AN EXCHANGE RATE BAND IN TIMES OF TURBULENCE :
COLOMBIA 1991-96

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An Exchange Rate Band in Times of Turbulence: Colombia 1991-96

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Abstract

In the context of a medium term process of real appreciation, linked largely to fiscal policy and capital inflows, Colombia was hit by a political shock and had to deal with expectations of nominal devaluation. This paper discusses three issues. First, the process of appreciation itself is analyzed in order to sort its causes. Second, the functioning of the exchange rate band is examined. Third, the role of the band in the resolution of the basic policy dilemma is studied. Two conclusions emerge. Firstly, the appreciation process has clear causes and explains departures of nominal exchange rate behavior, within the band, with respect to hypotheses derived from the usual conceptual models. Second, the choice of a band-based exchange rate regime has been very important in securing relatively smooth adjustment in the context of the two contradictory forces facing policy makers in this period.

I. Introduction

Graph 1 shows a conventional PPP measure of the real exchange rate in Colombia and an index of the relative price of tradable goods in terms of non tradeable.. The common conclusion is that, since 1990-92 there has been a medium term process by which the RER has appreciated by as much as 26%. The analysis of this process is the first objective of this paper.

Graph 2 shows the evolution of the nominal exchange rate during the same time period, measured as the percentage deviation from the exchange rate band´s central parity. The conclusion there is the presence of an important degree of volatility in the latter part of the sample. The analysis of this aspect is the second objective of the paper.

In abstract terms, the case for a nominal exchange rate band is based upon the argument that the regime allows a combination wherein the expectational effects associated with anchoring are obtained, without sacrificing the required degree of flexibility. At its best, a band system can obtain these effects, anchoring expectations while absorbing (and even smoothing) external shocks and thus achieve all of what one wants from an exchange regime. At its worst, the band operates much like a fixed parity under increasing pressure.

The argument of this paper is that the recent experience of Colombia offers interesting evidence in favor of the idea that the exchange rate band is very helpful in anchoring substantial swings of expectations. First, economic fundamentals are the main driving force of the real appreciation. Second, the devaluation which occured in mid 1995 was limited, in size, by the presence of the band. Moreover, it would have proven extremely difficult to handle had the system been a crawling peg, given its discretinary features. Third, the nominal appreciation which occured in 1996 is a return to fundamentals which, once again, might have been more difficult under a managed regime.

II. Real Appreciation[1]

The point of this section is that the real appreciation, documented in Graph 1, has been driven by fundamentals and that a shift of policy, in several areas, is required in order to reduce the negative impacts of the process. The section begins with the presentation of a simple two period model which is calibrated to fit the Colombian situation as of 1990-91. Four types of shocks, which reflect what happened between 1990-91 and 1996, are then introduced. The conclusion is that most of the appreciation can be accounted for by these shocks.
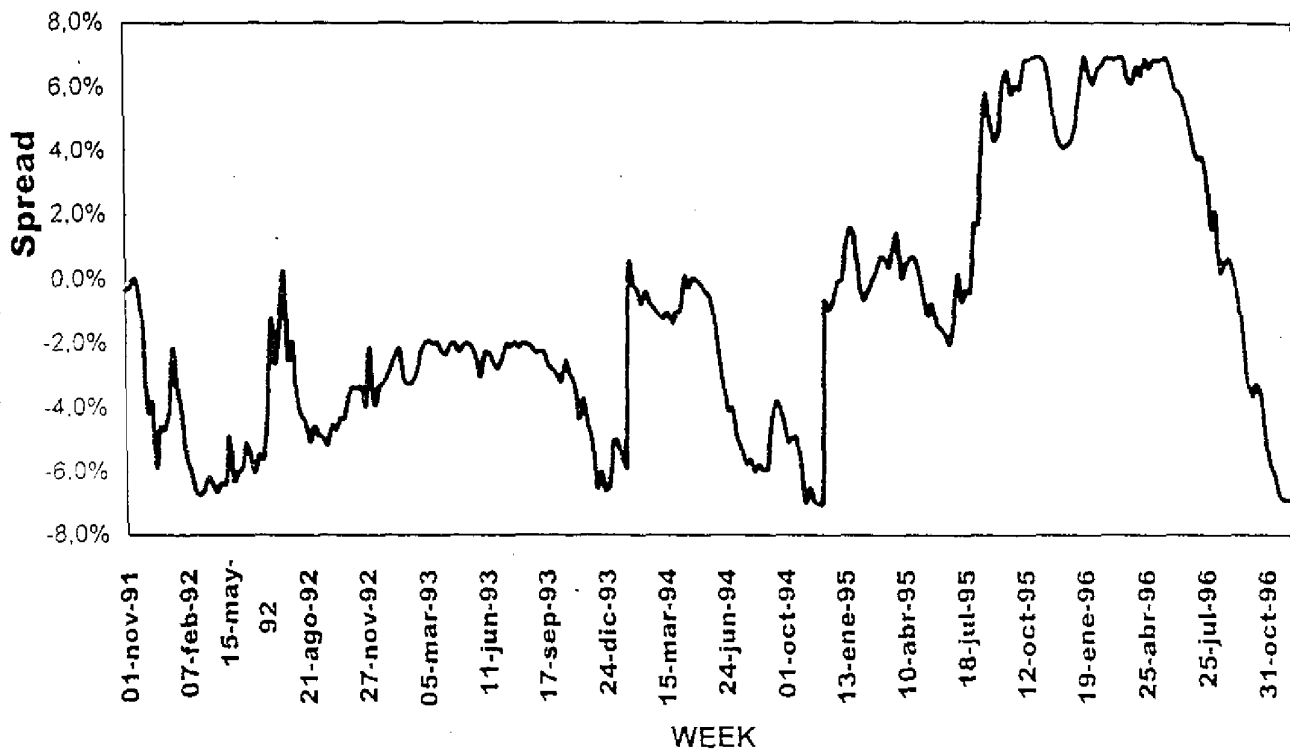
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[1]This section draws heavily on previous joint work with Andrés Arias.

