflation, computed from the consumer price index (IFS line 64) using a 12-month rolling window. The share of total public debt to gross national income (GNI) and the share of short-term debt to total public debt were collected from the World Bank Global Development Finance.

21. **Regression specification.** The regressions presented in this chapter shared the following specification: $r_{it} = \alpha r_{it-1} + \mathbf{x}'_{it} \boldsymbol{\beta}_1 + \gamma_t + \eta_i + v_{it}$ where the index $i=1, \dots, N$ stood for countries, and $t=1, \dots, T_i$ was the time dimension, which varied by country since the panel was unbalanced. In all the regressions, the dependent variable was the level of real interest rates. The set of explanatory variables included the lagged dependent variable to accommodate the persistence of real interest rates (the first order autocorrelation of real interest rates was high at 0.65 and statistically significant at the 1 percent level).

44. **Explanatory variables.** The explanatory variables included a set of macroeconomic factors, namely inflation volatility, debt to GNI ratios, and short-term debt to total debt, grouped in vector \mathbf{x}_{it} . Since these factors were unlikely to be exogenous, they were treated as either predetermined or endogenous covariates in two alternative specifications. In particular, the equations were estimated using: (i) the Within Group estimator with robust standard errors, and (ii) the Generalized Method of Moments (GMM) estimator proposed by Arellano and Bond (1998) for the equation in first differences, using lagged levels of the explanatory variables as instruments with a lag truncation of 4 years. All the regressions were computed with country fixed-effects denoted by η_i , plus a full set of time dummies, γ_t , to control for common global shocks to real interest rates. The observation-specific error term, v_{it} , was assumed to be independent from the unobserved country effects and not autocorrelated.

⁵ In some countries with no available information on money market rates, real interest rates were computed using the discount rate (IFS line 60) or the treasury bill rate (IFS line 60c).

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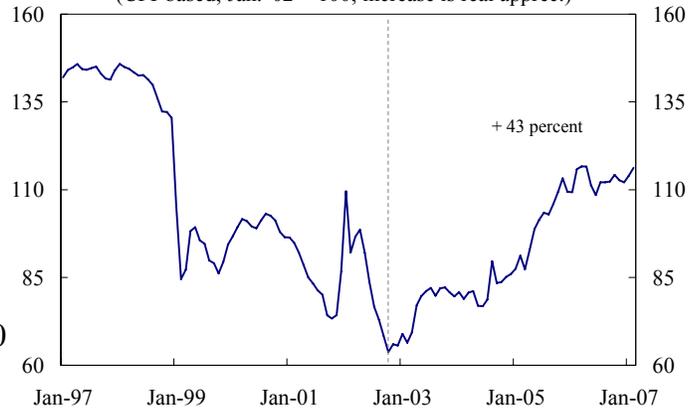
IV. AN ASSESSMENT OF BRAZIL'S EXPORT PERFORMANCE AND EXTERNAL COMPETITIVENESS¹

The appreciation in real terms of the Brazilian real since late 2002 (from a very depreciated level) reflects in part the successful implementation of the authorities' stabilization policies, which have strengthened the current account and exports. At the same time, this appreciation has dampened the expansion of exports since early 2005. Econometric estimation indicates that this appreciation has largely been a return to equilibrium levels--although it is difficult to assess the equilibrium exchange rate with precision. Moreover, the geographic and sectoral diversification of Brazil's export base highlights its resilience to temporary shocks.

A. Introduction

1. ***In recent years, the Brazilian real has appreciated sharply against most major currencies, reflecting significant improvements in fundamentals.*** The appreciation has been strong in terms of the U.S. dollar (48 percent from October 2002 to May 2007) and somewhat less marked against the Euro (28 percent). In real (CPI-based) effective terms, the Brazilian real appreciated by more than 40 percent from October 2002 to end-2006. However, this appreciation followed a sharp depreciation during 2001-02 and, in real effective terms, the real has broadly returned to its level in the period that immediately followed the January 1999 devaluation.

Figure 1. The Real Effective Exchange Rate, 1997-2006
(CPI-based; Jan. '02 = 100; increase is real apprec.)



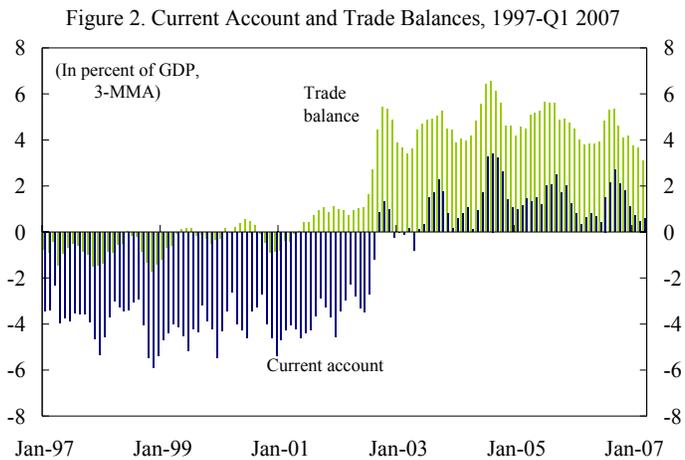
2. ***This chapter examines how exchange rate developments are affecting external competitiveness and exports.*** Competitiveness can be defined as structural and price conditions that are supportive of sound growth in net exports, consistent with longer-term balance of payments sustainability. The analysis will draw, in part, on an econometric estimation of the equilibrium exchange rate. The next section presents an overview of trade and exchange rate related indicators. Section C examines export developments, Section D presents an analysis of the equilibrium real exchange rate, and Section E concludes.

B. Trade and Exchange Rate-Related Indicators

3. ***Brazil's external position has strengthened noticeably since 2002.*** The recovery of the external current account in the wake of the 1999 devaluation only fully materialized by

¹ Prepared by Jan Kees Martijn.

mid-2002, when the trade balance shifted to a strong surplus (Figure 2). This recovery was supported by strong external demand and rising commodity export prices. In turn, the improvement in the current account has helped fuel a sustained appreciation of the real effective exchange rate. This has been made possible by the prudent fiscal policies implemented in recent years, including a sharp increase in public sector savings. These developments have also helped improve investor confidence, while a favorable international environment has also been instrumental to improved export performance and investor interest.



4. ***The sizable trade surplus that has emerged since 2002 reflects both strong export growth and containment of import growth.***

- Movements in export volume seem to follow those in relative domestic export prices with some lags (Figure 3). Following the 1999 devaluation and the further subsequent depreciation of the real, relative export prices rose, resulting in a sharp export response. This expansion lost steam by 2000, with electricity shortages and the Argentinean crisis.
- A second expansion began in late 2002, following further depreciation and supported by a strong world economy and rising commodity prices. In addition, a pick up in FDI since 1998 had helped expand production and export capacity. Despite the subsequent appreciation of the real, exports have continued to rise in volume terms, albeit at a reduced pace since early 2005.
- Throughout the period, import volume growth has remained fairly moderate, with a pick up in 2005-06 (Figure 4). Over the past decade, import volume growth showed a clear inverse relationship with movements in relative import prices.

5. ***The composition of financial flows has also improved in recent years.***² Inward FDI, which rose sharply during 1998-2001 due to large privatizations, has remained fairly stable at US\$15-19 billion a year since 2003. Outward FDI has been more volatile, peaking in 2006 with an outflow of US\$27 billion, largely due to the purchase of a foreign company by a large Brazilian mining group. Net foreign medium- and long-term borrowing has been on a

² See Pitt (2006).

downward trend since 1999, reflecting reduced private and public sector external financing needs and large foreign debt repayments abroad. In addition, private flows have shown a marked shift from loans and debt securities toward equity financing, with rising portfolio investment by foreigners since 2004. Finally, short-term inflows, which had turned sharply negative after 1997 in the wake of the Asian and Russian crises, have since recovered, especially after 2003—supporting a strengthening of the *real*.

Figure 3. Export Developments and Prices, 1997-Q1 2007

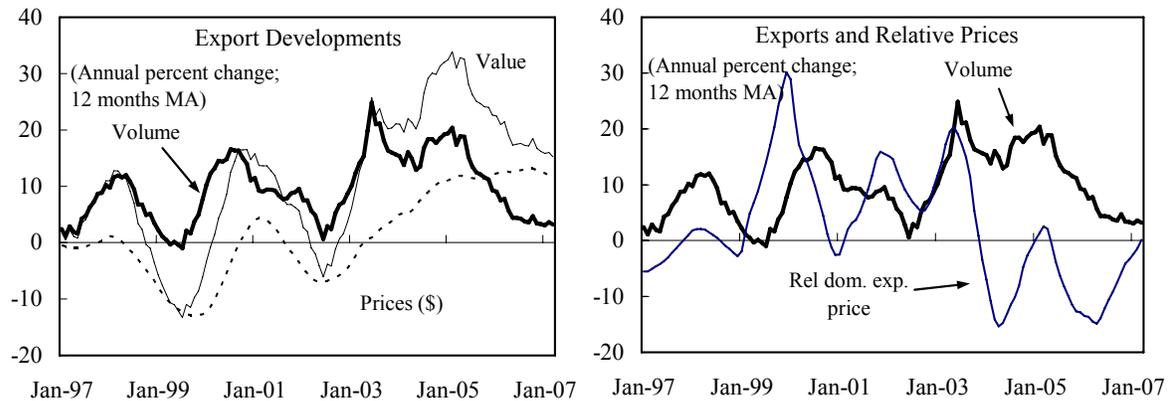
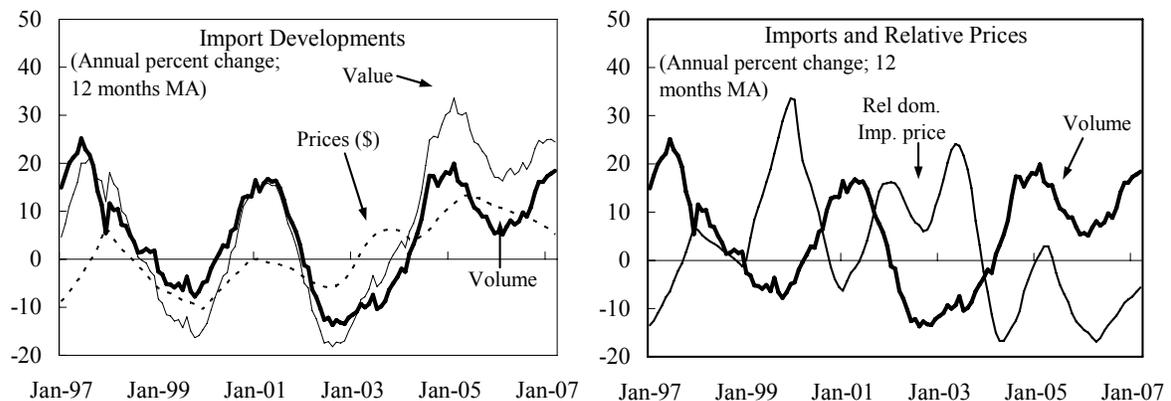


Figure 4. Import Developments and Prices, 1997-Q1 2007

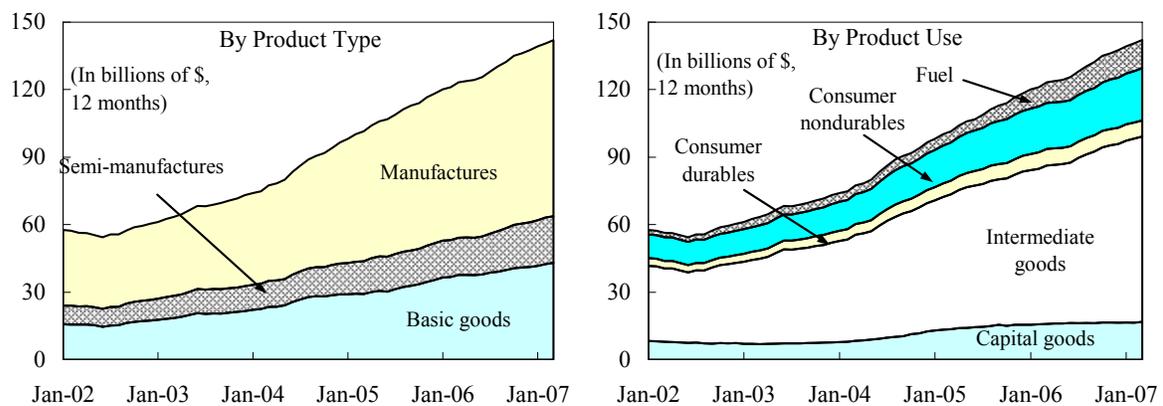


6. ***In turn, these developments have led to a sharp improvement in Brazil's net foreign asset position in recent years.*** The central bank has been taking advantage of the increasing supply of foreign exchange to accumulate reserves since 2002, with a sharp pick up since mid-2006—after the repayment of the bulk of external public debt had largely been completed. Net official reserves have increased sharply, from US\$38 billion at end-2002 to close to US\$145 billion by end-June 2007. Debt indicators have also improved because of the elimination of virtually all dollar-denominated domestic debt.

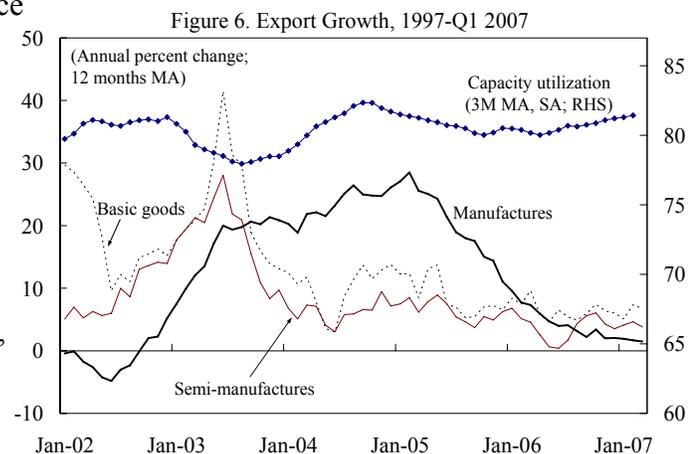
C. A Review of Brazil's Export Performance

7. *While Brazil's exports are well diversified, the pace of export expansion in recent years has varied across sectors* (Appendix Table 1). The composition of exports has remained fairly stable over the past decade, tilted toward agriculture and manufactures, in particular intermediate goods (Figure 5). The share of exports in GDP remains fairly low, but has expanded strongly over the past decade, from 7 percent in 1997 to 13 percent by 2006. The rebound in export growth, following the 2002 depreciation, has been shared across sub sectors, but sustained longest in manufacturing (Figure 6).

Figure 5. The Composition of Exports, 2002-Q1 2007



- Primary products (agriculture and mining).** The high share of agriculture (in particular, soybeans, meat, coffee, and tobacco) and mining (iron)—at about 30 percent of total exports—reflects Brazil's resource endowments. Moreover, a gradually rising share of production is exported following transformation, as (semi-) manufactured goods.³ Export growth of primary products declined in volume terms from 13 percent in 2003 to 6 percent in 2006, but owing to the strong global commodity prices, the share of primary products in total exports remained broadly unchanged.

