Borradores de ECONOMÍA

Inflation Targeting, Reserves Accumulation, and Exchange Rate Management in Latin America

Por: Roberto Chang

No. 487
2008

BANCO DE LA REPÚBLICA
COLOMBIA

Inflation Targeting, Reserves Accumulation, and Exchange Rate Management in Latin America[1]

Roberto Chang[2]

Rutgers University and National Bureau of Economic Research

October 2007

Abstract

This paper examines whether central banks in Latin America have implemented conventional inflation targeting (IT) prescriptions, with a focus on foreign exchange intervention and official reserves accumulation policies. To this end, the paper reviews the experiences of Brazil, Chile, Colombia, and Peru, and finds significant departures from the dominant theory of IT. Foreign exchange intervention has often been used to prevent excessive financial volatility, bubbles, and panics. Ongoing patterns of reserves accumulation have been the outcome of an effort to build "war chests" against speculative attacks and, more recently, of a fight against real exchange appreciation. Possible justifications of the discrepancies between conventional IT theory and practice are discussed and generally found unsatisfactory.

Keywords: Inflation Targeting, Exchange Rate Policy, International Reserves.

JEL Classification Codes: E5, F4

---

[1] Financing for this paper was kindly provided by the Latin American Reserves Fund (FLAR) and Banco de la Republica de Colombia. I thank Hernán Rincón, Lars Svensson, Saki Bigio, Ricardo Meirelles Faria, Vitoria Saddi, seminar participants at Villanova, and participants at the FLAR Conference on International Reserves in Middle- and Low-Income Countries for advice and suggestions. Adam Gulan provided excellent research assistance. Of course, all errors and omissions are mine alone.

[2] Department of Economics, Rutgers University, New Brunswick NJ 08901, USA. Email: chang@econ.rutgers.edu

Inflation Targeting, Reserves Accumulation, and Exchange Rate Management in Latin America*

Roberto Chang†

Rutgers University and NBER

Revised Draft, 31 October 2007

1. Introduction

An increasingly dominant view on monetary policy suggests that central banks should adopt inflation targeting (IT) regimes, as advocated by Svensson (1999, 2000), Woodford (2003), and others. Following this advice, several Latin American central banks now claim to have established IT regimes. This process has coincided with a period of low and declining inflation in most countries, which has been cited as *prima facie* evidence of the superiority of IT over other monetary rules.

However, actual IT regimes in Latin America appear to be rather different from their theoretical counterparts, most markedly on the extent to which central banks have engaged

*Financing for this paper was kindly provided by the Latin American Reserves Fund (FLAR) and Banco de la Republica de Colombia. I thank Hernán Rincón, Lars Svensson, Saki Bigio, Ricardo Meirelles Faria, Vitoria Saddi, seminar participants at Villanova, and participants at the FLAR Conference on International Reserves in Middle- and Low-Income Countries for advice and suggestions. Adam Gulan provided excellent research assistance. Of course, all errors and omissions are mine alone.

†Department of Economics, Rutgers University, New Brunswick NJ 08901, USA. Email: chang@econ.rutgers.edu

on foreign exchange intervention and, more recently, accumulated foreign exchange reserves. Conventional theory prescribes that an ideal IT regime should have an inflation target as its primary objective[1] and, therefore, should not simultaneously pursue an exchange rate goal. It follows that the exchange rate should be allowed to float. In contrast, Latin American central banks have intervened actively to stabilize foreign exchange rates. In addition, they have recently increased their stocks of foreign exchange rate reserves drastically. This represents a challenge for dominant IT theories, which are typically silent about the role of foreign reserves.

The objective of this paper is to document this state of affairs, identify possible interpretations, and derive implications for IT and monetary management. To this end, the paper includes a review of the inflation targeting experiences in Brazil, Colombia, Chile, and Peru, with emphasis on the actual details of, and rationale for, reserve accumulation and foreign exchange intervention. Having presented the stylized facts, the paper then discusses some theoretical arguments that may explain the discrepancies between conventional IT regimes and actual IT in Latin America.

To be sure, a conventional IT regime does not preclude exchange rates from having an influence on monetary policy. As Svensson (1999) emphasizes, in an optimal IT regime the policy instrument should respond to any variable that marginally helps predicting inflation. Hence, monetary policy may have to respond to exchange rate movements if the latter are correlated with future inflation, which is likely to be the case for most Latin American countries. This analysis is summarized in Section 2 of this paper.

Section 3 reviews episodes in Brazil, Colombia, Chile, and Peru and reveals, however, that actual policymaking departs from the preceding ideal view in substantial ways. Latin American central bankers have often reserved and exercised the right to adjust interest rates

[1] This is not to say that the central bank cannot have objectives other than inflation. However, in ideal IT regimes those other objectives are subordinate to inflation.

to influence exchange rates, not only when the latter have signalled impending inflationary pressures, but also to curtail "excessive volatility" in the foreign exchange market and to "calm financial markets." In addition, Latin central banks have engaged in a pattern of accumulation of international reserves with the stated objective of preventing financial crises, dealing with "sudden stops," and preventing "excessive appreciations. "

Accordingly, Section 4 reviews some possible rationales for the actual practices of Latin American IT central banks, namely:

- The combination of "dollarized" debts, balance sheet effects, and financial imperfections may exacerbate and/or reverse the effects of exchange rate fluctuations on aggregate demand, employment, and income. If domestic firms have net debts denominated in foreign currency, a fall in the exchange rate will significantly reduce corporate net worth which, if financial frictions are present, may lead to a cut of foreign financing. The final result is a halt to investment and a contraction of aggregate demand. This line of argument strongly suggests that exchange rate fluctuations may imply much larger costs than usually recognized and, accordingly, that central bankers should intervene often to limit those fluctuations (Calvo 2006).

- Recent financial and exchange rate crises in Mexico 1994-95, Asia 1997-98, Argentina 2001-2, and other emerging economies have been attributed, to a large extent, to a shortage of international liquidity, that is, a large excess of potential short term liabilities over assets in international currency (Chang and Velasco 2000). The current accumulation of reserves in Latin America and other emerging regions appears to be, at least partly, an attempt to increase international liquidity levels to minimize the likelihood of crises.

- While IT theories are built upon rational behavior, theoretical models have failed at providing a convincing account of exchange rates. Hence central bankers may justifiably

worry about the possibility of irrational exchange rate market behavior, bubbles, or multiple equilibria, and choose to limit exchange rate movements that may be out of line with equilibrium fundamentals.

- Conventional IT arguments are built upon the implicit assumption that the central bank controls only one instrument, usually a short term interest rate or a monetary aggregate. However, recent renewed interest on portfolio balance models admits the possibility that sterilized foreign exchange intervention may have real effects. If so, exchange rate management amounts to an independent instrument of policy, which then could and should be taken advantage of as part of the overall monetary strategy (Bofinger and Wollmershauser 2003).

- Exchange rate fluctuations may have strong distributional effects. Appreciations, in particular, reduce the profitability and competitiveness of export and import competing industries, and may require costly adjustment in terms of reallocating labor and other factors to alternative occupations. Not surprisingly, some recent experiences of exchange rate appreciation have witnessed strong political pressures for the monetary authorities to intervene to limit and reverse the appreciation, resulting in the accumulation of foreign reserves.

The discussion in Section 4 highlights that, at different times, unconventional exchange rate and reserves management may have responded to one or more of the concerns just mentioned. But Section 4 also finds that, while each argument is intuitively plausible, its policy implications for the episodes reviewed in this paper appear somewhat limited and are rarely straightforward.

2. Exchange Rates in a Canonical Inflation Targeting Framework

To discuss how actual exchange rate management by Latin American IT central banks may have departed from conventional IT, it will be useful to have a specific view of the latter. For our purposes, Svensson's (2007) characterization of IT for the forthcoming New Palgrave Dictionary of Economics is a suitable one:

> Inflation targeting is a monetary policy strategy that was introduced in New Zealand in 1990...characterized by (a) an announced numerical inflation target, (b) an implementation of monetary policy that gives a major role to an inflation forecast and has been called "inflation forecast targeting", (c) and a high degree of transparency and accountability.

In practice, the numerical inflation target is chosen in advance by the government and/or the central bank. Hence, in an IT regime, the central bank is not "goal independent" since its ultimate objective is fixed.[2] However, the central bank is "instrument independent," in the sense that it is free to try to attain the inflation target by adjusting any policy instrument it controls. Often, the main operating instrument has been an overnight interbank interest rate, although control of a monetary aggregate has also been observed in IT experiences (e.g. Peru between 1994 and 2001).

In an inflation targeting regime, the inflation rate is (of course) the main target of policy. In fact, in the Latin American episodes to be reviewed below, the charters establishing IT regimes clearly mention that inflation should be the overriding goal of monetary policy, if not the only one. Hence one could restrict discussion to the case in which IT is "strict," meaning that inflation is the only goal. However, the relevant theory is easily extended to the case of "flexible" IT regimes, which are concerned not only with inflation but also with

[2]The inflation target can, of course, be modified, but not in the short run. Peru's central bank, for instance, set an inflation target of 2.5 percent at the start of 2002, and only changed to 2 percent in 2007.

other indicators of aggregate real activity, such as the output gap or the unemployment rate. This is of interest partly because, as Woodford (2003) has shown in a variety of contexts, the maximization of the welfare of a typical citizen is equivalent, in some cases, to the minimization of a loss function quadratic in inflation and the output gap.

In any event, in a conventional IT regime, the central bank is directed to minimize a function of inflation and possibly the output gap or an alternative indicator of activity. In contrast, and significantly for our purposes, the ultimate goals of policy do not include other variables, including real or nominal exchange rates, or international reserve levels.

Does this view mean that neither exchange rates nor international reserves play a role in monetary policy making? Not necessarily. But the view does mean that such a role, if it exists, is limited to the way exchange rates or reserves either affect how monetary policy translates into current and future inflation and output gaps, or provide information about future values of inflation and output gaps.

To understand this important result, it is convenient to refer to a stylized view of optimal policy in an inflation targeting regime. A canonical formulation is developed in Svensson (1999). In it, the central bank is mandated to minimize a loss function of the form:

$$E_t \sum_{s=0}^{\infty} \delta^s L_s$$

where $E_t(.)$ denotes expectation conditional on information as of period t, δ is a discount factor between zero and one, and L_t is a linear quadratic function of a vector of variables Y_t from some specified targets. (A key example is

$$L_t = (\pi_t - \pi^*)^2 + \lambda y_t^2$$

where y_t denotes the output gap, π_t denotes inflation, and π^* the inflation target. The parameter λ gives the relative importance of inflation versus output gap stabilization.)

In each period t, the central bank chooses the current and future setting of a policy instrument, i_t, to minimize the loss function subject to the laws of motion of the economy, given by a linear model:

$$\begin{bmatrix} X_{t+1} \\ E_t x_{t+1} \end{bmatrix} = A \begin{bmatrix} X_t \\ x_t \end{bmatrix} + B i_t + \begin{bmatrix} \upsilon_{t+1} \\ 0 \end{bmatrix}$$

In the preceding equation, A and B are matrices of constants, which reflect the structure of the economy; X_t is a vector of predetermined state variables, such as capital; x_t is a vector of jumping variables, such as exchange rates; and $\{\upsilon_t\}$ is a vector of shocks, assumed to have mean zero and to be independently and identically distributed. In this notation, the ultimate goal or target variables are those which enter the central bank's loss function (the components of Y_t), and are linear combinations of X_t, x_t, and i_t.[3]

In this context, Svensson (1999) shows that the optimal monetary policy is given by a system of equations of the form:

$$G_t(Y_t, E_t Y_{t+1}, E_t Y_{t+2}, ...) = 0$$

involving the current value and future expected values *of the target variables only.*[4] At least in principle, this system can be solved to yield a path for Y_t, $E_t Y_{t+1}$, $E_t Y_{t+2}$, and so on, representing the optimal expected path of the target variables. So, in this analysis, the first

[3]Note that this structure includes a wide class of dynamic stochastic equilibrium models. Hence, the arguments to follow apply to that large class, and it will not be necessary to set up a more specific open economy model.

[4]Note that the central bank is assumed to be able to commit to a time and state contingent policy at $t = 0$.In the absence of commitment, time inconsistency emerges, and it is not clear how to find a satisfactory solution.

task in a monetary policy exercise is to identify the most desired values for the current value and expected future values of target variables. The current value and future expected values of the policy instrument (i_t, $E_t i_{t+1}$,...) must then adjust so as to deliver the desired path for the targets. This is why the solution is sometimes called "inflation forecast targeting".

These results imply that any variable not included in the vector of targets Y_t can affect the current setting of the monetary instrument, i_t, as long as that variable affects the forecasts of the target variables. Moreover, this is the only way in which nontarget variables should affect the optimal instrument path.

The case of most interest in our context is when one of the components of the vector Y_t is the inflation rate (that is, inflation is one of the ultimate goals of policy) but does *not* include the exchange rate. For that case, two implications of the preceding analysis have special relevance for our subsequent discussion:

1. Even if the exchange rate is not an ultimate target of policy, setting the central bank instrument optimally requires responding to information embodied in the exchange rate, if that information is marginally relevant in forecasting inflation. Hence, observing that a central bank, say, raises interest rates in response to an exchange rate depreciation does not necessarily mean that the central bank is pursuing a target other than inflation. Such a policy would be consistent with strict inflation targeting if, for example, a depreciation is expected to result in an acceleration of inflation above the target.

This observation, incidentally, means that identifying whether monetary policy is departing from strict inflation targeting is more difficult than has been acknowledged in the literature. Often, answers to this question has been based on the econometric estimation of policy rules of the form

$$i_t = \alpha + \beta \pi_t + \gamma s_t + ...$$

say, where s_t is the exchange rate (nominal or real), and α, β, and γ are parameters to be estimated.[5] It is not too uncommon for γ to turn out to be statistically significant. In that case, a pitfall in the interpretation of the results is to conclude that the monetary authority is targeting the exchange rate. As we have seen, it is possible for inflation to be the only target, yet for the optimal setting of the instrument i_t to depend on the exchange rate.

2. If the exchange rate is not one of the ultimate policy targets, however, optimal policy should respond to exchange rates only insofar as the latter affect target forecasts. In particular, under strict inflation targeting, allowing for monetary policy to depend on exchange rate shocks can be justified only on the basis of such shocks having significant implications for future expected inflation.

The latter implies that the central bank should also explain how exchange rate shocks are expected to affect inflation forecasts, particularly since "a high degree of transparency" is a defining characteristic of inflation targeting. Typically, this must be done by disclosing the economic model that the central bank uses in order to produce those forecasts.

While the central bank can in principle embrace any model for its purposes, in practice inflation targeting regimes (and also the theoretical literature on IT) have adopted versions of what is known as the "New Open Economy Macroeconomics " paradigm. In that paradigm, exchange rate news affect forecasts of future inflation through a few specific channels, including:

- Exchange rate shocks affect the prices of some imported goods that are included in the consumer price index (this is known as the *direct channel);*

- Exchange rates also affect the cost of imported intermediate inputs to domestic production, which in turn may affect aggregate supply relations between inflation and the output gap;

[5] See, for example, Mohanty and Klau (2004).

- Real exchange rate movements, which may be due to nominal ones, can affect the relative demand for domestically produced goods vis a vis foreign goods, therefore affecting aggregate demand;

- Finally, exchange rate shocks may affect domestic interest rates through interest parity conditions, and hence investment demand.

Hence, one should expect IT central bankers to justify any policy reaction to exchange rate developments on the basis of one of the arguments above. Notably, references to exchange rate volatility, market uncertainty, and the like, are absent in this framework. This is partly because of the theory's restriction to a linear quadratic framework but, more importantly, to the fact that exchange rates play a relatively restricted role in the New Open Economy Macroeconomics paradigm. Likewise, there is no role for nor any mention of a need for international reserves accumulation.

This analysis is the basis for the usual opposition, from IT proponents, to have a monetary policy response to exchange rate shocks over and above the implications of those shocks on future expected inflation. And, clearly, stabilizing exchange rates for its own sake is viewed as being inconsistent with inflation targeting. Mishkin and Schmidt-Hebbel (2002), for example, argue that

> The fact that exchange rate fluctuations are a major concern in so many countries raises the danger that monetary policy may put too much focus on limiting exchange rate movements, even under an inflation targeting regime. The first problem with a focus on limiting exchange rate movements is that it can transform the exchange rate into a nominal anchor that takes precedence over the inflation target...The second problem...is that the impact of changes in exchange rates on inflation and output can differ substantially depending on the nature of the shock that causes the exchange rate movement...Targeting the exchange

rate is thus likely to worsen the performance of monetary policy. This does not imply, however, that central banks should pay no attention to the exchange rate. The exchange rate serves as an important transmission mechanism for monetary policy, and its level can have important effects on inflation and aggregate demand, depending on the nature of the shocks. This is particularly true in small, open economies.

Likewise, in an independent review of the Central Bank of Norway (Norges Bank Watch 2002) one reads:

> Inflation targeting in an open economy will include an element of *implied* exchange rate stabilization...Importantly, this implied exchange rate stabilization is not for its own sake; it is derived from the objectives of stabilizing inflation and the output gap.
>
> A separate issue is the desirability and feasibility of independent stabilization of the exchange rate...Except in situations of financial fragility with concerns about the stability of the payment and financial system, we find it difficult to see good reasons for such stabilization at the cost of increased inflation and output gap variability.

The above considerations concern the optimal setting of the monetary policy instrument, which is typically an interest rate or a monetary aggregate. In contrast, sterilized foreign exchange intervention receives virtually no attention by the conventional wisdom. This is embodied on the fact that the models that dominate IT theories do not describe the asset side of the central bank explicitly, reflecting the view that the division of the central bank's portfolio between foreign currency assets (reserves) and domestic currency assets is of no consequence. This view can be given microfoundations, although it requires a set of implicit

or explicit assumptions that may not be trivial.[6] Of course, the practical justification for ignoring the possibility and implications of sterilized foreign exchange intervention is the substantial body of empirical work that has failed to find systematic and durable effects of such intervention in the data.

3. The Latin American Experience

To examine how Latin American inflation targeting regimes compare with the conventional IT framework of the previous section, we now turn to a description of observed experiences in Colombia, Chile, Peru, and Brazil. Our review is (necessarily) rather selective, and emphasizes those episodes in which departures between the conventional IT wisdom and real world policy appears to be greatest. We also try to identify what is the "official " position of each IT regime with respect to foreign exchange intervention, exchange rate management, and reserves accumulation, so we can ascertain whether official deeds have followed words.

3.1. Colombia

Background. Colombia started implementing an inflation targeting regime after the 1991 Constitution and the 1992 Central Bank Law (Ley 31) gave the central bank (Banco de la Republica) the chief objective of "maintaining the purchasing value of the peso," granting it independence for this purpose. In addition, Ley 31 stated that the Banco de la Republica must "adopt specific inflation goals".

