INFLATION TARGETING IN BRAZIL

Philip Arestis (University of Cambridge)
Luiz Fernando de Paula (University of the State of Rio de Janeiro and CNPq)
Fernando Ferrari-Filho (Federal University of Rio Grande do Sul and CNPq)

Abstract: The purpose of this paper is to examine the Inflation Targeting (IT) framework as it is applied in the case of Brazil since its adoption in June 1999. For this purpose we first summarises the macroeconometric model utilised by the Central Bank of Brazil (BCB) in its pursuit of the IT framework. While the focus of this paper is on Brazil, we also examine the experience of other countries with IT (in particular, the BRIC countries), both for comparative purposes and for evidence of the extent of success of this 'new' economic policy pursued by other IT countries. In addition, we compare the experience of Brazil with IT and with that of non-IT countries. In the context of non-IT countries, we ask the question of whether it makes a difference in the fight against inflation whether a country has adopted IT or not. Finally, we examine some features of the Brazilian experience with IT regime.

1. Introduction[1]

The purpose of this paper is to examine the Inflation Targeting (IT) framework as it is applied in the case of Brazil. This economic policy framework was adopted by the Brazilian authorities in June 1999. The main purpose of this paper is to assess the experience with IT in this country since its adoption. It is the case that IT as a new monetary policy framework has been adopted by a significant number of countries since the late 1980s; the list includes both emerging and developed countries (see, for example, Angeriz and Arestis, 2007a, 2007b, 2008). While the focus of this paper is on Brazil, we also examine the experience of other countries with IT, both for comparative purposes and for evidence of the extent of success of this 'new' economic policy pursued by other IT countries. In addition, we compare the experience of Brazil with IT and with that of non-IT countries. An interesting comparison in the latter case is between Brazil and the other BRIC countries (Russia, India and China). In the context of non-IT countries, we ask the question of whether it makes a difference in the fight against inflation whether a country has adopted IT or not.

We proceed as follows: section 2 summarises the macroeconometric model utilised by the Central Bank of Brazil (BCB) in its pursuit of the IT framework. This is followed in section 3 by an examination of recent stabilization policies in Brazil. This enables us to demonstrate how Brazil came to implementing the IT strategy. Section 4 concentrates on the Brazilian experience with IT, while section 5 is concerned with a comparison of the Brazilian IT experience with that of other 'similar' IT emerging countries. The latter group includes both countries within Latin America and other countries outside Latin America. The experience of non-IT countries is also examined. Finally, section 6 summarizes and concludes.

2. The Macroeconomic Model of the BCB

The purpose of this section is to argue that the macroeconomic model utilized by the BCB in its pursuit of the IT framework is firmly embedded in the New Consensus Macroeconomic model.[2] The latter model has emerged over the past twenty years or so, and has become highly influential in terms of current macroeconomics thinking and of macroeconomic policy, especially monetary policy. In Arestis and Sawyer (2009) the argument is put forward that a model of sixteen equations, similar to the following fourteen equations, describes the macroeconomic model utilized by the BCB. In what follows we modify the model reported in Arestis and Sawyer (*op. cit.*) to fit the realities of the economy of Brazil and the central bank system of IT as it currently operates in this country.

We suggest that the main ingredients of the BCB macroeconomic model are captured by the following fourteen equations. It should be stated at the outset that the BCB has never

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revealed, let alone published, a formal macroeconomic model. What we propose below is such a model that is heavily based on publications by the BCB, such as, for example, De Freitas and Muinhos (2001), Minella *et al*. (2003), Muinhos and Lago Alves (2003), and Tombini and Lago Alves (2006). A useful publication in this respect is also Schmidt-Hebel and Werner (2002).

The fourteen equations we believe summarizes the BCB macroeconometric model are as follows:

(1) $Y = C + I + G + X - Q$

(2) $C = C(Y, NW)$

(3) $X = X(rer, Y_W)$

(4) $Q = Q(rer, Y)$

(5) $rer = [(er)(P_W)]/P$

(6) $NW = K + PD + NFA$

(7) $Y^g = Y - Y^p$

(8) $Y^p = (1-a)K + aL^s + T$

(9) $K = (1-\delta)K_{t-1} + I$

(10) $I = I[(R-p), Y]$

(11) $p = p(p^e, p_{t-1}, rer, U)$

(12) $U = [(Ls - L)/ Ls]$

(13) $L = L(Yg, K)$

(14) $R = R[(R-p)^*, R_{t-1}, (p - pd), Yg]$

where the symbols have their usual meaning, so that Y is income and Y_W is world income, C is consumption, I is investment, G is government expenditure, X is exports and Q imports, NW is net Wealth (K is capital, PD is public debt, and NFA is Net Foreign Assets). Y^g is output gap, Y^p is potential output, U is unemployment, p is rate of inflation, p^e is expected inflation, L is labour, L^s is labour supply, T is productivity trend, R is nominal rate of interest [so that (R-p) is real rate of interest], $(R-p)^*$ is the long-run real rate of interest, p^d is inflation rate target, rer stands for the real exchange rate, and er for the nominal exchange rate, defined as in equation (5) and expressed as foreign currency units per domestic currency unit, P and P_W are domestic and world price levels respectively, and R^* is the equilibrium real rate of interest. It should also be noted that G, Y_W, P_W, p^d, L^s, T, PD and NFA are treated here as exogenous for convenience.

Equations (1) to (6) capture the demand side of the economy, with equation (5) defining the real exchange rate, and equation (6) net wealth. The latter is arrived at by iterating over individuals' period-by-period budget constraints, and then aggregating over the whole population. An individual's wealth is defined as all the resources that are available for expenditure at the start of a period. Financial assets include money, the domestic currency value of foreign bonds, corporate bonds, government bonds, and shares, plus the interest returns and dividends arising from holding these instruments over from the previous period. Non-financial assets include human wealth, transfer wealth, and the value of dwellings.

We may summarise the key features of the first four equations succinctly: in terms of the consumption relationship in particular it should be noted that consumption is explicitly derived from forward-looking optimising behaviour, and it is based on income, the rate of interest and wealth. Economic agents maximise lifetime utility subject to their expected lifetime resources. This process is based on the transversality condition meaning that all debts are ultimately paid in full since economic agents are credit worthy, all IOUs are perfectly acceptable in exchange, and no economic agent is liquidity constrained. This process produces a non-monetary model with no private banks or monetary variables. Interestingly enough, in a recent paper Catão *et al*. (2008) investigate the transmission mechanism of monetary policy in the case of Brazil to conclude that an important channel of it is through bank credit. A change in the nominal rate of interest and the associated change in the real rate of interest affects the real exchange rate, which influences output gap and the tradeable sector. This, however, is expected to influence the non-tradeable sector in the opposite direction. With the tradeable sector being more bank-dependent than the tradeable sector, the overall demand for bank credit is thereby affected as relative prices shift towards non-tradeable producers. Monetary policy, therefore, has non-trivial effects on bank lending, an important channel of monetary policy in a mainly bank-based economy. But such a channel is not captured by the macroeconometric model employed by the BCB in view of the transversality condition.

Furthermore, goods markets are monopolistically competitive, with firms being in a position to charge non-competitive sticky prices. The latter help to clear domestic production to satisfy aggregate demand; that is demand for consumption, investment, including changes in inventories, government spending and exports, all net of imports. In view of the assumption of sluggish price and wage adjustments, actual output is determined by aggregate demand in the short run, with the standard equations for its main components: consumption, exports and imports, with government expenditure treated as exogenous and investment determined in the supply-side block.

Equations (7) to (14) refer to the supply side, with equation (7) defining the output gap. The supply side of the model depends on an aggregate Cobb Douglas production function, equation (8), whereby output depends on capital stock, effective labour supply and technical progress. With equation (9) defining capital stock, investment (equation 10) and employment (equation 14) are determined by profit maximisation and inverting the production function, respectively.

The variables investment and capital stock specifically, although all variables in general, are scaled against the level of output. Hence, the desired capital stock, relative to output, depends on the cost of capital, and actual capital stock adjusts to the desired level, taking into account costs of adjustment. A change in the rate of interest through its impact on the cost of capital would change desired capital stock; there would be a relative price effect but the underlying growth of output would be unaffected. Investment (in terms of the desired capital stock) depends on the rate of interest (via the cost of capital), with the demand for capital depending on the relative prices involved. But it is scaled against the level of output, which is treated as growing at an exogenous rate. The growth of output pulls along the growth of the capital stock as in the neo-classical growth model.