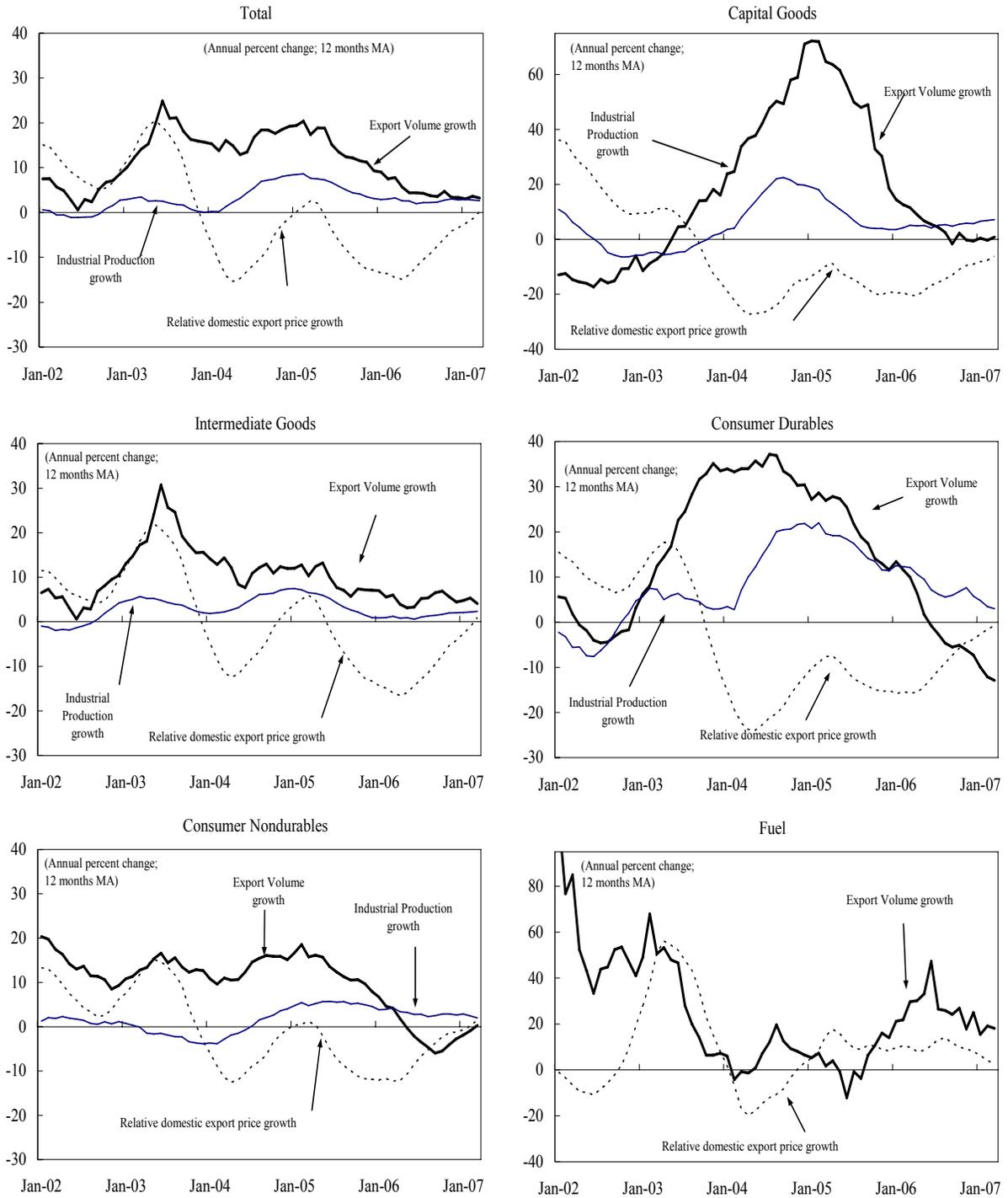


³ In 2005, processed products accounted for 44 percent of total agro-food exports, from slightly less than 40 percent in 1998 (USDA, 2006).

- ***Semi-manufactures.*** The main products in this category are iron products, chemicals and sugar, and recent trends have broadly tracked those of primary products.
- ***Manufacturing.*** Brazil's industrialization programs in the 1970s and the 1980s, which boosted heavy manufacturing, provided the basis for the development of a large manufacturing sector, which accounts for more than 55 percent of total exports. Since the 1980s, production has diversified somewhat toward higher value-added products (including aircraft and other transportation equipment), but the share of light manufacturing has remained modest (about a quarter of total manufacturing). The breakdown of (total) exports based on product use in Figure 7 (and in Appendix Table 1) helps shed light on both the high volume growth of manufacturing exports from 2003 through early 2005 and the subsequent slowdown. The expansion was strongest for capital goods (in particular, aircraft in 2005) and consumer durables (notably, passenger cars). A more recent weakening of exports has been particularly apparent for consumer durables (in particular, motor vehicles, due to strong domestic demand) and nondurables (in particular, textiles—a sub sector that is relatively labor intensive and exposed to foreign competition)—with negative volume growth in 2006.
- ***Energy.*** A notable development within primary and manufacturing products is the sharp expansion of (crude and refined) fuel exports, which accounted for 9 percent of total exports in 2006, up from 5 percent in 2002; such exports include ethanol (1 percent). This expansion is linked with Brazil's successful move toward self-sufficiency in energy, which has largely removed its vulnerability to oil-price shocks.

8. ***The wide distribution of Brazil's exports across destination countries supports their resilience.*** About one fifth of exports are destined to the European Union (EU), the United States (U.S.), and Latin America (supported by trade preferences within Mercosur), respectively (Figure 8). A notable development has been the rise and decline in the U.S. share (from 19 percent in 1998, to 26 percent by 2002, and 18 percent in 2006), broadly in line with changes in the U.S. share in global imports. Second, during this period, Asia's share rose from 11 percent to 15 percent. This increase largely relates to China's surging demand for food products (in particular, soy) and industrial inputs (especially iron and steel), which matches Brazil's export profile. The latter shift and the strong expansion of Brazilian exports since 2002, followed by a leveling off in 2005-06, are also reflected in its share in foreign imports (Figure 9). While Brazil's share in global imports increased sharply during 2001-04, it has since declined. Its share in the imports of developing countries, in particular China, has expanded rapidly since 1999.

Figure 7. Exports, Export Prices, and Production Growth, by sector, 2002-Q1 2007



Sources: Central Bank of Brazil, Funcex, and IPEA.

9. ***The outlook for export growth appears mixed.*** On the one hand, global demand is projected to remain strong, and the share of exports in Brazil's GDP is still modest. On the other hand, exports are tempered by the appreciation of the *real* and the strength of domestic demand—reflected in high capacity utilization and supporting the appreciation. Figure 7 illustrates the recent reversal in the generally positive association between exports of manufactures and overall industrial production growth, which suggests that increased domestic demand is limiting the scope for exports, at least for some sectors. The slowdown of export growth in the context of an appreciation of the currency has also heightened interest in the appropriateness of the level of the exchange rate.

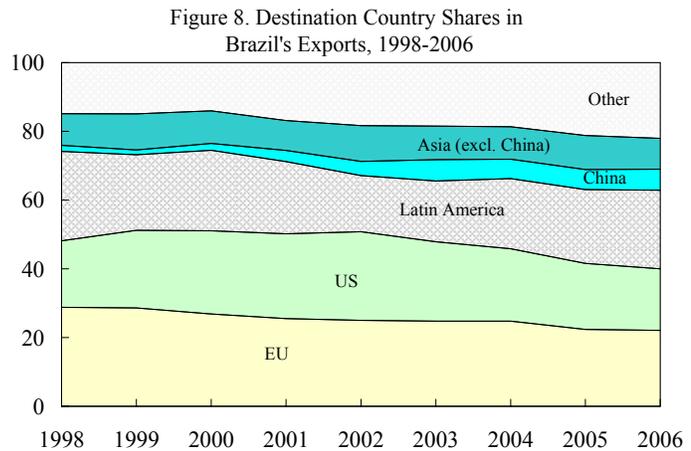
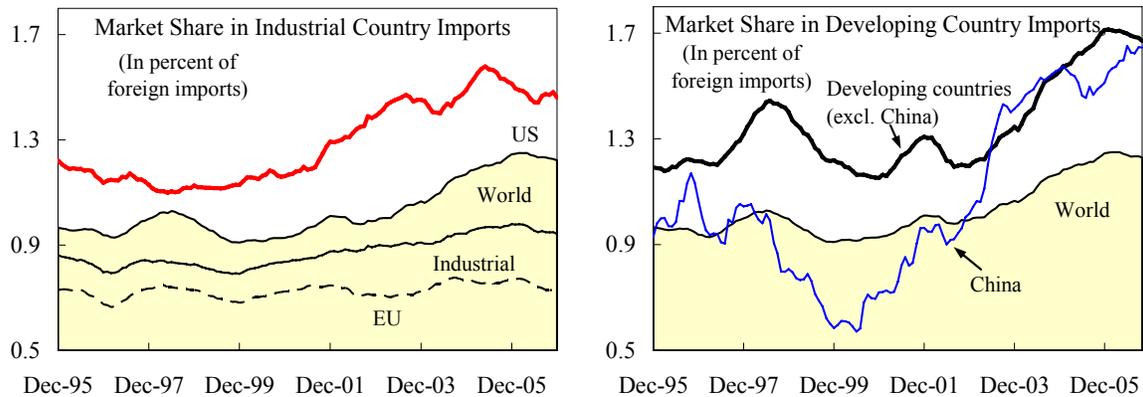


Figure 9. Brazil's Market Share in Country Imports, 1995-2006



D. Estimating the Equilibrium Exchange Rate

10. ***This section presents several possible measures of the equilibrium exchange rate for the Brazilian real, and assesses differences between actual and equilibrium levels.*** A key question is to what extent the recent appreciation of the *real* is in line with fundamentals. Studies using cointegration to derive the equilibrium exchange rate path have been conducted for a number of countries, including Brazil, in recent years, and we refer to them for the underlying methodology (Appendix II).

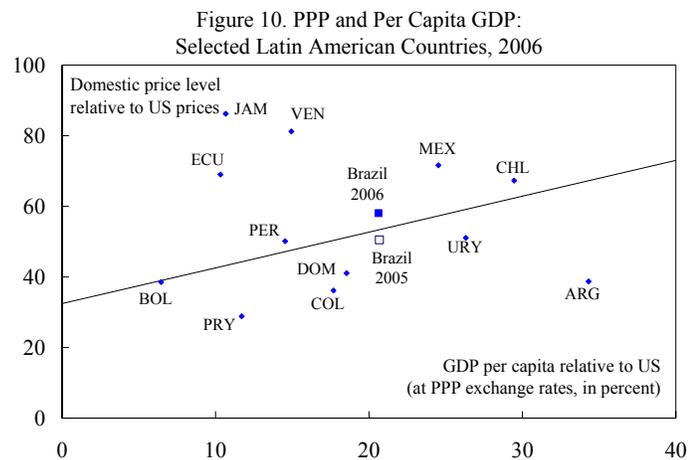
11. ***While this approach helps assess recent exchange rate developments relative to historical patterns, it does not provide clear policy guidance.*** Assessments of the

equilibrium exchange rate typically relate the real exchange rate to its determinants based on the econometric estimation of persistent patterns of co-movements among variables. This approach can show when the exchange rate seems to have been out of line with the estimated long-term relationships. It can also help clarify the driving forces behind persistent changes in the REER. But this methodology does not assess what has been the impact of policies (including monetary policy) on the REER, nor what policies should be.

12. ***Within this broad approach, we consider two alternative methods:***

- The behavioral equilibrium exchange rate (BEER), which is essentially empirical, without reference to a specific model or concept of equilibrium.
- The more common fundamental equilibrium exchange rate (FEER) approach, pioneered by Edwards (1989), which seeks to identify factors that affect the long-run equilibrium exchange rate.⁴ The FEER analysis below derives the equilibrium exchange rate by combining the “permanent” component of the fundamentals behind the real effective exchange rate with their estimated effect on the real exchange rate.

13. ***An assessment of GDP per capita and PPP suggests that Brazil’s real exchange rate is broadly in line with fundamentals.*** Figure 10 plots estimates of PPP (relative to U.S. prices) on the vertical axis against real per capita incomes on the horizontal axis. In terms of the fundamentals affecting the real exchange rate, this captures the productivity effect. The underlying hypothesis is that countries with higher productivity and incomes should have higher nontradables goods prices and, thus, more appreciated real exchange rates. In the case of Brazil, this overall pattern is supported by the chart below, including for 2006.

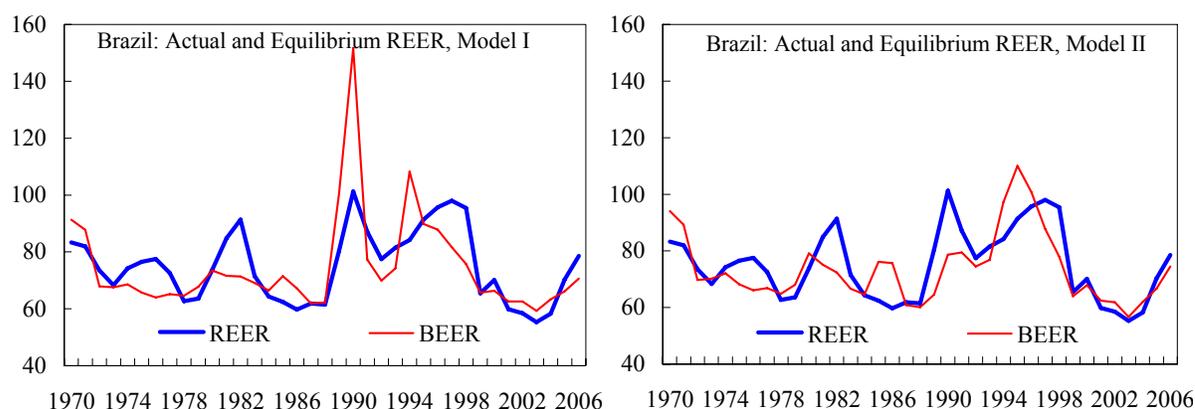


14. ***An estimation based on the behavioral exchange rate approach (BEER) also indicates that the Brazilian real is broadly in line with fundamentals.*** The analysis updates Paiva (2006). The determinants used in the computation of the equilibrium REER are the

⁴ Other approaches—not applied in this paper—explicitly consider the sustainable level of financial flows and then derives the equilibrium exchange rate for which the current would match this level over the medium term. These sustainable financial flows could correspond to either the underlying level in the past (the macroeconomic balance approach) or to the level that would stabilize the country’s NFA (the external sustainability approach). Both approaches are used in the Fund-wide CGER exercise.

terms of trade, the relative price of traded goods, interest rate differentials, the ratio of public debt to GDP (as a proxy for country risk), and Brazil's NFA.⁵ The resulting BEERs for two alternative models are depicted in Figure 11. Model I includes all the above determinants, while in Model II the interest differential is excluded from the equilibrium relationship.⁶ Visual inspection of the results confirms that the estimated BEERs follow patterns similar to those of the actual REER.⁷ In particular, the recent appreciation seems broadly in line with underlying fundamentals. For 2006, these models suggest a small overvaluation of about 5 percent, within the margin of error.