GRAPH 1

REAL EXCHANGE RATE
Alternative Definitions 1990-96
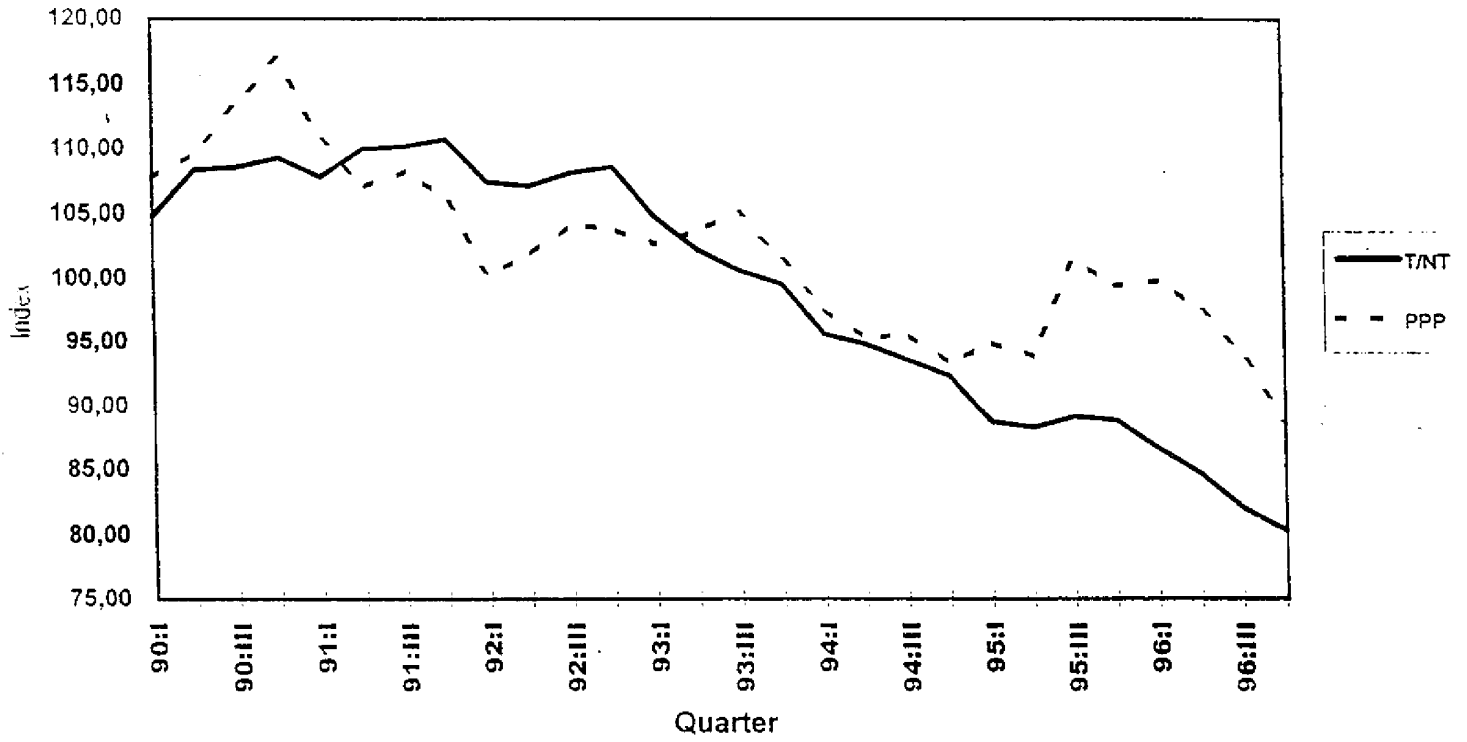
Graph 2

Spread From Central Parity Rate
Weekly Data 1991-Dec.16 1996

A.   A Simple Model

In order to study the appreciation process, I use a very simple model in which there are three periods and three goods, tradeable, non tradeable and petroleum, which is an enclave. The two goods are produced with one factor of production (labor) and enter the consumer's utility function.. The government spends on both types of goods. All budget constraints must be met in present value terms. The model has the following system of equations. First, utility in consumption is logarithmic:

$$U = \sum_{t=0}^{2} \phi A_t^j \log C_t^j \tag{1}$$

where U measures the present value of utility obtained from consumption of tradable and nontradable goods (j=T,NT) and A_t^j is the parameter in the additively separable function. Government expenditures at each time period are given by:

$$g_t = g_t^T + g_t^N \tag{2}$$

and, in present value terms:

$$G = \sum_{t=0}^{2} \frac{g_t}{(1+r)^t} \tag{3}$$

The aggregate budget constraint implies that present value production equals present value expenditure:

$$\sum_{t=0}^{2} \frac{P_t Y_t^P + e_t Y_t^N + Y_t^T}{(1+r)^t} = \sum_{t=0}^{2} \frac{e_t C_t^N + C_t^T}{(1+r)^t} + G \tag{4}$$

where all prices are measured in terms of tradable goods, Y_t^j is period t production of good j (j=Petroleum,T,NT) and C_t^j is consumption (j=T,NT) In this expression, e_t is the real exchange rate. Aside from the intertemporal budget constraint, six first order conditions are obtained. They are:

$$A_0^T = \lambda C_0^T \tag{5}$$

$$A_0^N = \lambda e_0 C_0^N \tag{6}$$

$$A_1^T = \lambda \frac{1+\delta}{1+r} C_1^T \tag{7}$$

$$A_1^N = \lambda \frac{1+\delta}{1+r} e_1 C_1^N \tag{8}$$

$$A_2^T = \lambda \left[\frac{1+\delta}{1+r} \right]^2 C_2^T \tag{9}$$

$$A_2^N = \lambda \left[\frac{1+\delta}{1+r} \right]^2 e_2 C_2^N \tag{10}$$

where δ is the discount rate. A first set of determinants of the real exchange rate, linked to consumer preferences, appears in these equations.