Equation (11) represents the Phillips' curve, which is vertical in the long run by assumption. It should be noted that it is important to include a combination of forward-looking and backward-looking specifications. This is due to the fact that since the BCB does not have enough credibility to affect inflation expectations and assure convergence of inflation to the set inflation target the combination modelled in equation (11) is vital (see, also, De Freitas and Muinhos, 2001; Tombini and Lago Alves, 2006). Equations (12) and (13) define unemployment and labour supply respectively; the latter is related to the output gap and capital.

Equation (14) is the monetary rule relationship. The variable $(p - p^d)$ is by far the more important variable in policy decisions than Y^g. $(R-p)^*$ is very important but highly problematic (see, for example, Weber *et al.*, 2008). Monetary policy is modelled by Taylor's rule. The problematic nature of $(R-p)^*$ needs more elaboration. Clearly this is the long-run equilibrium real rate of interest. It is, in other words, the real rate that is associated with output being at its potential level (see equation 3 above). The nominal rate of interest in the hands of the central bank should be anchored to $(R-p)^*$ and to the target inflation as set by the central bank. Anchoring the real equilibrium rate of interest, though, is hazardous. If the central bank targets the wrong $(R-p)^*$ then it may drive the economy on a wrong path. Econometric evidence on the extent to which central banks can obtain the information necessary for a good knowledge of $(R-p)^*$ is by no means encouraging (Weber *et al.*, 2008). The inclusion of the R_{t-1} variable is particularly relevant in the case of Brazil. This variable reflects the smoothing in the interest rate undertaken by the BCB. The justification is that there exists a persistence effect that is not negligible in the Brazilian economy (see, for example, Mendonça, 2007, 2008).

The main theoretical features of the macroeconomic model just summarized may be briefly put forward. Price stability, meaning low and stable inflation, is monetary policy's primary long-term objective; and inflation is a monetary phenomenon. The price stability goal may be accompanied by output stabilization so long as price stability is not violated. Ultimately, though, an important role of the IT is to 'lock in' earlier disinflationary gains along with those emanating from 'taming' inflation. IT is a monetary policy framework whereby public announcement of official inflation target is undertaken. In this approach, 'expected inflation', see equation (14), and the transparency of inflation forecasts is an important element of the policy. However, the centrality of inflation forecasts and the margin of errors represent a major challenge to the type of this approach to monetary policy.

In this policy framework, monetary policy is the main instrument of macroeconomic policy, and it should not be operated by politicians but by experts: 'independent' central bank. An 'independent' central bank would also have greater credibility in the financial markets and be seen to have a stronger commitment to low inflation than politicians do. In this approach, the principle of 'constrained discretion', middle ground between 'rules' and 'discretion', is adopted. Fiscal policy is no longer viewed as a powerful macroeconomic instrument. The level of economic activity fluctuates around a supply-side equilibrium, which corresponds to $Yg = 0$ or to NAIRU (non-accelerating inflation rate of unemployment), a supply-side phenomenon. Say's Law holds. The level of effective demand does not play an independent role in the long-run level of economic activity. Openness, communication, transparency, accountability, credibility, and individual reputation of the members of the committee that decide on the appropriate level of the central bank rate of interest, see equation 15, are all important ingredients. It is clear from the analysis pursued in this section so far that the BCB macroeconomic model is firmly embedded in the New Consensus Macroeconomic model (see, for example, Arestis, 2007).

Brazil is an open economy, and as such exchange rate considerations are of crucial importance. They transmit both certain effects of changes in the policy instrument, interest rates, and various foreign shocks. Given this critical role of the exchange rate in the transmission process of monetary policy, fluctuations in interest rates can produce excessive variability in output by inducing significant changes in exchange rates. This may suggest exchange rate targeting. However, the experience of a number of emerging countries, which pursued exchange rate targeting but experienced financial crises because their policies were not perceived as credible, is relevant to the argument. The adoption of IT, by contrast, may lead to a more stable currency since it signals a clear commitment to price stability in a freely floating exchange rate system. This, of course, does not mean that monitoring exchange rate developments should not be undertaken. Indeed, weighting them into decisions on setting monetary policy instruments is thought desirable[3]. These considerations are well embedded in the above fifteen equations as this is clearly can be seen from equations (3), (4) and (5) above.

It should be readily acknowledged that IT has been a more challenging task in emerging economies rather than in developed ones. The reasons are clear enough: building policy credibility, reducing high inflation rates and dealing at the same time with greater vulnerability to shocks, has been a greater burden for the emerging counties. Brazil is no exception to these observations, especially so in view of the extremely sensitive reaction of this economy to high exchange rate variability.

3. Recent Brazilian experience: from the exchange rate anchor to IT

Stabilization policies in Brazil, and more generally in Latin American countries, in the 1990s were based on some form of exchange rate anchor. Liberalization of the trade,

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[3] Indeed, Ho and McCauley (2003), in their analyses of the experience of inflation targeting with flexible exchange rates, conclude that as emerging economies are more exposed to exchange rate changes, such changes have a significant role in policy analysis and decision-making in these countries.

financial and capital accounts was thought paramount. The experience with those programmes showed that although they were successful in ending the history of chronically high inflation, they showed, nonetheless, that local currency appreciation as a result of favourable differentials between domestic and foreign prices, was causing balance of payments disequilibria. A new problem emerged, which was closely related to the endeavour to achieve and maintain balance of payments equilibria. That was the use of high interest rates by monetary authorities to attract foreign capital. The need to maintain high interest rates in order to attract foreign capital increased public internal debt (monetary authorities had to sterilize the inflow of foreign capital), which deteriorated economic performance and fiscal balances. Under those conditions in a global world where financial and productive capital are mobile, the successful application of an internal stabilization policy generated an endogenous process of deteriorating economic conditions. That, then, left Latin American countries vulnerable to speculative attacks on their currencies, and thus subjected them to currency crises (Kregel, 1999). The currency crises in Mexico (1994-95), in Brazil (1998-99, and 2002), and in Argentina (2001-02), are some good examples of this dynamic process. That unhappy experience of some Latin American countries with pegged exchange rate regimes, and the associated era of deep financial crises in the 1990s, led them to search for alternative nominal anchors. Since at the same time more or less several industrial countries adopted the IT as a new monetary policy framework, it became an alternative policy regime for countries in Latin America.[4]

The Real Plan, in Brazil, was created on the same basis as the stabilization programmes applied all over Latin America over the period of late 1980s to late 1990s. That system was characterised by a fixed or crawling-peg exchange rate, in combination with a more open trade policy. The exchange rate was the price anchor utilized throughout that period.[5] During the exchange rate anchor period, very high interest rates were targeted designed to attract short-term foreign capital for balance-of-payments purposes. The volume of those capital flows was many times greater than the volume required for the needs of the balance of payments, thus raising the level of foreign reserves and leading to a real appreciation of the exchange rate.[6] That appreciation resulted in significant balance of trade deficit. The effect of that liberal economic policy arrangement aggravated Brazil's external fragility and, consequently, the country had three speculative attacks on its currency over the three-year period 1995 to 1998. Furthermore, the Brazilian economy, from the third quarter of 1998 to the first quarter of 1999, was characterized by macroeconomic instability, resulting in a sharp outflow of short-term capital. Thus, repeated financial crises in a very short

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[4] In fact, IT was adopted by Chile in 1990, Mexico in 1999, Colombia in 1999, Brazil in 1999, and Peru in 2002.

[5] The Brazilian Real Plan differed from Argentina's Convertibility Plan in that it adopted a more flexible exchange rate anchor. At the launch of the Brazilian programme in July 1994, the government's commitment was to maintain an exchange rate ceiling of one-to-one parity with the dollar. Moreover, the relationship between changes in the monetary base and foreign reserve movements was not explicitly stated, allowing some discretionary leeway. After the Mexican crisis, the exchange rate policy was reviewed and in the context of a crawling exchange rate range, the nominal rate began to undergo gradual devaluation. In early 1999, however, after six months of speculative pressure, the *real* was devalued and, some days later, the Brazilian government adopted a floating exchange rate. For a general analysis of the origins and development of the Real Plan, see Ferrari-Filho and Paula (2003).