But arguably inflation targeting was fully embraced only in 1999 when, as a consequence of the Russian crisis and the Brazilian devaluation, the Banco de la Republica announced that it would allow the exchange rate to float. This reform replaced a system of preannounced

[6] One such set is that the economy is small in world financial markets, that the central bank cannot issue securities that are not available from the world capital market, and that domestic residents have unrestricted access to the latter.

exchange rate bands that had been in place since 1994 and was subject to speculative attacks during 1998-99. Vargas (2005) notes that, in the latter period, international reserves fell by eighteen percent, and the Banco de la Republica had to sell US$ 2.6 billion to defend the exchange rate bands. Yet, the pressure on the peso did not subside, and the midpoints of the exchange rate bands had to be realigned twice, in September 1998 and June 1999, each time by nine percent.

Finally, in September of 1999 the exchange rate bands were dropped and the Banco de la Republica announced that, from then on, exchange rates were to float. This commitment was included a few weeks later (December 1999) in a Letter of Intent submitted to the IMF in the context of a three year Extended Fund Facility credit.

As stated in the Memorandum of Economic Policies attached to the Letter of Intent, floating rates were to be implemented to help monetary policy continue the process of disinflation:

> The central bank expects that allowing the market to set the rate for the peso will enable the Colombian economy to better absorb external shocks and facilitate the conduct of monetary policy, as well as reduce speculation against the currency, while allowing the central bank to continue its disinflation policy.

But, at the same time, the Banco de la Republica explicitly "reserved the right to intervene " to prevent unwarranted volatility in the foreign exchange market and to help rebuilding the stock of international reserves:

> Under the floating exchange rate regime, intervention by the Banco de la Republica in the foreign exchange market will be limited to maintaining orderly market conditions by smoothing short-term movements in the nominal exchange rate consistent with the program projections for the net international reserves.[7]

[7] Colombia Letter of Intent, December 3, 1999. The quotes here are from paragraph 26 of the Memorandum of Economic Policies.

The claim for a right to intervene has persisted since then. Indeed, the Banco de la Republica website describes the objective of its exchange rate policy in the following terms:

> The strategy of monetary policy has been implemented within a regime of flexible exchange rates, subject to intervention rules through which the following objectives have been sought:
>
> * To maintain an adequate level of international reserves that reduce the vulnerability of the economy to foreign shocks, both on current account and on capital account;
>
> * To limit excessive volatility of the exchange rate at short horizons, and
>
> * To moderate excessive appreciations or depreciations that endanger attaining future inflation targets and the financial and external stability of the economy.[8]

The Inflation Targeting Regime. How, then, has inflation targeting in Colombia worked? Chart 1 shows the evolution of CPI inflation for the last twenty years.[9] As shown by the chart, the formal adoption of inflation targeting in 1991-2 was preceded by a period of relatively high inflation, at rates around thirty percent per year. Since then, the inflation rate has fallen gradually, to its current level of four and a half percent per year. Notably, the fall in inflation has been more drastic since the start of floating exchange rates in 1999 (the subperiod shown as the shaded area in the chart). During that year, the inflation rate fell to 9.2 percent, from 16.7 in 1998.

The reduction of inflation appears to be associated with the behavior of the output gap in the expected way. Between 1992 and 1995, GDP growth was better than five percent per year, and the inflation rate, while falling, was sluggish. A big fall in inflation from about

[8] From the "Foreign Exchange Policy " entry of the Banco de la Republica web site, at http://www.banrep.gov.co/politica_cambiaria/index.html

[9] Charts can be found at the end of the paper. Data for Charts 1-3 and 5-6 were taken from the Banco de la Republica's web site (www.banrep.gov.co). The source for Chart 4 is JP Morgan.

17 percent in 1998 to 7 percent in 2002 was coupled with subpar growth. This is shown in Chart 2, which decomposes 1996-2007 GDP quarterly growth between its Hodrick-Prescott trend component and a cyclical component. Annual GDP growth was only one half of one percent in 1998 and then fell dramatically, by 4.5 percent, in 1999. Recovery was very tepid up to 2003: GDP growth was only 2.9 percent in 2000, and less than two percent in 2001 and 2002. Since 2003, however, growth has been rather robust, as evident from Chart 2.

Since 1999, the main instrument of monetary policy has been the overnight repo rate, which has generally followed a downward trend. This is shown in Chart 3. Relative to inflation rates, interest rates were kept at a rather high level until July 2001, implying a real interest rate of about four percent. In the following year the repo rate was lowered by 625 basis points, perhaps reigniting growth. Since then, the repo rate hovered between 5.25 percent and 7.5 percent until about a year ago, when a series of increases started aiming at preventing overheating and bringing inflation down to target.

Interest rate adjustments have, therefore, been broadly consistent with a conventional IT framework. The Banco de la Republica, however, has exercised its option to intervene in the foreign exchange market in response to two episodes of significant foreign shocks.

2002-3: Political Uncertainty and Volatile Capital Markets. The first episode was associated with the Brazilian presidential elections of 2002, which resulted in an increase in the Brazilian EMBI spread to almost 2500 basis points, and political uncertainty in Venezuela following the popular revolt against Hugo Chavez in April 2002. While most other Latin American economies were relatively unaffected by the Brazilian shock, Colombian spreads increased by almost 600 basis points, probably reflecting the market expectations about the impact of the Venezuelan turmoil on Colombia (Chart 4).[10]

[10]To be sure, events in Venezuela affected Colombia through several channels in this period. Weak oil prices, for example, led to a fall in aggregate demand in Venezuela and to a reduction in Venezuela's demand for Colombian exports. This trend was exacerbated by the imposition of capital controls in Venezuela, starting early 2003. Yet, as apparent from Charts 3 and 4, the sharpest movements in exchange rates and EMBI spreads took place during the summer of 2002, thus following the political shocks emphasized in the

As shown in Chart 3, the Colombian peso depreciated sharply, losing thirty percent of its value between March of 2002 and March of 2003. One consequence was that tradable goods prices had to increase, pushing inflation above the target range of six percent for 2002 and five and a half percent for 2003. Indeed, annual CPI inflation was to rise above seven and a half percent by mid-2003.

The Banco de la Republica response had two dimensions. The first one was conventional: repo rates, which had been following a downward path since the beginning of 2001 and until June of 2002, were increased by 100 basis points in January 2003 and again in April of 2003.

The unconventional dimension was that the Banco de la Republica sold foreign exchange call options between July 2002 and May 2003 for about US$ 745 million, through a pre-announced auction mechanism that had been established after the peso was floated. The auctions that took place in 2002 were part of an automatic procedure that had been established in 1999 to respond to exchange rate volatility. On the other hand, the 2003 auctions, announced in February of that year, were discretionary moves by the Banco de la Republica, and were explicitly intended as a response to expectations of higher inflation and depreciation.[11]

It is noteworthy that the amounts involved were very small relative to the foreign reserves of the Banco de la Republica (about US$ 11 billion at the time). Also, the private sector's appetite for the options was limited. As discussed by Vargas (2005) and the March 2003 *Report from the Banco de la Republica to the Congress*, the auctions mechanism stipulated that there was a set and preannounced maximum amount of international reserves to be sold. For the second half of 2002, the amount was $ 540 million, of which US$ 414 were sold. For the first half of 2003, the amount was US$ 1 billion, of which only US$ 345 million were sold. (Chart 5)

text.

[11] See, for example, section 2 of Banco de la Republica's *Informe sobre inflacion, Marzo de 2003.*

By the end of 2003, the Banco de la Republica appeared to have succeeded both in stopping the depreciation of the peso and in reducing inflation to target levels. The peso-dollar exchange rate stabilized around February of 2003 and settled on a decidedly appreciating trend from October 2003 on. Annual CPI inflation fell below 6.5 percent by October 2003, and has continued to fall until very recently.

In discussing this episode, Vargas (2005) argues that

> Intervention of the central bank in the forex market was a very useful complement to interest rate policy. It was perceived that the increases of the interest rates alone were not sufficient to correct the depreciation of the Col peso or to curb inflation expectations. In other words, the exclusive use of interest rates would have required much larger movements than those observed, probably introducing inefficient output volatility.

However, it is not clear exactly how forex intervention may have been operated as a complement to repo rate increases. By themselves, the increases were bound to strengthen the peso, and at the same time put a brake on real activity and rein on inflation. So, one could argue that the foreign exchange auctions were effective simply because they signaled future increases in repo rates. The small size of the auctions is consistent with such an interpretation, as is the fact that the intervention of February 2003 was discretionary and followed by a relatively large repo increase (100 basis points) in April.[12] On the other hand, the fact that the 2002 auctions were automatic rather than discretionary suggests that those auctions could have not been interpreted as informative signals by the public.

2004 to Present: Persistent Real Appreciation. A second episode has been the strong and continued appreciation of the Colombian peso since 2004. Several developments appear

[12]Notice that this argument is consistent with the view that the repo rate was adjusted solely to attain the inflation target, as seems to have been the case. But the intervention may have strenghtened the market's belief that more repo increases were coming.

to be behind pressures for the peso to appreciate. In Venezuela, Hugo Chavez consolidated power by defeating a recall referendum in August 2004. Colombia's terms of trade kept improving. Domestic confidence improved, perhaps due to a combination of improved security and macroeconomic stability, which resulted in a vigorous expansion of domestic demand, led by private investment (Chart 6).[13] Foreign direct investment has also increased as the result of recent privatization efforts. Transfers from abroad, especially workers' remittances, increased significantly during the period. [14] Finally, world interest rates and risk premia kept falling, reflecting the now famous "savings glut."

The exchange rate fell from 2790 pesos per US dollar to 2350 pesos per dollar between the end of 2003 and the end of 2004, a 18.7 percent appreciation. A policy response to the appreciation was then deemed to be necessary for at least two reasons: the appreciation was expected to reduce inflation significantly below the 2004 inflation target of 5.5 percent; and, also, a real peso appreciation was thought to be detrimental to the external competitiveness of Colombian exports.

The initial response of the Banco de la Republica was, again, two pronged. Auctions of foreign exchange put options were sold in January 2004 (for US$ 400 million) and April 2004 (for US$ 200 million). This was followed by reductions in repo rates of 25 basis points in February and again in March 2004.

This time, however, the policy response proved to be insufficient to stop the appreciation of the peso. As a consequence, the Banco de la Republica announced its intention to purchase up to US$ 1 billion during the last quarter of 2004. Significantly, this amount was to be bought under a new "discretionary" mechanism which freed the Banco de la Republica from the constraints that had shaped foreign exchange auctions. At the end of 2004, the last constraint was dropped, as the Banco de la Republica announced that discretionary

[13] As percentage of GDP, investment jumped from 15% in 2003 to 26.3% in 2006.

[14] According to the *Informe al Congreso de Julio 2007,* workers' remittances jumped from an annual average of US$ 2.3 bn. in 2000-3 to US$ 3.7 bn. in 2004-6.

intervention would no longer be subject to limits in either transactions amounts or time horizon.

Repo rates were reduced by 25 basis points in December 2004, and by 50 more basis points during 2005. These reductions were clearly insufficient to curb the strength of the peso, and in response the Banco de la Republica continued purchasing dollars at healthy rates. Foreign exchange purchases reached US$ 2.9 bn. in 2004 and US$ 4.7 bn. in 2005.

After purchasing US$ 1.2 bn. in the first quarter of 2006, the Banco de la Republica stopped discretionary intervention in response to the reversal of capital inflows in the second quarter of 2006, during which the peso lost 15 percent of its value. As is well known now, foreign appetite for risky investments in emerging markets dropped in that quarter, due to uncertainty about the future course of the United Stated economy and Federal Reserve policy. This episode, however, proved to be short lived, and since the third quarter of 2006 the peso has settled on a path of frank appreciation. At the end of June 2006, the exchange rate was 2633 pesos per US dollar. By the end of May 2007, it was 1930 pesos per dollar (an appreciation of 36 percent).

The recent peso appreciation has defied very large intervention by the Banco de la Republica (Charts 3 and 5). Between January and May 2007, foreign exchange purchases totaled US$ 4.9 bn,[15] increasing the Banco's stock of net foreign reserves by about one third.

In this case, and in contrast with previous experiences, the Banco's dollar purchases have occurred against a backdrop of tightening monetary policy. The repo rate, which stood at 6 percent at the beginning of 2006, as been increased several times since, and stood at 9 percent as of July 2007. The rationale has been that Colombia's economy may be on the verge of overheating, which would endanger the attainment of the inflation target for 2007. And indeed inflation has been accelerating recently, and markets increasingly doubt that the Banco de la Republica will succeed in keeping 2007 inflation within its target range of 3.5-4.5

[15] Of which US$ 4.5 were discretionary purchases.

percent.

In fact, there seems to be a consensus now among market analysts that the Banco de la Republica is pursuing not only an inflation objective, but an exchange rate objective as well.[16] And, in a break with the past, these two objectives conflict. In this period, the Banco apparently used the interest rate as instrument to target inflation, and foreign exchange intervention to target the exchange rate. (Discretionary intervention was halted, however, after May 2007.)

Current forecasts are that the Banco de la Republica will have to increase interest rates even more in order to bring inflation under control. Given this, and not too surprisingly, foreign exchange intervention has failed to prevent peso appreciation. In response, the Banco de la Republica has considered more radical measures, starting with the imposition of capital controls in May. [17] Predictably, the market reaction to this move has been mixed, although there appears to be a widespread belief that the existing capital controls will also be insufficient to revert the appreciation of the peso.

A potentially significant issue raised by the massive dollar purchases by the Banco de la Republica is the impact on monetary and credit aggregates.[18] To a large extent, the Banco de la Republica has managed to ameliorate the expansionary implications of intervention by selling foreign exchange for the Treasury to prepay external debt (US $ 3.5 bn in 2005 and US $ 1 bn in 2006). In addition, the Treasury's deposits at the Banco de la Republica increased significantly since 2003.

[16] See the analysis by various investment banks at http://www.rgemonitor.com/367/americas /andean_countries_ (colombia_ecuador_peru_and_bolivia)/?more=cluster&cluster_id=1929#11

[17] Since early May, the Banco requires forty percent of all dollar borrowing from abroad to be held in non interest bearing accounts. This requirement was extended to include portfolio flows in late May.

[18] Of course, dominant theories of inflation targeting emphasize that, under interest rate control, the behavior of monetary and credit aggregates has little bearing on the determination of inflation (Woodford 2003), and the Banco de la Republica's management of repo rates seems consistent with the pursuit of its inflation targets. However, it is fair to say that rapid monetary and credit growth remains a source of concern in actual central banking practice.

Also to reduce the impact of credit growth, the Banco de la Republica decided in May to increase reserve requirements for bank deposits (from 13% to 27% for checking accounts, 7% to 12.5% for savings accounts, and from 2.5% to 5% for time deposits).

It is too early to tell how this episode will end. But, as our discussion shows, recent foreign exchange intervention has worked at cross purposes with monetary management, raising serious questions about the ability of the Banco de la Republics to attain its 2007 inflation targets.[19]

3.2. Peru

Background. Although the Peruvian Banco Central de Reserva started announcing one year inflation targets in 1994, it moved towards an explicit inflation targeting regime in January 2002. Then, the *2002 Monetary Program* stated that the target for inflation would be 2.5 percent, with a tolerance band of plus or minus one percentage point. That target was to be maintained until January 2007, when it was lowered to 2 percent.

Under inflation targeting, the main monetary policy instrument has been the interest rate for overnight interbank loans. The *2002 Monetary Program* envisioned that interbank rates would be adjusted solely to attain the inflation target, and hence the exchange rate had to float:

> The management of the operational target is oriented towards attaining the inflation target and not any other nominal variable such as a monetary aggregate or the level of the exchange rate. Therefore, this regime [of inflation targeting] is only compatible with floating exchange rates.

In line with conventional views on inflation targeting regimes, the *2002 Monetary Program* did allow for monetary policy to respond to exchange rates, but only as long as the latter

[19] Again, see the market commentary available at the RGE web site, cited in footnote 16.

affected prospective inflation:

> The decisions about the operational target of monetary policy will be based on an integral assessment of the determinants of inflation, for which we will consider surveys on inflation expectations, the evolution of economic activity, and the exchange rate, mainly.

However, this position was quickly dropped in favor of intervening in the foreign exchange market in case of need. The *September 2002 Inflation Report* stated this option explicitly:

> In an exceptional way and even if there may not be inflationary pressures, the Banco Central can modify the availability of liquidity for the banking system, the reference interest rates, or intervene in the foreign exchange market, in order to ameliorate abrupt fluctuations in the exchange rate or to prevent speculative bubbles that may affect the normal performance of financial markets and the real economy.

In fact, the Banco Central has been quite forthcoming in reporting its foreign exchange intervention operations since 2002. At various times, it has justified intervention on at least two related but conceptually separate grounds. First, as already mentioned, the Banco Central has often cited the need to curb excessively volatile exchange rates. This is not too different from practice by other central banks. But Peru's Banco Central has stressed that the large exchange rate fluctuations, or speculative bubbles, may be more damaging for Peru than for other countries because of the extent of financial dollarization and the associated balance sheet effects:

> Central Bank intervention in the foreign exchange market seeks to minimize the probability that an abrupt increase in the exchange rate, through the process

> of dollarization of the economy, result in high costs in terms of the insolvency of firms and of a reduced stability in the financial system. This type of interventions are, therefore, consistent with a prudent monetary policy. [20]

Secondly, in justifying foreign exchange purchases, the Banco Central has often argued that there are key benefits from holding a large stock of international reserves. These benefits include the ability of the Banco Central to serve as a lender of last resort in dollars, and hence to reduce the likelihood of a bank run (Armas and Grippa, 2006).

The Peruvian macroeconomy under inflation targeting. The period just before explicit inflation targeting, in 2002, had been characterized by mild deflation. Since then, the Banco Central has been very successful in keeping Peru's inflation rate within one percentage point of the inflation target. Violations of the target range have been small and short lived. (See Chart 7)[21]

At the same time, Chart 8 shows that real activity has been exceptionally favorable. The growth rate of GDP, which had been close to zero between 1998 and 2001, jumped to 5.2% in 2002 and, after falling to 3.9% in 2003, accelerated in subsequent years, reaching 7.9 percent in 2006. For 2007, the Banco Central current projection is 6.8 percent. (chart).

Several factors appear to be driving the Peruvian performance. Clearly, low interest rates in the world economy have played a role. However, the behavior of the current account gives little indication of excessive foreign borrowing. As displayed in Chart 9, the current account, in fact, has changed from a deficit of 1.9 percent of GDP in 2002 to a surplus of 2.3 of GDP in 2006, improving every year in between.

Arguably, better terms of trade, particularly copper prices, are better explanations of the Peruvian expansion. (Chart 10) Also, domestic confidence has improved strongly, perhaps following many years now of monetary and fiscal stability. This has been expressed in healthy

[20] January 2006 Inflation Report.

[21] Data for Charts 7-12 are from the Banco Central de Reserva's web site (www.bcrp.gob.pe).

rates of private investment, which as a percentage of GDP increased from 14.7 in 2007 to 16.8 in 2006, and is expected to reach 18.8 in 2007, as shown in Chart 11.

In this context, the Banco Central has had to change interest rates relatively infrequently. But, as we will discuss, there have been notable episodes of foreign exchange intervention.