On the production side, we have:

$$Y_0^T = B^T l_0^\gamma \tag{11}$$

$$Y_0^N = B^N (1 - l_0)^\rho \tag{12}$$

$$Y_1^T = B^T l_1^\gamma \tag{13}$$

$$Y_1^N = B^N (1 - l_1)^\rho \tag{14}$$

$$Y_2^T = B^T l_2^\gamma \tag{15}$$

$$Y_2^N = B^N (1 - l_2)^\rho \tag{16}$$

profit maximization implies:

$$e_0 = \frac{\gamma B^T l_0^{\gamma-1}}{\rho B^N (1 - l_0)^{\rho-1}} \tag{17}$$

$$e_1 = \frac{\gamma B^T l_1^{\gamma-1}}{\rho B^N (1 - l_1)^{\rho-1}} \tag{18}$$

$$e_2 = \frac{\gamma B^T l_2^{\gamma-1}}{\rho B^N (1 - l_2)^{\rho-1}} \tag{19}$$

and, hence, a second set of determinants of the real exchange rate, this type of technological nature, appears.

To close the model we assume that the non tradable market clears in both periods. On the other hand, the current account deficit must be zero in present value terms. In other words, there can be disequilibria in the tradable sector but it must close in intertemporal terms (no ponzi). Hence:

$$g_0^N + e_0 C_0^N = e_0 Y_0^N \tag{20}$$

$$g_1^N + e_1 C_1^N = e_1 Y_1^N \tag{21}$$

$$g_2^N + e_2 C_2^N = e_2 Y_2^N \tag{22}$$

$$CA_t = P_t Y_t^X + Y_t^T - C_t^T - g_t^T \tag{23}$$

$$CA_0 = \frac{CA_1}{1 + r} + \frac{CA_2}{(1 + r)^2} \tag{24}$$

we further assume that the share of government expenditures in each good is fixed, where $g_t^N = \alpha g_t$ for t=0,1,2.

The model has thirteen equations; six first order conditions in consumption, three in production, three equilibrium conditions for non tradables and the economy's wide budget constraint. These equations identify thirteen endogenous variables, which is the economic equilibrium; six consumption levels (two for each period), three labor quantities (one for each period), three real exchange rates (one for each period) and the Lagrangian multiplier.

B. Initial Conditions

We seek to calibrate the model in such a way that quantities reflect the Colombian situation as of 1989-91, which we take to be the initial condition. Table 1 compares the actual and simulated situation obtained with the parameters and exogenous variables contained in the appendix.

Table 1-Initial Conditions

Variable	Model	Economy 1989-91
$\frac{Y^T}{Y}$	42.3%	43.2%
$\frac{Y^N}{Y}$	52.3%	52.2%
$\frac{Y_P}{Y}$	5.5%	4.6%
$\frac{G}{Y}$	15.1%	13.5%
$\frac{CA}{Y}$	0%	0.6%

C. Shocks

Beginning with the initial conditions of the model economy, which adequately reflect what the Colombian economy looked like in 1989-91, we proceed to introduce four shocks. The first one is public expenditure. Graph 3 shows the evolution of government expenditure to GDP ratio from 1985 to 1996. As can be seen, there is a substantial increase in the period 1989/91-96. The precise increase is around 50%. This is the shock we introduce first. The model associates a 3.07% appreciation of the real exchange rate to this shock.

The second shock is technological. We estimated *trend* values for the output to worker ratio in both sectors of the economy and concluded that between 1990 and 1993 there is a 10% increase in the relative trend productivity of the tradeable sector with respect to the non tradeable. This shock implies an appreciation of 9% in the real exchange rate.

The third shock is related to petroleum discoveries. We estimate that discoveries which occured during the period raised known reserves by 100%. This is the shock which we introduce. This implies an appreciation of 5.33% in the RER.

Fourthly, we use the model to generate exogenous private expenditure increases. The fall in Colombian savings rates and the increase in total private sector debt is very substantial in the period under consideration.

The justification for our simulation is linked to the type of analysis which has been presented, for example, by McKinnon and Pill (1994). According to that analysis, a liberalization process, even when it is fully credible, can create an "overborrowing syndrome" due to information problems stemming from the relationship between the banking sector and its clients. Agents, including policy makers, domestic banks, foreign lenders and consumers can become excessively optimistic about the outcome of reforms and an episode of this type can occur.

Graph 3
Government Expenditures
(% of GDP)
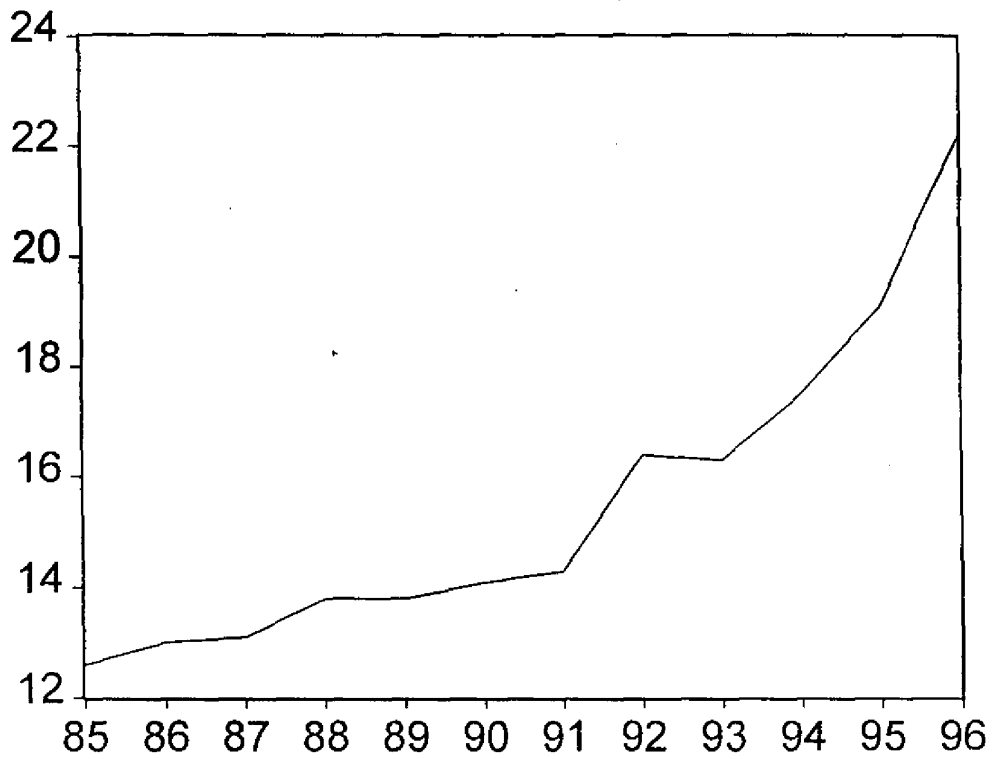
Source: National Planning Department