Figure 11. Actual and equilibrium Real effective Exchange Rate, 1970-2006



15. ***This conclusion is confirmed by Table 1, which depicts the drivers behind changes in the BEER.*** The models I and II suggest an equilibrium appreciation since 2003 by 19 percent and 31 percent, respectively, compared with an actual appreciation of 42 percent (based on annual averages). This equilibrium appreciation is largely driven by the increase in NFA and, to a lesser extent, the improvements in public debt and the terms of trade.

⁵ Brazil's net foreign assets (NFA) position concerns the country as a whole—and not of just the central bank, or the public sector—and reflects the accumulated past current account balances. By implication, there is no simple link between this variable and any policy instrument. It should have a positive relationship with the equilibrium real exchange rate, as higher NFA (implying reduced future debt service and/or higher earnings on foreign assets) allows for a weaker current account position in the future (associated with a more appreciated real exchange rate), while still maintaining consistency with external viability.

⁶ The methodology and estimation results are summarized in Appendix II. In deriving the vector error-correction specifications, standard selection procedures were followed. All estimated coefficients have the expected signs and most are (strongly) significant.

⁷ The sharp peak in the BEER in 1990 in model I reflects the peak in Brazilian interest rates (and thus in the interest differential).

Table 1. Relative Contributions of Fundamentals to the Equilibrium Appreciation, 2003-06

Model	Equilibrium appreciation	Contribution of fundamentals (in percentage points)						
		TOT	NTT	RINTTDIFF	DEBT	NFA	PROD	OPENNESS RELINVEST
I	19%	0.47	0.23	0.47	3.41	12.83		
II	31%	2.39	0.31		3.07	24.06		
III	37%	-0.98			3.61	34.00	-0.02	
IV	14%	-1.16			1.50	17.56		-1.55 -2.24
Actual	42%							

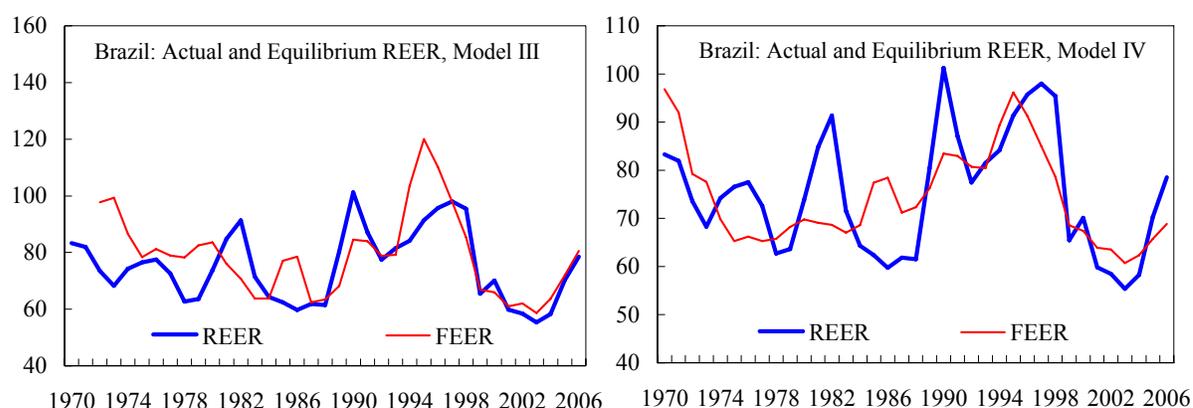
16. ***The fundamental equilibrium approach confirms the findings about the level of the real exchange rate.*** In this approach, only fundamental determinants of the long-run equilibrium exchange rate enter into the estimation, which rules out the interest differential and the relative price of traded versus nontraded goods. Instead of the latter—intermediary—variable, FEER estimation generally includes variables that should drive the relative tradables price, in particular relative productivity (to capture the Balassa-Samuelsson effect) and indicators of the composition of aggregate demand (as different demand categories may put different weight on tradables).⁸ The estimation results for two alternative FEER specifications are depicted in Figure 12. The results of the FEER analysis do not materially change in the assessment of the recent appreciation. Models III and IV suggest an equilibrium appreciation between 2003 and 2006 of 37 percent and 14 percent, respectively, driven by the improvements in Brazil's public debt and NFA.⁹ While Model III indicates that the 2006 REER was still marginally undervalued, Model IV suggests a modest overvaluation.

17. ***These assessments of the valuation of the real are also consistent with the spring 2007 CGER estimates.*** The Fund-wide CGER exercise uses cross-country data for assessing the equilibrium exchange rate, thus complementing the above analysis, which is based on time series for individual countries. The CGER combines three methodologies: (a) a macroeconomic balance approach; (b) a reduced form equilibrium real exchange rate approach; and (c) an external sustainability approach, based on external current account and net foreign assets positions. The latest CGER assessment indicates that there is no misalignment for the Brazilian *real*, with point estimates suggesting a small remaining undervaluation as of February 2007.

⁸ Furthermore, the equilibrium rate is computed using the long-run or permanent components of the fundamentals, approximated using an HP-filter (with a smoothing factor 50). However, relative public debt and NFA, are largely policy driven and, therefore, are not decomposed into a permanent and a transitory component.

⁹ While the actual terms of trade improved between 2003 and 2006, its trend based on the HP-filter remained negative (due to the sharp worsening between 2000 and 2003), explaining the negative effect of the terms of trade on the FEER during these years.

Figure 12. Actual and equilibrium Real effective Exchange Rate, 1970-2006



E. Conclusion

18. ***The recent appreciation of the real exchange rate testifies to the strength of the Brazilian economy.*** The appreciation has been supported by a marked improvement in the external current account, reflecting higher domestic savings, and a strengthened net foreign assets position. Exports have expanded strongly since 2002, with sustained high volume growth of manufacturing exports until 2005, while exports of primary products have been supported by strong world market prices. China has quickly become an important destination of Brazil's exports, while the share of the United States has declined since 2002.

19. ***Over the medium term, Brazil's current account surplus should be expected to gradually narrow.*** A small current account deficit would be the counterpart to its underlying net financial inflows, given the country's level of development and long-term investment opportunities. Against this background, recent signs of a weakening in export growth and a narrowing in the current account surplus is consistent with a strengthening of domestic demand, when output is closer to potential. The associated sectoral reallocations highlight the importance of structural reforms that would facilitate such shifts, and thereby limit their social costs. In addition, the gradual removal of emerging infrastructure and transportation bottlenecks to exports should help maintain export competitiveness and growth.

20. ***Although empirical estimation cannot determine the precise level of the equilibrium exchange rate, it signals that the Brazilian currency is broadly at an appropriate level.*** The formal analysis can support our understanding of the forces behind exchange rate developments but does not lend itself to simple conclusions about the "right" level of the exchange rate, especially for recent observations. The empirical analysis indicates that the real exchange rate depreciation of 2002 involved some overshooting, and that, overall, the subsequent real appreciation was an equilibrium phenomenon.

Appendix I. Sectoral Export Growth

Appendix Table 1. Export growth by product, 2003-Q1 2007 1/, 2/
(percent, year on year, for the past 12 months)

	Export share 2006	Export growth				
		2003	2004	2005	2006	Q1 2007
Primary products	32.1	13.1	7.2	6.6	6.0	6.7
Agriculture	5.3	24.1	1.3	6.5	14.6	9.3
Meats	6.1	23.2	26.8	15.2	-1.8	2.9
Coffee	2.4	-8.8	4.1	-2.1	6.0	14.7
Mining	8.1	8.8	29.0	3.9	5.0	5.6
Oil and coal	5.0	3.9	-4.5	18.9	34.1	28.9
Semi-manufactures	14.5	9.7	26.1	6.3	3.5	3.8
Sugar	4.5	-4.1	22.2	14.6	3.2	11.2
Vegetable oil	2.7	13.9	5.8	2.4	-13.3	-12.3
Nonmetallic minerals	0.8	27.5	25.7	3.1	0.8	3.3
Noniron metals	3.8	4.7	9.9	-1.9	8.9	5.4
Wood and furniture	3.0	21.5	24.7	-5.2	-7.8	-4.9
Cellulose and paper	3.0	27.1	7.5	10.7	7.0	4.8
Rubber	1.0	23.8	8.6	10.0	7.1	4.7
Elementary chemicals	3.1	14.7	30.4	10.0	22.1	31.5
Manufactures	55.4	20.9	26.1	11.1	2.0	1.4
Textile	1.3	39.2	15.8	6.6	-9.4	-13.1
Footwear, hides	2.9	8.2	9.8	-3.9	4.1	3.9
Agro products	2.8	8.8	18.4	2.7	-5.5	-3.1
Other food products	1.2	26.2	5.5	4.5	2.8	5.3
Refined petroleum and petrochemicals	5.5	20.2	0.2	12.1	7.3	3.7
Chemicals	1.1	10.6	19.1	1.6	3.9	3.0
Iron and steel industry	6.6	15.9	-0.2	8.3	-0.1	-5.7
Other metal products	1.3	4.7	16.6	-4.5	4.2	10.2
Machinery and tractors	5.0	54.8	51.8	14.1	-5.1	1.8
Electrical equipment	2.7	28.3	17.1	9.7	17.0	10.4
Motor vehicles	5.1	37.6	38.9	26.5	-8.5	-14.6
Motor parts	8.5	1.9	66.7	2.7	1.3	1.0
Industrial products	1.1	-10.0	20.9	13.7	9.9	11.6

Source: Funcex

1/ Data are not available for all products.

2/ The subsectors correspond only approximately with the three broad sectors.

Appendix II. Data Sources and Estimation Methodology

Data sources

The database for the estimation of the equilibrium exchange rate consists of annual observations for both Brazil and partner countries for the period 1970-2006. The partner country data were used to derive a partner country average using the following weights:

Argentina	2.32	Italy	6.04
Australia	1.60	Japan	11.00
Belgium	3.09	Korea	2.11
Canada	4.75	Netherlands	4.24
Chile	1.34	Russia/C528	2.11
China	1.90	Spain	2.20
China/HK	1.30	Sweden	1.70
France	6.76	Switzerland	2.10
Germany	12.15	United Kingdom	5.67
		United States	25.80

In line with Paiva (2006), all variables, except Brazil's real effective exchange rate, the interest differential, and NFA, are computed as the natural logarithm of the ratio of the underlying variable for Brazil to its average level in Brazil's partner countries. The specific variable definitions and sources are as follows:

- Real effective exchange rate (REER): natural logarithm of the real effective exchange rate. *Source: Information Notice System (INS)*
- Terms of Trade (TOT) for good and services. *Source: IMF, WEO database*
- The relative price of tradables versus nontradables (TNT) is measured as the ratio of the (more tradable intensive) WPI (or, if not available, PPI) to the (less tradable intensive) CPI. *Source: IMF, International Financial Statistics and WEO database*
- The real interest rate differential (RINTDIFF) is the real interest rate for Brazil minus its average level in Brazil's partner countries (using money market rates and the CPI). *Source: IMF, International Financial Statistics and WEO database*
- Public sector indebtedness (DEBT) is the ratio of general government net debt to GDP. *Source: IMF, International Financial Statistics and WEO database*
- Brazil's net foreign assets (NFA) position. *Source: Lane and Milesi-Ferretti (2006) and staff updates using BCB data.*

- Productivity (PROD) is approximated by real per capita GDP. *Source: IMF, WEO database*
- The share of investment in GDP (RELINVEST) is defined as the ratio of gross fixed capital formation to GDP. *Source: IMF, WEO database*
- Openness is defined as the ratio of the sum of imports and exports (of goods and services) to GDP. *Source: IMF, WEO database*

Estimation

In light of the nonstationarity of the variables (see Appendix Table 2), the analysis uses the cointegration method of Johansen, which provides a framework for testing and estimating long-run equilibrium relationships among such economic variables. For further examples and discussion of this approach, see Abdih and Tsangarides (2006) and Paiva (2006).

Appendix Table 2. Stationarity Tests 1/

Variable 2/	ADF test		Phillips-Perron test level
	level	First Difference	
REER	-3.31 **	-4.67 ***	2.70 *
Relative price nontraded goods	-0.76	-6.05 ***	
Relative terms of trade	-2.00	-5.18 ***	
Relative productivity	-0.75	-3.57 ***	
Relative govt. consumption to GDP	-0.51	-5.42 ***	
interest rate differential	-3.01 **	-5.81 ***	2.95 **
Relative debt to GDP	-2.84 *	-5.27 ***	2.90 *
NFA	-2.29	-4.20 ***	

1/ *** (**, and *) denotes rejection of unit root hypothesis at the 1-percent level (and at the 5 percent level, and 10 percent level, respectively).

2/ All variables are in logs, with the exception of the interest differential.

The estimation results are shown in Appendix Table 3, which depicts the estimates for the coefficients in the long-run equilibrium relationship (i.e., cointegrating vector) together with the t-statistics. All estimated coefficients (representing elasticities given the use of natural logarithms, except for the interest rate differential) have the expected signs. Below that, it shows the short-run feedback coefficient for deviations from the estimated BEER (which are negative as required for stability).

The Models I and II provide the basis for the BEER estimates.¹⁰ The other two specifications relate to FEER models.¹¹ Model III replaces the relative traded goods price by relative productivity, but this determinant is not significant (including in many alternative specification that are not shown). Model IV does not include productivity, but does incorporate two variables that capture demand effects that may drives the relative price of tradables: relative investment (as a share of GDP) and relative openness.

Appendix Table 3. Estimates of the cointegrating relationships 1/
Dependent variable: ln (real effective exchange rate)

	BEER		FEER	
	Model I	Model II	Model V	Model VI
ln (relative terms of trade)	0.64 (2.80)	1.05 (4.26)	0.45 (1.88)	0.54 (3.46)
ln (relative price traded goods)	-0.12 (-1.54)	-0.15 (-1.79)		
interest rate differential	0.20 (6.99)			
ln (relative debt to GDP)	-0.25 (-5.87)	-0.23 (-4.01)	-0.26 (-5.70)	-0.11 (-4.13)
ln (NFA)	-0.18 (2.82)	-0.32 (-5.38)	0.44 (8.77)	0.24 (7.05)
ln (relative productivity)			0.01 (-0.06)	
ln (fixed capital formation to GDP)				-1.02 (-4.93)
ln (openness)				-0.18 (-3.43)
Constant	3.61	2.37	4.98	8.43
adjustment coefficient (half life of deviation; years)	-0.25 2.8	-0.69 1.0	-0.57 1.2	-0.17 4.1
Δ BEER 2003 \rightarrow 2006	19%	31%	37%	14%

Finally, Appendix Table 4 confirms the existence of a single cointegrating relationship for each of the specifications.

¹⁰ The specifications includes a dummy variable for the years in which a stabilization plan was introduced, which takes on the value one in the years 1986, 1987, 1989, 1990, 1991, and 1994, and zero in all other years. Model II adds a dummy variable for the fixed exchange rate period (1995-1999).