Repercussions from the 2002 Brazilian election. A first notable episode was associated with the 2002 Brazilian election. While the impact on capital flows to Peru was relatively mild, the Peruvian sol lost six percent against the US dollar between May and September of 2002. According to the *September 2002 Inflation Report,* anxiety about future exchange rates built up, putting pressure on the Banco Central to increase interest rates:

> On September 17 an unusual tension in the market was faced, caused by expectations of sol depreciation, and the interbank rate climbed up to 16.1 percent. In the following days, after a stabilizing intervention by the Banco Central, the reduction of those expectations and the return of liquidity to the banks made the interbank rate to return to the reference interest rate corridor.

The "stabilizing intervention" was a sale of US$ 127 million in the open market. In addition, the Banco Central increased interest rates by 100 basis points. After these policy moves, financial markets stabilized. By the end of December, the exchange rate was back to the June 2002 level, where it would remain for all of 2003. In November 2002, the Banco Central bought back US$ 100 million. These operations appear in Chart 12.

Since the Banco Central's net international reserves were around US$ 9.8 billion at the time, the size of the foreign exchange intervention was decidedly small. What is noteworthy is the Banco Central's emphasis that intervention was not to be taken as a departure from floating rates:

> The intent of policy was to smooth exchange rate volatility, without commit-

ment to any level [of the exchange rate].[22]

In addition, the record is clear in the objective of the intervention was to calm foreign exchange markets rather than to fight any inflationary implications of the sol depreciation. Indeed, a discussion of such implications is notably absent from the period's Banco Central's documents and announcements.

2003-2006: Accumulation of Reserves, with Elections in the Middle. Since 2003, Peru's external position has been rather strong and, as mentioned earlier and shown by Chart 9, driven by several favorable domestic and foreign factors, including improving terms of trade, decreasing cost of external credit, macroeconomic stability, and improving business confidence. The improvement has been most remarkable in the trade surplus, which increased from 0.6 of GDP in 2002 to 9.6 of GDP in 2006. The current account balance, in turn, improved from a deficit of 1.9 percent of GDP in 2002 to a surplus of 2.8 percent of GDP in 2006. As a result of the implied capital inflows, the Peruvian sol has settled on an appreciating path against the US dollar, except for a relatively brief period surrounding the presidential elections of early 2006.

In this context, the Banco Central has been very active in the foreign exchange rate market. Between 2003 and the third quarter of 2005, the Banco Central bought US $ 6.5 billion, increasing its stock of net foreign reserves from US $ 9.6 billion to US $ 13.6 billion. The rationale for this strategy is well summarized by Grippa and Gondo (2006):

> According to the inflation reports published by the BCRP [Peru's Banco Central] between 2004 and 2005, the Banco anticipated risks for the economy of possible increases in international interest rates, which would increase country risk; electoral processes in Latin America between the end of 2005 and 2006, which could also increase country risk according to their development, especially

[22] September 2002 Inflation Report.

> the local electoral process in 2006; and the uncertainty of how significant was the transitory component of the increase in terms of trade (...) These risks, according to the BCRP, justified the accumulation of international reserves in a preventive manner...

Interestingly, Grippa and Gondo (2006) argue that, in fact, this episode shows that the inflation objective had clear priority over foreign exchange intervention:

> Inflation expectations for 2005 showed an increase between July and August of 2004...In this situation, the Banco increased the reference interest rate twice, in August and October, by 25 basis point each time. A smaller monetary stimulus was inconsistent with a putative wish to maintain the exchange rate above some determined level, given the tendency towards a reduction then experienced. Also, the Banco reduced its dollar purchases in the market, and the exchange rate experienced a greater fall [appreciation].
>
> In this way, in a situation in which there was foreign exchange intervention in a buying position ...that were in conflict with fulfilling the inflation target, the Banco Central privileged the latter.

However, the available data presents a murkier picture. Although the sol appreciation became faster in the second half of 2004, the Banco Central's dollar purchases, in fact, accelerated, as shown in Chart 12. The purchases, which had added up to US $ 840 million in the first six months of 2004, increased to US $ 1.5 billion during the second half of that year.

As anticipated by the Banco Central, the sol's appreciating run was interrupted by the run up to the presidential elections of April 2006. The ascent of Ollanta Humala (a self proclaimed *ethno-nationalist* candidate) in the polls was received with dismay by the markets

and reflected in an increase in Peru's risk premia and a five percent depreciation of the sol in the second half of 2005.

In this juncture, the Banco Central raised interest rates by 150 basis points between November 2005 and May 2006. In addition, the Banco reversed course and started selling dollars, most intensely during December 2005 and January 2006 when it sold US $ 700 million. (Chart 12)

The increases in interest rates may have been justified on the basis of strong real activity and expectations of increasing inflation at the end of 2005. But the *May 2006 Inflation Report* makes it clear that exchange rate volatility was also a consideration:

> The increase in the reference interest rate also helped to prevent situations of excessive volatility in the foreign exchange market which, given the economy's financial dollarization, could generate undesired effects on inflation and economic activity.

With respect to the sales of foreign exchange, the 2006 Inflation Report states:

> The foreign exchange operations undertaken by BCRP have sought to prevent that an excessive volatility of the exchange rate, in a context of high financial dollarization, negatively affect the dynamism of economic activity...[Intervention] also permits the foreign exchange market to continue operating under circumstances in which the volume of supply or demand in said market contracts significantly, preventing the normal formation of prices.

Market volatility fell after February 2006, reflecting Alan Garcia's rise and eventual victory in the elections. Since then, pressures for sol appreciation have intensified. In response, the Banco Central has resumed the accumulation of international reserves, with *gusto.* The Banco purchased US $ 4.2 billion in the second half of 2006, and US $ 4.5 billion

between January and May this year. This policy resulted in an increase in net international reserves from US $ 14.4 billion in June 2006 to US $ 21.2 billion in last May. The stated rationale for the huge accumulation of reserves, according to the latest (May 2007) *Inflation Report,* is still "to afford eventual negative external shocks in the future ".

3.3. Chile

Background. Chile was among the early adopters of New Zealand-style inflation targets, having started to announce inflation goals since 1990. However, Chile maintained a system of crawling exchange rate bands for most of the nineties, and exchange rate objectives played an important role in the formulation of monetary policy in several occasions, such as the period of the Russian crisis and the Brazilian 1999 devaluation.

The exchange rate bands were finally dropped in September 1999, and from then on the Banco Central de Chile has claimed to implement a full inflation targeting regime along with flexible exchange rates. Inflation was to be kept between two and four percent, a range that has been maintained to this day. The main monetary policy instrument is the interest rate for overnight interbank loans, and is supposed to be adjusted until the forecast for inflation in the following twelve to twenty four months falls within the target range. (Chart 13)[23]

While the Banco Central emphasizes that inflation targeting can only be compatible with floating exchange rates, it also explicitly states that it reserves the right to intervene in the foreign exchange market in some cases. The *January 2003 Inflation Report,* for example, says:

> The floating exchange rate is a distinctive component of Chile's macroeconomic policy framework...In exceptional circumstances, nonetheless, the Central Bank may choose to participate in the foreign exchange market.

[23]Data for Charts 13-15 are from the Banco Central de Chile 's web site (www.bcentral.cl).

"Exceptional circumstances" are to be understood as periods of heightened volatility of the exchange rate not justified by fundamentals:

> The exchange rate over-reacts when, with no major change in its main determinants (e.g. terms of trade, conditions for accessing international financing) a substantial depreciation is followed by a similar appreciation, or vice versa, in a relatively brief period of time.

According to the Banco Central, such episodes are hard to deal with through normal monetary adjustments (that is, changes in interest rates), because of the collateral effects of the latter on real activity:

> For example, a sharp depreciation could generate inflation that would be necessary to compensate with monetary policy tightening. But if the exchange rate movement was an overreaction, this monetary tightening would unnecessarily deepen the cycle. (De Gregorio, Tokman, and Valdes 2005, p.12)

Of course, identifying when exchange rate volatility is not warranted by fundamentals is rather tricky. The Banco Central has acknowledged this fact, and as a consequence it has promised to limit exchange rate intervention in magnitude and horizon, as well as making intervention operations as transparent as possible. It also emphasizes that intervention is not intended to support specific levels of the exchange rate but, rather, to provide adequate liquidity so that market forces can bring exchange rates to equilibrium levels.

The Chilean Experience. As is well known, Chile's economic performance since 2000 has been enviable. Annual inflation has remained close to three percent and, except for 2002, GDP growth rates have been 3.4 percent or better (Charts 14 and 15).

In this period, the Banco Central has abstained from intervening in the foreign exchange market, except for two episodes in which it determined that exchange rates were "overreacting ". The first episode was in 2001, during which the Chilean peso came under intense

pressure, losing about one fifth of its value between the end of December 2000 to early August 2001. The fall in the value of the peso was associated with adverse movements in the price of copper as well as contagion from the deteriorating market outlook on Argentina. Then, as described by the *September 2001 Monetary Policy Report*,

> The speed and quick succession of movements that led to a decline in conditions abroad exacerbated peso volatility and depreciation, despite the strength of Chile's economy and the coherence of its macroeconomic policies. This led the Central Bank's Board to adopt measures to improve the stability of the country's financial markets.

The measures, which were adopted in August 2001, included the announcement that the Banco Central would sell up to US $ 2 billion dollars (out of US $ 15 billion in international reserves) in the spot market in the next four months. [24]

The hope appears to have been that the intervention would be enough to prick a bubble on the dollar, as expressed by De Gregorio and Tokman (2004):

> The intervention appeared as the first line of defense against an inflation caused by an excessive depreciation. The possibility of a bubble dominating the market required actions to verify if this was an overreaction. The success of the sterilized intervention shows that the market reaction was indeed exaggerated. Otherwise, the intervention would have been ineffective, and would have required a monetary contraction if inflation expectations had been very far from the target.

Happily, the Banco Central's move was followed by a good response by the markets, to the point that the final amount of dollars actually purchased (US $ 803 million) was less than half the maximum originally announced.

[24] In addition, the Banco Central would sell up to US $ 2 bn in peso bonds indexed to the dollar.

The second episode was triggered by the Brazilian 2002 elections. Between August 2002 and October 2002, the Chilean peso embarked on a path of clear depreciation, losing almost ten percent of its value. In response, the Banco Central announced its willingness to intervene to support the peso between October 2002 and February 2003, as it had done the year before. This time, however, the pressures on the peso subsided quickly, and the Banco Central ended up not intervening in the spot market.[25]

In commenting on this episode, De Gregorio and Tokman (2004) stress the fact that the operations were preannounced and transparent, and that they were designed to deal with nonfundamental exchange rate volatility:

> The specific form taken by the intervention package is of special interest, since it is not shared by other countries. In Chile, when intervention has been announced, both start and end dates have been published. Also, the maximum amount of intervention in the spot market and the calendar of monthly issues of Central Bank Deposit Certificates have been disseminated...In fact, the intervention takes place to inform the market that the monetary authority considers that the evolution of the exchange rate is not justified given its fundamentals...Thus, the *intervention is a test to find a possible bubble* [emphasis added].

3.4. Brazil

Background. After the Asian and Russian crises of 1997-98, enormous pressures on the Brazilian Real, which had been pegged to the dollar ever since the 1994 Real Plan, led the Banco Central do Brasil to adopt floating rates in January 1999. As the Banco was then free to adopt an alternative nominal anchor, a June 1999 presidential decree (3.088) directed the Banco to follow an inflation targeting regime.

[25] It did sell, however, a small amount of Central Bank dollar denominated certificates.

The decree mandated that inflation targets, chosen by a National Monetary Council, would provide the "anchor for fixing the regime of monetary policy". The target horizon was fixed at three years, so inflation targets for 1999, 2000, and 2001 were announced (respectively, at eight, six, and four percent per year). The target for 2002 were to be announced in June 2000, and so on. Tolerance bands of plus and minus two percentage points were accepted.

From the start, the policy instrument was the interest rate for overnight interbank loans, commonly known as the SELIC rate. The setting for the SELIC rate is decided by a Monetary Policy Committee (COPOM), which met once a month until 2006, and has met eight times a year since.

In contrast to the other cases discussed in this paper, the Banco Central do Brasil has refrained from any explicit claims to any "right to intervene" in the foreign exchange market. Instead, official documents, speeches, and presentations emphasize that there is a floating exchange rate regime, mentioning only occasionally that monetary policy may have to respond to external developments insofar as they affected the inflation objective. For example, a July 2, 1999 Letter of Intent to the IMF stated:

> in its conduct of interest rate policy, the BCB will respond to any significant pressures on net international reserves or to exchange rate developments that may threaten the achievement of the inflation target.

Similar statements, however, are hard to come by, and the record suggests that the Banco do Brasil explicit embracing of floating exchange rates is part of its effort to build credibility for the inflation targeting regime.

Overall Performance. As given in Chart 16,[26] progress towards low and stable inflation since the establishment of inflation targeting has been notable but unsteady. Annual inflation

[26] Data for Charts 16-19 comes from the Banco Central do Brasil's web site (www.bcb.gov.br). In addition, the spreads data in Chart 19 was kindly provided by JP Morgan.

fell to almost nine percent in 1999 (in spite of a huge Real depreciation) and six percent in 2000, and hence very close to the official targets. However, inflation increased to 7.7 percent in 2001 and to 12.5 percent in 2002; as we discuss next, this was mostly in response to contagion from Argentina, the impact of the September 11, 2001 attacks and the 2002 presidential elections. Since 2003, however, the outlook has continuously improved, and inflation is currently stable at around three percent per year.

One well known aspect of the Brazilian experience with inflation targeting is that interest rates have been rather high (Chart 17). As discussed by Fraga, Goldfajn, and Minella (2003) and others, the Banco do Brasil sees high interest rates as necessary given the low credibility inherited from the past. In addition, very high interest rates were necessary to fight the strong adverse shocks of 2001-2.

Perhaps as a consequence, the performance of the real economy has been rather uneven relative to other Latin American countries. GDP growth was close to one percent in 1999, 2001, and 2003. The other years in the period covered saw reasonable but not spectacular growth, with the exception of 2004 when growth was 5.7 percent. (Chart 18)

Recently, however, Brazil has become the darling of the international investment community. As the Lula administration has proven to be a welcome surprise in terms of macroeconomic management, fiscal and debt consolidation, and political stability, Brazil's risk spread has plummeted and international capital inflows are flooding the financial system (Chart 19). As discussed below, these flows have also presented the Banco do Brasil with a substantial challenge in terms of exchange rate management.

2001: Real depreciation and a missed target

As already mentioned, inflation in 1999 and 2000 was in line with the targets set in 1999. However, inflation accelerated in the second half of 2001, to the point that by the end of the year the inflation rate reached 7.7 percent, well outside the tolerance band (two to six percent).

The Banco do Brasil's analysis of this event is best summarized in the 2002 Open Letter to the Minister of Finance which, as required by the inflation targeting rules, was written to explain the causes for missing the target as well as to describe policy measures to address the failure. As the Letter states, one proximate cause of inflation acceleration was a combination of external shocks:

> On the external front, the deceleration of the world economy, the negative factors stemming from the Argentine crisis, and the terrorist attacks to the United States generated strong pressure for the depreciation of the Real in 2001. In October, the Real peaked at R$ 2.84 to the US dollar, accumulating a depreciation of 42.6 %...The depreciation of the Real markedly pressured domestic prices.

The Letter went on to say that the direct effect of the Real depreciation on inflation was 2.9 percentage points, so that 2001 inflation would have been only 4.8% , hence within the inflation tolerance bands, if the Real had not depreciated.

In this situation, the Banco's main policy response was to adjust the SELIC rate, from a low of 15.25 percent in January 2001 to 19 percent at the end of 2001. In view of the Banco's analysis, these interest rate increases were consistent with the conventional wisdom on inflation targeting, as they were a response to the inflationary effects of the external shocks affecting the economy.

Yet, the Banco's response also included, less conventionally, an element of intervention in the foreign exchange market. The objective of intervention appears to have been not the preservation of the inflation goal, but stabilizing market volatility. This is cryptically acknowledged in the Open Letter:

> The exchange rate market showed instability at some moments, especially after the September attacks. As a response, the Central Bank chose to complement the interest rate policy by increasing the reserve requirement ratio on

time deposits and by temporarily intervening in the exchange rate market, with satisfactory results.

But foreign exchange intervention is not mentioned anywhere else in the Letter, which closes by claiming that

> The macroeconomic regime of inflation targets, floating exchange rates and fiscal responsibility proved to be effective to deal with a perverse sequence of strong shocks...

Indeed, the Banco do Brasil rarely mentioned the fact that there was an significant element of intervention in the foreign exchange market during 2001. And when it did, "intervention" was meant to refer to the issuance of US dollar indexed debt in Real, instead of direct sales of foreign exchange in the market.[27] For example, the November 2001 Memorandum of Economic Policies sent to the IMF states:

> The BCB remains committed to the floating exchange rate regime, and will continue to avoid targeting any particular level of the exchange rate. Nevertheless, because of concern about the inflationary implications of exchange rate depreciation and volatility, the BCB has sought to offset recent pressures on the exchange rate arising from the extraordinary circumstances since early September by intervening in the foreign exchange market through the sale of foreign exchange-indexed debt.

In contrast, the March 2002 Memorandum reluctantly acknowledges that direct intervention had, in fact, taken place:

[27] See Bevilaqua and Azevedo (2005).

> The experience of last year confirms the importance of the floating exchange rate regime in helping the economy respond to shocks. Nevertheless, the size and scope of the shocks experienced last year and the high volatility and low liquidity of the FX market required the Central Bank to intervene through the issuance of foreign exchange-indexed securities, as well as through pre-announced spot market sales of limited quantities of foreign exchange. With exchange rate pressures largely having abated, the Central Bank has ceased direct and indirect intervention in foreign exchange markets,

Direct foreign exchange intervention is not mentioned in the Banco de Brasil's Inflation Reports. But the Banco's 2001 Annual Report includes (in page 142) what appears to be the only explicit description of foreign exchange sales:

> Banco Central interventions in the domestic exchange market resulted in net sales of US$ 7.2 billion [in 2001]. Sales were sporadic in the first six months of the year and totaled US$ 885 million. As of the month of July, interventions became more frequent, particularly in light of the excessive volatility of exchange rates in the period, as sales rose to a total of US$ 6.3 billion in the second half of the year.

This indicates that the amount of direct foreign exchange intervention was substantial: since the Banco Central's net international reserves at the end of 2000 were US $ 33 billion, the Banco's dollar sales in the second half of 2001 were between one fifth to one sixth of its reserves. And, again, the reason stated was the volatility of the exchange rate, termed as "excessive".

2002: Electoral Uncertainty

The 2001 episode was to be dwarfed by the market volatility surrounding the 2002 presidential elections. Market anxiety began to grow at the start of the summer, fueled by the rise

of Lula and Ciro Gomes in the polls. Investors stayed away from Brazil, which was reflected in a steep increase in country risk premia. Reflecting this situation, the Brazil EMBI Spread jumped from 701 basis points on March 20th to 2422 basis points on July 30th. The impact on exchange rates was correspondingly large. At the end of March, the Real was trading at about R$ 2.3 per US dollar; by mid-October, the exchange rate had depreciated to almost R$ 4 per US dollar. (See Chart 19)

The consequences for inflation and monetary policy were predictable. Yearly inflation in 2002 closed at 12.5 percent, way above the target of 3.5 percent and outside the 1.5-5.5 tolerance band. In addition, inflation increased every month after August, prompting concerns that the Banco Central had lost control of inflation.