Graph 3.1
Private Savings Rate
(% of GDP)
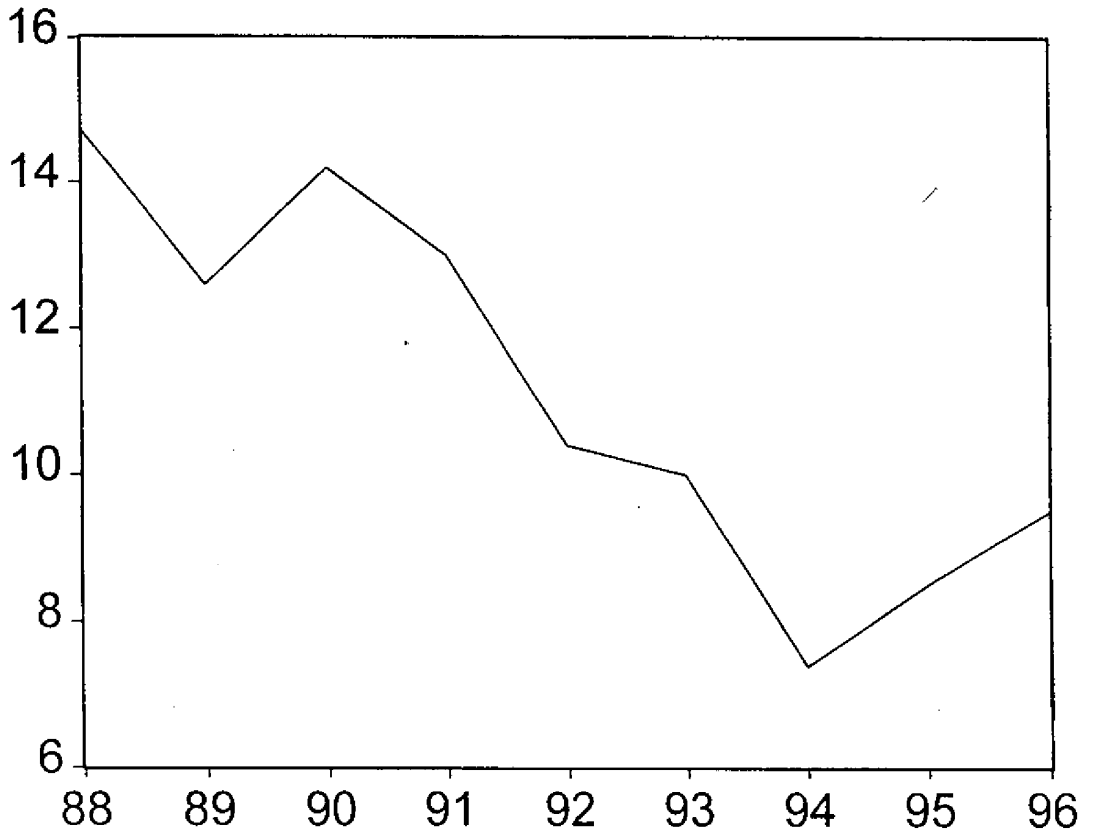
Stylized facts in Colombia match well the basic predictions of the McKinnon-Pill story: domestic credit expanded to a very important extent (Graph 4.1), largely financed out of capital inflows; foreign private debt rose substantially (Graph 4.2), while, as mentioned above, the current account deficit widened (Graph 4.3).

The findings of Calvo, Leiderman and Reinhart (1993) in the sense that an important part of capital inflows in the early nineties were associated with "external factors" tend to reinforce the point.

Given its simplicity, we are unable to fully spell out a transmission mechanism for this process within the model. However, if we assume that these expectations reflect themselves in a shift of preferences, we can easily simulate the type of shock which interests us by simply altering consumer preference parameters. To tie down the exercise, we seek to generate a fall in the current account during the first period which reflects what occured in Colombia. In other words, we shock preferences so that the current deficit in the second period falls, with respect to the initial conditions, by 5.4% of GDP as actually occured in Colombia. This shock implies an appreciation of 5.4%. It could obviously overestimate the true force of the exogenous shock to preferences given that the petroleum shock, by raising permanent income, can account for part of the fall in the current account. We examined this point and concluded that the effect is not very significant, hence, it is adequate to think the problem in the terms stated.

In summary, using a simple model, calibrated to reflect the Colombian economy in the initial 1989-1991 period, and shocked with reference to actual developments during 1991-96, we are able to assign a substantial part of Colombia's real appreciation to the four forces outlined above. Adding the effects, we find that these factors account for an appreciation of close to 22.8%.

This appreciation, in turn, has both a temporary and a permanent component. By the underlying budget constraint, we know that the effect of private excess absortion is temporary. In absence of microeconomic reform, the effect of technological factors upon competitiveness are also permanent.

III.   The Nominal Exchange Rate Band 1991-96

A.   A Basic Description

The dominant medium term force during the 1990-96 period is a real exchange rate appreciation which is crucially linked to expansionary fiscal policy, greater private sector expenditures, technological factors and petroleum discoveries. This fundamental driving force has implied a good deal of difficulty in defining the location of the nominal exchange rate band.