[6] During the pegged exchange rate period, July 1994 to January 1999, the basic interest rate (Selic) was raised and kept at high levels in order to avoid large outflow of reserves.

period of time, *i.e.* the South East Asian crisis and the Russian crisis along with the international recession of 1997-1998, contributed to deteriorating the Brazilian economy. In fact, as a result of the effects of the Russian crisis in particular, Brazil was forced to abandon its crawling-peg exchange rate and adopted a floating exchange rate regime. The exchange rate depreciated as a result, thereby producing significant price pass-through effects with the inevitable adverse consequences on the inflation front.

Following the transition to a floating exchange rate, in January 1999, Brazil adopted an IT regime, in June 1999, to keep inflation under control. At the same time, BCB raised the basic short-term interest rate to accommodate the currency depreciation shock. As a result, an appreciation to the exchange rate occurred very soon and inflation, despite the huge devaluation in the beginning of 1999, ended the year in single figures.

4. The Brazilian experience with IT from 1999 to 2007

4.1 The institutional dimension

The Brazilian IT monetary policy regime is modelled on the basis of the British IT model. The National Monetary Council (CMN) sets the inflation targets, which are proposed by the Minister of Finance. CMN has three members: the Minister of Finance, the Minister of Planning and the President of the BCB. All three members are appointed by the President of Brazil and do not have fixed mandates. In June of each year, the CMN establishes the inflation targets, and their corresponding intervals of tolerance for the next two years. Besides the inflation target, CMN is also responsible for the approval of the main norms related to monetary and exchange rate policies, and the regulation of the financial system.

The Central Bank of Brazil Monetary Policy Committee (COPOM) has to achieve the inflation target through the use of the short-term interest rate.[7] Inflation targets are based on the headline inflation index, i.e. extensive national consumer price index (IPCA).[8] A certain degree of flexibility is introduced through defining IT within a range, which has varied between 2.0 or 2.5 percentage points above and below the central point target. The other main reason for the introduction of this flexibility is that it helps the Central Bank of Brazil to achieve its inflation target in view of the serious supply shocks to which the Brazilian economy is exposed.

The inflation target is fulfilled when yearly variation of the inflation index is inside the set range. If inflation breaches the target set by the CMN, the Governor of the BCB is required to write an open letter to the Minister of Finance explaining the reasons the target was missed, as well as the measures proposed to bring it back to target, and the time period over which these measures are expected to take effect. The interest rate target set by the

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[7] COPOM was created on 20 June 1996, and was assigned the responsibility of setting the stance of monetary policy and the short-term interest rate. It is composed of the members of the BCB's Board of Directors.
[8] IPCA covers a sample of families with a multiple of up to 40 times the minimum wage, which is determined every year by the Brazilian federal government. It now stands at approximately US$ 260 per month (beginning of August 2008), and it is thought to be enough to cover the basic needs of a family. The sample covered by IPCA has a broad geographical basis that includes families in the biggest cities of Brazil. IPCA is calculated by IBGE (National Bureau of Geography and Statistics).

COPOM is the target for the Selic interest rate, the interest rate for overnight interbank loans, collateralised by those government bonds that are registered with and traded on the 'Sistema Especial de Liquidação e Custodia' (Selic). The Selic target is fixed for the period between its regular meetings. The Governor of the BCB, though, has the right to alter the Selic interest rate target anytime between regular COPOM meetings (once per month). This is made possible by the COPOM, which has the right to introduce a monetary policy bias at its regular meetings, where the bias refers to easing or tightening of monetary policy outside meetings. The COPOM authorizes the Governor of the BCB to alter the SELIC interest rate target in the direction of the bias at anytime between regular COPOM meetings. Eight days after each meeting, the Committee releases the minutes on the BCB website and to the press through the BCB press officer. The minutes provide a summary of the COPOM's discussion and decisions. At the end of each quarter (March, June, September, December), the COPOM publishes the BCB Inflation Report, which provides detailed information on economic conditions, as well as the COPOM's inflation forecasts upon which changes in the SELIC interest rate are determined. The objective of this report is to inform the public and the market about the goals, design and implementation of monetary policy.

4.2 Experience with IT

Table 1 shows actual inflation and the targets for 1999-2007. From 1999 (when IT was introduced in Brazil) to 2002, the tolerance intervals were 2 percentage points above and below the central target. For 2003, 2004 and 2005 the intervals were enlarged to 2.5 percentage points[9] and for 2006 and 2007 the tolerance intervals decreased to 2 percent. The inflation rate was 8.9% and 6.0% for targets of 8% and 6% in 1999 and 2000, respectively. The targets were within the acceptable range. However, in 2001 and 2002, several external and domestic shocks – such as domestic energy crisis in Brazil, effects of 11th September 2001, the Argentine crisis, and the confidence crisis related to the presidential election in 2002 – hit the Brazilian economy with significant impacts on inflation. Indeed, the inflation rate reached 7.7% in 2001, 1.7% above the target's upper range, and 12.5% in 2002, more than 5 percentage points above the upper range. According to Minella *et al*. (2003, pp. 6-8), the exchange rate rose 20.3% and 53.5% in 2001 and 2002, respectively. As a result, in 2001, 38% of the inflation rate can be explained by the exchange rate depreciation, whereas for 2002 the contribution of the exchange rate stood at 46%.[10] In 2003 the inflation rate was 9.3% above the adjusted target of 4.0%, and outside the range of 2.5% tolerance interval.[11] The high inflation in 2003 was due mainly to the initial effect of 2002 high inflation, in spite of the maintenance of the conservative economic policy with very high interest rates by the new President, Lula da Silva, from the Workers Party. In 2004 IPCA was 7.6%, well above the target of 5.5%. Growth of administered prices (mainly gasoline, health plans, fixed telephone and electricity rates) in

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[9] For more information on the macroeconomic background that led to the shift of IT in Brazil, see Bogdanki *et al*. (2000).

[10] Minella *et al*. (2003) calculations are based on the structural model of the BCB and the information concerning the mechanisms for the adjustment of administered prices.

[11] CMN Resolution No. 2972, 27 June 2002, changed the inflation targets for 2003, while a later Resolution, No. 3108, 25 June 2003, changed inflation targets for 2004. They were raised to 4.0% and 5.5% for 2003 and 2004, from the original inflation targets of 3.25% and 3.75%, respectively.

the same year, reached 10.2%, accounting for 29.0% of the change in the IPCA or equivalently 2.94% out of 10.2%. In 2005 the inflation rate was 5.7%, which was within the upper and lower tolerance levels for inflation set by the CMN for that year. The factors that influenced the lower growth rate in prices (mainly in market prices) in 2005 were, among others, an abundant supply of farm products (rice, perishable foodstuffs and soy bean) and, especially, exchange rate appreciation. In 2006, the inflation rate was 3.14%: it was the lowest inflation rate in the period 1999-2007. Once again, the exchange rate appreciation explains the low inflation rate for 2006. Finally, in 2007 the inflation rate was 4.46% (0.04% below the inflation target).[12]

TABLE 1 AROUND HERE

Examining Table 1 more closely, further comments are in order. It is notable that over the period 1999-2007 IT targets in Brazil were within the set range in 3 out of the 9 years of the operation of this monetary policy strategy. The targets were missed in 2001, 2002 and 2003 (despite raising the inflation target to 5.5% from 3.75%) by a substantial margin, especially in 2002. On a different occasion (2004), the inflation target was only met after it had been raised by mid-2003. It may, thus, be concluded that IT in Brazil was not completely successful over the first nine years of its implementation. Moreover, inflation targets were only met when international financial conditions allowed it; that is, IT was successful when the exchange rate helped the BCB efforts to maintain inflation under control; that is, disinflation in 2005-2007 was obtained mostly through exchange rate appreciation. Indeed, as Barbosa-Filho (2007) stresses, in practice Brazil ends up with an asymmetric dirty floating exchange rate regime in which the BCB not only does it have to fight devaluations but also to tolerate revaluations in order to meet the inflation targets set by the Brazilian government. This begs the question of whether this result can be sustained when Brazil's IT performance is compared with that of other emerging countries both within Latin America and outside it, and also both with IT and non-IT countries. In section 5 below we undertake this particular exercise. We look into further data in an attempt to prepare the discussion of section 5.