Again as prescribed by the inflation targeting rules, the Banco Central's Governor had to send an explanation letter to the Minister of Finance. The Open Letter, dated January 21, 2003, mentions that there was "a confidence crisis in the performance of the Brazilian economy and an increase in risk aversion in international markets. " The confidence crisis was expressed in a drastic reduction in the demand for public securities, as well as in a fall of US$ 27.8 billion in foreign capital inflows. As a result,

> The domestic confidence crisis coupled with increasing global risk aversion had significant impacts on the economy...investment dropped to 18.8% of GDP in the third quarter of 2002 (vs. 19.45% at the end of 2001)...consumption dropped to 77.99% of GDP in the third quarter of 2002, from 79.82% of 2001 GDP...the current account declined to US$ 7.8 billion in 2002 (1.7% of GDP) from US$ 23.2 billion in 2001 (4.6% of GDP)

As a result, the Letter argues,

> The difficulties faced by the country were reflected mainly in the exchange rate

> and inflation expectations...It is estimated that the exchange rate depreciation contributed 5.8 percentage points to inflation in 2002.

The policy response was based on a drastic adjustment of the SELIC rate, as well as a change in the inflation targets. The target for the SELIC rate, which had been lowered to 18 percent by July 2002, was increased in successive steps to close 2002 at 25 percent. In addition, Open Letter proposed to raise the inflation targets for 2003 and 2004 to 8.5 percent and 5.5 percent, from the original ones of 4.0 and 3.75 respectively.

The decision to raise the inflation targets in mid course was, perhaps, the most noticeable and debatable aspect of the Banco Central's policy response (see, for instance, Fraga, Goldfajn, and Minella 2003 and the discussion in the 2003 *NBER Macroeconomics Annual*). For our purposes, however, the most relevant feature of the response was the intervention in foreign exchange markets, starting in July.

Foreign exchange intervention had three dimensions. First, the Banco Central agreed to provide up to US $ 2 billion dollars in export credit lines, of which US$ 1.4 billion were drawn in 2002. Second, the Banco engaged in US$ 1.8 billion in foreign exchange repos. Finally, there were spot sales of US $ 5.9 billion. All in all, the Banco Central sold US $ 9.1 billion in 2002, more than one quarter of its reserves at the end of 2001, as a result of its intervention policy. [28]

Again, in spite of its substantial size, these foreign exchange interventions have received little attention and are mentioned only sporadically by the Banco Central. For example, the August 2002 Technical Memorandum of Understanding to the IMF says

> The experience of the current and past years confirms the importance of the floating exchange rate regime in helping the economy respond to shocks. Nevertheless, the size and scope of the shocks experienced recently required the central

[28] This information is taken from the Banco's 2002 Annual Report.

> bank to alleviate some of the pressure on the exchange rate by intervening in the foreign exchange market. In the case of intervention reaching an accumulated amount of U$3.0 billion, on a rolling 30-day basis, a general discussion of monetary and intervention policies will be initiated with the staff.

Inflationary pressures began to subside only in the second half of 2003, after the Banco Central had increased the SELIC rate even more, to 26.5 percent in February 2003. After surpassing 16 percent in June, year to year inflation had dropped to 9.5 percent by December, and the exchange rate appreciated to about R$ 3 per US dollar. By the beginning of 2004, the Brazil EMBI spread had dropped to about 400 basis points. The return of confidence has been widely attributed to political stability and disciplined monetary and fiscal management.

2004 to the Present: Reserves Accumulation and Fighting Appreciation

2004 turned to be a banner year for Brazil. GDP growth jumped to 5.7 percent, up from only 0.5 percent in 2003. Annual inflation fell to an average of 6.6 percent. Exports grew by more than thirty percent, from US$ 73.1 billion in 2003 to US$ 96.5 bn., helping the current account surplus reach 1.9% of GDP.

Clearly, much of the credit goes to the success of the Lula administration is consolidating fiscal and monetary management. On the fiscal side, credibility was enhanced by the announcement of reforms of the social security and tax systems, and by more stringent targets for primary surpluses. On the monetary side, the Lula administration kept reaffirming support for the independence of the Banco Central, in spite of widespread debate about the desirability of the very high interest rates in place since 2003. In fact, the Banco Central, which had started gradually reducing the SELIC rate to a low of sixteen percent in April 2004, started a new round of increases in September 2004 in order to crush expectations of reviving inflation. The SELIC rate would be increased several times up to 19.75 in May 2005.

International capital started to flow back into Brazil, and the Real kept appreciating: it would close 2004 at 2.7 per US dollar, and would continue to appreciate until the current value of about 1.95 per dollar.

It was in this context that the Banco Central a change in its foreign intervention policy, which is summarized in the 2004 Annual Report as follows:

> In 2004, the country maintained its strategy of reducing the share of the internal public debt tied to the dollar and of purchasing exchange in the market for purposes of external debt payment and rebuilding of its international reserve position. Here, the overall aim was to attenuate balance of payments and public sector balance sheet vulnerability.
>
> On 1.6.2004, a program of rebuilding the country's international reserve position was announced. This program was designed to make it possible to take advantage of liquidity conditions whenever they turned favorable, in order to be able to ensure a neutral impact on exchange market volatility and floating exchange rates. The BCB began purchasing exchange in the market in order to gradually restructure its international reserves and the National Treasury interrupted its policy of acquiring exchange in the market to be used for external debt servicing involving bonds and the Paris Club. Net BCB purchases in the market totaled US$ 5.3 billion in 2004.

Since then, the Brazilian economy has continued to improve. After falling to 2.9% in 2005, annual GDP growth increased to 3.7% in 2006 and is currently projected to be 4.7% in 2007. Inflation has been falling, and is widely expected to be between 3.5 percent and 4 percent for 2007 and 2008. Export growth has continued to be robust, and the current account surplus is expected to remain around one percent of GDP in 2007.

The Banco Central response to falling inflation rates has been to gradually reduce the

SELIC rate, an ongoing process that started in September 2005 and has brought the SELIC to 12 percent as of this writing. In spite of the interest rate reductions, however, the Real appears stronger than ever. The Real appreciation is expected to influence monetary policy in two ways. First, appreciation is associated with deflationary pressures, allowing for event further SELIC reductions. Second, the Banco Central stated policy of reserves accumulation has intensified. The current level of reserves is US $ 145 billion, more than double the US$ 62.7 billion level of the end of June 2006.

The furious pace of reserves accumulation has prompted a lively debate on whether the Banco Central has abandoned its stated policy of floating exchange rates, and why. Clearly, one of the reasons for the current policy of accumulating reserves is the belief that a large "war chest" can be useful as insurance against international shocks. This was acknowledged recently by the government:

> Finance minister Guido Mantegna commemorated the fact [that reserves had surpassed US$ 100 bn. in February 2007] stating that it "makes the country more resistant to the foreign turbulence that occasionally materializes " "(...) "With the reserves, we will be vaccinated against international turbulence, " he guaranteed.[29]

On the other hand, the policy appears to respond also to concerns about competitiveness and, hence, about the impact of the exchange rate level on exporters. This is clearly expressed by President Lula in a recent interview, summarized by JP Morgan Chase:

> Lula reaffirmed that the floating fx regime will continue, along with a strong pace of reserve accumulation. He mentioned that the government is concerned about the effects of BRL appreciation on some sectors, and that this is why the

[29] Market analysts up their bets for Brazilian economy, by Stenio Ribeiro, Brazzil Magazine, Monday May 28, 2007.

central bank will continue to purchase USD in the spot market (Lula mentioned US$ 200 billion of reserves as a target, vs the current level of US$ 145 billion). The policy of giving sectoral fiscal incentives and tariff protection to sectors most affected by the overvalued currency will continue. He denied any plan to implement a more aggregate measure to contain BRL appreciation, such as taxing short-term capital inflows, which the market has begun to talk about.[30]

3.5. Summary and Discussion

The four cases reviewed in this section share several aspects, notable among them:

- In spite of having adopted inflation targeting, Latin American central banks have explicitly claimed a right to intervene in the foreign exchange market under some circumstances, most often related to instability in the foreign exchange market and the financial system. In addition, Latin American central banks consider it beneficial to build a substantial stockpile of foreign exchange reserves.

- In the four cases reviewed here, the most significant episodes involving capital outflows and rapid depreciating trends were related to political shocks (the 2001 crisis in Argentina, Lula's 2002 election in Brazil, Humala's rise in Peru at the end of 2005). The resulting exchange rate depreciation was a concern not only because of the impact on prospective inflation but also, and sometimes more significantly, because of the effect on financial variables. The policy response was typically to fight the depreciation via increases in interest rates aided by sales of foreign exchange. The relative size of the intervention operations differed from case to case.

- More recently, the countries under review have witnessed strong currency appreciation coupled with massive accumulation of international reserves. There has been little

[30] Global Data Watch, June 22 2007, p. 49.

attempt at consistency between this accumulation policy and the overall effort to manage interest rates to hit the inflation targets. References to overvaluation and loss of competitiveness have become more frequent.

4. Rationalizing Actual Inflation Targeting Practices

Why have Latin American central bankers departed from the conventional inflation targeting script in terms of exchange rate management and reserves accumulation? The answer may be that the applicability of the conventional script to Latin American economies is believed to be only partial. It turns out that good reasons for such a belief can be found in recent academic work. In this section we review some of those reasons, and we also ask whether they in fact warrant observed policies.

4.1. Balance Sheet Effects and Dollarization

The New Keynesian open economy models underlying the conventional IT wisdom are built upon the assumption that an exchange rate depreciation is expansionary. This is because, in those models, the main channel through which a depreciation affects aggregate demand is by changing the relative price of domestic vis a vis foreign goods and by reducing domestic interest rates.

The view that depreciations are expansionary, however, has been long at odds with empirical evidence, and has come under substantial challenge following the crises in Mexico 1995 and Asia 1997-98, the Russian 1998 default, and the Brazilian 1999 devaluation. Those episodes were associated with widespread financial contagion and exchange rate depreciation in many emerging economies. And in several cases it was observed that a weaker currency impaired the balance sheets of debtor firms, reducing the access of those firms to credit and, as a consequence, restricting investment demand. The balance sheet impact of a depreciating

exchange rate was greater for those agents that had taken debts in foreign currency (typically the US dollar) when their revenues were given in domestic currency.

These observations have motivated a substantial body of research focusing on the links between currency mismatches, balance sheet effects, and monetary and exchange rate policy. A main finding of these research efforts is that it is not too hard to identify circumstances in which exchange rate depreciations are, in fact, contractionary instead of expansionary. In particular, if corporate firms have dollar debts but their assets or revenues are determined by the value of the domestic currency, a fall in the exchange rate reduces their net worth. The fall in net worth, in turn, can easily lead to reduced credit. Why? If financial markets are characterized by asymmetric information, imperfect contract enforcement, or other frictions, lenders may require borrowing firms to secure any loans with collateral funds. But the availability of the latter is directly related to each firm's net worth.

So Leiderman, Maino, and Parrado (2006) write that, in an economy characterized by currency mismatches,

> it is plausible to argue that balance sheet effects will give rise to contractionary devaluations and induce financial stress...In turn, the potentially adverse effect of large exchange rate devaluations is likely to induce fear of floating by the authorities and require that they closely target the exchange rate, even when the underlying shocks are transitory.

This reasoning implies that the incidence of balance sheet effects depends on the degree of dollarization, as well as on the severity of the imperfections of the financial system. Central bankers in highly dollarized economies will naturally be concerned with the potential impact of an exchange rate depreciation on corporate balance sheets, and their concern will be greater the less developed the financial system.

Hence it is no surprise that monetary policy has been most influenced by balance sheet

considerations in Peru, which is the most dollarized of the countries under review and has a relatively small financial sector. According to Armas and Grippa (2006), the Peruvian Banco Central de Reserva "limits balance sheet effects by moderating the volatility of the exchange rate." Armas and Grippa also mention that, in fact, the Peruvian monetary strategy explicitly allows for switching the policy instrument from the normal overnight interbank interest rate to a monetary aggregate precisely because of potential balance sheet effects.

While strong balance sheet effects raise concern about contractionary devaluation, it is not obvious that the proper monetary policy response is to stabilize the exchange rate. This is because, when balance sheet effects are present, they usually depend on the real exchange rate, not the nominal exchange rate. Monetary policy can stabilize the latter, but cannot prevent a real exchange rate adjustment if one is required. This point was developed by Cespedes, Chang, and Velasco (2004) which studied a New Keynesian open economy model with balance sheet effects. In their model, an inflation targeting policy that stabilizes the price of domestically produced goods is socially optimal and, in particular, it dominates fixed exchange rates. The reason is that fixing nominal exchange rates does not prevent real exchange rate movements, and it is the latter which cause strong balance sheet effects.[31] That the presence of balance sheet effects leaves fixed exchange rates inferior to inflation targeting is also found by Devereux, Lane, and Xu (2004), Gertler, Gilchrist and Natalucci (2003), and many others.

This is not to say that central bankers should not pay attention to the balance sheet effects of exchange rate movements, but to stress that we are far from understanding how

[31] To see why this happens in the Cespedes- Chang-Velasco model, let PY denote the revenues of domestic firms, where Y is production and P the domestic currency price of home produce. If S is the exchange rate (domestic currency per unit of foreign currency), firms' revenues in foreign currency are $(P/S)Y$. Hence, if the firms have debts in foreign currency, the value of the latter relative to revenues increases if S/P increases, that is, if there is a real depreciation. A fixed exchange rate means that S is fixed, but S/P can (and does, in the model) adjust in response to shocks.

the setting of their policy instruments should be in view of those effects. Perhaps the best response, instead of defending the exchange rate against depreciation, will turn out to be to foster the de-dollarization of the financial system (as the Peruvian Banco Central is actually doing), as well as to work on the development of more efficient and deeper capital markets.

4.2. Crises, International Liquidity, and Reserves Accumulation

A somewhat different lesson from the period of emerging markets crises of the last decade was that international liquidity is a key factor on the generation of crises. Following Chang and Velasco (2000) we will say that a country has an international liquidity shortage if its potential short term liabilities in international currency exceed the liquidation value, also in hard currency, of its assets. A crisis can then occur if the country's creditors panic and demand immediate payment of their short term claims. In that case, liquidating the country's assets is insufficient to honor the claims, leading to bankruptcy.

The concept of international liquidity is useful in understanding crises for a variety of reasons. First, it focuses squarely on financial contracts and institutions, as opposed to other theories of open economy crises which assigned a prime role to inconsistent macroeconomic policy. This is significant because the emerging markets crises of the 1990s looked a lot like crises of the financial system, while the evidence of a flawed macroeconomic policy was decidedly mixed.

Second, a country with an international liquidity problem may or may not experience a crisis. Whether a crisis materializes depends on market expectations, since it is only if creditors attempt to convert their potential short term claims into actual claims that the country goes bankrupt. If they do not, the country may remain in a favorable no crisis equilibrium. This is consistent with at least three observations: that several crises were almost completely unexpected by the markets; that market expectations and psychology were assigned a prime role during crisis periods; and that there was widespread contagion,

that is, financial panics affected countries that had little in common with the original crisis countries.

Third, the theoretical links between international liquidity and crises were consistent with a variety of evidence. Most convincingly, econometric studies found that the probability of a crisis was increasing on the ratio of short term foreign debt to reserves (see Rodrik and Velasco 2000, for instance). But the short term debt/reserves ratio is an obvious indicator of international liquidity.

As the view that international liquidity was a prime factor behind crises, emerging country governments have started taking active steps towards reducing vulnerabilities in this regard. One concrete instance is the effort to reduce reliance on short term debt denominated in foreign currency, with many governments now issuing domestic currency denominated debt. In a complementary fashion, emerging country governments have stepped up efforts to build up international reserve levels, which can be sufficient to deal with the sudden demands for international liquidity that characterized recent crises.

This is why the four central banks reviewed here have explicitly stated that the accumulation of international reserves is one of the tasks to be performed in an inflation targeting framework. As mentioned earlier, Colombia's Banco de la Republica notes that foreign exchange intervention is to be allowed "to maintain an adequate level of international reserves that reduce the vulnerability of the economy to foreign shocks." For Peru, Armas and Grippa (2006) write:

> If a bank run on foreign currency denominated deposits occurs, a high level of net international reserves acts as a buffer stock for supporting the financial system. Moreover, the availability of international reserves may in itself be an insurance against negative shocks...Since the beginning of 2003, the BCRP has purchased around US$ 4.5 billion (as of 31 March 2005) in the foreign exchange

market...Thus, international reserves exceeded US$13.5 billion in March 2005, the highest level ever recorded. This is an important buffer stock against any shock, considering that it is more than twice the stock of the due-in-one-year external debt.

The Central Bank of Chile (2007) states:

> [The stock of international reserves] also reduce the probability of liquidity perturbations and make it possible to face exceptional situations of loss of access to international financial markets, minimizing the probability of problems in balance of payments...the Banco Central de Chile monitors the adequate level of international reserves as well as its composition. [32]

And, as we stressed, the current buildup of international reserves in Brazil is justified on the basis that a large stock of reserves provides a "vaccine against international turbulence."

Overall, then, current efforts at accumulating international reserves are consistent with the view that international liquidity matters for crises. Yet one can identify several issues that deserve further study.

First, there is nothing in the theory that says that hard currency "war chests" should be built by the central bank, as opposed to a distinct government agency similar, say, to the U.S. Treasury's Exchange Stabilization Fund. And there may be good reasons to keep the war chests separate from the central bank. One could argue, for example, that the current arrangements, by confounding policies to achieve the inflation targets with attempts at accumulating reserves, undermine the stated objectives of transparency and accountability that an inflation targeting regime should aim at. [33]

[32] La Politica Monetaria de Chile en el Marco de Metas de Inflación, p. 20

[33] Notably, and perhaps in response to this concern, Chile set up an Economic Stabilization Fund as a separate entity from the Central Bank, which presumably has allowed the latter to focus on the attainment of its inflation target.

Second, the accumulation of foreign exchange reserves is costly, and perhaps inefficiently so. International reserve assets pay little or no interest, so holding them implies an opportunity cost approximately equal to the interest foregone by not holding interest bearing assets or by financing reserves with public debt. If purchasing foreign exchange is possible because of the issuance of public debt, the cost of the "turbulence vaccine" is increased fiscal expenditures later on, to finance the interest on the debt. More generally, one could ask why it is necessary to hold international reserves to match short term debt, as opposed to using reserves to prepay the debt.

Existing theories also imply that reserves accumulation is not the only way to prevent liquidity driven crises. And some of the alternatives are less costly. For example, as stressed by Chang and Velasco (2000) and others, a credible announcement that payments of the short term debt would be suspended in case of a panic could do the job at no cost. Alternatively, liquidity driven crises would be ruled out for a country that could ensure enough access to international liquidity in a crisis; one way this could be accomplished would be to set up an international line of credit akin to the Contingent Credit Lines offered by the IMF.