Graph 5 shows Colombia's exchange rate band for the period 1991-96. The first phase is 1991-January 1994 in which the band was not explicit. Rather, it was based on the introduction of one year dollar denominated debt instruments (CCAMB)
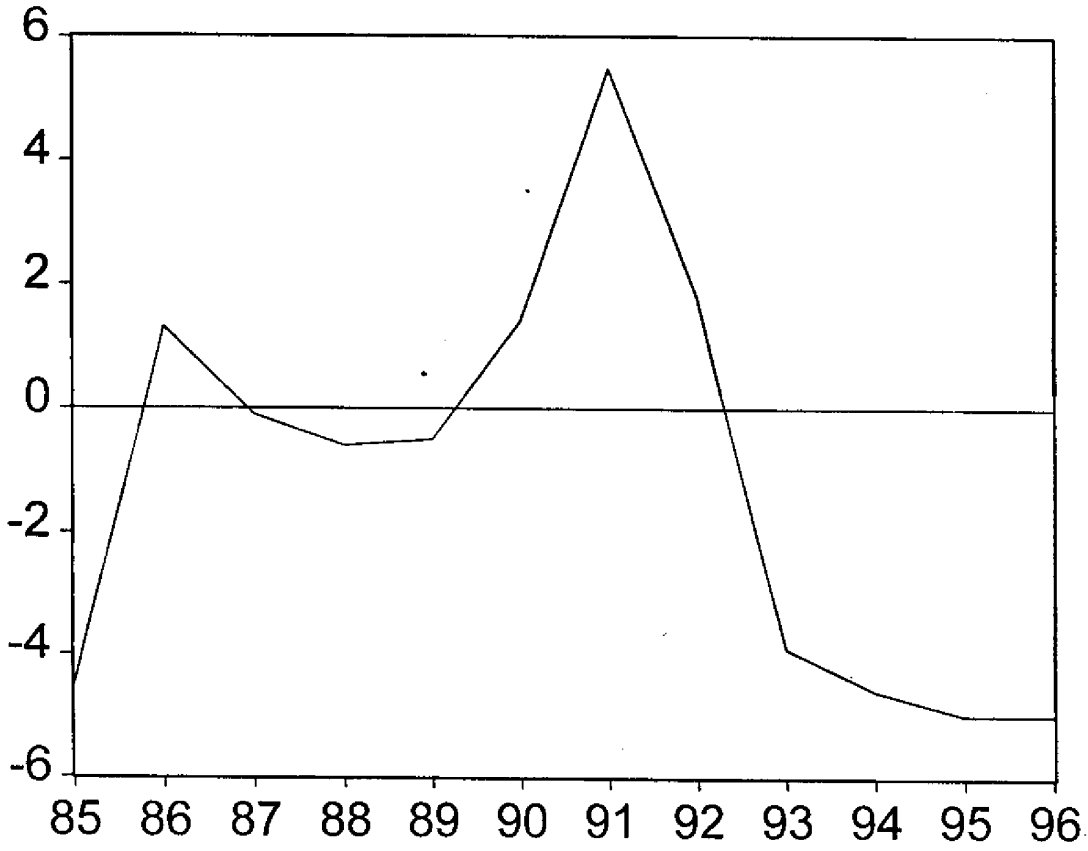