4.3 Inflation, GDP and unemployment performance in Brazil: 1999 to 2007

The average inflation rate in Brazil from 1999 to 2007 was 7.2%. It means that the average inflation rate in Brazil is still high. Furthermore, Brazil's GDP performance has been poor. When we consider the period of IT implementation (1999 to 2007), the average growth rate of GDP was, approximately, only 3.1%, while, according to Fabris (2007), during the same period the average growth rate of emerging countries was 5.1% per year. In addition, GDP has followed a *stop-go* pattern over this period: according to IPEA data (Table 2), GDP

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[12] It is important to mention that high real interest rates combined with current account surplus from 2005 to 2007 resulted in a gradual appreciation of the Brazilian exchange rate that contributed to the reduction of the inflation rate. As we know, exchange rates can influence inflation rate ('exchange rate pass-through') through the prices of traded final goods and imported intermediate goods, and their impact agent's inflation expectations. Ho and McCauley (2003), for instance, show evidences that: (i) income is negatively and significantly correlated with pass-through as lower-income economies have a larger portion of traded goods in the consumption basket; and (ii) exchange rate pass-through has tended to be stronger in Latin America than in Asia.

growth was 0.3% in 1999, 4.3% in 2000, 1.3% in 2001, 2.7% in 2002, 1.1% in 2003, 5.7% in 2004, 3.1% in 2005, 3,7% in 2006 and 5.4% in 2007. The variance is 1.8, indicating quite high variation. Table 2 also shows the average unemployment rate during the inflation-targeting period in Brazil. From 1999 to 2007, the average unemployment rate, according to IBGE (2008) data, was 9.3% per year.

TABLE 2 AROUND HERE

Turning to the rate of interest over the period of the IT regime, it is clear that it has been very high in Brazil, even after the adoption of the exchange rate regime in January 1999. The average nominal basic interest rate (Selic) was 18.3% over the period 1999 to 2007 (Figure 1), while the average real interest rate (Selic/IPCA) during this period was 10.3%. It was so high because of the monetary policy requirement that aimed at keeping inflation under control, and stabilizing the exchange rate volatility. Indeed, empirical studies show that the monetary authorities use interest rate not only to control inflation directly but also to control exchange rate pressures, with evident 'fear of floating' behaviour.[13] On the other hand, the literature that estimates the reaction function of the BCB, after the adoption of IT, shows that the BCB reaction to inflation has been asymmetric: (i) the increase in the inflation rate generates a more than proportional reaction of the Selic; and (ii) BCB reacts very gradually (it means, it reduces the Selic very slowly) when there is a fall in the inflation rate and/or a sharp reduction in the output growth.[14] In the same connection, Libanio (2008) argues that the way that monetary policy has been conducted in Brazil under the IT regime and floating exchange regime with a liberalized capital account, brings about an upward bias in interest rates, which harms aggregate demand and, as a consequence, affects negatively economic growth. Using a VAR model, he produces evidences that shows monetary policy has been procyclical and asymmetric in Brazil, described by the expression "too tight during contractions, not so loose during expansions" (p.9).

The consequences of high interest rates are: (i) serious constraint on economic growth, through the price of credit (loan rates) and entrepreneurs' poor expectations; and (ii) it increases public debt, which has been formed mainly by indexed bonds or short-term pre-fixed bonds.[15] Despite the significant improvement in the balance of payment figures since 2003, due essentially to the surplus in the trade balance increasing, Brazil's recent experience shows that in countries with a high level of external debt and a fully-liberalized capital account, external capital flows can cause periods of intense exchange rate

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[13] Mendonça (2005), using a Taylor rule to study the determination of interest rate by the BCB, over the period 1999-2004, finds that exchange rate changes explained a great deal of the variation of the Selic interest rate (around 57% after one year of the exchange rate shock in 2003).

[14] According to Modenesi (2008, p.21), the weight of the auto-regressive components of the BCB reaction function ($\alpha_1 + \alpha_2 = 0.92$) is much higher than the Federal Reserve System reaction function during the Volcker-Greenspan period ($\alpha_1 + \alpha_2 = 0.79$).

[15] The behaviour of the domestic public debt in Brazil has proved particularly vulnerable to changes in the rate of interest and exchange rate (see, in this regard, Paula and Alves Jr., 2003).

instability.[16] This can jeopardize efforts to achieve and maintain announced inflation targets. This situation has also caused low economic growth, because monetary authorities tend to increase interest rates during periods of external turbulence in order to meet inflation targets, and also stabilize exchange rates.

FIGURE 1 AROUND HERE

In Brazil, exchange rate volatility has been considerable (Figure 2).[17] Macroeconomic instability brought a strong currency devaluation of the Real (the name of the Brazilian currency), which, as a result, affected domestic prices via the exchange rate pass-through. This came about through the direct impact of devaluation on the imported inputs or indirectly through the 'monitored' prices. Monitored or administered prices are defined as those that are relatively insensitive to domestic demand and supply conditions or that are in some way regulated by a public agency. The group includes oil by-products, telephone fees, residential electricity, and public transportation. Its dynamics differ from those of market prices in three ways: "i) dependence on international prices in the case of oil by-products; ii) greater pass-through from the exchange rate; and iii) stronger backward-looking behavior" (Minella *et al.*, 2003, p. 7),[18] as electricity and telephone rates are generally adjusted annually by the General Price Index (IGP).[19] Furthermore, Figure 3 shows that administered prices increased more than market prices, from 1999 to 2006. In 2007, however, market prices increased more than administered prices.

FIGURE 2 AND FIGURE 3 AROUND HERE

A final comment on the transmission channel from exchange rate to inflation in Brazil, is in order. Exchange rate variations affect the IGP, which in its turn affects the index of administered prices. As administered prices change, IPCA is also affected.[20] IPCA is also affected directly by exchange rate changes due to their effects on the imported inputs. Since IGP has been higher than IPCA, the latter has been influenced by the IGP behaviour

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[16] According to data from BCB, the ratio of external debt to exports declined from 3.6 in 2001 to 1.5 in 2007, due to the recent increase in exports, and the ratio of foreign reserves to external debt increased from 17.1 in 2001 to 75.9 in 2007.

[17] Souza and Hoff (2006), using Calvo-Reihart's fear of floating indicators, show that from January 1999 to December 2005 the frequency that monthly variation of exchange rate exceeded the band of ± 2.5% was 52% in Brazil, compared to 27% in other emerging countries of Latin America, and to 19% in Asian emerging countries (Indonesia, Singapore, Thailand, and South Korea).

[18] According to Minella *et al.* (2003, p. 7) "[t]here are three basic links: i) the price of oil by-products for consumption depends on international oil prices denominated in domestic currency; ii) part of the resetting of electricity rates is linked to changes in the exchange rate; and iii) the contracts for price adjustments for electricity and telephone rates link these adjustments, at least partially, to the General Price Index (IGP), which is more affected by the exchange rate than the consumer price indexes".

[19] IGP is prepared by Getulio Vargas Foundation, a private foundation, and it is calculated through a weighted index that includes wholesale price index (60.0%), consumer price index (30.0%) and national index of building costs (10.0%). The reason for the use of this index to adjust electricity and telephones rates (instead of IPCA) is that when these services were privatised in the second half of the 1990s, Brazilian government was interested to attract foreign firms, and for these firms IGP is better than IPCA, as it is much more sensitive to exchange rate variations (due to the high weight of the wholesale price on it).

[20] Minella *et al.* (2003, p. 25) estimated that the pass-through to administered prices from July 1997 until December 2002 was 25%, resulting in a pass-through of about 16% for the headline IPCA.

through administered price adjustments (see Figure 2). On the other hand, periods of appreciation of the exchange rate have resulted in a decrease in the rate of inflation, after a time lag. As we show above, the decline in the inflation rate in 2005 and 2006, compared to 2003 and 2004, is basically related to the exchange rate appreciation over the period. So, inflation in Brazil is very much influenced by exchange rate movements.[21] Under these conditions, monetary policy may have some effect on market-determined prices, but it is not very effective in controlling administered prices. Consequently, in view of the importance of administered prices in the determination of the Brazilian inflation rate, inflation pressures result in the BCB having to increase interest rates higher than might be necessary to restrain inflation that derives from market prices. This is so since the BCB has to account for the secondary effects that emanate from the shocks of monitored prices.[22]

The argument may be briefly summarized: inflation in Brazil has been mainly cost-determined, explained by negative or positive supply shocks (movements in the exchange rate, changes in the international prices of commodities and energy, etc.) and by partial inertia due to the indexation of the administered prices.