Third, the international liquidity argument provides a justification for the accumulation of reserves, but only up to a point. Once short term potential liabilities in hard currency are covered by international reserves, there is no further gain from additional reserves. This point seems to have been reached in several Latin countries, such as Brazil and Peru, yet reserves accumulation continues.

These considerations have motivated an ongoing and spirited debate on the costs of holding large amounts of international reserves, as well as the relative size of the chest of reserves that is necessary to ameliorate the possibility of crises. Rodrik (2005) argued that the annual cost of the current reserve buildup by emerging economies is around one percent of their GDP, although Lipschitz, Messmacher and Mourmouras (2006) dispute the accuracy of Rodrik's calculations.

As for the size of war chests, two rules of thumb have emerged. The first is the so called Greenspan-Guidotti rule, which prescribes that emerging economies should hold reserves of the same magnitude as their short term foreign debt. The second is due to Jeanne and Ranciere (2006), and suggests that emerging economies should hold no less than ten percent of their annual GDP as reserves.

Whatever one thinks of these rules of thumb, it is instructive to ask how they apply to the countries we have reviewed. The ratio of Brazil's reserves to GDP at the end of June 2007 stood at 14.3 percent, and hence well above the Jeanne-Ranciere ten percent guideline. Likewise, Brazil's net reserves exceeded its short term external debt by more than US$ 124 billion.[34] In Peru, international reserves stood at US$ 18.5 billion at the end of March 2007, almost six times the amount needed to service the short term external debt of US$ 3 billion. In addition, the ratio of reserves to 2006 GDP stood at 19.2 percent.

It is then clear that it is no longer easy to justify the current efforts at reserves accumulation on the basis of international liquidity considerations. At this point, there is widespread agreement that Latin countries hold enough reserves to forestall any conceivable financial panic.

4.3. Nonfundamental exchange rate volatility

As we have seen, Latin American central banks have frequently justified a monetary policy response to exchange rates whenever the latter exhibits movements that are considered excessive. Presumably, "excessive" is taken to mean that those movements were not warranted by the economy's fundamentals. The academic literature has tried to model such excessive volatility in at least two related ways: multiple equilibria and bubbles.

One way to think about excessive exchange rate volatility is to admit the possibility that an economy has several self fulfilling equilibria, some of which display larger exchange rate

[34] These figures come from Vittoria Saddi of the RGE Monitor.

movements than others. Exchange rate volatility can then be excessive in the sense that, with the fundamentals of the economy being given, the economy could move to an alternative equilibrium with less volatility, presumably if only market expectations could coordinate on the more stable equilibrium.

One policy implication is that, if policymakers believe that the economy is stuck in an equilibrium with high exchange rate volatility but a better, less volatile equilibrium exists, then it may be advisable to intervene in the foreign exchange market to smooth exchange rate fluctuations, in the hope of convincing market participants to settle in the less volatile equilibrium.

While this chain of reasoning sounds plausible, unfortunately no satisfactory theory exists of how a particular equilibrium is selected when there may be many and, hence, of how foreign exchange intervention may work to switch from a bad to a good equilibrium. Hence, the practical approach to this issue remains at the level of art rather than science.

This is acknowledged, for example, by De Gregorio, Tokman, and Valdes (2005) in the case of Chile:

> The CB has made public the view that interventions could be warranted in cases when there is an overreaction of the exchange rate and that this overreaction could be damaging for the economy...The CB has explicitly recognized that detecting an exchange rate overreaction or overshooting is not an easy task. Even in cases where there is no full certainty that there is an overreaction, it may be advisable to intervene. In some occasions such interventions may be ineffective, but the cost of [not] intervening outweighs the expected costs of unjustified turmoil...At the end, determining exceptional circumstances or whether the exchange rate is overreacting is a judgmental call of the CB Board. However, it is an informed call...

A second way to model excessive exchange rate volatility is by allowing for the existence of bubbles in the exchange rate. An exchange rate bubble is a deviation of the exchange rate from the present discounted value of its expected fundamentals. The bubble can be rational in the short run because of the expectation of an even larger bubble tomorrow, and so on.[35]

Bubbles have proven to be more amenable to modeling than multiple equilibria. For closed economies, an important paper is Bernanke and Gertler (2000), which discussed the role of asset price bubbles in a model with balance sheet effects and inflation targeting. In such a model, asset bubbles and balance sheets interact, since the value of corporate net worth may depend on asset prices inclusive of bubbles. In such a case, a positive bubble (i.e. an episode of "irrational exuberance") inflates net worth and the value of collateral, expanding access to credit, and boosting investment and aggregate demand. Hence a positive asset bubble is expansionary and contributes to inflation. Surprisingly, however, Bernanke and Gertler argue in favor of an inflation targeting regime in which the monetary instrument does not respond directly to bubbles. This is because, if there is a positive bubble, the associated inflationary pressures would automatically lead to an increase in interest rates. So, Bernanke and Gertler conclude that "central banks should ignore movements in stock prices that do not appear to be generating inflationary or deflationary pressures."

4.4. Sterilized Foreign Exchange Intervention as an Independent Policy Instrument

Under strict inflation targeting, inflation is the sole objective of policy. But one can argue that, in practice if not *de jure*, central banks pursue other objectives in addition to low inflation. If that is the case, monetary policy would benefit from the availability of additional monetary policy instruments.

In Latin America, it has been sometimes suggested that foreign exchange intervention

[35] However, in conventional models bubbles cannot be fully rational.

can serve as one such additional instrument. For example, Vargas (2005) argues that one lessons from the 2002-3 turmoil in Colombia was that "interest rate movements alone were not deemed sufficient to curb depreciation and inflation expectations, and foreign exchange intervention turned out to be a valuable complement, " although he is quick to acknowledge that "the relationship between central bank interest rates and exchange rates in Colombia is not well understood. "

In conventional IT theories, foreign exchange intervention plays no role as an independent policy instrument. This omission is based on widespread empirical evidence that *sterilized* foreign exchange intervention has very weak and transient effects, if any, on the macroeconomy. This body of evidence is the decisive one for IT regimes in which the main policy instrument is an interest rate, since the theory implies that interventions are automatically sterilized.

However, Bofinger and Wollmershauser (2003) have recently taken issue with both the evidence and the conventional theory. With respect to the evidence, they argue that

> The most serious flaw of this literature is that almost all papers analyze the mark-dollar rate. Interventions in this market have been extremely small so that the lack of a firm empirical evidence for the effectiveness of such interventions can simply be explained with an insufficient dose of intervention. In other words, analyses of the mark-dollar rate cannot be taken as an evidence for the ineffectiveness of managed floating in emerging market economies and other developed countries where the relative amount of interventions is in some case several times higher.

And with respect to conventional IT models, they write

> With their reliance on UIP [uncovered interest parity] or any other relationship between the exchange rate and the interest rate, such models rest upon a

pillar for which no empirical evidence can be found.

Bofinger and Wollmershauser (2003) then proposes an alternative framework based on a portfolio balance assumption, in which domestic currency bonds and foreign currency bonds are imperfect substitutes. Then the relative supplies and demands for each bond is assumed to determine a risk premium that is added on to the interest parity condition.

Bofinger and Wollmershauser fail to provide, however, a convincing theoretical argument or empirical evidence supporting their alternative specification. This is significant, as older portfolio balance models fell out of favor partly because of a number of theoretical shortcomings, such as incomplete microeconomic foundations and a partial equilibrium focus, that remain in Bofinger and Wollmershauser (2003).[36]

More importantly, recent studies have found that, in contrast with Bofinger and Wollmershauser's claims, the available evidence strongly suggests that sterilized foreign exchange intervention is likely to be ineffective at the horizons usually associated with monetary policy. For example, Disyatat and Galati (2005) conclude, after a careful survey of the literature, that

> Overall, combining the available evidence for emerging market countries with that from advanced economies, the tentative conclusion points towards the existence of a high frequency - ranging from intradaily to a few days - connection between foreign exchange market intervention and the level and volatility of exchange rates. There does not appear to be a reliable connection between official transactions and fundamental determinants of exchange rates that would allow

[36] Obstfeld and Rogoff (1996, page 594), for example, argue that the same arguments underlying the Ricardian Equivalence Theorem apply and imply that changes in the currency composition of governments' portfolios, and hence sterilized intervention, are irrelevant. Portfolio balance effects reappear if Ricardian Equivalence fails, but Obstfeld and Rogoff argue that there is little evidence for such effects. A similar point was raised in a very influential paper by Backus and Kehoe (1989). Note, however, that these critiques only establish that portfolio balance effects are absent under some conditions. Recently, there has been a revival of research on what happens if those conditions fail. See, for instance, Kumhof and Van Nieuwerburgh (2007).

central banks to determine exchange rates independently of monetary policy for sustained periods.

It appears, therefore, that it would be premature to attempt to amend the dominant models underlying inflation targeting in order to add portfolio balance effects and sterilization as an independent monetary policy instrument.

It must be stressed that we are not arguing that foreign exchange intervention is completely ineffective. As mentioned in the above quote from Disyatat and Galati, there is some evidence that intervention does affect exchange rates for a few days. (Similar evidence for Colombia is provided in Uribe and Toro 2005). One could, accordingly, conjecture that foreign exchange intervention may have significant effects in unconventional ways.

One possibility is that, if there are bubbles or multiple equilibria, foreign exchange intervention can be hoped to help "pricking " the bubble or switching from a bad to a good equilibrium. Indeed, this hope was expressed in the case of Chile's intervention episodes by De Gregorio and Tokman (2004):

> Intervention appeared as the first line of defense against an inflation caused by an incommensurate depreciation. The possibility of a bubble dominating the market required actions to verify if this was an overreaction. The success of the sterilized intervention showed that the market reaction was indeed exaggerated. Otherwise, the intervention would have been ineffective, and a monetary contraction would have been required if inflation expectations had been very far from the target.

While this approach sounds intuitively plausible, one has to recognize that it is not based on a well developed theory. In addition, this approach does not hold that foreign exchange intervention is an independent monetary instrument, one that can be used alongside interest

rates or monetary aggregates to pursue an exchange rate target together with an inflation target.

4.5. Competitiveness and the Political Economy of Exchange Rates

As we have argued, the recent accumulation of reserves in Brazil, Colombia, and Peru is too large to be justified by concerns about international liquidity. The current policy looks more consistent with an effort to prevent real exchange appreciation to preserve international competitiveness.

While officers at the central banks under study have often stressed that monetary policy does not target a level for the real exchange rate, they obviously face very strong pressures from other government branches to prevent appreciation. As we have mentioned, Lula has been on record in expressing concern for the distributional effects of the Brazilian Real's appreciation, and support for "sectoral fiscal incentives and tariff protection to sectors most affected by the overvalued currency." In the case of Colombia, Vargas (2005) wrote

> The Government regards the real exchange rate as a key element of its security strategy, arguing that the employment loss due to the real appreciation strengthens the position of the illegal armed groups, especially in the countryside. Also, some Government officials believe that a currency depreciated in real terms is a requisite for sustained economic recovery. The complaints of some tradable sectors add to this demonizing of appreciation.

If one admits that political pressures for the central bank to prevent real exchange rate appreciation are at the heart of current episodes of reserves accumulation, several questions emerge. Can the central bank succeed and how? What is the role of sterilized foreign exchange intervention? And, how can one introduce such political considerations into the theory of inflation targeting?

With respect to the possibility of successfully targeting the exchange rate to preserve competitiveness, it is widely accepted that monetary policy can affect the *real* exchange rate only in the short run, and perhaps at considerable cost. The Norges Bank Watch 2002 review of Norway's inflation targeting regime summarizes this eloquently:

> Importantly, these adjustments of the real exchange rate and the real interest rate are *equilibrium adjustments of the real economy...independent of monetary policy.* [37] *Monetary policy cannot prevent these adjustments;* it can at most delay them somewhat, but at the cost of more inflation...and probably a future recession.

It is probably the recognition that monetary policy, understood as the control of interest rates, cannot prevent real exchange rate adjustments that has motivated the current accumulation of reserves. This is most evident in Colombia, where, as we noted, increases in interest rates have worked at cross purposes with foreign exchange purchases (and other measures such as capital controls). So, it appears that the Banco de la Republica is setting interest rates to keep inflation from accelerating, while purchasing large amounts of dollars to prevent real exchange rate appreciation. Existing economic theory, however, predicts that such a strategy cannot be successful in the long run, and in fact the strategy seems to be reaching its limits as of this writing.

All of these considerations suggest a need for a hard look at the role of political pressures in inflation targeting. In the conventional treatment of inflation targeting, the central bank is just assigned a loss function (a function of the targets) to minimize, and it is assumed that the central bank can credibly commit to performing that task. However, the theory is relatively silent about how such a credible delegation takes place. And while Woodford (2003) has shown that choosing the loss function to include inflation and the output gap in

[37] The emphasis is from the original. The quote refers to real appreciation in response to anticipated fiscal expansion in Norway, but the argument applies just the same for the Latin American case.

an adequate way leads to the maximization of the welfare of a representative agent, actual economies have no representative agent. Instead, they are populated by heterogenous agents that have conflicting views on monetary and exchange rate policy.

This suggests that, in reality, policymakers are chosen in a process that accommodates diverse and conflicting interests. The underlying conflicts may not surface for a while, but when they eventually do, as with the recent appreciation episodes, policymakers mat have to be more responsive to their original allegiances. The result may be a muddling of formulation of monetary policy, as we have observed in the recent Latin American experience. This is significant since it leads to the erosion of the very transparency and credibility that should characterize an inflation targeting regime.

There has been very little work on these issues, but some interesting starts exist and are rather illuminating. For Colombia, for example, Jaramillo, Steiner and Salazar (2001) studied the links between exchange rate policy and the political system. They uncovered a number of facts of potentially relevance for our discussion. In particular, they find that, between 1930 and 1998, "the coffee growing region, with less than a quarter of the population and GDP, has provided 40 percent of the Ministers of Finance and Governors of the Central Bank." This suggests that it would be not too surprising if the Banco de la Republica turned out to be sensitive to the interests of exporters. In a related fashion, Sanchez, Fernandez and Armenta (2007) wrote

> The independence of the Banco de la Republica from the Executive was a product of the ideas of the "monetary technocracy " and of the international context in which the reduction of inflation gained importance among the priorities of economic policy...However, it must be noted that...even though exporters do not longer hold a seat at the Board of Directors of the Banco de la Republica, they continue to apply political pressure on the management of the exchange rate, as

has been evident from the appreciation processes of 1993 and 2005.

Similarly for Peru, Pasco Font and Ghezzi (2001) argue that

> The history of Peruvian exchange rates demonstrates that interest group pressures, as well as overall policy orientation, help to explain both the choice of exchange rate regime and the degree of misalignment.

Unfortunately for our purposes, Pasco Font and Ghezzi's paper covers the 1950-96 period, and hence its relevance for the current inflation targeting regime is unclear.

Nonetheless, the studies just cited suggest significant links between political conflicts and exchange rate policies, which may affect the functioning of an inflation targeting regime.

A potential avenue for future research, therefore, may be to incorporate political pressures against appreciation into the theory of inflation targeting. One possibility would be to assume that the central banker may (or may not) want to pursue, in addition to the objectives assigned to it by the inflation targeting charter, an exchange rate objective, representing his responsiveness to political interests. If the true preferences of the central bankers are private information, the public must infer them from observable policy outcomes. This would affect expectations formation, but also the optimal monetary strategy pursued by the central banker, leading to a potentially interesting interplay. [38]

5. Final Remarks

In a conventional, strict inflation targeting regime, monetary policy should respond to exchange rates if and only if the latter provide information about future inflation. In addition,

[38] In a closed economy context, Faust and Svensson (1998) analyzed a similar problem, in which the public is uncertain about the true relative weights that the policymaker place on inflation and the output gap. They used their setup to study the role of transparency.

there is no useful role for foreign exchange intervention, nor reserves accumulation. A conventional inflation targeting regime is not concerned about the variability of the exchange rate, the stability of financial markets, or the effects of an appreciating exchange rate on competitiveness.

We have seen that the actual implementation of inflation targeting in Latin America differs substantially from the conventional paradigm. Our central banks often claim a right to intervene in the foreign exchange market, and they have exercised that right in several, identifiable occasions. Our central banks have also endeavored to accumulate international reserves as insurance against turmoil coming from the world capital market and, more recently, to prevent appreciation from eroding international competitiveness.

We have examined several ways to rationalize the discrepancies between the conventional IT framework and actual monetary policies. All of the arguments reviewed here are intuitively plausible, but it is unclear whether they are applicable to the episodes we have examined and, in some cases, their policy prescriptions are different from what our central bankers have actually claimed. In particular, the current amount of reserves accumulation can no longer be rationalized by the need of insurance.

This is, of course, not to say that the rationalizing arguments will turn out to be invalid or that the policies chosen by our central bankers have been unsound. Rather, it is to stress that we have a very incomplete understanding of the channels through exchange rate management and foreign exchange intervention work in Latin America. Until new research clarifies those channels, our inflation targeting regimes will retain an significant element of art (and luck) rather than science.

References

[1] Armas, Adrian, and Francisco Grippa. 2006. "Inflation Targeting in a Dollarized Economy: The Peruvian Experience. " In *Financial Dollarization: The Policy Agenda,* Armas, Ize, and Levy Yeyati (eds.), International Monetary Fund.

[2] Backus, David, and Patrick Kehoe. 1989. "On the Denomination of Government Debt: A Critique of the Portfolio Balance Approach." *Journal of Monetary Economics* 23, 359-376.

[3] Bernanke, Ben, and Mark Gertler. 1999. "Monetary Policy and Asset Price Volatility." Economic Review, Federal Reserve Bank of Kansas City, issue Q IV, pages 17-51.

[4] Bevilacqua, Afonso, and Rodrigo Azevedo. 2005. "Provision of FX hedge by the public sector: the Brazilian experience. " In *Foreign exchange market intervention in emerging markets: motives, techniques and implications,* BIS Papers 24.

[5] Bofinger, Peter, and Timo Wollmershauser, 2003. "Managed Floating as a Monetary Policy Strategy." Working Paper, University of Wurzburg.

[6] Calvo, Guillermo, 2006. "Monetary Policy Challenges in Emerging Markets," working paper, Columbia University.

[7] Céspedes, L.F., R. Chang and A. Velasco (2004), "Balance Sheets and Exchange Rate Policy," *American Economic Review*, 1183-1193.

[8] Chang, R. and A. Velasco. 2000. "Liquidity Crises in Emerging Markets: Theory and Policy." In NBER Macroeconomics Annual 1999 (Ben Bernanke and Julio Rotemberg, eds.), The MIT Press, Cambridge.

[9] De Gregorio, Jose, and Andrea Tokman. 2004. "Overcoming Fear of Floating: Exchange Rate Policies in Chile. " Documento de Trabajo 302, Banco Central de Chile.