Graph 4.1
Stock of Real Domestic Credit to Private Sector
(Index)
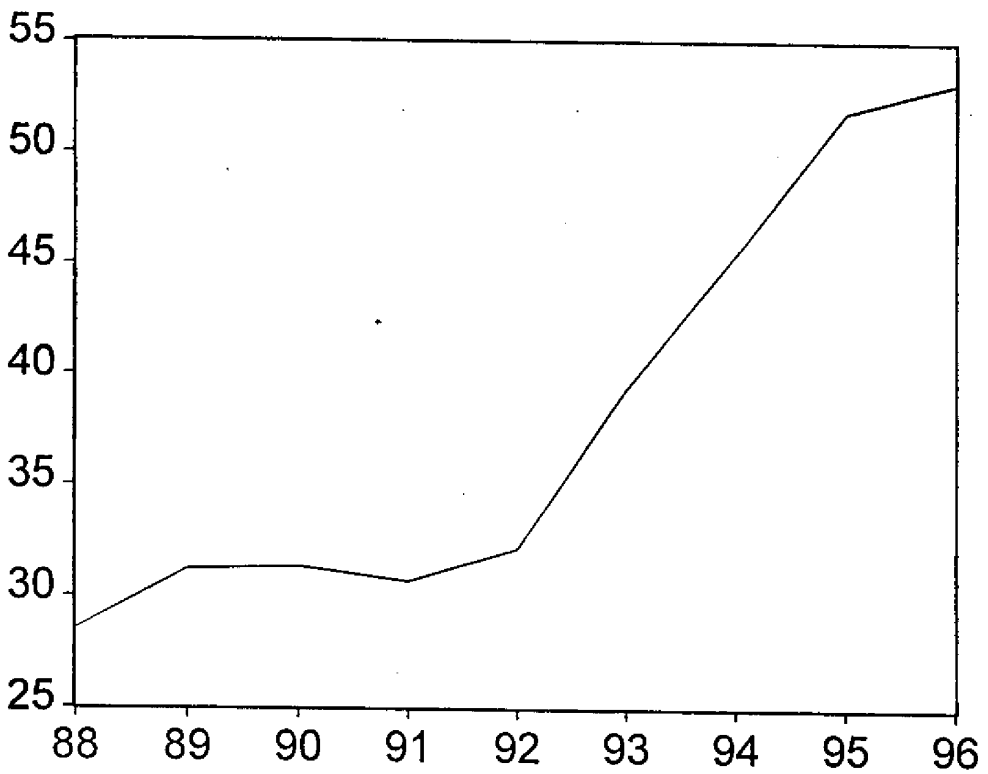
Graph 4.2
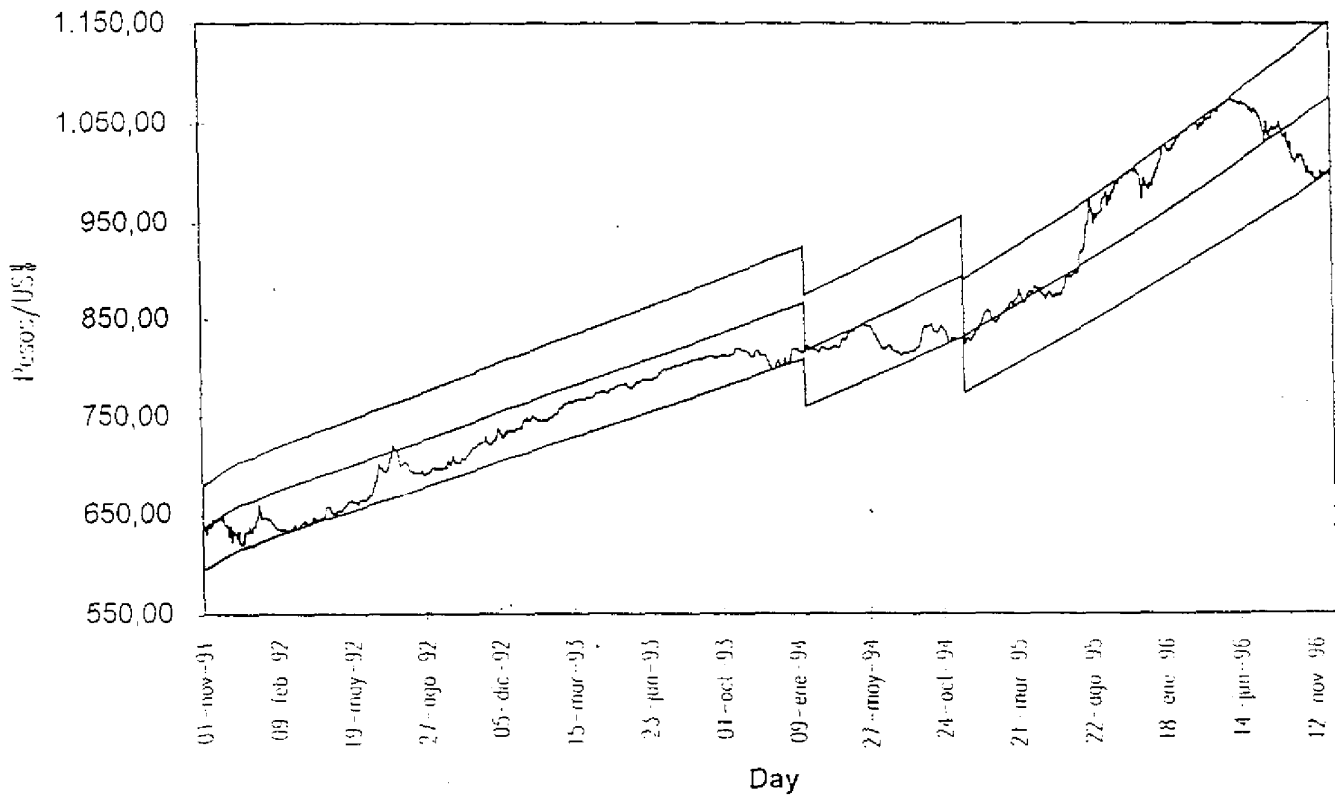## Private External Debt
(Millions of US$)
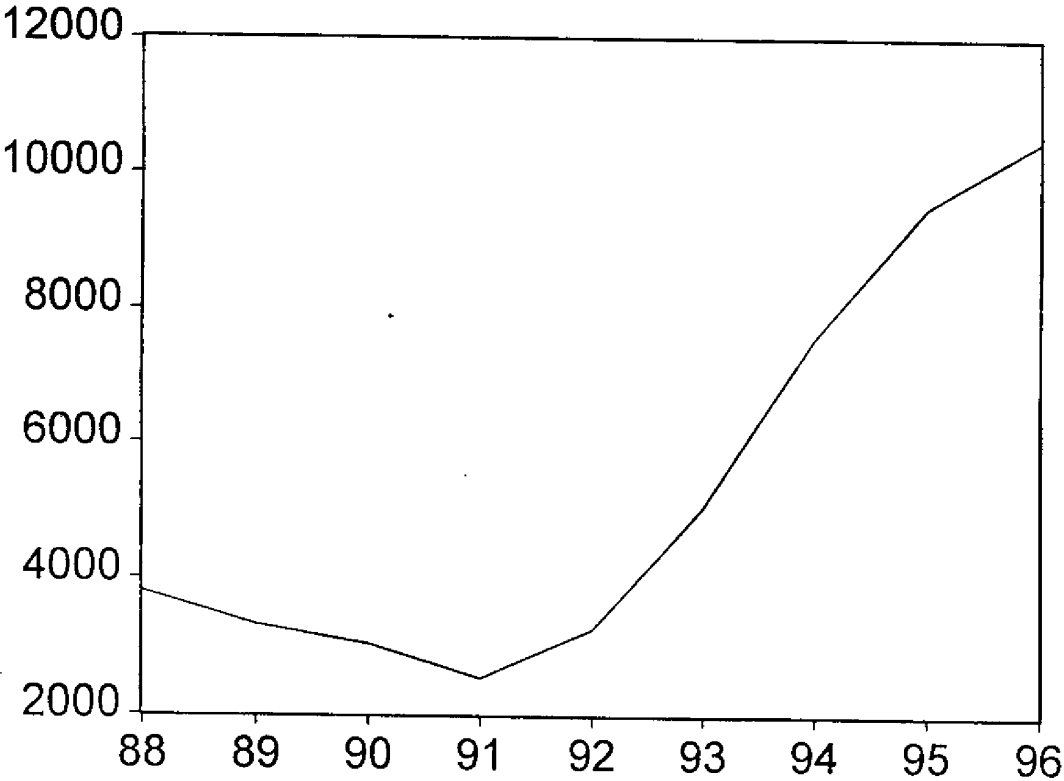
Graph 4.3
Current Account
(% of GDP)