5. Comparing the Brazilian experience with other 'similar' countries

We compare the experience of Brazil with other countries with the help of Table 3 and Table 4, which contain data of inflation and GDP (average, standard deviation and coefficient of variation).[23] Two groups of countries are examined: one is a group of emerging countries that have adopted IT (Brazil, Chile, Colombia, Mexico and South Africa) and another group comprises of countries that have not adopted the IT strategy (Argentina, China, India and Russia). So, we have selected the so-called BRIC countries (Brazil, Russia, India, and China) plus South Africa and the more important Latin American countries (Argentina, Chile, Colombia, and Mexico, besides Brazil). Standard deviations and coefficients of variation can be sometimes misleading, as for example in the case of China, where a high inflation standard deviation is present, as a result of a sharp decline of high to low inflation, although this country has had a very low inflation since the late 1990s. It is for this reason that we also report data on inflation in Figure 4 and Figure 6 by countries that adopt IT, and those that do not adopt IT, respectively. These figures are very important for the analysis, since they report inflation trends in each country.

The following observations are in order:

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[21] Ferreira (2004), using a VAR model to evaluate the determinants of the rate of inflation in Brazil in 1995-2004, finds a positive response of inflation to shocks in nominal exchange rate, an effect that spreads over time. In the same connection, Gomes and Aidar (2005) estimate, using a VAR, a Taylor rule for the Brazilian economy from January 1999 to May 2004, and conclude that 24.4% of the inflation rate (IPCA) variation is explained by the exchange rate. It is interesting that some economists of the BCB also conclude that "exchange rate volatility is an important source of inflation variability. The design of the inflation-targeting framework has to take into account this issue to avoid that a possible non-fulfilment of inflation targets as a result of exchange rate volatility may reduce the credibility of the central bank" (Minella *et al.*, 2003, p. 29).

[22] The credit channel is also limited in Brazil since the ratio of credit to GDP has been around 24-35% in 2000-07, according to data from Central Bank of Brazil (2008), while it was 45.3% in US, 84.7% in Japan and 103.7% in the euro area in 2000 (Belaisch, 2003).

[23] The coefficient of variation is calculated as the ratio of the standard deviation over the average of the variable in question.

(a) Inspection of Table 3 and Table 4 clearly shows that the fall of inflation is a recent general tendency in emerging countries, whether or not they adopt an IT regime (see, also, Figure 4 and Figure 6).[24] Although in all IT emerging countries the rate of inflation declined after the adoption of IT, in most of them the coefficient of variation increased (Table 3). It is also true that countries that did not adopt IT experienced improvements around the same time as IT countries (Table 4). Indeed, some emerging non-IT countries, such as China and India have had low inflation rates in the last few years. Argentina and Russia have had a gradual reduction in the inflation after the peak of 2002 (41.0%) and 1999 (85.7%), respectively, due to the huge exchange rate devaluation in 2001-02 in Argentina and the subsequent Russian crisis in 1998. For some countries, China, India , and Russia the stability of the nominal exchange rate had an important role for price stabilization purposes over the period (Paula, 2008). So, IT and non-IT countries have experienced similar reductions in inflation in recent years. Theory suggests that 'flexible' IT stabilizes both inflation and output. However, there is no clear evidence that emerging countries that adopted IT have had a better performance in GDP terms (both in terms of output growth and GDP coefficient of variation) when compared to the emerging countries that do not adopt IT; the evidence as reported in this paper (Figure 5 and Figure 7) is very clear on this point. Indeed, China and India are amongst the countries that have had the highest output growth in recent years, and they are non-IT countries (their growth rates are 10.3% and 6.3%, respectively, in the years 1991-2007). Consequently, there is no evidence that inflation targeting improves performance in emerging economies as measured by the behaviour of inflation and output. This finding suggests that better performance resulted from something other than IT.[25]

**TABLE 3 AND TABLE 4 AND FIGURE 4, FIGURE 5, FIGURE 6 AND FIGURE 7
AROUND HERE**

(b) The picture in Latin American countries should be interpreted with due attention given that these countries have suffered currency crises recently: Mexico in 1994-95, Brazil in 1998-99 and 2002, and Argentina in 2001-2002. Such crises have had big effects on both inflation and GDP in these countries. Argentina, after the experience of hyperinflation (1989-1990), adopted a currency board in 1991 and the inflation rate declined sharply during the 1990s. In 2002 the country had a serious currency crisis and, as result, a sharp recession in 2001-2002 took place, followed by a rapid recovery after the crisis. Indeed,

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[24] In Table 3 (IT emerging countries) we consider the time 'before IT' (ten years before the implementation of IT), while in Table 4 (non-IT emerging countries) we divide this group of countries into two periods: 1991-1998 and 1999-2007, so that this division allows a better comparison with Brazil's performance since this country adopted the IT framework in 1999.

[25] One might argue that these findings are due to specific economic problems of emerging countries, in a way that developed countries are not faced with, and thus IT might be better suited for these countries. However, a recent paper on OECD countries shows that this is not the case: comparing seven OECD countries that adopted inflation targeting in the early 1990s to thirteen that did not, Ball and Sheridan (2003) find that on average there is no evidence that IT improves performance as measured by the behaviour of inflation, output, and interest rates. They conclude that "the formal and institutional aspects of targeting – the public announcements of targets, the inflation reports, the enhanced independence of central banks – are not important. *Nothing in the data suggests that convert targets would benefit from adopting explicit targets*" (p. 29, italics added; see also Angeriz and Arestis, 2007a, 2007b, 2008).

and since 2006, inflation rate has increased in Argentina. Mexico has had poor economic performance with a declining inflation after the 1994 Tequila crisis. Although general conclusions are difficult to derive in the case of Latin America in view of the fact that IT is a recent import in these countries, a general observation emerges from this experience: in three cases, Brazil, Colombia, and Mexico, economic performance worsened since the adoption of IT by these countries (Table 3). Chile is an exception; it is the single Latin American country that has had real GDP growth above 5% (from 1991 to 2007 the average growth rate was 5.6% per year). Non-IT countries have had similar experiences (Table 4).

(c) Although there is a clear downward trend in inflation in emerging countries, Brazil is an interesting case. Inflation has been maintained high in relation to other IT countries over the relevant period: from 1999 to 2007, the average inflation rate was 7.2%. However, then, the coefficient of variation is the lowest over the same period (Table 3). Furthermore, Brazil's GDP performance has been poor compared to other 'big' emerging countries. From 1999 to 2007, the average growth rate in Brazil was, approximately, 3.1%, as compared to the average of the other IT emerging countries (Figure 5) and the BRIC group (Figure 7); the latter two groups producing a clearly and substantially higher average GDP over the period.

(d) In Brazil, as argued earlier, nominal and real interest rate have been high and exchange rate volatility has been considerable (Figure 1 and Figure 2). The combination of high interest rate and exchange rate volatility has contributed to low economic growth and a pass-through effect from exchange rate to inflation.

6. Summary and conclusions

We have summarized the theoretical aspects of IT, and the principles that govern its implementation in the case of Brazil. It is clear from this analysis that the authorities in Brazil adhere religiously to the theoretical principles of the IT framework. We have examined the experience of Brazil with IT, compared it with the experience of the pre-IT period and with the experience of other countries, IT and non-IT ones.

Two general conclusions emerge from this analysis. IT countries appear to have been successful in taming inflation. But, then, so have non-IT countries. Furthermore, although Brazil has implemented IT as the theory of the framework suggests, inflation rates over the IT period have been high. Brazil has one of the highest interest rates in the world, along with inflation, which has been maintained at a significantly high level. The BCB has to maintain very high interest rates in its attempt to control inflation. High interest rates have been associated with poor economic growth performance, and deterioration of other macroeconomic variables, such as public debt. It appears that we have a rather bad economic scenario in Brazil: low economic growth with relatively high inflation.