[10] De Gregorio, Jose, Andrea Tokman, and Rodrigo Valdes. 2005. Flexible Exchange Rate with Inflation Targeting in Chile: Experience and Issues. Unpublished paper, Central Bank of Chile.

[11] Devereux, Michael, Philip Lane, and J. Xu (2004) "Exchange Rate Regimes and Monetary Policy Rules for Emerging Markets." Mimeo, University of British Columbia.

[12] Disyatat, Piti, and Gabriele Galati. 2005. "The effectiveness of foreign exchange intervention in emerging market countries. " In *Foreign exchange market intervention in emerging markets: motives, techniques and implications,* BIS Papers 24.

[13] Fraga, Arminio, Ilan Goldfajn, and Andre Minella. 2003. "Inflation Targeting in Emerging Markets. " In *NBER Macroeconomics Annual 2003.*

[14] Gertler, M., S. Gilchrist, and F. Natalucci. 2003. "External Constraints on Monetary Policy and the Financial Accelerator." Mimeo, NYU.

[15] Grippa, Francisco, and Rocio Gondo. 2006. "Las Intervenciones Cambiarias. Son Consistentes con un Esquemas de Metas de Inflacion? " Revista Moneda.

[16] Jaramillo, Juan, Roberto Steiner and Natalia Salazar. 2001. "A Long Lasting Crawling Peg: Political Determinants of Exchange Rate Policy in Colombia. " In *The Currency Game,* J. Frieden and E. Stein (eds.), Interamerican Development Bank, Washington DC

[17] Jeanne, Olivier, and Romain Ranciere. 2006. "The Optimal Level of International Reserves for Developing Countries: Formulas and Applications. " IMF Working Paper 06/229

[18] Kumhof, Michael, and Stijn van Nieuwerburgh. 2007. "Monetary Policy in an Equilibrium. Portfolio Balance Model." IMF Working Paper 07/72

[19] Leiderman, Leonardo, Rodolfo Maino, and Eric Parrado. 2006. "Inflation Targeting in Dollarized Economies. " In *Financial Dollarization: The Policy Agenda,* Armas, Ize, and Levy Yeyati (eds.), International Monetary Fund.

[20] Lipschitz, Leslie, Miguel Messmacher and Alexandros Mourmouras. 2006. "Reserve Adequacy: Much Higher than you Thought? " Unpublished paper, IMF.

[21] Mishkin, F. and K. Schmidt-Hebbel. 2002. "A Decade of Inflation Targeting in the Worl": What do we know and what do we need to know? " In *Inflation Targeting: Design, Performance, Challenges,* Norman Loayza and Raimundo Soto (eds.), Banco Central de Chile.

[22] Mohanty, M. S. and Marc Klau. 2004. "Monetary policy ruels in emerging market economies: Issues and evidence." BIS Working Papers, 149.

[23] Norges Bank Watch. 2002. *An Independent Review of Monetary Policy and Institutions in Norway,* Centre for Monetary Economics, Norwegian School of Management.

[24] Obstfeld, Maurice, and Kenneth Rogoff. 1996. *Foundations of International Macroeconomics.* MIT Press, Cambridge, MA.

[25] Pasco Font, Alberto, and Piero Ghezzi. 2001. "Exchange Rates and Interest Groups in Peru, 1950-1996. " In *The Currency Game,* J. Frieden and E. Stein (eds.), Interamerican Development Bank, Washington DC

[26] Rodrik, Dani. 2005. "The Social Cost of Foreign Exchange Reserves. " Unpublished, Harvard.

[27] Rodrik, Dani, and Andres Velasco. 2000. "Short Term Capital Flows. " Annual World Bank Conference on Development Economics 1999.

[28] Svensson, L. 1999. "Inflation Targeting as a Monetary Policy Rule," Journal of Monetary Economics 43, 607-654.

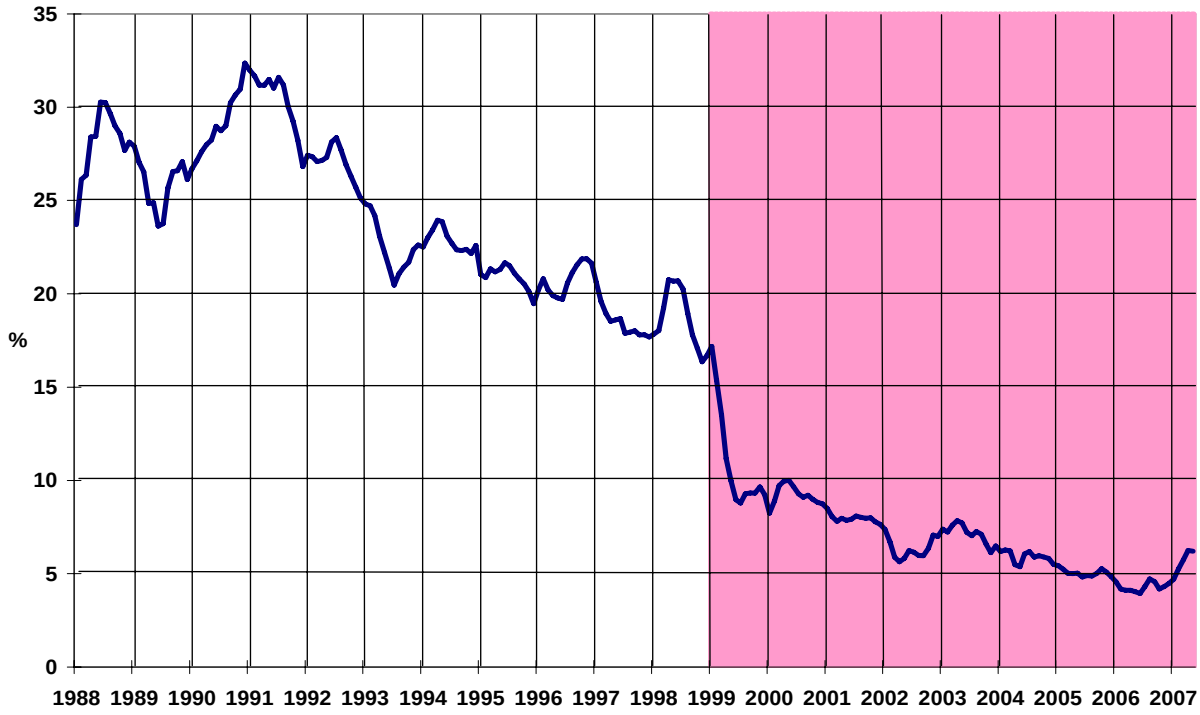
[29] Svensson, L. 2000. "Open-Economy Inflation Targeting," Journal of International Economics 50, 155-183.

[30] Uribe, Jose, and Jorge Toro. 2005. "Foreign exchange market intervention in Colombia. " In *Foreign exchange market intervention in emerging markets: motives, techniques and implications,* BIS Papers 24.

[31] Vargas, Hernando. 2005. Exchange Rate Policy and Inflation Targeting in Colombia. Unpublished paper, Banco de la Republica, Colombia.

[32] Woodford, M. 2003. Interest and Prices. Princeton University Press, Princeton NJ.