¹¹ The interest differential was maintained in the short-term part of both equations, as was the dummy variable defined above, for the years in which a stabilization plan was introduced. The second model also includes an additional dummy variable, which takes on the value one in 1985, based on statistical grounds.

Appendix Table 4. Test of the Existence of Cointegration 1/

			FEER	
	Model III	Model IV	Model V	Model VI
Cointegration tests: Trace statistics				
$H_0: r = 0$ 2/	106.75 **	75.14 *	75.52 **	111.66 **
critical value	103.85	76.97	69.82	95.75
$H_0: r \leq 1$ 2/	63.99	39.92	33.52	55.6
critical value	76.97	54.08	47.85	69.82
Cointegration test: Max Eigenvalue Statistic				
$H_0: r = 0$ (critical value) 2/	42.76 **	35.21 **	42.00 **	56.05 **
critical value	40.96	34.81	33.88	40.08
$H_0: r \leq 1$ (critical value 34.81) 2/	26.25	20.91	23.24	27.05
critical value	34.81	28.59	27.58	33.88

1/ ** denotes significance at the 5-percent level; * denotes significance at the 10 percent level.

2/ If the the test statistic exceeds the critical value the null hypothesis is rejected at the 5 percent level.

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V. PUBLIC DEBT MANAGEMENT – RECENT EXPERIENCE AND POLICY CHALLENGES¹

Brazil has made good progress in improving its debt management in recent years, and vulnerabilities associated with the public debt have been much reduced, especially with regard to exchange rate risk. Nevertheless, debt levels remain high and are declining only gradually, average maturities are relatively short, and average interest rates are still high. This chapter discusses Brazil's debt management strategy, the structure of the debt and the interest rates on government paper, and issues related to debt market development, with a particular focus on three issues in particular: extension of maturities in domestic debt; increased net external debt issuance; and efforts to reduce the overall debt level.

A. Introduction

1. ***In recent years, Brazil has made important progress in improving the level and structure of its public debt, establishing a robust framework for debt management, and developing the domestic public debt market.*** The level of net debt is on a gradually declining trend and debt exposure to exchange rate changes has been virtually eliminated. Debt data and debt management strategy are reported transparently, and domestic government bond markets have become deeper and more liquid, with improved access for foreign investors. Nevertheless, significant challenges persist, including the needs to further reduce overall debt levels, improve the maturity structure and reduce rollover risks, and deepen liquidity in the secondary market, especially for longer-dated instruments.

2. ***This chapter provides a summary of the main characteristics of the Brazilian public debt and of its management.*** It discusses two issues in particular: (a) How to extend the average maturity of domestic debt; and (b) whether to take advantage of low spreads in global debt markets to significantly increase the net issuance of external bonds. The chapter is structured as follows: Section B briefly summarizes the government's debt management strategy. Section C describes the results of the implementation of this strategy, in terms of main developments in Brazilian debt structure and levels, using international comparisons where appropriate. Section D considers the two issues set out above, in light of the discussion of the previous sections. Section E concludes.

B. Debt Management Strategy

3. ***Brazil has implemented a broad range of measures that have brought its public debt management in line with international best practices.*** Following the passage of the fiscal responsibility law in 2000, debt issuance by the central bank ceased, and debt management is now consolidated within the National Treasury. Brazil has adopted a transparent strategy involving an overall objective with long-term goals, coupled with annual

¹ Prepared by James Roaf.

borrowing plans which include short-term targets in pursuit of these goals. Performance against these targets is covered in detailed annual debt reports. Brazil has developed a strong investor-relations program aimed at both domestic and foreign investors.

4. ***The overall objective of Brazil's federal public debt management is to minimize long-term financing costs, while ensuring the maintenance of prudent risk levels and contributing to the well functioning of the public debt market.*** This strategic objective corresponds closely to those adopted by many countries in recent years. The priorities of the borrowing plan for 2007, in line with those of recent years, include: lengthening maturities and reducing the share of short-term debt; continuing to substitute floating-rate and exchange rate-linked debt for fixed rate and inflation-linked securities; developing interest rate term structures; issuing external debt on the basis of qualitative indicators; and broadening the investor base. The plan sets out a baseline scenario and conducts stress tests based on various positive and negative shocks. Although reporting of the debt management strategy and debt data is generally comprehensive, reporting of the results in achieving the objective of financing cost minimization is weak in comparison to the reporting of the measures of risk.

5. ***Brazil is developing a model for analysis of optimal debt structures, and has made some steps toward an integrated model of asset and liability management.*** The National Treasury is developing a model for cost and risk analysis of the public debt, involving identification of an efficient frontier across these two dimensions by testing alternative debt portfolio compositions by maturity, currency, and indexation type. Preliminary results point to a potential for continued reductions in both cost and risk, especially by further shifts from floating rate to fixed rate and index-linked bonds. Under the asset-liability management, mismatches according to currency denominations and interest rate types on the sovereign balance sheet are monitored. This covers assets and liabilities related to floating interest rates, fixed rates, the inflation index, and the exchange rate. Given the sharp increase in international reserves that has occurred over the past year, such considerations are expected to take growing importance. It is also becoming increasingly important to consider the asset allocation for reserve management, and a new strategy is being developed in this regard.

C. Developments in Public Debt Levels and Structure

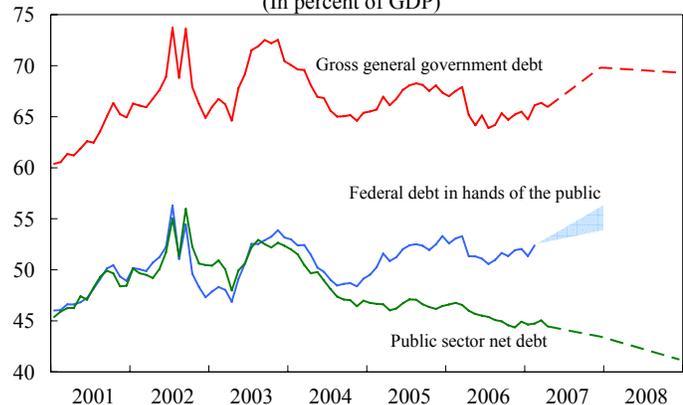
Debt levels

6. ***Indicators of both gross and net debt are commonly used in describing Brazil's debt.*** Figure 1 show three of the most frequently reported aggregates of Brazil's public debt expressed as ratios to GDP:²

² The authorities' presentation of debt ratios shown here uses as denominator GDP revalued at the prices of the month in which the debt stock is measured. This adjustment was very significant at times of high inflation, but is now much less relevant.

- **Gross general government debt** includes all domestic and external debt of the federal, state, and local governments. Importantly, it includes the very substantial government debt held by the central bank, and used in its open-market operations.
- **Gross federal debt in the hands of the public** nets out central bank holdings of government debt, as well as the extra-governmental debts of state and local governments (which are relatively small).³ For most analytical and comparative purposes, this is probably the most relevant of the series and it is used by the authorities for much of their analysis and reporting on the structure of public debt. For convenience, unless otherwise stated, this is the measure of total debt referred to in the remainder of this chapter. At the same time, the net debt measure remains an important indicator of overall sustainability.

Figure 1: Measures of Public Debt, 2001-2008
(In percent of GDP)



- **Net public sector debt** is a more complicated measure, in which various well-identified government assets are subtracted from gross debt. It includes the net debts of the central bank and public enterprises.^{4 5}

7. **While net debt is on a gradual declining path, gross debt has fallen relatively little in recent years.** Although all the measures of debt show significant declines since 2002, when the depreciation of the *real* pushed debt ratios up sharply, the declines have been relatively modest in more recent years. The main reason for the divergence of gross and net debt has been the large accumulation of net international reserves, which have been sterilized by issuance of additional domestic debt. At around 53 percent of GDP at end-March 2007, gross federal debt in the hands of the public remains relatively high in comparison with most other major emerging market economies. In the near term, it appears likely that the gross debt ratios will rise, if the reserves buildup continues. Figure 1 includes the projections made

³ Although referred to as debt “in the hands of the public” the series includes debt to external official creditors.

⁴ Assets netted off including those of the Laborer Assistance Fund (the FAT), equivalent to nearly 6 percent of GDP in 2006.

⁵ Central bank domestic debt fell from over 10 percent of GDP in 2001 to below 1 percent of GDP from 2004 onward.

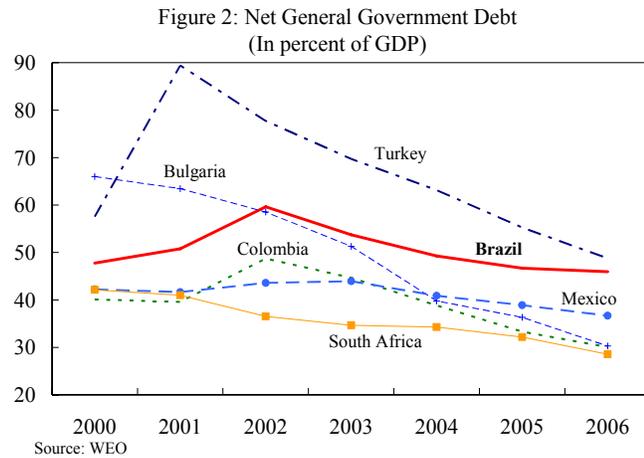
under Fund staff's debt sustainability analysis, and the indicative band for debt in the hands of the public is as presented in the authorities' Annual Borrowing Plan for 2007.⁶

8. ***Compared to most other emerging market countries, Brazil's debt is relatively high, and falling relatively slowly.*** This is particularly clear when comparing gross debt levels, but is also apparent among countries for which net debt data is available (Figure 2.)

Debt structure

Classes of debt instrument

9. ***Brazil's domestic government debt includes a full range of market instruments.*** Domestic debt is concentrated in the following main types: floating rate bonds (average maturity 22 months); fixed rate bonds (13 months); and inflation-linked bonds (5 years). The external debt is predominantly in U.S. dollars, but medium to long-term global bonds denominated in *real* have also been issued since 2005 (Box 1).



Brazil—Debt Instruments

Domestic debt

- ***Floating rate bonds*** (LFT), linked to the overnight Selic rate (34 percent of total debt). Maturities range up to five years, with an average of 22 months.
- ***Fixed rate bonds*** (LTN and NTN-F). LTNs are zero-coupon notes of up to two years maturity (26 percent of total debt). The NTN-F bonds carry coupons of 10 percent and have maturities of up to 10 years (5 percent of total debt). Average maturity of fixed rate bonds is just over a year.
- ***Inflation linked bonds*** (NTN-B and NTN-C). Maturities are up to 40 years, with an average of 5 years (19 percent of total debt).

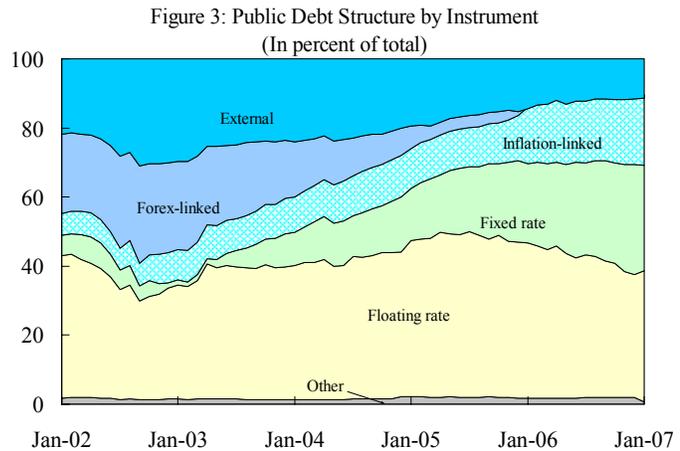
External debt

- ***Foreign currency bonds***. Predominantly in U.S. dollars (8 percent of total debt).
- ***Global BRL bonds***. Three issues have been made since 2005, with maturities of 10-20 years, under the New York law, and with settlement in U.S. dollars (0.5 percent of total debt).
- ***Official debt*** (2 percent of total debt).

⁶ Computed using staff projections of GDP

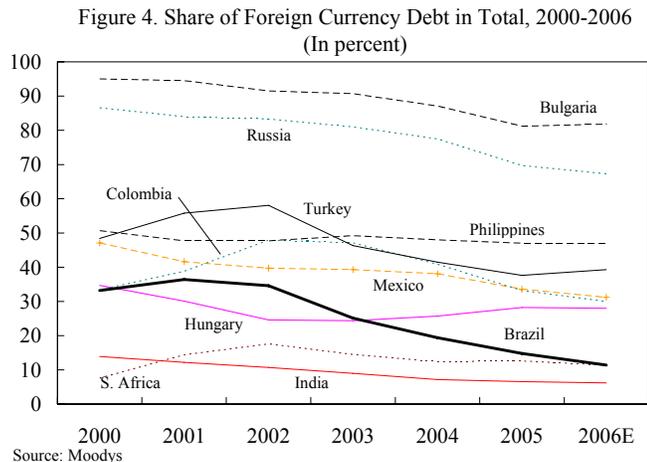
10. ***The most significant change in Brazil's public debt structure in recent years has been a steep decline in foreign currency-linked debt.*** Figure 3 shows the shares of debt by type of instrument. After the 2002 crisis, the authorities made a decision to reduce exposure to exchange rate risk.

Domestic foreign-exchange linked bonds, which had traditionally been used as a means of hedging exchange rate exposure by local agents, were gradually phased out.⁷ At the same time, external debt was also reduced sharply. Thus, the share of foreign currency and foreign currency-linked debt in total fell from over 50 percent at end-2002 to a little over 10 percent at end-2006.



11. ***In recent years, other emerging market countries have also shifted from external to domestic debt, and from foreign currency to domestic currency instruments*** (Figure 4).

These shifts partly reflected a decision by the authorities to reduce vulnerabilities, coupled with foreign investors' increased willingness to hold domestic currency bonds. The decline in the share of foreign currency debt to total debt also reflected the effect of real exchange rate appreciations. In Brazil, this decline has been more marked than in other countries, and this is even more evident when the swaps issued by the central bank, which were high in the early 2000s, are taken into account.



Maturity and duration

12. ***While exchange rate exposure has been cut sharply, Brazil has so far made limited progress in extending the average maturity of the debt.*** Indeed, the shift from external debt to domestic debt has tended to increase the share of short-term debt in total, and only in the

⁷ For a period, the role of providing U.S. dollar hedge to the private sector was played by currency swaps issued by the central bank, but these have also now been phased out, and indeed reversed as the central bank has increasingly moved to a net long dollar swap position.

last two years has this trend begun to be reversed (Figure 5). At end-2006, the share of total debt falling due within one year stood at 33 percent, equivalent to 16 percent of GDP.⁸ With a relatively high debt level and a large share of short-term debt, Brazil has one of the highest short-term debt to GDP ratios among emerging market economies.