Our results conform to recent contributions on the IT experience of a number of Latin American countries. Especially so with the Eichengreen (2002) contention that IT is more complicated in countries like the Latin American ones, essentially for three main reasons: their economies are exposed to financial and international commodity shocks because of the liberalization of the balance of payments trade, financial and capital accounts; their

liabilities are almost dollarized; and their policy makers lack credibility. The first and the second reasons are particularly pertinent in the case of Latin America countries. Openness exposes these economies to disturbances that emanate from exchange rate fluctuations that cause pass-through inflation. Liability dollarization affects financial institutions, because in general terms the banking system of Latin America countries is weak, and as such it brings financial vulnerability when external shocks occur. However, Paula and Alves Jr. (2003) demonstrate that this is not typical of the Brazilian banking sector in recent years. Moreover, IT is too rigid for these countries essentially because it affects economic growth and exchange rate flexibility that is required under such a regime of monetary rules. The latter can cause financial instability, a very real possibility in these countries as history has demonstrated vividly. Schmidt-Hebel and Werner (2002) are very clear on the dangers of IT: "all Latin American inflation targeters are open economies that employ floating exchange rate regimes … [and] are subject to large external shocks and significant exchange rate volatility, and the exchange rate may therefore play an important role in the conduct of monetary policy under inflation targeting" (p.2). Exchange rate market volatility generates frequent changes to inflation rates and results in countries not being able to meet their inflation targets.

The larger external shocks faced by Latin America countries affect the exchange rate, and, consequently, the inflation rate, leading to higher interest rates to curb the inflationary pressures. As a result, these economies in general are confronted by higher volatility of interest rates and exchange rates. In this context, "monetary policy in emerging economies may therefore be more sensitive to exchange rate movements both indirectly (because of pass-through effects on inflation) and directly (because the exchange rate is an additional argument in central bank objective functions, reflecting their concern for devaluation-induced bank failures and domestic recessions)" (Schmidt-Hebel and Werner, *op.cit.*, p. 15). In other words, the pass-through from exchange rate changes to inflation is larger and more significant in the Latin American economies than in industrial countries because the former have a substantially higher degree of openness, a history of high inflation, and low central bank credibility. In addition, Latin American countries present large mismatches between foreign currency assets and liabilities, which bring two adverse shocks: self-fulfilling attacks and financial crises on the country's asset and domestic recession following large exchange rate depreciations. It is the case that Latin American countries are susceptible to supply shocks, perhaps more so than many other countries, than to demand shocks. To the extent that this is validated, IT might not work as effectively as in those countries where demand shocks dominate over supply shocks. Brazil is no exception and these conclusions are applicable with some force in the case of this country.

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TABLES AND FIGURES

TABLE 1
Inflation Targets[a] and Consumer Price Index in Brazil: 1999 to 2007

Year	Point Inflation Target	Range of Inflation Target	Actual IPCA
1999	8.0%	6.0% to 10.0%	8.94%
2000	6.0%	4.0% to 8.0%	5.97%
2001	4.0%	2.0% to 6.0%	7.67%
2002	3.5%	1.5% to 5.5%	12.53%
2003	4.00	1.5% to 6.5%[b]	9.30%
2004	5.5%	3.0% to 8.0%[c]	7.60%
2005	4.5%	2.0% to 7.0%	5.69%
2006	4.5%	2.5% to 6.5%	3.14%
2007	4.5%	2.5% to 6.5%	4.46%

Notes: (a) It is important to note that the IT framework in Brazil sets year-end inflation targets for the current and the following two years; (b) The original inflation target for 2003 was 3.25% (with a tolerance interval of 2.0%). Subsequently, the BCB decided to change the inflation target to 4.0% with a tolerance interval of 2.5%; (c) The original inflation target for 2004 was 3.75% (with a tolerance interval of 2.5%). Subsequently, the BCB changed the inflation target to 5.5% and kept the 2.5% of tolerance interval.
Source: BCB (2008).

TABLE 2
GDP Growth and Unemployment Rates in Brazil (average rate per year, %)

	1999	2000	2001	2002	2003	2004	2005	2006	2007	Average
GDP Growth Rate	0.3	4.3	1.3	2.7	1.1	5.7	3.1	3.7	5.4	3.0
Unemployment Rate	8.3	7.9	6.8	7.9	12.3	11.5	9.8	10.0	9.3	9.3

Sources: IPEADATA (2008) and IBGE (2008).

TABLE 3
IT Emerging Countries

Country	Before IT						After IT					
	Inflation			GDP			Inflation			GDP		
	Average	SD	CV	Average	SD	CV	Average	SD	CV	Average	SD	CV
Brazil	405.17	911.83	2.25	1.97	3.00	1.52	7.22	2.83	0.39	3.06	1.92	0.63
Chile	20.38	5.46	0.27	2.92	6.87	2.35	6.32	4.77	0.75	5.57	3.02	0.54
Colombia	23.03	4.70	0.20	3.64	1.62	0.44	6.61	1.67	0.25	3.21	3.40	1.06
Mexico	20.34	13.20	0.65	3.37	3.59	1.07	5.71	2.99	0.52	3.05	2.09	0.69
South Africa	7.40	2.48	0.34	2.20	1.92	0.87	5.68	4.35	0.77	4.53	0.91	0.20

SD = Standard deviation; CV = coefficient of variation (SD/average)
Note: Before IT / After IT: (i) Brazil = 1989-1998/1999-2007; (ii) Chile = 1981-1990/1991-2007; (iii) Colombia = 1989-1998/1999-2007; (iv) Mexico = 1989-1998/1999-2007; and (v) South Africa = 1992-2001/2002-2007.
Source: IMF (2008).

TABLE 4
Non-IT Emerging Countries

Country	1991-1998						1999-2007					
	Inflation			GDP			Inflation			GDP		
	Average	SD	CV	Average	SD	CV	Average	SD	CV	Average	SD	CV
Argentina	12.66	28.58	2.26	5.86	4.25	0.72	7.95	13.19	1.66	2.48	7.69	3.10
China	8.94	9.01	1.01	11.04	2.42	0.22	1.67	2.33	1.40	9.59	1.32	0.14
India	10.12	3.58	0.35	5.39	1.77	0.33	4.14	1.97	0.47	7.08	2.12	0.30
Russia	222.21	854.60	3.85	- 6.69	5.18	- 0.77	15.96	8.45	0.53	6.95	1.59	0.23

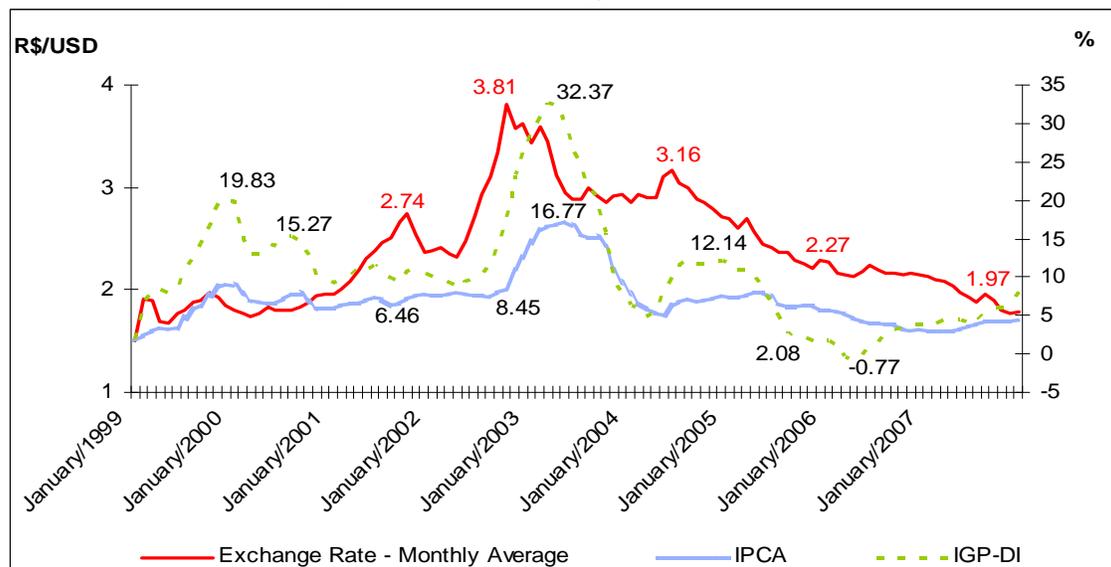SD = Standard deviation; CV = coefficient of variation (SD/average).
Source: IMF (2008) and Deutsche Bank Research (2008).