GRAPH 5

Exchange Rate Band

which were issued by the central bank in exchange for foreign currency and could be negotiated in the market. The central bank offered the choice of redeeming the paper for domestic currency at a 12.5% discount over face value, which in turn was computed at the "official exchange rate" or redeeming it at maturity at the face value then prevailing. An implicit band was thus established, wherein the ceiling (weak part) is roughly equivalent to the official parity and the floor (strong part) is equivalent to the 12.5% discount[2]. During this period (1992-1993) the implicit band crawled at an average rate of 14%.

In January, 1994 the system was changed to an explicit dollar based crawling exchange rate band. Firstly, a 5% appreciation of the band as a whole was introduced. Secondly, the rate of crawl was set at 14%, while the width established was 15%. This band was abandoned in mid December, 1994, in the context of strong appreciation forces. At that time, a further 7.5% appreciation of the band was introduced, while the width and crawl of the band were left, largely, unmodified. Since December, 1994, the band has not been substantially modified, though the rate of crawl has changed somewhat from year to year.

B. Does experience match basic theory?

The basic exchange rate target zone literature predicts the occurrence of at least two empirical regularities. Firstly, the exchange rate should exhibit a U shaped frequency distribution, remaining near the edges of the band more often than at the central areas. Secondly, a negative relation must exist between the interest rate differential and the exchange rate spread[3].

1. Marginal Frequency Distributions

The first prediction results from the fact that expectations drive the observed exchange rate, while a credible commitment to the band in effect truncates expectations. Fundamental shocks rapidly move the exchange rate from the center of the band towards the edges. As the exchange rate approaches the edges, the effects of the same type of shocks are weaker because expectations are not affected to the same extent. On the edge of the band itself, the same shock lacks any exchange rate effect. To move the exchange rate by a certain given percentage, fundamentals have to change little at the center of the band, and much more near the edges of the band. Largely

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[2]The central bank made no commitment to halt a devaluation at the official exchange rate. Thus, the exchange rate *could have*, in principle, depreciated beyond the official rate given sufficiently strong differentials between the rate of devaluation and the interest rate differentials. This did not occur.

[3]Among the additional predictions, a nonlinear relationship is posited between conditional volatility and relative position within the band. Galindo (1996) studied the Colombian band with maximum likelihood GARCH methods and found that weekly data, for 1994-96, match this prediction. He found the expected hump-shaped relation between these variables.

related to this prediction is the notion that the relationship between fundamentals and the exchange rate are highly non linear.

First, look at the distribution of the spread with respect to central parity for the entire sample. Graph 6 shows this distribution. It is clear that it does not exhibit the type of shape which is predicted by the standard models. This result has been presented in studies of other exchange rate zones[4]. Second, it could be argued that, given the presence of two realignments, the result could not be reliable. Indeed, after a realignment the exchange rate moves, by definition, to the center of the band. Graphs 7A-7C show the frequency distributions for the three subsamples. It can be seen that there are some differences; most prominently, the fact that the latter part of the sample is characterized by a tilt to the weak part of the band, whereas in the former two the tilt is the other way.

2. Interest Rate Differentials

The second prediction results from arbitrage assumptions.. Under UIP, for example, the interest rate differential is equal to the expected exchange rate. If, as is usual in this literature, the expected exchange rate is given by the difference between the observed rate and the observed fundamentals f_t, corrected by the semi elasticity of money demand, then:

$$\widehat{E}_t^e = \frac{E_t(f_t) - f_t}{\alpha} = i_t - i_t^* = \delta(f_t) \tag{25}$$

Taking first differences:

$$\frac{d\delta}{df_t} = \left[\frac{dE}{df} - 1\right]\frac{1}{\alpha} \tag{26}$$

since $\frac{dE}{df} < 1$ it is clear that $\frac{d\delta}{df} < 0$. The interest rate differential is decreasing in the fundamentals and, thus, it is decreasing in the exchange rate.