13. ***In terms of duration, Brazil's debt remains highly exposed to changes in short-term interest rates.*** With 38 percent of the

debt stock in floating rate instruments, and short average maturity of fixed rate instruments, changes in the main policy interest rate have a powerful impact on debt servicing costs. Figure 6 shows the sensitivity of the debt stock to changes in exchange rates and short-term interest rates. With the expectation of continued declines in short term interest rates in the coming years, this is likely to lead to reductions in debt servicing costs.

Debt holders

14. ***An important change in debt holdings in recent years has been the expansion of the share held by mutual funds.*** As shown in Figure 7, the fall in gross government debt since 2003 is fully accounted for by the decline in external debt. The main holders of domestic debt are as follows:

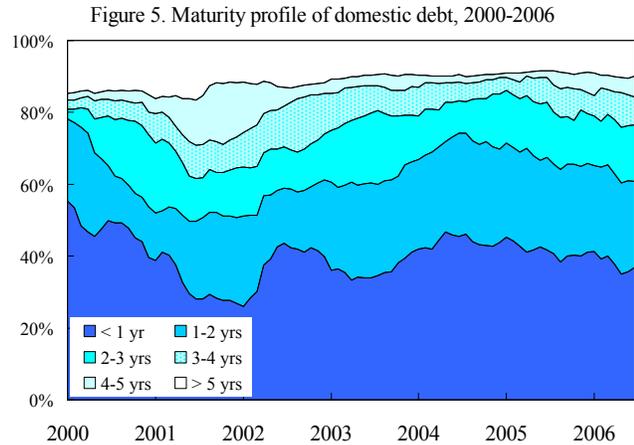


Figure 6: Sensitivity of the public debt (In percent of GDP)

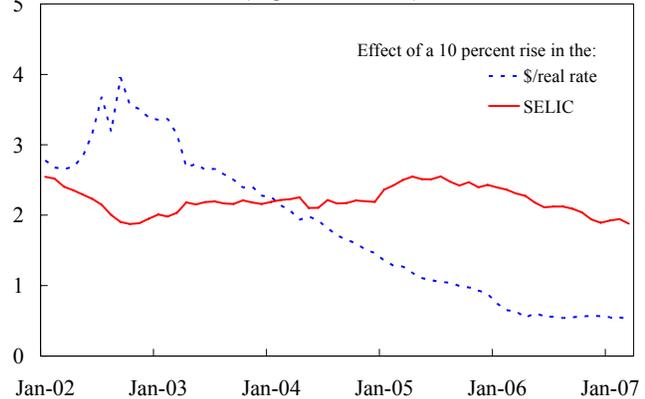
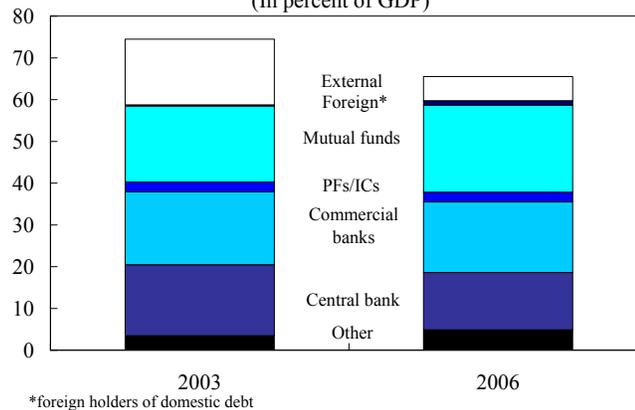


Figure 7. Public Debt Structure by Holder (In percent of GDP)



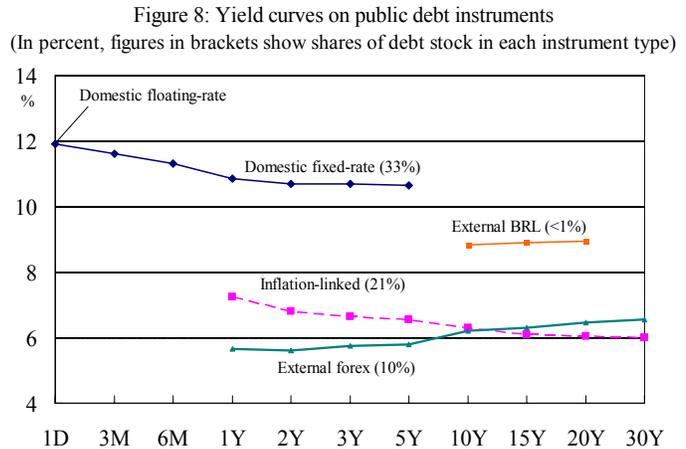
⁸ This figure is somewhat higher than normal practice, as the Brazilian convention is to quote maturities calculated at NPVs and including interest.

- **Mutual funds** have become the largest class of domestic debt holders. A key question is how volatile mutual fund holdings could be in times of crisis, and whether withdrawal of these funds could have a destabilizing effect. However, given that the investor base includes domestic retail and institutional investors, including pension funds, this risk seems moderate.
- **Pension funds and insurance companies.** Although Brazil has not implemented a public pension reform involving a second pillar of mandatory contributions to pension funds, private pension funds are large, with assets equivalent to close to 20 percent of GDP. These are mainly closed funds associated with private companies, but open schemes taking contributions from the public represent a growing share. Pension funds hold a surprisingly small amount of government paper directly—only around 10 percent of their assets. However, they do invest indirectly by placing a large share of their assets in mutual funds which, in turn, invest in the government debt market. Traditionally, macroeconomic uncertainty has led pension funds to invest in short-term bonds, despite the long-term nature of their liabilities. However, this is gradually changing as the funds increasingly recognize the advantages of moving out along the yield curve, and into inflation-linked bonds in particular.
- **Commercial banks.** Bank holdings of government bonds account for around 20 percent of bank assets. This proportion is declining gradually, but banks remain heavily exposed to, and reliant on, income from government paper. Holdings are concentrated at the short end of the curve, and banks do not generally appear to be performing a role of maturity transformation, preferring to match the liquidity of customers' deposits with short-term debt.
- **Central bank.** Government securities held by the central bank were equivalent to about 14 percent of GDP at end-2006. The government also holds considerable deposits with the central bank (10 percent of GDP at end-2006). As central bank holdings of government paper have remained fairly steady while deposits have grown, the government's net debt to the central bank fell from 14 percent of GDP in 2002 to 4 percent of GDP in 2006.⁹
- **Foreign investors.** Official data show that the share of government domestic debt held by nonresidents is a surprisingly small, at around 4 percent of the total. These figures do not show indirect holdings of foreigners through onshore mutual funds or banks, or their participation in total return swaps with local counterparties who hedge their positions by purchasing securities referenced in derivative contracts. However, this may be mitigated by the fact that foreigners now have a tax advantage by holding the paper directly.

⁹ The primary motivation for the large deposits is precautionary, to provide assurances of the government's ability to meet its debt service obligations, given the high short-term share. These holdings also take into account the fact that the central bank is precluded from providing credit to government under the fiscal responsibility law. The government's deposits at the central bank are remunerated at the average interest rate paid on central bank holdings of government debt.

Interest rates and yield curves

15. *The structure of domestic interest rates is characterized by strongly inverted yield curves, both in nominal and real terms.* The current structure of interest rates on government debt is shown in Figure 8. The inverted yield curves reflect continued expectations of cuts in the policy interest rate, as inflation and inflation expectations have been brought down. Nevertheless, long rates remain high, with real rates above 6 percent throughout the curve. Recent external issuances of bonds in domestic currency have been well received by foreign investors, with yields well below the closest comparators in domestic debt. This is thought to reflect in part a combination of investor segmentation, low liquidity in the long end of the domestic bonds, differences in taxation, and convertibility risks (the external bonds are settled in U.S. dollars and listed abroad).



16. *Interest rates on all classes of instrument have declined.* The principal factor in the fall in domestic interest rates has been the reductions in the overnight Selic rate, as inflation has fallen (Figure 9). Since the beginning of 2006, nominal and real yield curves have both fallen substantially, and have also flattened (Figure 10). Spreads on Brazil’s external bonds have also fallen sharply in recent years and, for the first time, the Brazilian debt is trading at lower spreads that the overall EMBI+ average of emerging market countries.

Figure 9. Interest and Inflation Rates
(In percent)

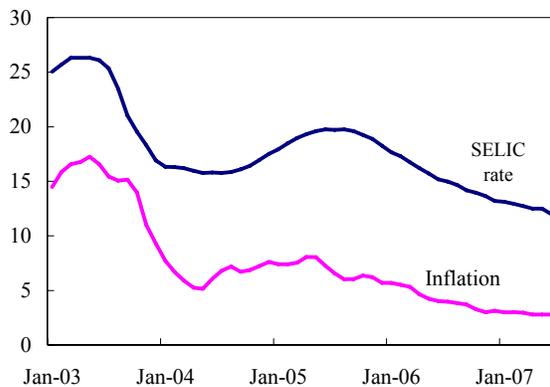
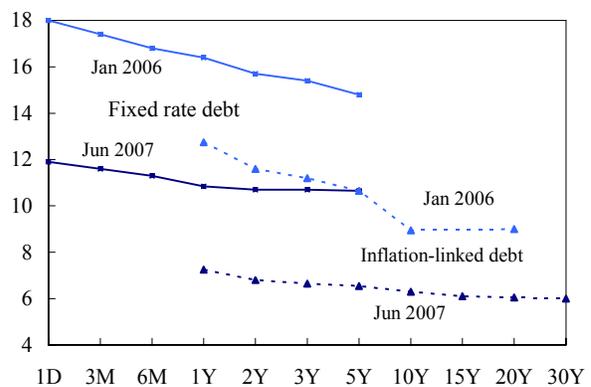


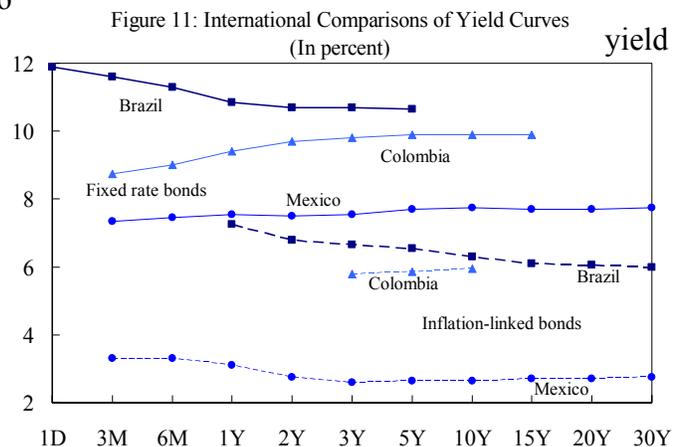
Figure 10: Historic Comparison of Yield Curves
(In percent)



17. **Notwithstanding the substantial falls in rates on all the main debt components, average interest rates have yet to show a significant decline.** In real terms, the average interest rate on the debt has actually risen in recent years. This apparent contradiction is explained by the large shifts in the composition of the debt that have taken place, with external debt carrying relatively low interest rates being replaced by higher-yielding domestic debt.¹⁰ At the same time, the reductions in yields on individual instruments may reflect in part the lower vulnerability of the debt stock associated with the reduction in exchange rate exposure. As the structure of the debt is not expected to change significantly in the future, further reductions in interest rates should be reflected fully in the overall debt financing cost.

18. **Brazil's interest rate structure is unusual in comparison with other emerging market countries.** Colombia and Mexico

both have upward sloping nominal curves at levels below those of Brazil (Figure 11). Mexico too has a mildly downward sloping real yield curve, but at markedly lower levels than the Brazilian real yield curve. However, Brazil's term structure has been converging toward these other examples.



Sovereign credit ratings

19. **Reflecting declining interest rates and spreads, and improved macroeconomic fundamentals, Brazil has seen a steady improvement in its credit ratings.** Brazil's external sovereign debt has recently been upgraded to one notch below investment grade by two of three main agencies, and stands two notches below with the third agency. Reports by credit rating agencies highlight Brazil's relatively high debt level and short maturity structure as among their principal concerns regarding sovereign risk.

Liquidity

45. **Liquidity in the government debt market appears to be reasonably high.** The turnover ratio (annual trading volume relative to the outstanding debt stock) was about 3.2 in 2006, in line with the levels in previous years. This compares with turnover ratios of 1.6 in Chile, 2.1 in Norway, 4.2 in New Zealand, 6.1 in Australia, and 17 in Canada. In common

¹⁰ Throughout the period considered, surveys of market expectations had suggested that the increased interest cost of domestic debt would be partially offset by revaluation gains due to exchange rate depreciation. However, in the event this factor has also gone in the opposite direction, as the *real* has appreciated against the U.S. dollar.

with international experience, liquidity is greatest in the short-dated instruments, with longer instruments tending to be favored by buy-and-hold investors.

20. ***The authorities have implemented a range of measures to improve the workings of the primary and secondary debt markets.*** In 2006, new rules were adopted for fixed-rate issuances, aimed at consolidating benchmark bonds. In the secondary market, measures were taken to improve transparency and liquidity in electronic trading. The income tax on foreign investments in the domestic debt market was reduced to zero, with a view to strengthening demand for longer-term fixed rate and index-linked bonds.

D. Challenges For Debt Management

21. ***Although significant progress has been made in recent years, significant challenges persist.*** In terms of volume, gross domestic government debt in the hands of the public has risen from below 40 percent of GDP at end-2002 to approximately 47 percent end-2006. Coupled with the high share of government paper held by banks, this raises the question of crowding out of domestic investment. The key challenges revolve around two main issues: (a) how to extend maturities and reduce financing costs of domestic debt; and (b) whether to take advantage of low spreads to step up the net issuance of external debt.

Extending the yield curve

22. ***As noted, Brazil's domestic debt structure remains characterized by relatively short maturities and a predominance of floating-rate debt.*** Although the government has succeeded in increasing the share of fixed-rate debt to over 30 percent of total debt, the average maturity of this debt is of only one year. Index-linked debt now accounts for nearly 20 percent of the debt stock, with an average maturity of 5 years. A remaining puzzle is why insurance companies and pension funds are not more willing to hold long-term securities, which offer high yields, especially long-term indexed debt.

23. ***Several factors are commonly cited as hampering the extension of yield curves.*** These factors include the following:

- ***Investors' preferences.*** Investors may have a strong preference to invest for the short-term, based on historical experience. It may be the case that expectations of high real yields distort investment decisions. This may be based on past experience, in which investors were able to achieve high returns by investing in floating rate debt. It is possible also that investors are suffering a form of illusion caused by the inverted yield curve, in that they perceive that they are not receiving any premium for moving out along the curve. In such a case, investor interest in longer term bonds may rise naturally over time, as the yield curve gradually moves to an upward-sloping position, as a result of the fall in short-term rates.

- ***Lack of liquidity in longer term instruments.*** Typically, long bonds would be expected to be purchased by “buy-and-hold” investors, who do not place a high value on liquidity. The increase in liquidity is expected to be a gradual process.
- ***Benchmarking.*** The extension of the yield curve may be hampered by the system of benchmarking used by investment managers, whose performance is typically measured against short-term interest rates.
- ***Reluctance by the government to lock in high rates.*** With the expectation that interest rates will decline further, the government may be justified in waiting until investors are willing to move out along the yield curve before issuing more long-term paper.