FIGURE 1
Nominal and Real Interest Rates in Brazil (%): 1999 to 2007
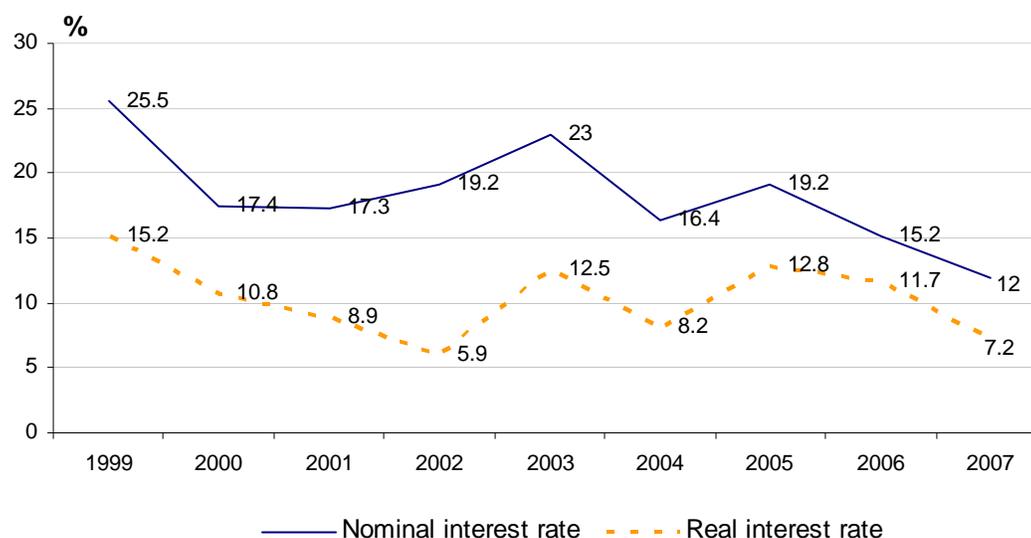

Source: BCB (2008).

FIGURE 2
Volatility of the Exchange Rate, R$/USD, and Inflation Rates, Accumulated over 12 months (IPCA and IGP-DI), in Brazil: 1999 to 2007

Note: Volatility of exchange rate was calculated as the difference between average annual exchange rate and the monthly average exchange rate.
Source: IPEADATA (2008).

FIGURE 3
Brazil: Extensive consumer price index (IPCA)
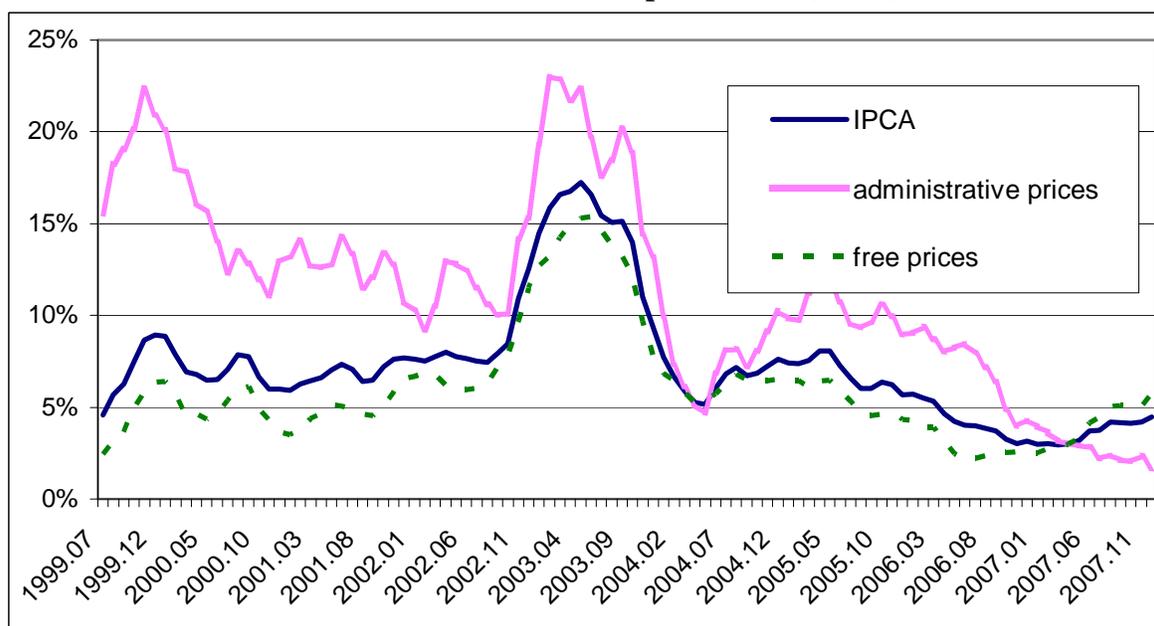
Note: Administered prices include utilities services (fixed telephone fees, residential electricity etc.), oil by-products, and private health plans, that is, prices that are or determined (or authorized) directly by government or are governmental permission that include some sort of price indexation.
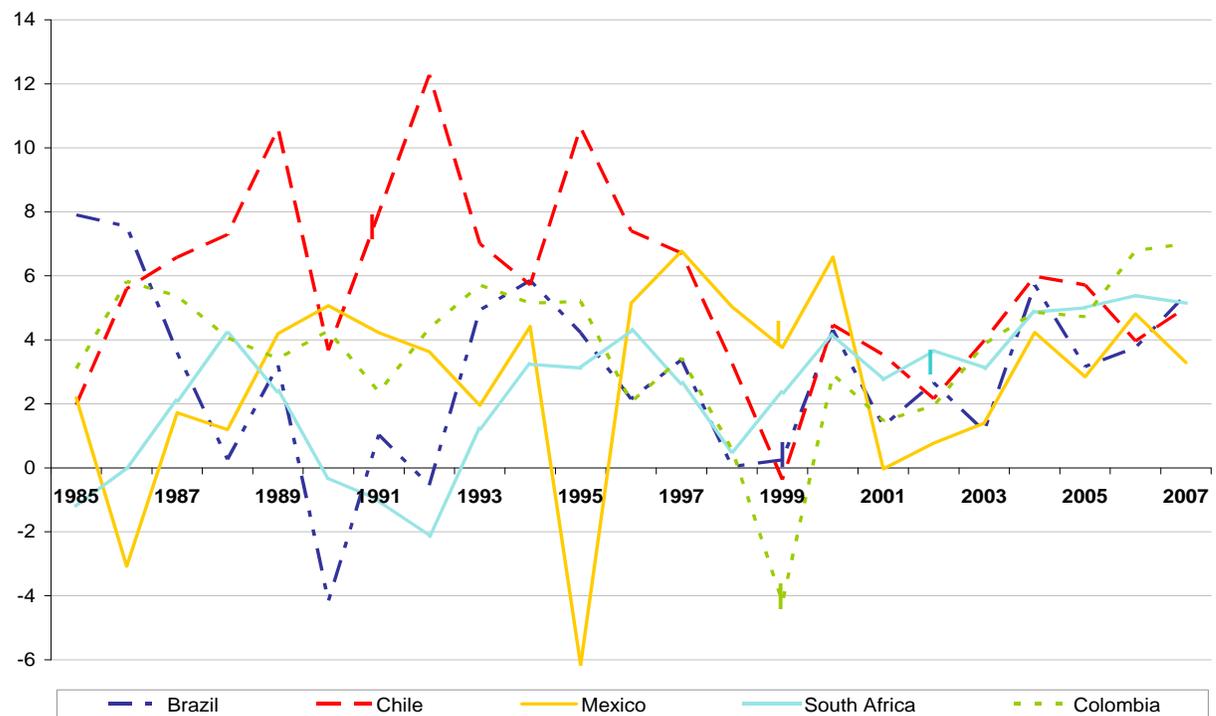Source: IPEADATA (2008).