Chart 1: Colombia, Inflation rate 1988-2007



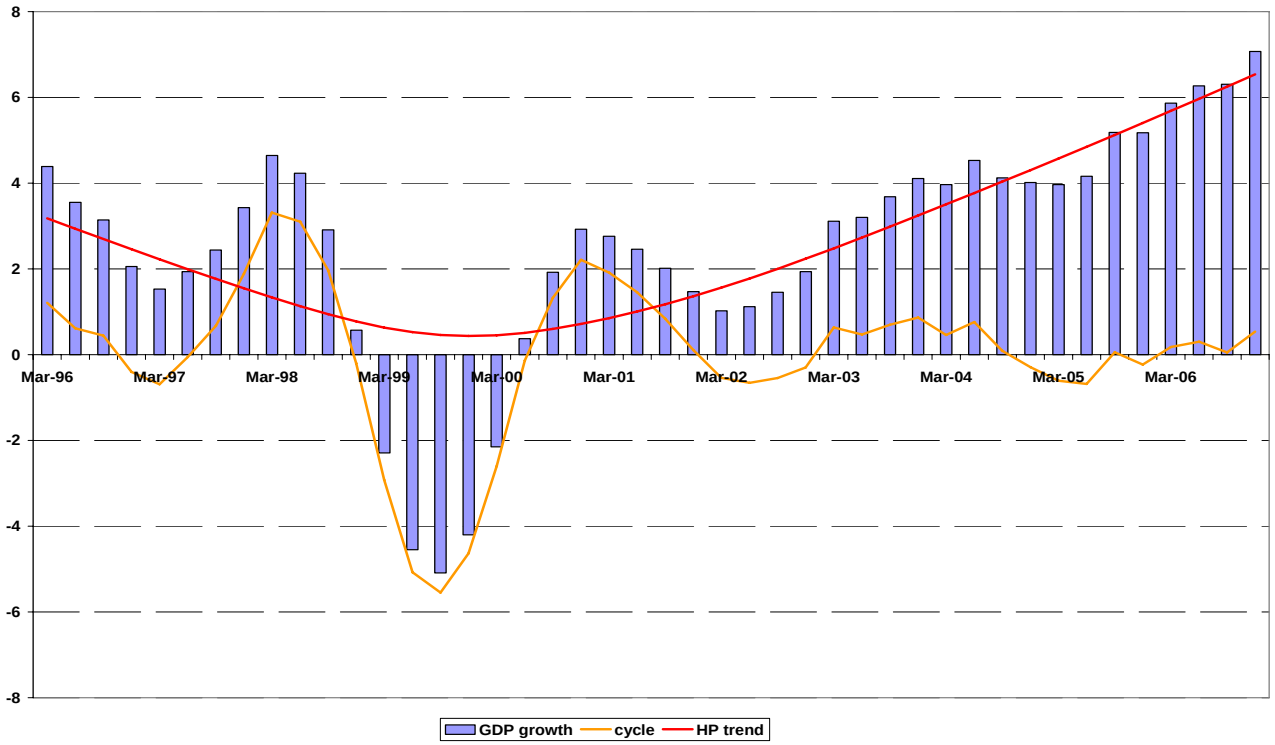


Chart 2: Colombia, GDP Growth, 1996-2007

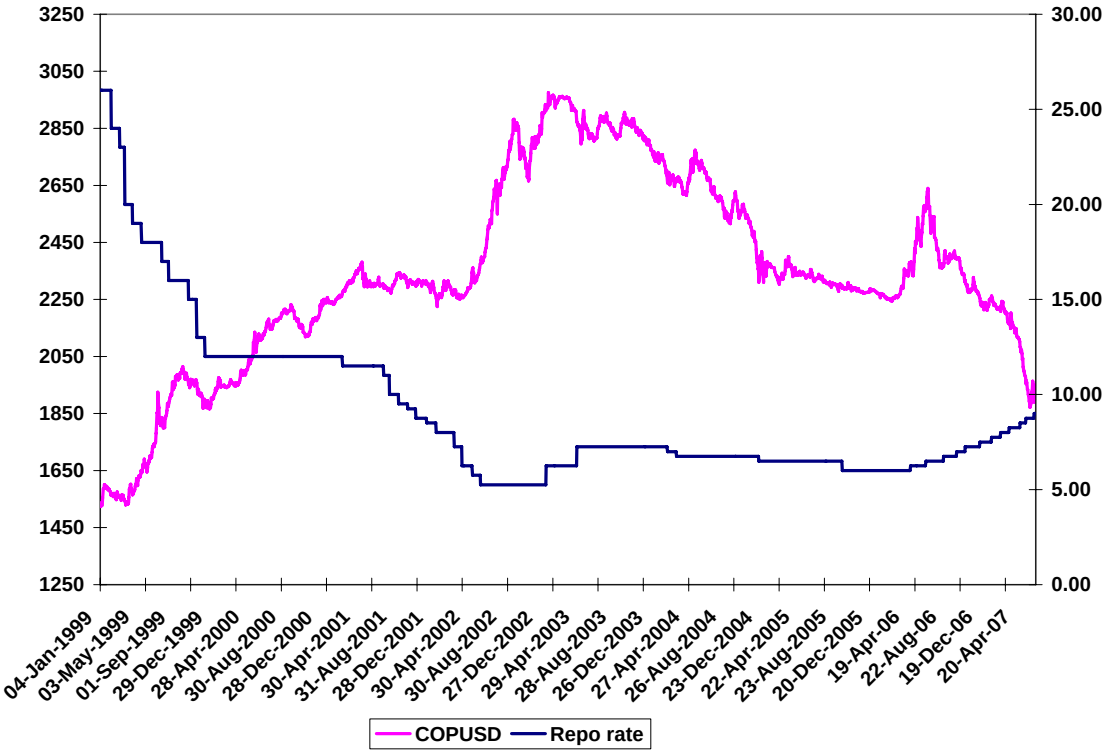


Chart 3: Colombia, Exchange Rate and Interest Rate Policy, 1999-2007

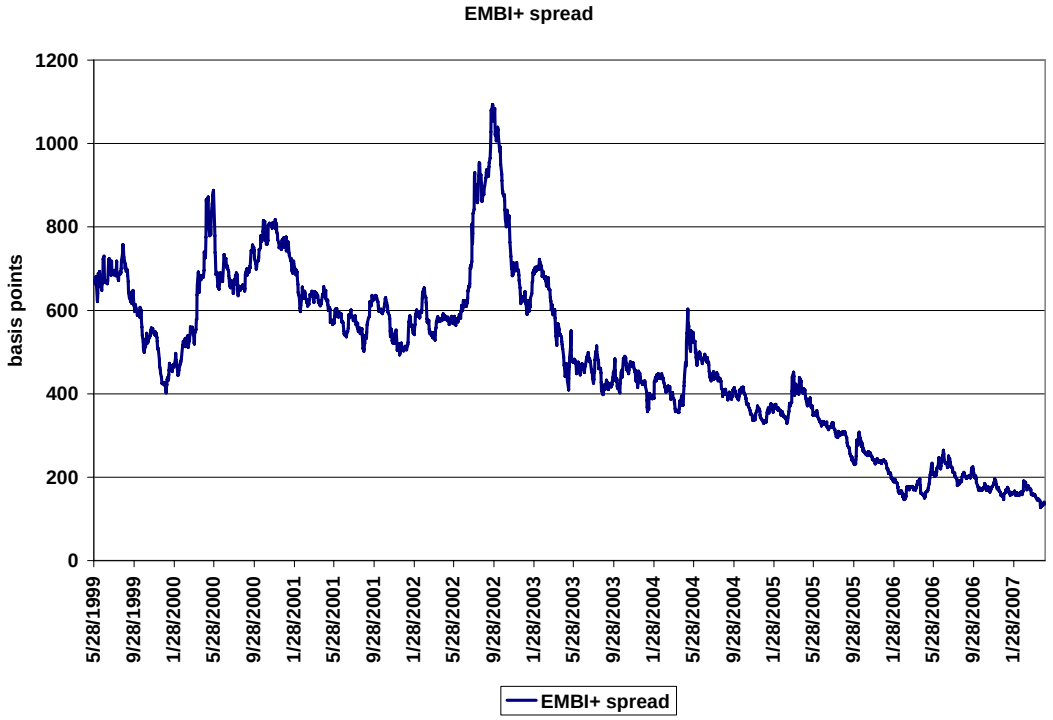


Chart 4: Colombia, EMBI+ Spread, 1999-2007

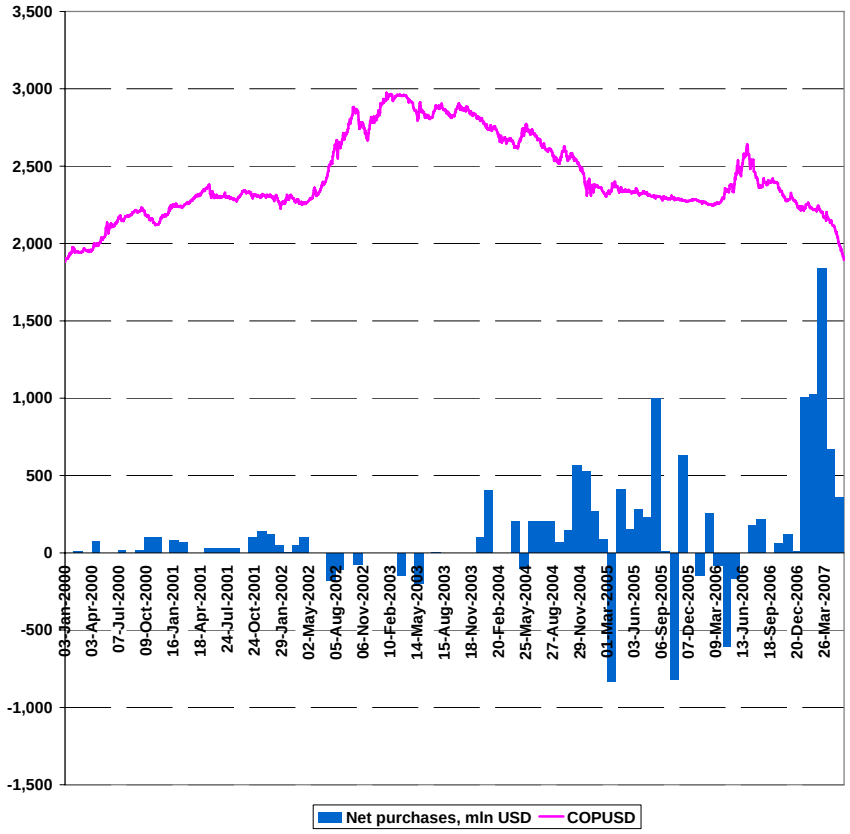


Chart 5: Colombia, Foreign Exchange Intervention and the Exchange Rate, 2000-7

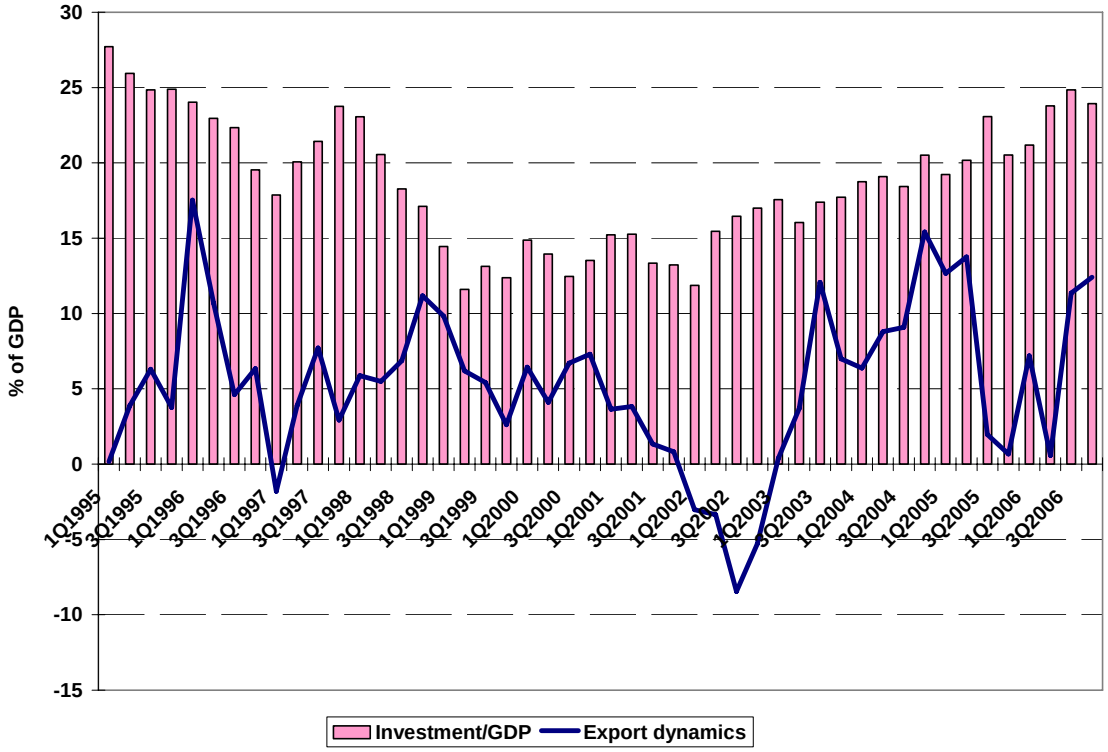


Chart 6: Colombia, Investment and Exports, 1995-2007

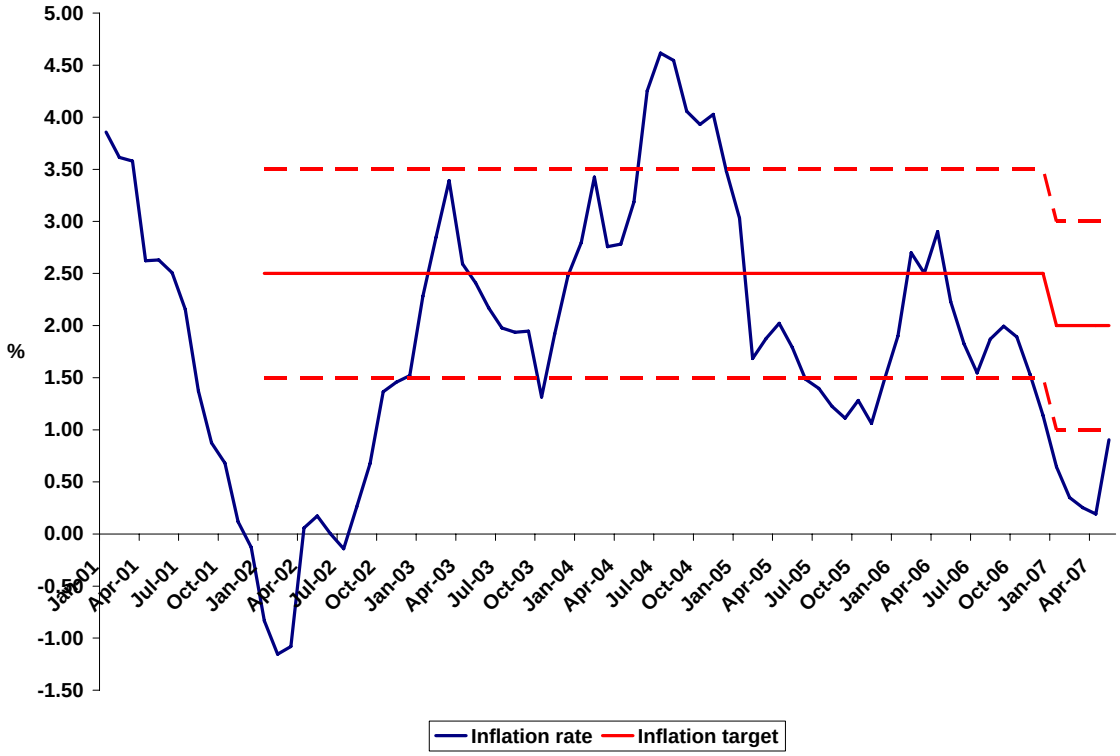


Chart 7: Peru, Realized Inflation versus Inflation Targets, 2001-07

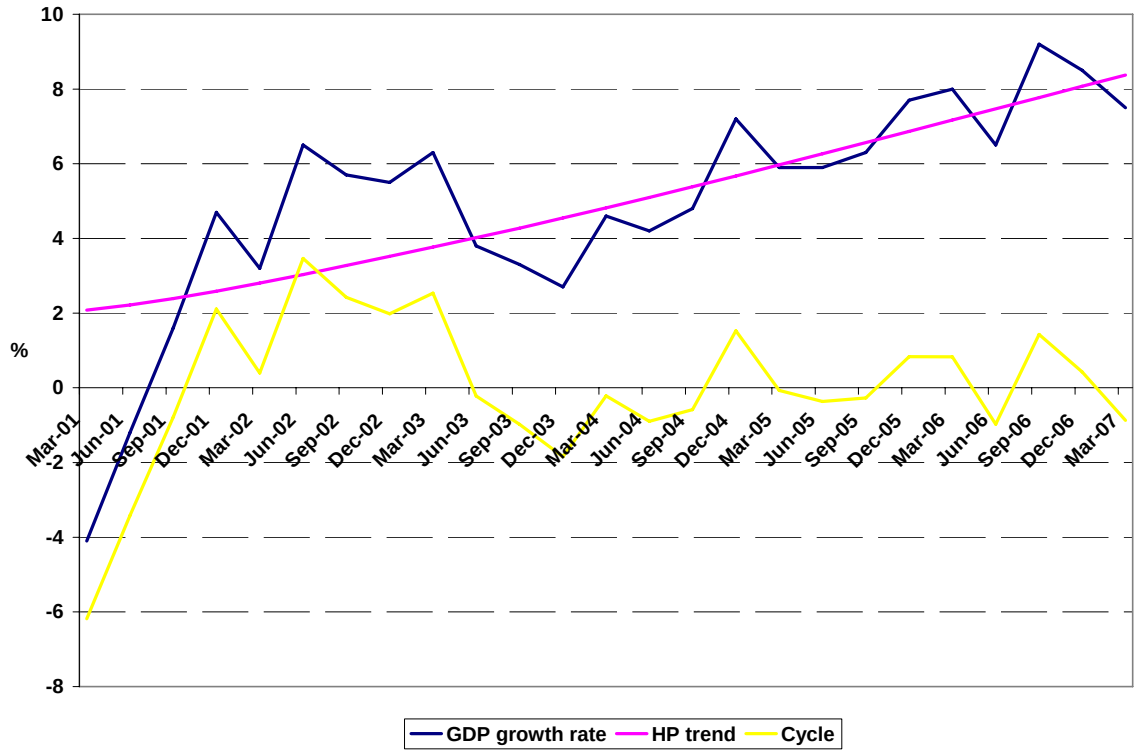


Chart 8: Peru, GDP Growth, 2001-07

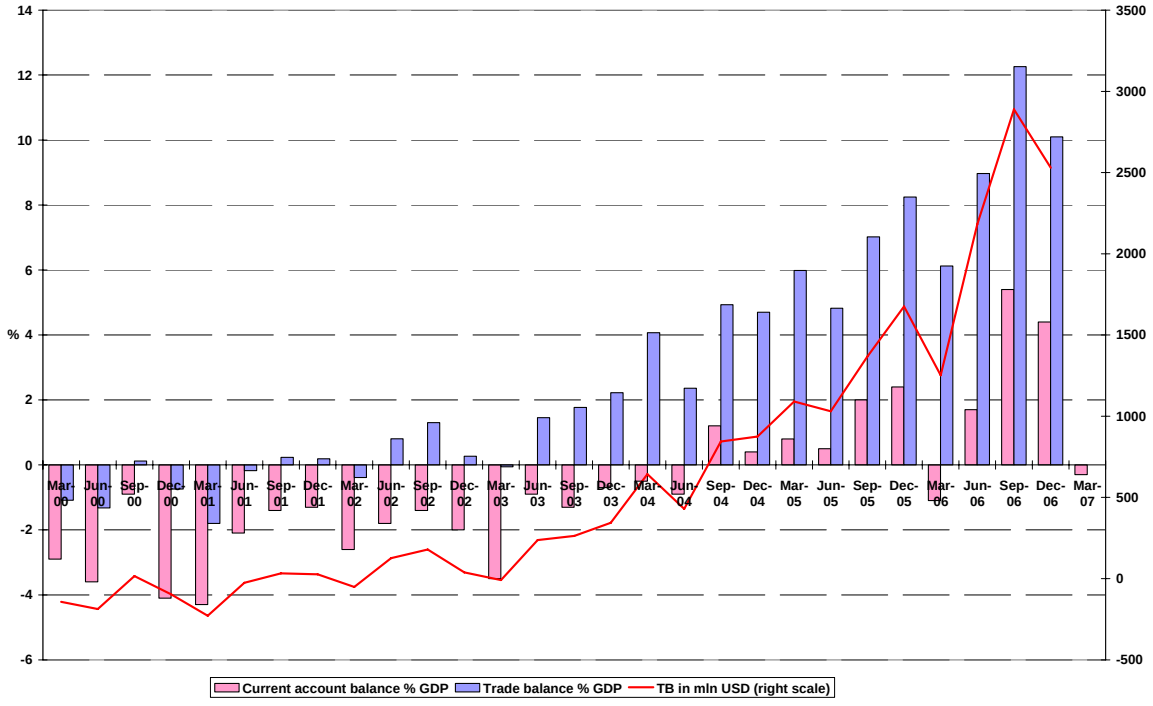


Chart 9: Peru, Current Account and Trade Balance

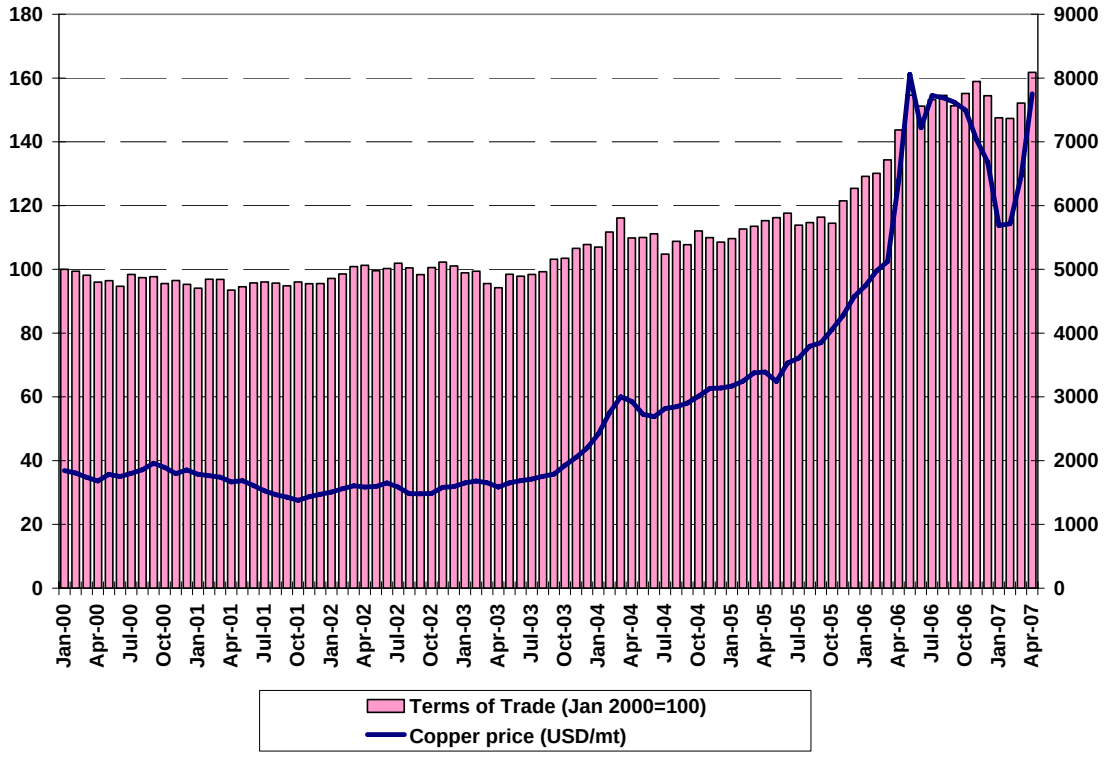


Chart 10: Peru, Terms of Trade and Copper Prices

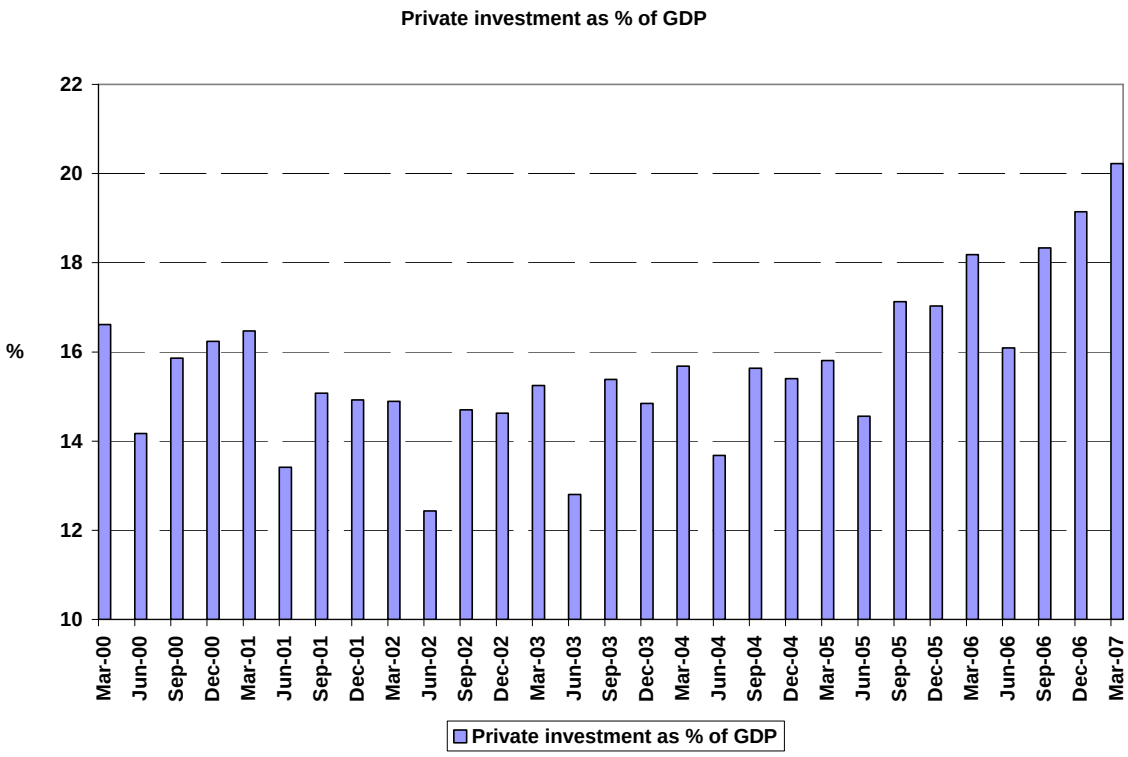


Chart 11: Peru, Private Investment, 2000-7

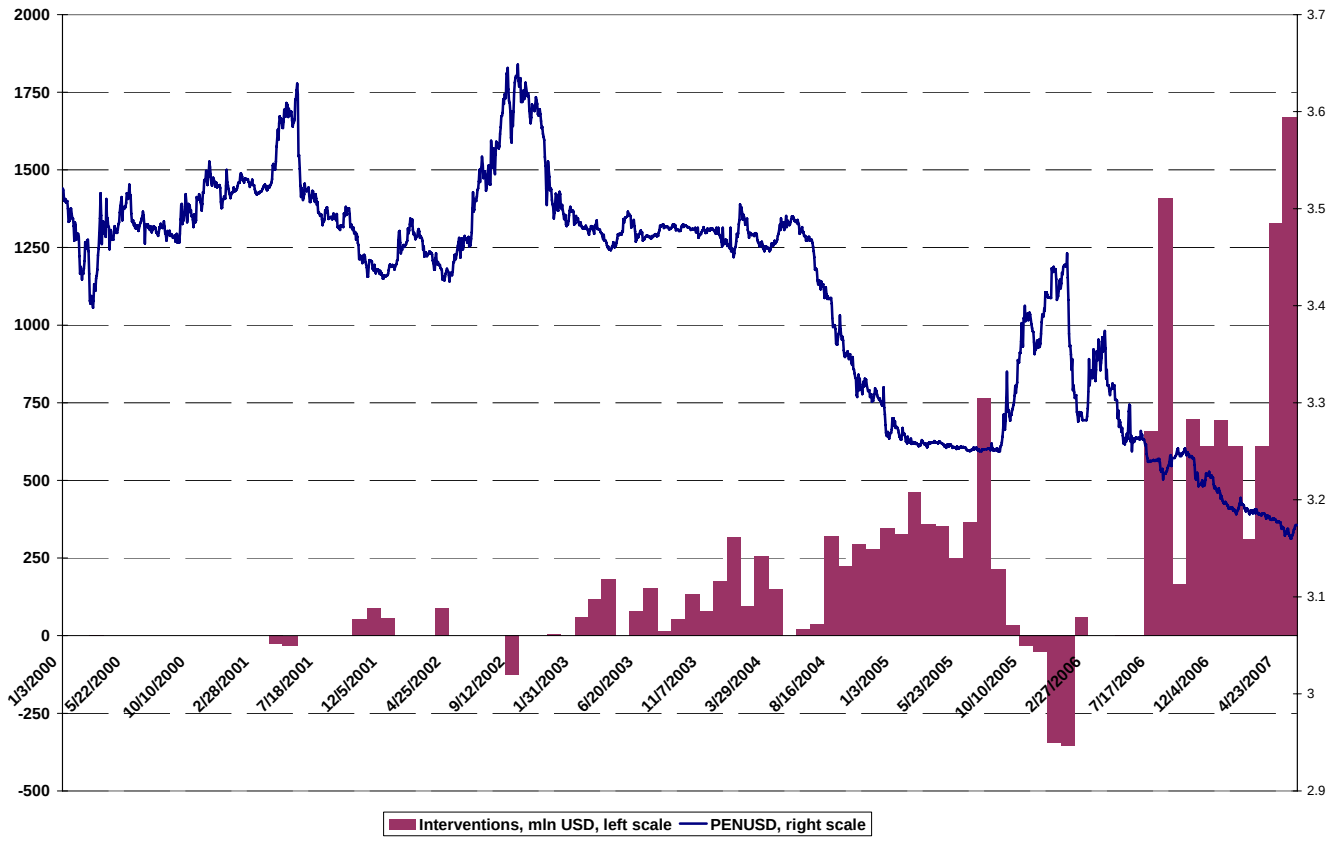


Chart 12: Peru, Central Bank Foreign Intervention, 2000-7

Chart 13: Chile, Inflation rate and target range, 1998-2007

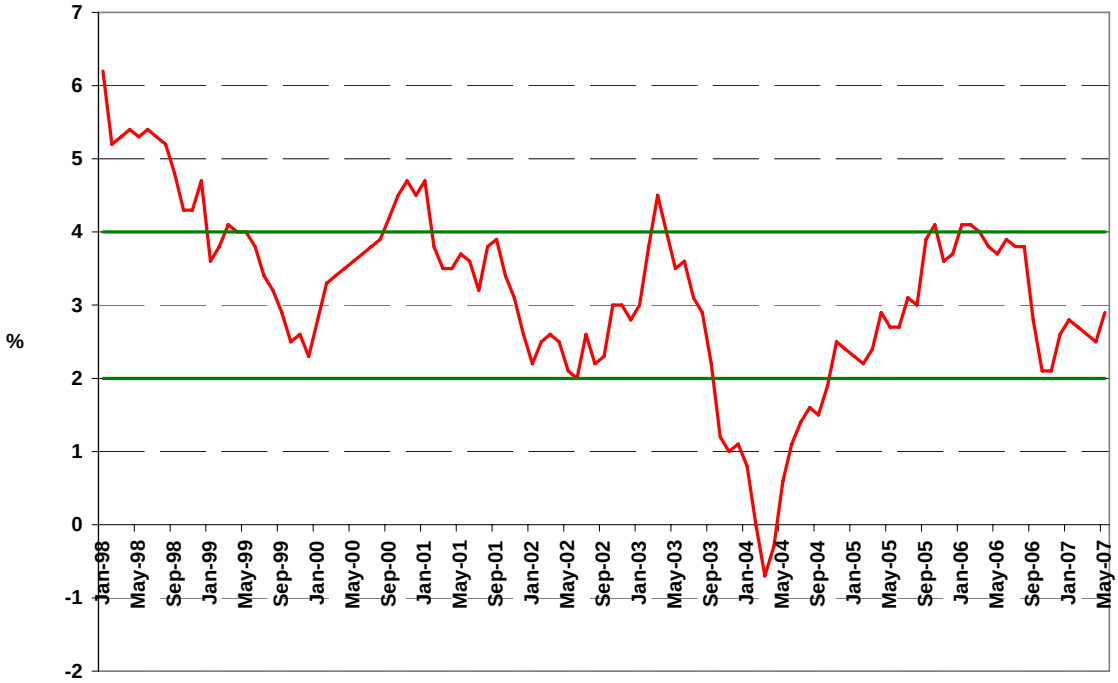


Chart 14: Chile, Exchange Rate and Monetary Policy