24. ***A range of measures are being taken to encourage investment at the long end of the curve.*** Measures being implemented both by the authorities and market agencies include: (i) consolidating benchmark bonds at longer maturities; (ii) improving liquidity in secondary market trading, including through improved information on pricing by both the Treasury and Andima, the bond market association; (iii) increasing issuance of medium and long term external bonds in domestic currency, with new benchmarks to develop a “global BRL” yield curve; (iv) deepening efforts to educate investors on the merits of moving along the curve; and (v) encouraging institutional investors to move away from reliance on benchmarking against short-term interest rates, including by providing alternative benchmarks. Other possible measures could include regulatory encouragement to pension funds to better match the maturity structure of their assets and liabilities, and extending the horizon of Brazil’s policy framework by setting a medium-term inflation target.

Should net external debt issuance be increased?

25. ***The sharp cut in foreign currency-related debt in recent years has reduced Brazil’s sovereign vulnerability to exchange rate movements to levels well below those in most other emerging market countries.*** Brazil’s overall sovereign balance sheet is now long in dollars, and therefore no longer exposed to losses in case of exchange rate depreciation (see Figure 4). Given the very low spreads Brazil enjoys on its external debt, a natural question is whether the authorities should reassess the balance of costs and risk and revert to positive net issuance of debt abroad, including in domestic currency.

26. ***A strategic decision on the appropriate share of foreign currency debt in total debt could take into account an assessment of the tradeoffs between costs and risks.*** Considerable progress has been made in approaches to assessing risks, including assessments of balance sheet mismatches and other attempts to establish integrated asset and liability frameworks, examination of covariances between asset prices and potential shocks, and the effects of volatility of exchange rates and asset prices. However, determining the relative cost of issuing bonds in different currencies remains difficult, because it requires projections

of the path of the exchange rate, which is notoriously difficult to predict. Various approaches are in common use, including using market data for the forward exchange rate and exchange rate forecasts from surveys of market participants; explicitly modeling exchange rate paths; and using simple assumptions about the path of the real or nominal exchange rate. These methods each have their advantages and drawbacks; probably the soundest approach is to model different scenarios using a variety of projection methodologies and parameters.

27. ***While both cost and risk considerations would seem to point toward higher external debt issuance, macroeconomic policy considerations impose an important constraint.***

Given the strong increase in official reserves and the low levels of foreign currency debt, an increase in dollar-denominated debt would appear to reduce risks on the sovereign balance sheet. In addition, as noted above, interest rates on sovereign debt issued abroad tend to be lower than those on domestically-issued debt. From a pure cost-risk point of view, it would seem an opportune time to move to higher net issuance of external debt. However, such a shift would further add to pressures on the currency to appreciate, and was thus considered by the authorities not to be desirable in the current context of large capital inflows.

E. Conclusion

28. ***In recent years, Brazil has made strong progress in improving its debt management and reducing vulnerabilities associated with the public debt.*** Prudent debt management has helped consolidate macroeconomic stabilization which, in turn, has improved debt dynamics. The sharp cut in foreign currency-related debt in recent years has virtually eliminated sovereign exposure to exchange rate changes. However, this has been at the cost of slower reductions in overall interest payments and in debt levels than might otherwise have been the case. Looking forward, lower interest rates are expected to translate more fully into declining net debt ratios and there are good reasons to expect that, as expectations of continued stability become more entrenched, the objectives of extending maturities and reducing rollover risks in the domestic debt market will become easier to achieve.

29. ***At the same time, there appear to be some steps that the authorities could consider to accelerate this process, and to bring forward the benefits of lower and less risky public debt structures.*** In particular, further measures aimed at extending domestic currency yield curves and a renewed overall policy focus on debt reduction, including through strengthened fiscal policy, would help bring debt levels down more rapidly than presently envisaged.

VI. THE EFFICIENCY OF SOCIAL EXPENDITURES IN BRAZIL: IS THERE ROOM TO IMPROVE SOCIAL OUTCOMES AND CREATE FISCAL SPACE?¹

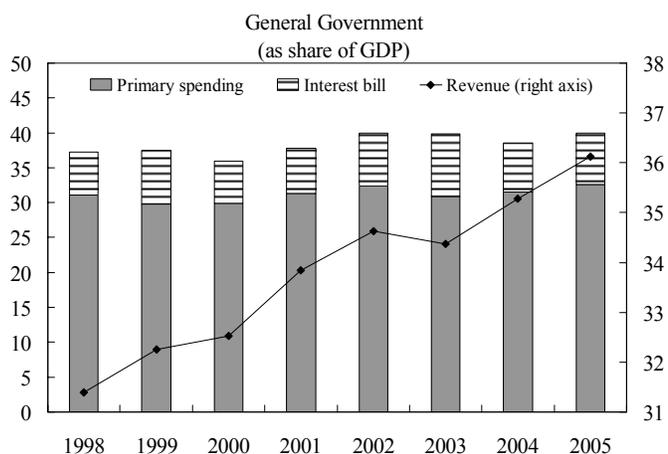
This chapter assesses the efficiency of social spending in Brazil relative to other countries. The results suggest that efficiency in the provision of public social services could be significantly improved and lead to important budgetary savings. Reducing budgetary rigidities would help by allowing for greater competition and accountability in the use of limited resources.

A. Introduction

1. ***This chapter assesses the efficiency of public social spending in Brazil based on international comparisons.*** Gradually improving the efficiency of social spending is critical to ensure further progress in social outcomes. It would also help create fiscal space for other priorities, such as investment in infrastructure and limiting the size of the tax burden. The next section provides a brief overview of spending trends in the general government in recent years, with a focus on social spending. Section C discusses the size and efficiency of social spending in Brazil relative to international experience. The concluding section presents some policy implications.

B. Main Expenditure Trends

2. ***General government expenditure has risen to an average close to 40 percent of GDP, despite lower public investment.*** The strong revenue effort at all levels of government, since 1997, led to a strengthening of the fiscal position, while allowing for an increase in expenditures in recent years. Over the 2000-05 period, primary spending rose by almost 3 percentage points of GDP to 33 percent of GDP, with social expenditures accounting for about half of the increase.² This increase has been accompanied by a fall in public investment to less than 2 percent of GDP. The decline in



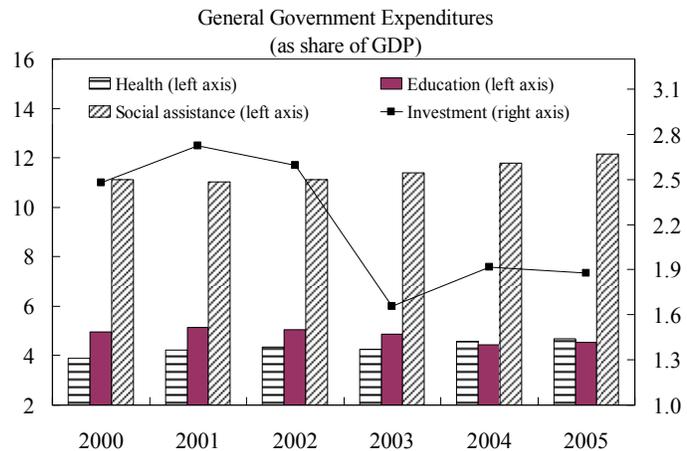
¹ Prepared by Paulo Medas and Juan Yopez.

² The definition of social spending includes education, health, pensions, and other social assistance programs. Brazil has both cash and in-kind based social assistance transfers at the federal and subnational levels. Some of the most important are the cash transfer programs, such as *Bolsa Familia* (conditional cash transfers for low income families), *Beneficio de Prestação Continuada* (benefits to low-income elderly and disabled), and unemployment benefits. Other programs include food and subsidized meal distribution, financial support to farmers, and subsidies for low-income housing.

capital expenditures reflects the pressures on current spending and budgetary rigidities, which make investment easier to cut to adjust to the business cycle and unexpected shocks (see Corbacho and Medas, 2006).

3. ***While total social expenditures have increased, spending on education has declined as share of GDP.***³ The main source of spending pressures has come from social security—mainly pensions and social assistance benefits—and health. The rise in social security has been partly a reflection of increases in the minimum wage, to which the minimum pensions and some assistance benefits are indexed. Health expenditures have also risen significantly, and now surpass education spending.

This increase primarily reflects the impact of mandatory spending and revenue earmarking in favor of health at all levels of government. Spending on public education has fallen as share of GDP, reflecting a decline at both the federal and the states levels. The authorities have, however, announced new initiatives that could lead to higher resources for education in the future.



C. The Relative Efficiency of Social Expenditures in Brazil

4. ***This section assesses the efficiency of social spending in Brazil relative to other countries.*** It looks at the impact of social spending on key social indicators: education, health, and poverty and income inequality. The analysis permits to assess the degree of relative efficiency of spending and whether there is room for budgetary savings and for improving the performance of public services and social programs. However, the analysis is based on a comparison across countries at a given point in time and, as such, it does not assess how efficiency has evolved over time.

Methodology and data

5. ***To conduct our assessment, we use a non-parametric approach, Data Envelopment Analysis (DEA), for measuring relative expenditure efficiency across countries.*** The main assumption is that country A is relatively more efficient than country B if it uses a lower

³ The functional data is based on staff's estimates for consolidated data at the level of the general government; the data for municipalities are based on an extrapolation prepared by the National Treasury, on the basis of a representative sample. We use 2000 as reference year, due to data constraints.

amount of inputs to achieve the same output.⁴ Using the DEA methodology, we build an efficiency frontier and estimate how far countries are from it; the farther away, the larger the degree of inefficiencies or waste. Efficiency scores range from 0 to 1, with 0 being the most inefficient and 1 the most efficient.⁵ The inputs used in the model are total public social spending, health expenditure per capita, and education spending per student; the data for education and health public expenditures are in purchasing power parity (PPP) dollars to correct for differences due to relative prices. In addition, when relevant and data permit, we test our results by using both private and public spending. Most of the expenditure data refer to the 1998-2001 period, to allow for measuring their impact on outcomes in recent years. Most social indicators reflect the latest available data for the 2002-04 period (Table A.1).

6. ***While the DEA approach provides an indication of the degree of inefficiencies, its results are subject to some caveats.*** In particular, the results are sensitive to sample selection, the quality of the data, and the presence of outliers. To ensure a high degree of robustness, we examine several social indicators for health, education, and income inequality and poverty. We also examine several country samples, with a group of Latin American countries used as the main benchmark.⁶ The analysis presented here should be seen as providing a broad indication of the degree of efficiency of social spending in Brazil.

Overall efficiency of public social spending

7. ***Brazil's levels of social spending are relatively high in Latin America, but some of the social indicators are weak.*** Over the 1998-2001 period, social spending averaged 20¼ percent of GDP, ranking Brazil third among a sample of 15 Latin American countries. Social security, mainly retirement and disability benefits, accounted for more than half of total social spending. This high level of spending has not been translated into higher social outcomes relative to other countries, as Brazil ranks below average among Latin American countries (Table A.2). This result is confirmed across a wide variety of social indicators, with a few exceptions.

⁴ This method, developed by Charnes, Cooper, and Rhodes (1978), generalizes the Farrell (1957) single-input/single-output technical efficiency measure. See also Zhu (2003) for details on the model used here.

⁵ There is a growing literature that uses the DEA method to measure relative efficiency of public spending. For instance Afonso, Schuknecht, and Tanzi (2006) used the same method to examine the public sector performance for ten new member states of the European Union (EU) as compared to emerging markets of different regions. The DEA framework is also being increasingly applied in the work of the Fund.

⁶ In general, when measuring the efficiency of public spending using the DEA, studies tend to focus on country samples that have some similarity (say regions) or try to correct for wide disparities and possible biases (e.g. controlling for large differences in per capita GDP). For more details, see Herrera and Pang (2005). In the samples we use, Latin America and emerging countries, Brazil's GDP per capita is about average.

8. ***The efficiency of Brazil's social public spending tends to be relatively low.*** In order to measure the overall efficiency of social spending, we built a composite indicator based on an average of standardized social indicators. This allowed us to assess the broader impact of policies followed, taking into account that specific spending items can have an impact on several indicators (e.g., health spending can lead to better education and poverty indicators).⁷ As a consequence of the relatively large spending and weak social outcomes, Brazil's efficiency scores tend to be relatively low (Table A.2).⁸

9. ***The low efficiency score partly reflects efforts to broaden the coverage of public services in the last two decades and the size of social security spending.*** The substantial efforts to increase coverage of public services in key social areas, particularly after the 1988 Constitution, has put a strain in the capacity of the state to maintain, and improve, the quality of public services. In addition, spending on social security alone in Brazil, as share of GDP, is broadly equivalent to total social spending in other countries. However, pensions do not tend to be the most effective tool to achieve progress in reducing poverty and inequality—and even bring an element of some regressivity to social spending in Brazil—and, as such, contribute to the low efficiency scores. In general, further efforts will be needed to improve the progressivity of social spending, including by placing a greater focus on better targeted social assistance programs, such as Bolsa Familia. The sections below discuss in further detail these issues for the individual social areas (education, health, and social security).

10. ***The constraints posed by the high degree of budget rigidities also represent a challenge to increase accountability and efficiency by line ministries and public agencies.*** Brazil has a relatively high level of budgetary rigidities, including revenue earmarking and mandatory spending (Alier and Costa, 2005). These have substantially increased with the 1988 constitution in an attempt to protect key priority areas. Nevertheless, the prevalence of a high level of rigidities impedes competition for resources during the budgetary process and reduces flexibility to adjust to changing priorities over time. Similarly, the rigidities, in favor of priorities defined at the national level, also constrain the ability of individual states or municipalities to allocate resources to their specific needs.

Public spending on education

11. ***Brazil's education outcomes show a mixed picture, with relatively broad coverage but weak quality indicators.*** Among Latin America countries, Brazil achieves good results in

⁷ The composite is an average of standardized indexes for health, education, and income inequality and poverty, with 1 being the average. The indicators are based on the latest data available (2002-2004).