FIGURE 4
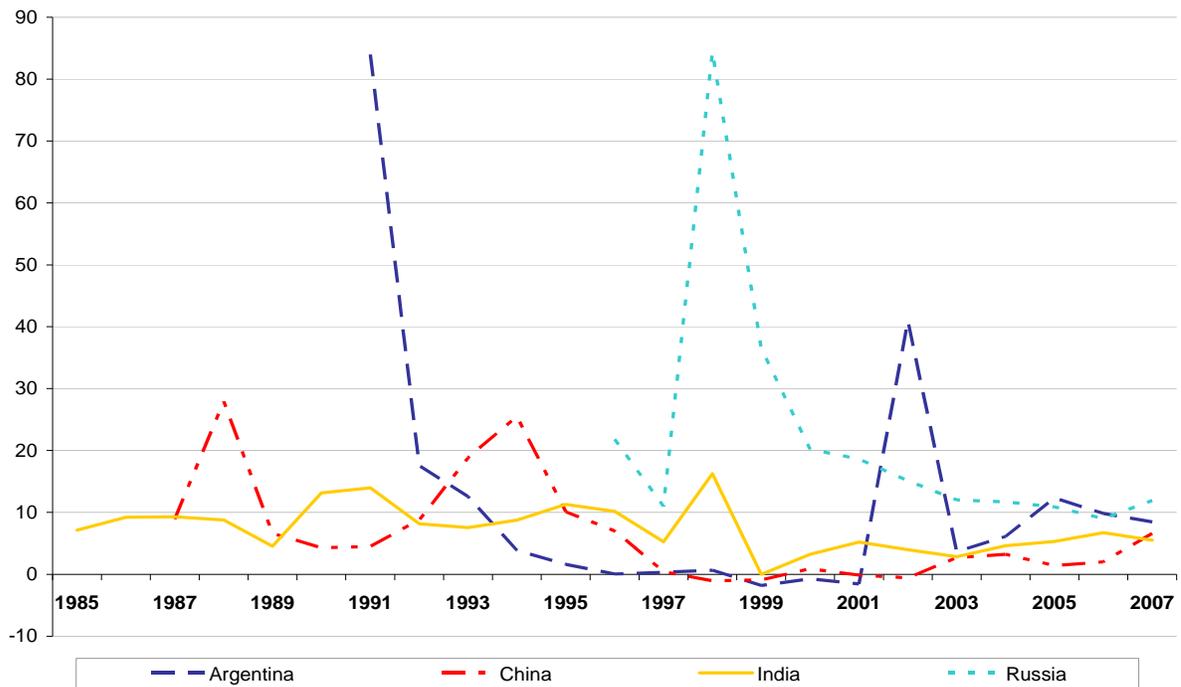**Inflation Rate (Annual Consumer Prices) in IT Emerging**
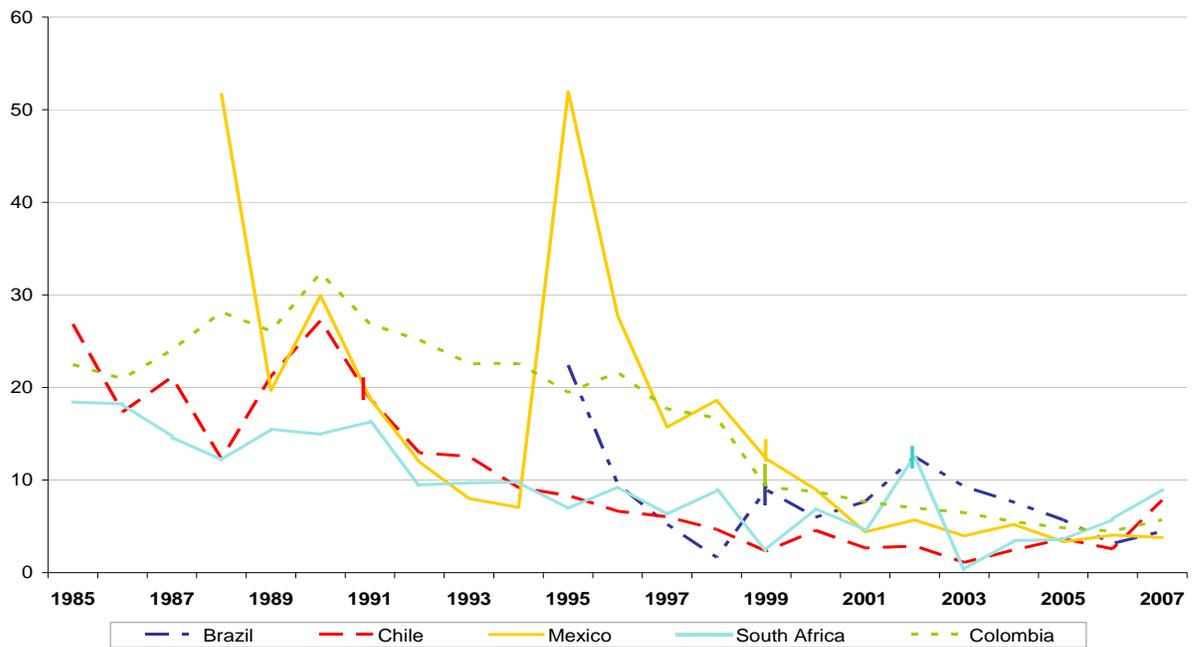
Source: IMF (2008).

FIGURE 5
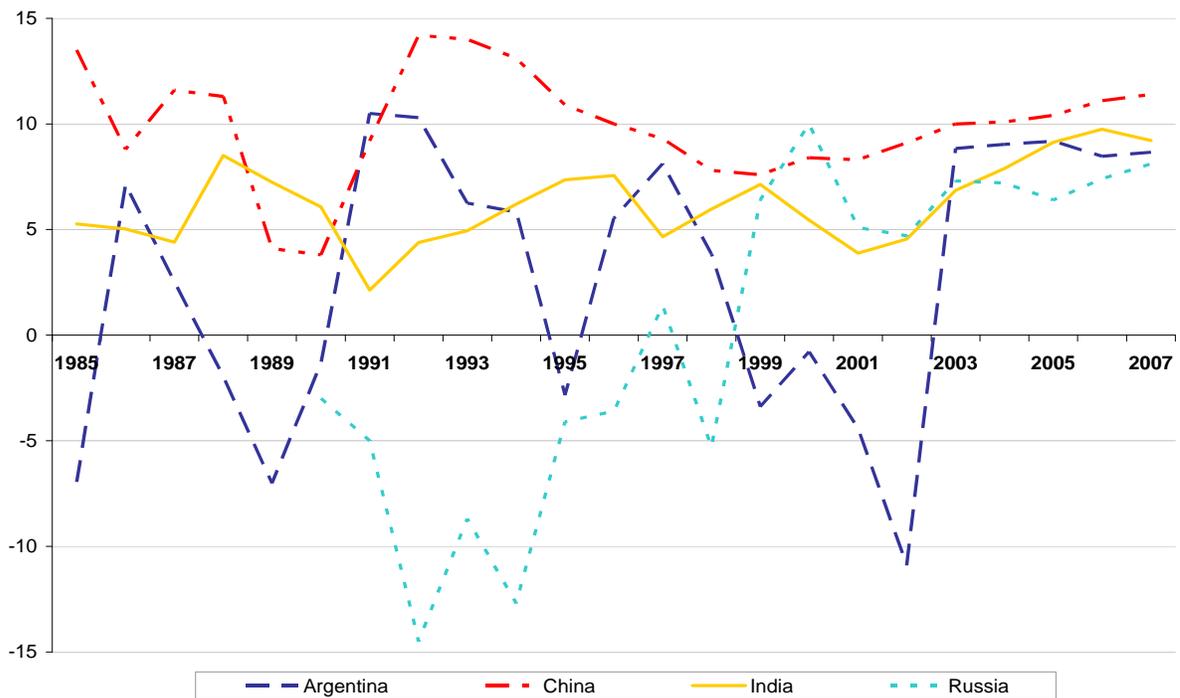**GDP (%) in IT Emerging Countries**

Source: IMF (2008).

FIGURE 6
Inflation Rate (Annual Consumer Prices) in Non-IT Emerging Countries

Source: IMF (2008).

FIGURE 7
GDP (%) in Non-IT Emerging Countries

Source: IMF (2008).