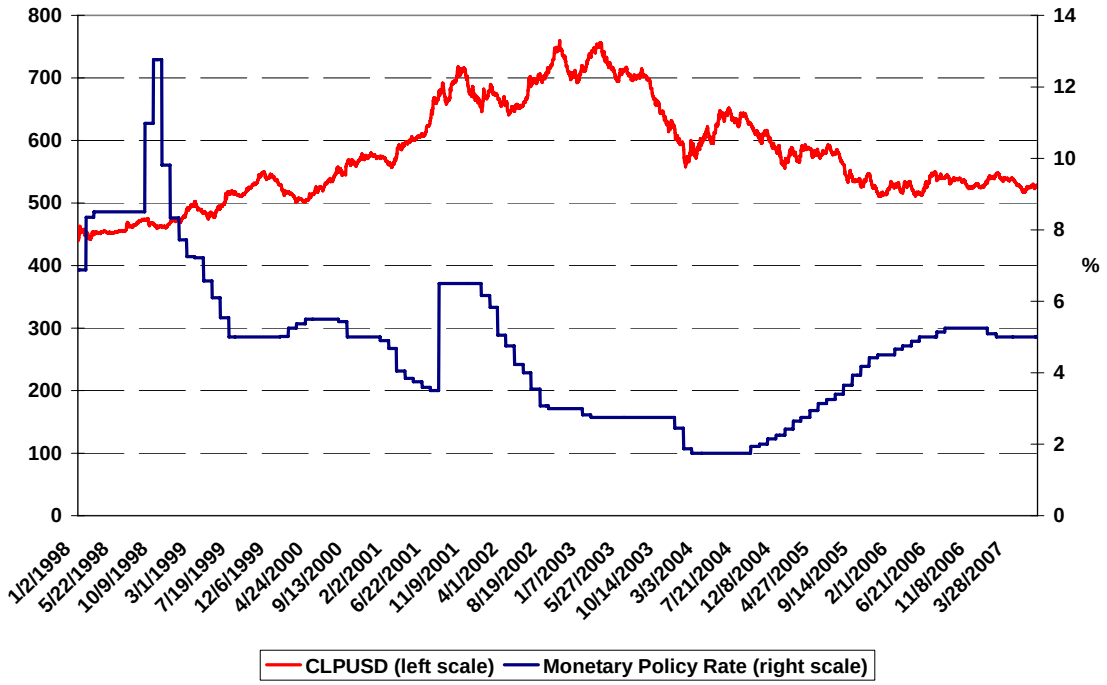


Chart 15: Chile, GDP growth rate

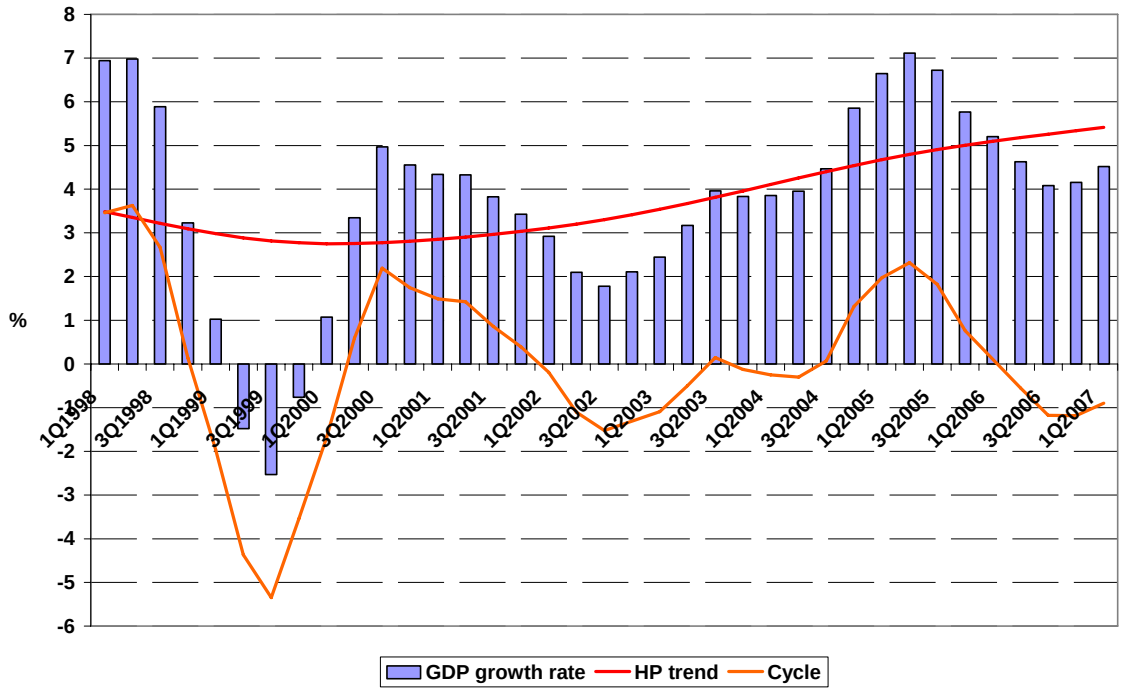


Chart 16: Brazil, Inflation and targets since 1999

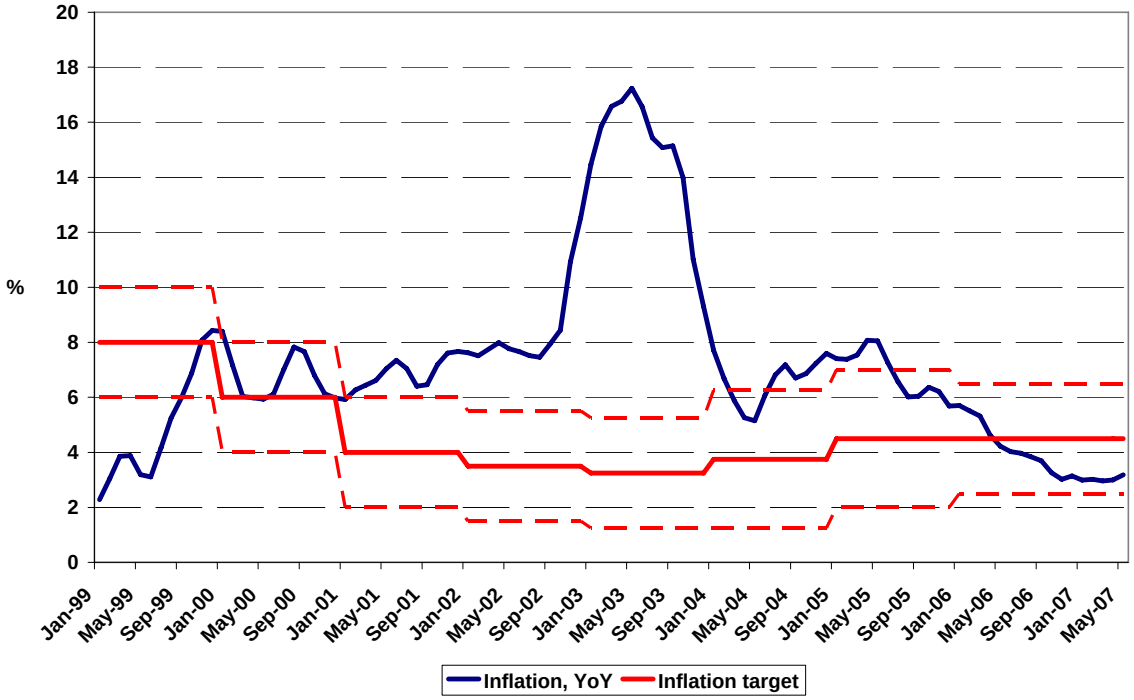
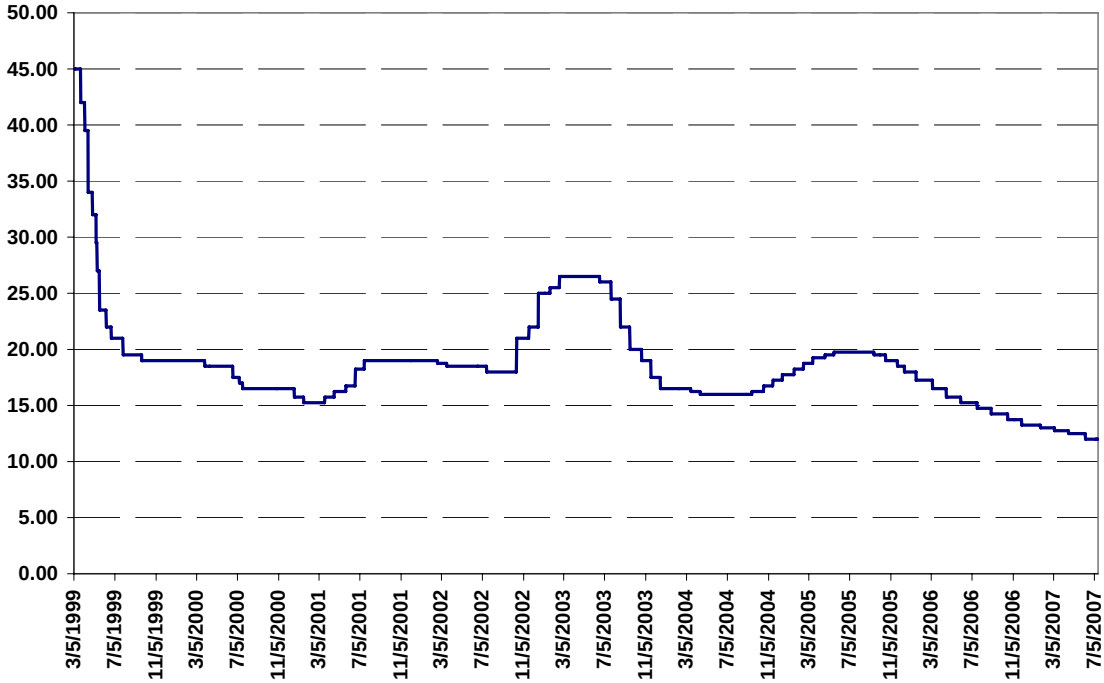


Chart 17: Brazil, SELIC target



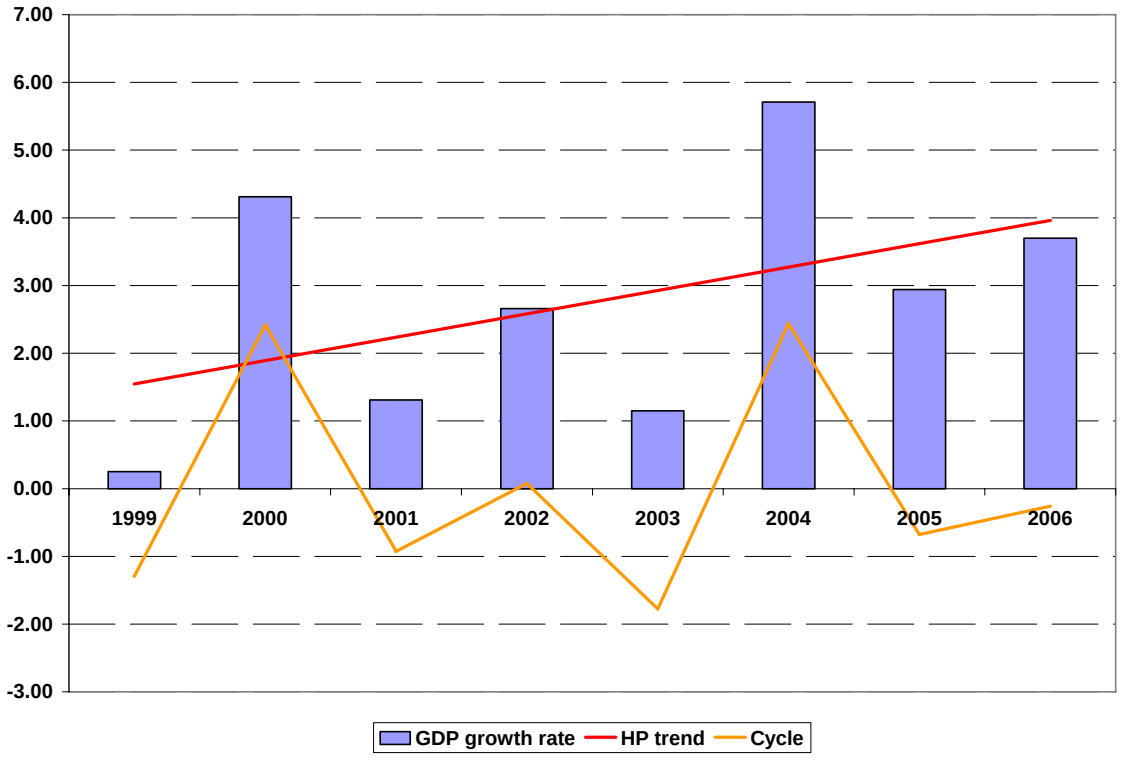


Chart 18: Brazil, GDP growth

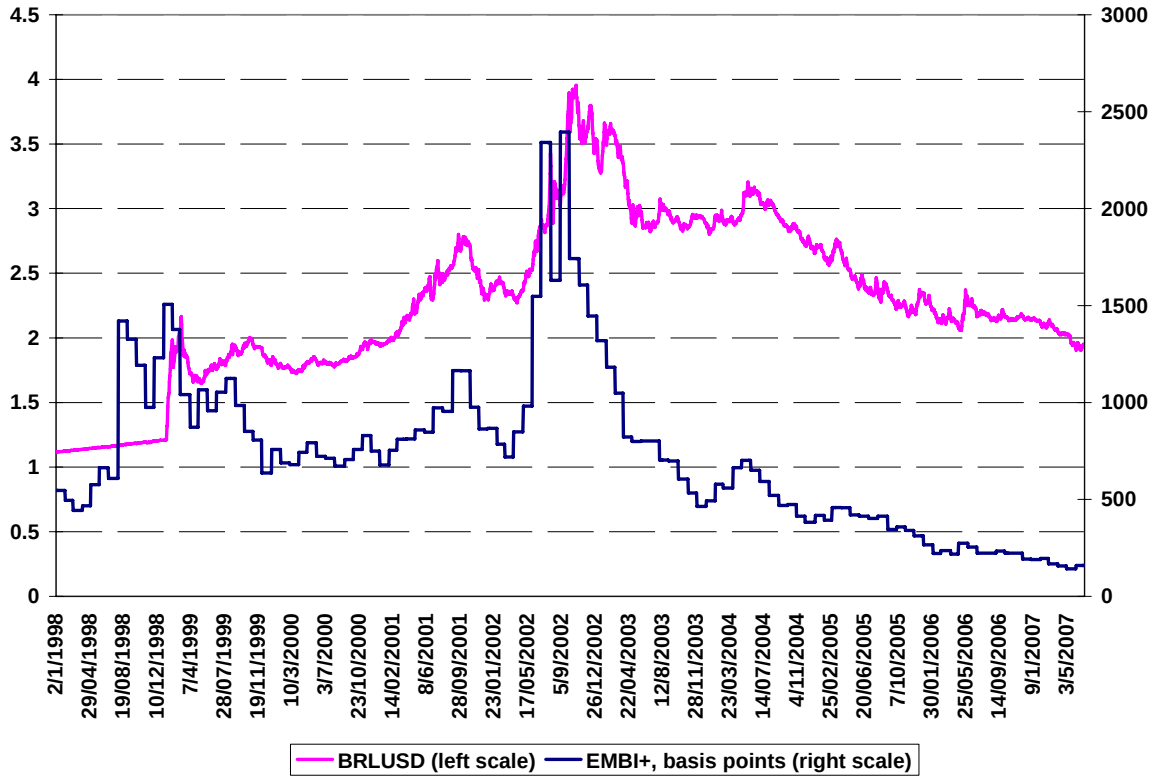


Chart 19: Brazil, Exchange Rate and EMBI Spread

Sources for Graphs:

Graph 1: Banco de la República de Colombia

Graph 2: Banco de la República de Colombia

Graph 3: Banco de la República de Colombia

Graph 4: J. P. Morgan

Graph 5: Banco de la República de Colombia

Graph 6: Banco de la República de Colombia

Graph 7: Banco Central de Reserva del Perú

Graph 8: Banco Central de Reserva del Perú

Graph 9: Banco Central de Reserva del Perú

Graph 10: Banco Central de Reserva del Perú

Graph 11: Banco Central de Reserva del Perú

Graph 12: Banco Central de Reserva del Perú

Graph 13: Banco Central de Chile

Graph 14: Banco Central de Chile

Graph 15: Banco Central de Chile

Graph 16: Banco Central do Brasil

Graph 17: Banco Central do Brasil

Graph 18: Banco Central do Brasil

Graph 19: Banco Central do Brasil and J.P. Morgan