⁸ Given that the efficiency results based on expenditure as share of GDP could be biased, we also estimated the efficiency by using expenditure per capita and corrected for PPP. The main conclusion that Brazil tends to show relatively low efficiency are common to the different methodologies.

net enrolment for the secondary level and is close to the average in retaining students throughout primary grades. However, the rates of repeaters in both primary and secondary education are high. In addition, Brazil's ranking in terms of the quality of education in science and math is below average (Tables A.2 and A.3). We see a similar tendency among emerging economies. Brazil also has one of the lowest scores among countries that participated in the OECD's Program for International Student Assessment (PISA).⁹

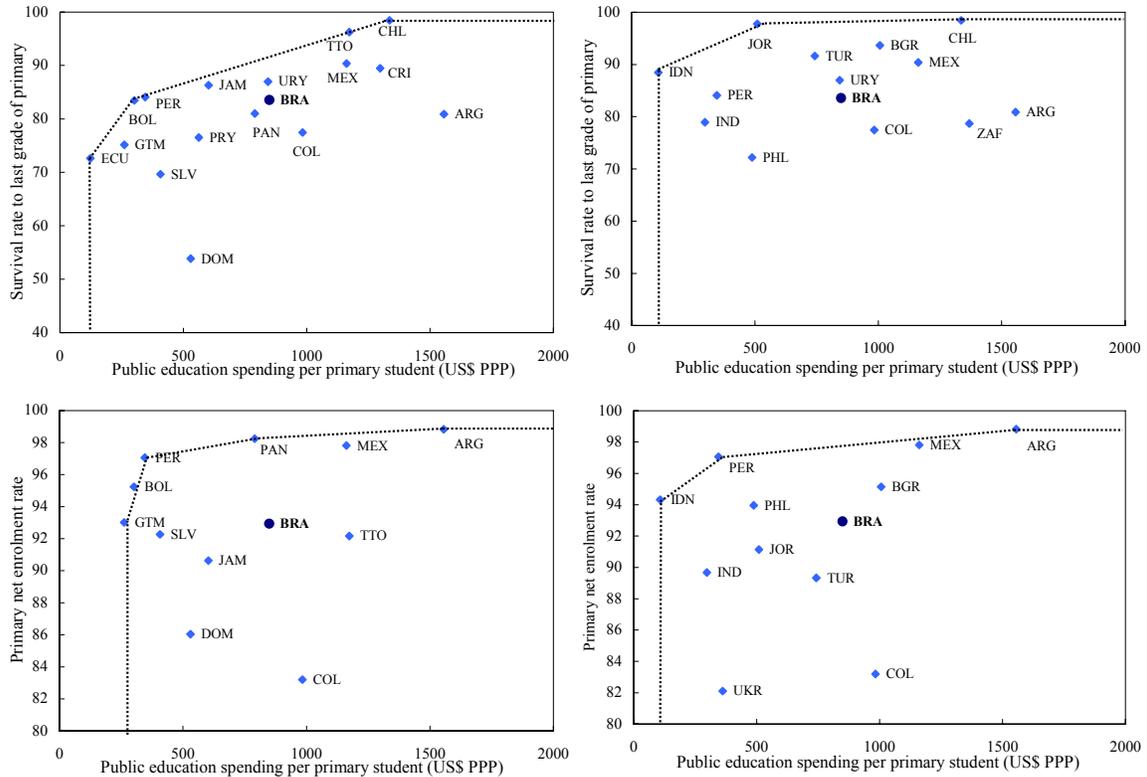
12. ***International comparisons suggest that there is room to significantly increase efficiency in spending on public education.*** For most indicators, Brazil's relative efficiency ranking tends to be below average or, in a few cases, at the average, suggesting ample room for improvement (Table A.4 and Chart C.1). For example, for net enrollment at the secondary level, the data suggest that the same outcome could be obtained using 40 percent less resources. The indicator on the quality of education confirms a low efficiency in producing results (Table A.5). The results also suggest that the relatively low efficiency is not related to a high level of spending, but more to the use of the resources and capacity constraints—e.g., the need to improve the qualification of teachers is widely recognized.¹⁰ In fact, public education spending per student (primary and secondary) in Brazil is close to the average in Latin America, but 10 percent lower than in the sample of emerging economies. In particular, spending on secondary education tends to be well below average.

13. ***These results partly reflect the drive to increase enrollment and attendance in schools in recent years, pointing to the need to place greater emphasis on quality in the period ahead.*** As noted by Paes et al (2006), significant efforts have been devoted to increasing enrollment in both primary and secondary school levels and to retaining students in school. Nevertheless, repetition rates although declining, remain relatively high, and the indicators of student performance have not shown significant improvements over time. Results from national tests in mathematics and Portuguese (Saeb) for students both in primary and secondary education show declining average scores between 1995 and 2005, which is thought to partially reflect the impact of a substantial increase in school enrolment.

⁹ Students are tested in 3 subjects: mathematics, science, language.

¹⁰ In relation to the OECD's PISA indicators, given that Brazil is an outlier, it is difficult to make any meaningful comparison on efficiency based on per capita spending. Brazil has the second lowest spending per student and the second lowest average scores in the sample. As such, it defines the efficiency frontier at a very low level of performance. If one uses public spending as share of GDP, the data would show room to improve the efficiency of spending (Table A.7). However, these numbers should be taken with some caution, given that it is a very diverse sample and where other factors could be influencing the results.

Chart C.1 Relative efficiency of public expenditure on education
for selected countries in Latin America and emerging economies



Source: UNESCO, World Bank, and Fund staff estimates.

14. *These results partly reflect the drive to increase enrollment and attendance in schools in recent years, pointing to the need to place greater emphasis on quality in the period ahead.* As noted by Paes et al (2006), significant efforts have been devoted to increasing enrollment in both primary and secondary school levels and to retaining students in school. Nevertheless, repetition rates although declining, remain relatively high, and the indicators of student performance have not shown significant improvements over time. Results from national tests in mathematics and Portuguese (Saeb) for students both in primary and secondary education show declining average scores between 1995 and 2005, which is thought to partially reflect the impact of a substantial increase in school enrolment.

Public spending on health

15. *While Brazil's per capita health spending is above average, health outcomes tend to be below average.* Public health spending is 5-15 percent higher than the averages for emerging and Latin American countries. However, given that, in many countries, private

health spending accounts for more than half of total spending, the assessment also considers the sum of public and private spending. On the basis of total health spending per capita, Brazil spends 30-40 percent more than other countries.¹¹ At the same time, Brazil indicators on infant and child mortality are weak compared to other countries (Table A.6). In addition, under the WHO Healthy Life Expectancy indicator (Hale index), Brazil's performance is relatively low among both Latin American and emerging market economies.¹²

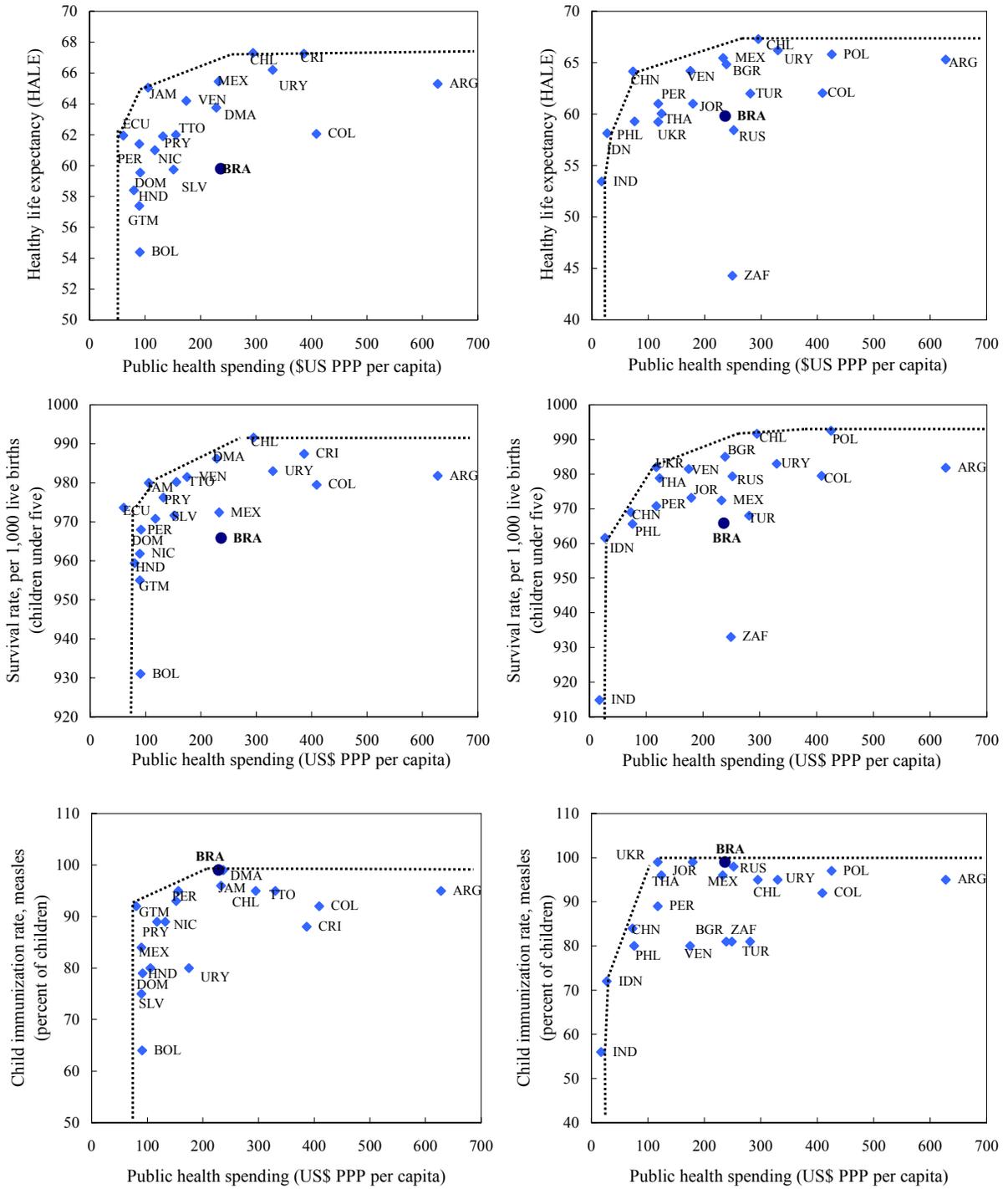
16. ***In general, there seems to exist significant room for improving the efficiency of health spending.*** In terms of the efficiency of public spending on health, Brazil performs below the average of other countries, ranking particularly low for infant and child mortality. Despite the increase in spending, improving basic health indicators remains a challenge (Table A.4), partly reflecting the difficulty in improving health indicators among the poorer (see also IPEA, 2007). The results are similar when comparing the efficiency of total health expenditure. A noticeable exception is for child immunization for measles, where Brazil ranks above average.

17. ***This relative weak performance in part also reflects the need for better coordination among the different levels of government and existing budgetary rigidities.*** The authorities have undertaken several reforms in the past two decades, including the creation of one health system (SUS) and moving towards decentralization of health services, in an effort to improve coverage and quality. However, the implement of national objectives and policies has been hampered, in the past, for the lack of sufficient flexibility to adjust to local and regional capacity constraints and needs. Marinho (2006) notes that the effective allocation and use of resources has been hindered by insufficient coordination between the federal level and subnational governments. In addition, while the earmarking and mandatory spending floors are intended to ensure a certain level of health services, an unintended consequence is that they could reduce accountability and incentives to improve efficiency. In practice, health agencies at all levels of government are ensured an increasing amount of resources every year, independently of the needs or their ability to spend well.

¹¹ It is important to look at public spending separately as this is more directed to poorer segments of the population and basic health.

¹² The average level of population health for WHO Member States in terms of healthy life expectancy (HALE). HALE is based on life expectancy at birth but includes an adjustment for *time spent in poor health*. It is most easily understood as the equivalent number of years in full health that a newborn can expect to live based on current rates of ill-health and mortality. The methods used by WHO to calculate HALE have been developed to maximize comparability across populations.

Chart C.2. Relative Efficiency of Public Health Expenditures for Selected Countries in Latin America and Emerging Economies



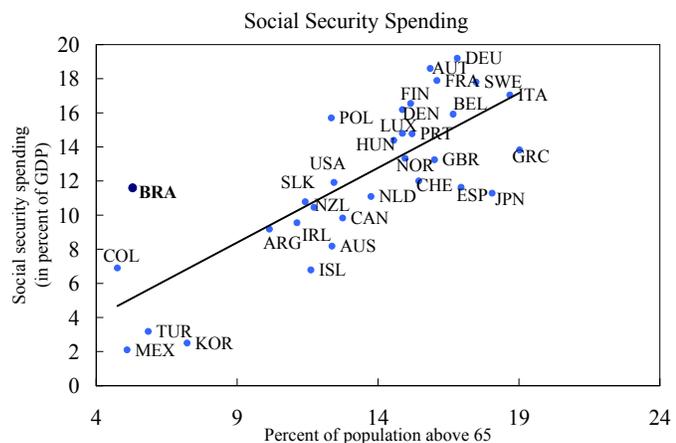
Source: WEO and IMF staff estimates.

Social Security and social assistance spending

18. **Given that social security is the largest component of social spending, it has a significant impact when measuring the overall efficiency of expenditure.** The rise in social security benefits and other assistance programs has been associated with an increase in both the size and number of benefits. Since 2000, the minimum wage, to which minimum pensions and other benefits are indexed, has increased by about 50 percent in real terms. This increase has been one of the main factors behind the rise in social security spending (see Varsano and Moura, 2007, and Cechin and Cechin, 2007). However, such large increases represent a significant burden to the budget and are not the most efficient way to reduce poverty and protect the most vulnerable groups.

19. **International comparisons suggest that the high cost and low efficiency of social security reflect poor targeting and generous benefits.** When using the DEA technique, the efficiency of social security spending in reducing poverty in Brazil appears to be low.

However, such a comparison should be interpreted with caution: there may be other factors that affect poverty levels and, thus, there may be a need for higher public welfare spending.¹³ Nevertheless, international comparisons do seem to suggest that some of the social security benefits are overly generous (see also Tafner, 2007). For example, Brazil has substantially higher social security costs than what would be expected for a country with a relatively young population.¹⁴

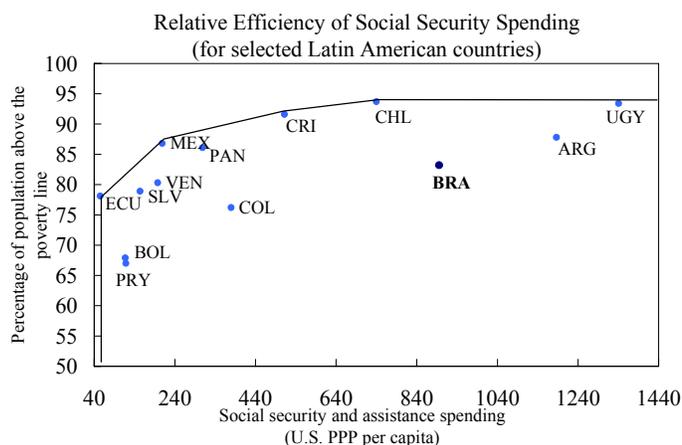


Source: OECD, World Bank, and CEPAL data.

¹³ The estimated efficiency is based on CEPAL indicator for share of population that lives below the poverty line. Data limitations prevent a more detailed comparison of the efficiency of social programs across countries.

¹⁴ Past reforms have attempted to contain the imbalances in the social security by reducing net benefits (introducing a tax/contribution on pensions) and tightening the rules for benefits, although with modest results. The latest reform was in 2003, however, further parametric reforms will likely be needed. Some of the areas that should be considered to significantly reduce the imbalances are: increasing the minimum retirement ages, increase the mandatory contribution period, and de-linking benefits from the minimum wage. In more recent years the focus has been on administrative reforms to reduce abuses and waste.

20. **Recent studies have pointed out that increases in pensions and the minimum wage are not the most efficient way to reduce poverty and inequality in Brazil, particularly when compared with mean-tested programs like Bolsa Familia.** For example, IPEA (2006) estimates that pensions and *Bolsa Familia* had similar contributions in the fall of income inequality in recent years with, however, large differences in budgetary costs. To achieve the same outcome, the cost associated with pensions was four to five times higher than the cost with *Bolsa Familia*, a program better targeted to the poorer families. Ferreira et al (2006) also noted that the increase in social security payments has been associated with greater regressivity, as the correlation between pensions and total income has increased between 1981 and 2004.



D. Conclusion

21. **International comparisons suggest that Brazil has a significant margin to further improve its social outcomes by increasing the efficiency of social spending.** While there have been important progress in the past years, social outcomes remain relatively low compared to other Latin American and emerging economies, as well as OECD countries. Efficiency in the provision of public services could be significantly improved, including in health, education, and in reducing poverty and income inequality. In part, these results may reflect the fact that a considerable effort has been made in the past 15-20 years to broaden the coverage of public services and social programs, thus putting a strain on public agencies.

22. **Reducing budgetary rigidities, together with better coordination between levels of government, would help increase accountability and performance in the use of limited resources.** Revenue earmarking and mandatory spending requirements were initially introduced to protect spending in priority areas, including for the most vulnerable groups. However, they have created rigidities that prevent an effective allocation of resources and limit accountability. A reduction in these rigidities, with strengthened coordination among the different levels of government, could lead to a more efficient use of resources and better responses to regional and local needs. In addition, the large increases in the minimum wage have led to substantial budgetary costs with relatively low impact on income inequality and poverty. Broadening the use of better targeted programs, like *Bolsa Familia*, would help better protect the more vulnerable groups at a significantly lower cost to the budget.

23. ***Improved efficiency would not only help improve social outcomes but also allow to redirect public resources for other spending priorities or increase savings.*** Containing the size of social spending by improving its efficiency would make it possible for the authorities to pursue other priorities, such as the planned increase in investment in public infrastructure and the reduction in the tax burden, without undermining the fiscal position.

Table A.1. Sources of Selected Input and Output Indicators.

	Input Indicators	Output Indicators	Input Years	Indicator Years	Source	
					Input	Output
Education	Education expenditure, public PPP corrected	Survival rate to last grade of primary	Ave. 1999-2001	2002-04 1/	UNESCO	UNESCO
	Education expenditure, public as a share of GDP	Percentage of non-repeaters, primary	Ave. 1998-2001	2002-04 1/	UNESCO	UNESCO
		Percentage of non-repeaters, secondary		2002-04 1/	UNESCO	UNESCO
		Net enrolment rate, primary		2002-04 1/	UNESCO	UNESCO
		Net enrolment rate, secondary		2002-04 1/	UNESCO	UNESCO
Health		HALE (healthy life expectancy at birth)	Ave. 1999-2001	2002	WHO	WHO
	Health expenditure, public PPP corrected	Infant mortality rate (per 1,000 live births)		2004	WHO	WHO
		Child mortality rate, under 5 (per 1,000 live births)		2004	WHO	WHO
		Child immunization rate, measles		2004	WHO	WHO
Composite		Gini coefficient		2002-04 1/	CEPAL and staff	CEPAL
	Total social expenditure, as a share of GDP	Proportion of population below minimum level of dietary energy consumption (FAO)	Ave. 1998-2001	2002-04 1/	CEPAL and staff estimates	CEPAL
		Life expectancy at birth, total (years)		2004	WHO	WHO
		Child mortality rate, under 5 (per 1,000 live births)		2004	WHO	WHO
		Quality of education		2005	GCR 2/	GCR 2/
		Percentage of non-repeaters, secondary		2002-04 1/	UNESCO	UNESCO

1/ Latest data available.

2/ Global Competitiveness Report

Table A.2. Relative efficiency of social expenditures based on selective indicators

	Social Expenditure 1/ as share of GDP	Gini coefficient 2/ indicator 3/	Poverty Life expectancy at birth 4/ indicator 3/ rate 5/ Under-5 mortality	Quality of education 6/ in secondary 7/ share of repeaters	Composite index 8/	Efficiency based on spending per capita 9/				
Argentina	21.4	0.54	3.0	74.6	18.2	3.3	11.5	1.03	0.33	0.14
Bolivia	11.4	0.61	23.0	64.5	69.0	2.4	3.4	0.90	0.43	0.62
Brazil	20.2	0.61	7.0	70.9	34.2	2.9	19.3	0.95	0.24	0.12
Chile	14.6	0.55	4.0	78.0	8.4	2.9	2.7	1.02	0.43	0.23
Colombia	11.6	0.58	13.0	72.6	20.5	3.6	2.6	1.02	0.53	0.39
Costa Rica	17.2	0.48	5.0	78.7	12.6	3.9	8.6	1.09	1	1
Ecuador	4.9	0.51	6.0	74.5	26.4	2.8	3.9	1.01	1	1
El Salvador	7.9	0.49	11.0	71.1	28.4	3.2	3.2	1.03	0.89	1
Guatemala	6.1	0.54	22.0	67.6	45.0	2.8	3.1	0.96	0.81	0.76
Mexico	9.5	0.52	5.0	75.1	27.6	2.9	2.1	1.03	0.69	0.39
Panama	16.9	0.55	23.0	75.1	23.9	2.8	4.8	0.97	0.29	0.16
Paraguay	8.6	0.55	15.0	71.2	23.8	2.2	1.1	0.95	0.57	0.44
Peru	7.6	0.51	12.0	70.4	29.2	2.1	4.6	0.96	0.64	0.46
Uruguay	22.1	0.46	2.5	75.2	17.0	3.6	10.1	1.08	0.65	0.59
Venezuela	10.2	0.47	18.0	73.7	18.5	3.0	8.4	1.01	0.48	0.28
Average	12.7	0.5	11.3	72.9	26.8	3.0	6.0	1.0		

1/ Average social expenditure in 1998-2001. Sources: CEPAL, Brazilian treasury, staff estimates.

2/ Latest available data from 2002-04

3/ Proportion of population below minimum level of dietary energy consumption (FAO) (2002-04)

4/ Life expectancy at birth, total (years) (2004, latest data)

5/ Under 5 mortality rate per 1000 live births (2004)

6/ Quality of math and science education, Global Competitiveness Report

7/ Percentage of repeaters in secondary school. UNESCO

8/ Average of normalized indicators (with average 1, higher number indicates better performance)

9/ Relative efficiency estimated based on social expenditures per capita and adjusted for PPP

Table A.3 Selected Indicators for primary and secondary levels, 2002-2004 1/

	Net enrolment rate (Primary)	Net enrolment rate (Secondary)	Percentage of repeaters (Primary)	Percentage of repeaters (Secondary)	Survival rate to last grade (Primary)
Argentina	98.8	79.1	6.4	11.5	80.9
Bolivia	95.2	73.6	1.6	3.4	83.4
Brazil	92.9	75.7	20.0	19.3	83.5
Bulgaria	95.1	88.5	2.3	1.7	93.7
Chile			2.4	2.7	98.4
Colombia	83.2	54.9	4.3	2.6	77.5
Costa Rica			6.9	8.6	89.5
Dominican Republic	86.0	49.3	7.3	3.1	53.9
Ecuador	97.7	52.2	2.0	3.9	72.6
El Salvador	92.3	48.1	6.7	3.2	69.6
Guatemala	93.0	33.7	13.3	3.1	75.1
India	89.7		3.2	4.7	78.9
Indonesia	94.3	56.9	2.9		88.5
Jamaica	90.6	79.2	2.8	1.5	86.3
Jordan	91.1	81.1	1.0	2.7	97.8
Mexico	97.8	63.8	4.8	2.1	90.4
Panama	98.2	63.7	5.5	4.8	81.0
Paraguay			7.3	1.1	76.5
Peru	97.1	68.8	7.6	4.6	84.1
Philippines	94.0	61.1	2.1	1.9	72.2
South Africa			5.2	10.9	78.7
Thailand					
Trinidad and Tobago	92.2	71.9	5.2	0.9	96.2
Turkey	89.3		3.2	1.3	91.6
Ukraine	82.1	83.5			
Uruguay			8.3	10.1	87.0

Source: UNESCO

1/ Latest data.

Table A.4 Summary of Brazil's Relative Efficiency Scores and Rankings

	Latin America 1/			Emerging economies 2/		
	Efficiency Score	Size Sample	Rank	Efficiency Score	Size Sample	Rank
Education						
Survival rate to last grade of primary	0.36	17	10	0.13	14 5/	11
Percentage of non-repeaters, primary	0.15	17	10	0.13	14 5/	10
Percentage of non-repeaters, secondary	0.21	17	12	0.50	13 6/	6
Net enrolment rate, primary	0.31	12 3/	10	0.13	12 7/	11
Net enrolment rate, secondary	0.63	13 4/	6	0.54	10 8/	7
Health						
HALE (Healthy life expectancy at birth)	0.26	20	18	0.17	20	17
Infant mortality rate (per 1,000 live births)	0.29	20	13	0.11	20	19
Child mortality rate, under 5 (per 1,000 live births)	0.26	20	18	0.19	20	18
Child immunization rate, measles	0.96	19 9/	3	0.50	20	9
Life expectancy	0.26	20	18	0.28	20	16

Sources: UNESCO, World Health Organization, and Fund staff estimates

1/ For education the sample consists of: Argentina, Bolivia, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Jamaica, Mexico, Panama, Paraguay, Peru, Trinidad and Tobago, and Uruguay. For health the sample consists of: Argentina, Bolivia, Chile, Colombia, Costa Rica, Dominica, Dominican republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru, Trinidad and Tobago, Uruguay, and Venezuela.

2/ For education the sample consists of: Argentina, Bulgaria, Chile, Colombia, India, Indonesia, Jordan, Mexico, Peru, Philippines, South Africa, Thailand, Turkey, Ukraine, and Uruguay. For health the sample consists of: Argentina, Bulgaria, Chile, China, Colombia, India, Indonesia, Jordan, Mexico, Peru, Philippines, Poland, Russia, South Africa, Thailand, Turkey, Ukraine, Uruguay, and Venezuela.

3/ Excludes Chile, Costa Rica, Ecuador, Paraguay, and Uruguay.

4/ Excludes Chile, Costa Rica, Paraguay, and Uruguay.

5/ Excludes Thailand and Ukraine.

6/ Excludes Indonesia, Thailand, and Ukraine.

7/ Excludes Chile, South Africa, Thailand, and Uruguay.

8/ Excludes Chile, India, South Africa, Thailand, Turkey, and Uruguay.

9/ Excludes Ecuador.

Table A.5. Quality of Education and the Efficiency of Public Education Spending

	Education Spending (in percent of GDP) 1/	Quality of Math and Science Education 2/	Efficiency Score	Rank
Argentina	4.5	3.3	0.51	14
Bolivia	5.6	2.4	0.30	24
Brazil	4.2	2.9	0.43	18
Chile	3.8	2.9	0.47	15
Colombia	4.2	3.6	0.62	12
Costa Rica	4.7	3.9	0.64	11
Dominican Republic	2.3	2.4	0.73	8
Ecuador	1.7	2.8	1.00	2
El Salvador	2.4	3.2	0.89	5
Jamaica	6.4	3.4	0.38	20
Jordan	5.0	4.3	0.70	10
Mexico	4.7	2.9	0.39	19
Nicaragua	3.6	2.8	0.46	16
Panama	4.8	2.8	0.35	22
Paraguay	4.7	2.2	0.35	21
Peru	3.2	2.1	0.53	13
Philippines	3.6	2.8	0.46	17
Poland	5.1	4.4	0.71	9
South Africa	5.6	2.4	0.30	23
Thailand	5.0	4.5	0.74	7
Trinidad and Tobago	3.7	4.5	1.00	1
Turkey	3.5	4.3	0.99	3
Ukraine	4.2	4.4	0.85	6
Uruguay	2.8	3.6	0.94	4

Source: UNESCO, Global Competitiveness Report (2003/04 edition), and Fund staff estimates.

1/ Average 1198-2001

2/ 1= lag far behind most other countries, 7 = are among the best in the world.

Table A.6. Selected Health Indicators, 2002-2004 1/

	Healthy Life Expectancy (HALE)	Under 5 mortality rate 2/	Child immunization rate, measles 3/	Infant mortality rate 2/
Argentina	65	18	95	16
Bolivia	54	69	64	54
Brazil	60	34	99	32
Bulgaria	65	15	81	12
Chile	67	8	95	8
China	64	31	84	26
Colombia	62	21	92	18
Costa Rica	67	13	88	11
Dominica	64	14	99	13
Dominican Republic	60	32	79	27
Ecuador	62	26		23
El Salvador	60	28	93	24
Guatemala	57	45	75	33
Honduras	58	41	92	31
India	53	85	56	62
Indonesia	58	38	72	30
Jamaica	65	20	80	17
Jordan	61	27	99	23
Mexico	65	28	96	23
Nicaragua	61	38	84	31
Paraguay	62	24	89	21
Peru	61	29	89	24
Philippines	59	34	80	26
Poland	66	8	97	7
Russian Federation	58	21	98	17
South Africa	44	67	81	54
Thailand	60	21	96	18
Trinidad and Tobago	62	20	95	18
Turkey	62	32	81	28
Ukraine	59	18	99	14
Uruguay	66	17	95	15
Venezuela	64	19	80	16

Source: World Health Organization

1/ Latest data.

2/ Per 1,000 live births.

3/ Percent of children ages 12-23 months.

Table A.7. PISA Scores of Education and the Efficiency of Public Education Spending

	Education Spending (in percent of GDP) 1/	PISA Average Score (2003)	Efficiency Score	Rank
Australia	4.85	526.15	0.72	11
Austria	6.13	498.35	0.54	26
Belgium	5.86	517.59	0.59	21
Brazil	4.20	379.84	0.67	15
Czech Republic	4.05	511.16	0.84	5
Denmark	8.34	499.65	0.40	31
Finland	6.14	545.90	1.00	2
France	5.78	509.34	0.58	22
Germany	4.57	502.53	0.73	10
Greece	3.67	461.67	0.83	6
Hungary	4.83	494.06	0.68	14
Iceland	6.56	501.57	0.51	27
Ireland	4.36	505.54	0.77	9
Italy	4.72	474.31	0.66	16
Japan	3.53	531.79	1.00	3
Korea	3.81	541.29	1.00	1
Latvia	5.76	486.39	0.56	23
Mexico	4.66	393.56	0.60	20
Netherlands	4.88	523.87	0.71	13
New Zealand	6.88	524.68	0.51	28
Norway	7.09	492.23	0.46	29
Poland	5.09	492.81	0.64	17
Portugal	5.74	470.29	0.54	25
Slovak Republic	4.06	488.49	0.80	8
Spain	4.46	483.75	0.72	12
Sweden	7.47	509.50	0.45	30
Switzerland	5.38	514.99	0.64	18
Thailand	5.03	422.73	0.56	24
Tunisia	7.20	365.70	0.39	32
Turkey	3.52	426.54	0.80	7
Unites States	5.29	486.67	0.61	19
Uruguay	2.81	426.35	1.00	4

Sources: OECD and World Bank; IMF staff estimates

1/ Average 1998-2001

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