The relationship between the exchange rate and the interest rate for the entire sample is depicted in Graph 8. The correlation coefficient, contrary to the prediction of the standard model, is positive (0.37).
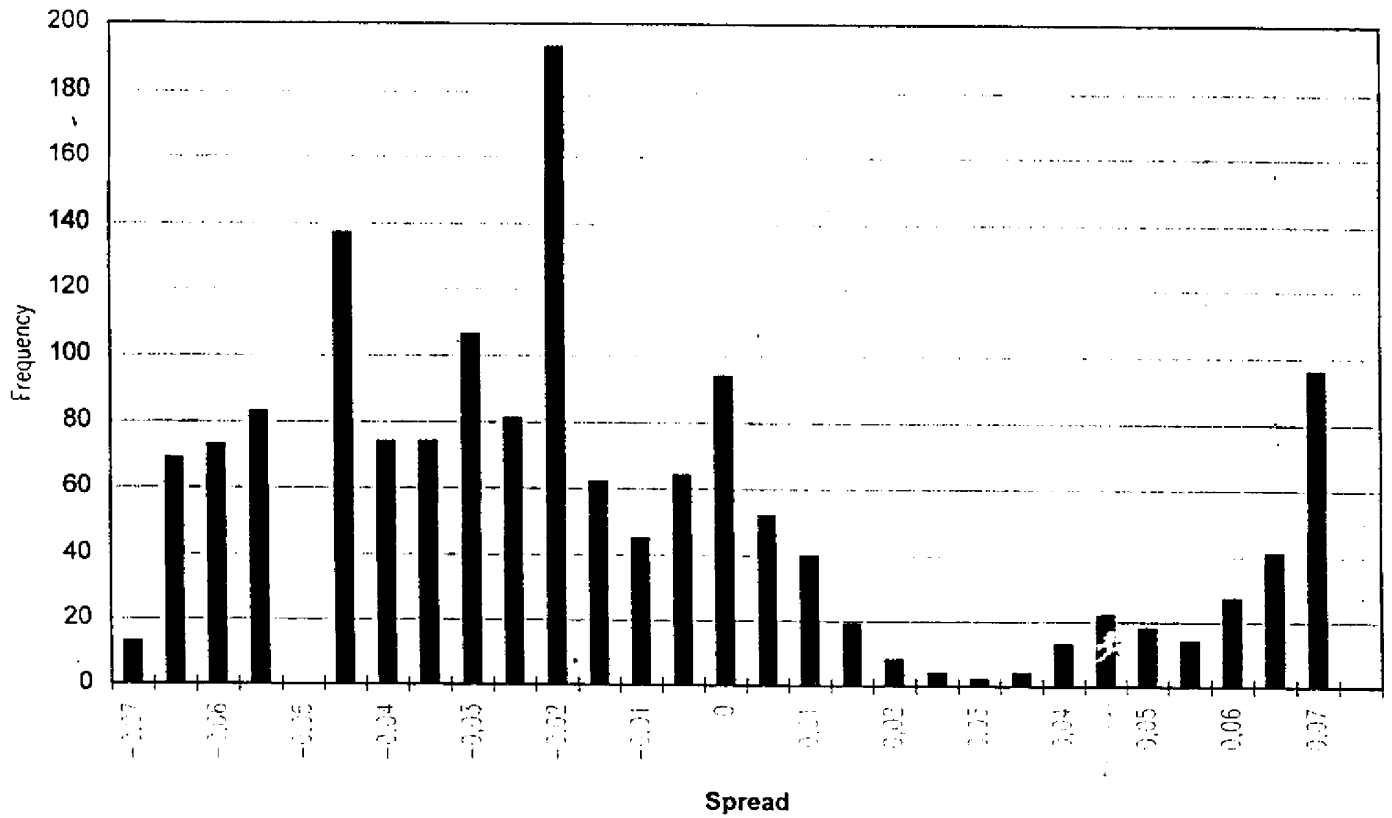
3. On the Realignments

The issue of target zone credibility has been approached from diverse perspectives. The "simplest test" of band credibility, proposed by Svensson (1991), states that a credible band has clear implications for interest rate differentials and that the behavior of these differentials reveals information regarding market perception of the band´s sustainability. A problem with this test is the inability to directly assess the degree to which there are realignment expectations, as opposed to within band expectations. Expected realignment is defined as the difference between within band

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[4]See, among others, Lindberg and Söderlind (1994) for the case of Sweden.

GRAPH 6

Marginal Distribution of Deviations From Central Parity:
Daily Data 1992-1996

GRAPH 7A

Frequency Distribution Band I:
Daily data Nov. 1991- Jan 1994

GRAPH 7B

Marginal Distribution Band 2:
Daily Data January-December 12 1994

GRAPH 7C

Marginal Distribution Band 3:
December 13 94 - December 16 1994
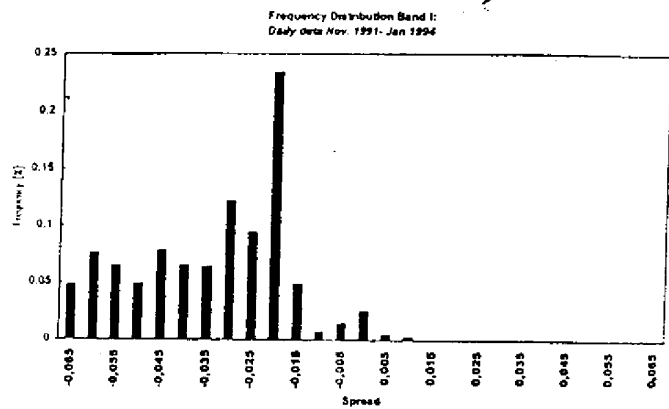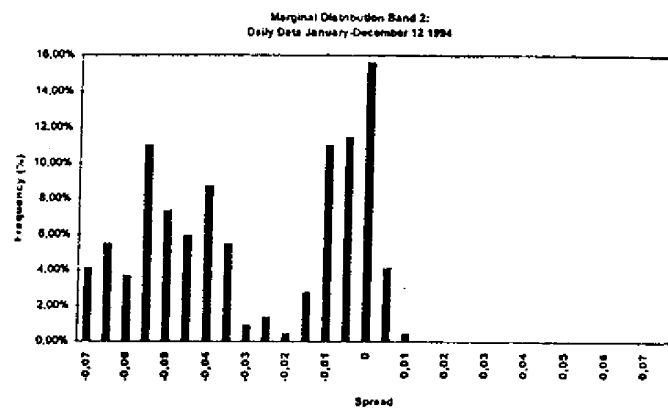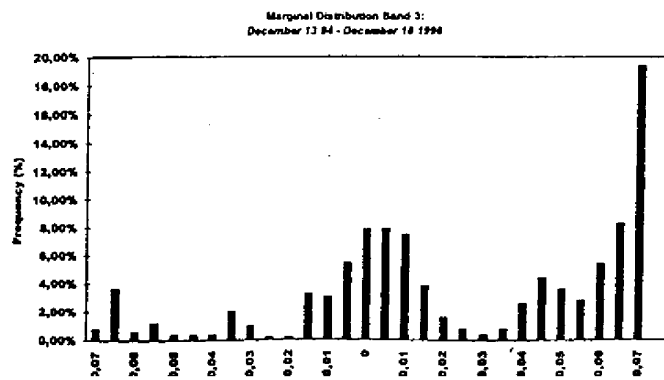
GRAPH 8

Exchange Rate Spread and Interest Rate

Corr. Coeff. = 0.37

—— Exch. rate spread ----- Interest rate

depreciation (drift) and the realignment expectation is defined as the difference between the prediction from estimated drift and observed interest rates (Bertola and Svensson, 1993). More recent tests are based not on interest rate differentials, but rather on arbitrage conditions governing alternative financial assets[5].
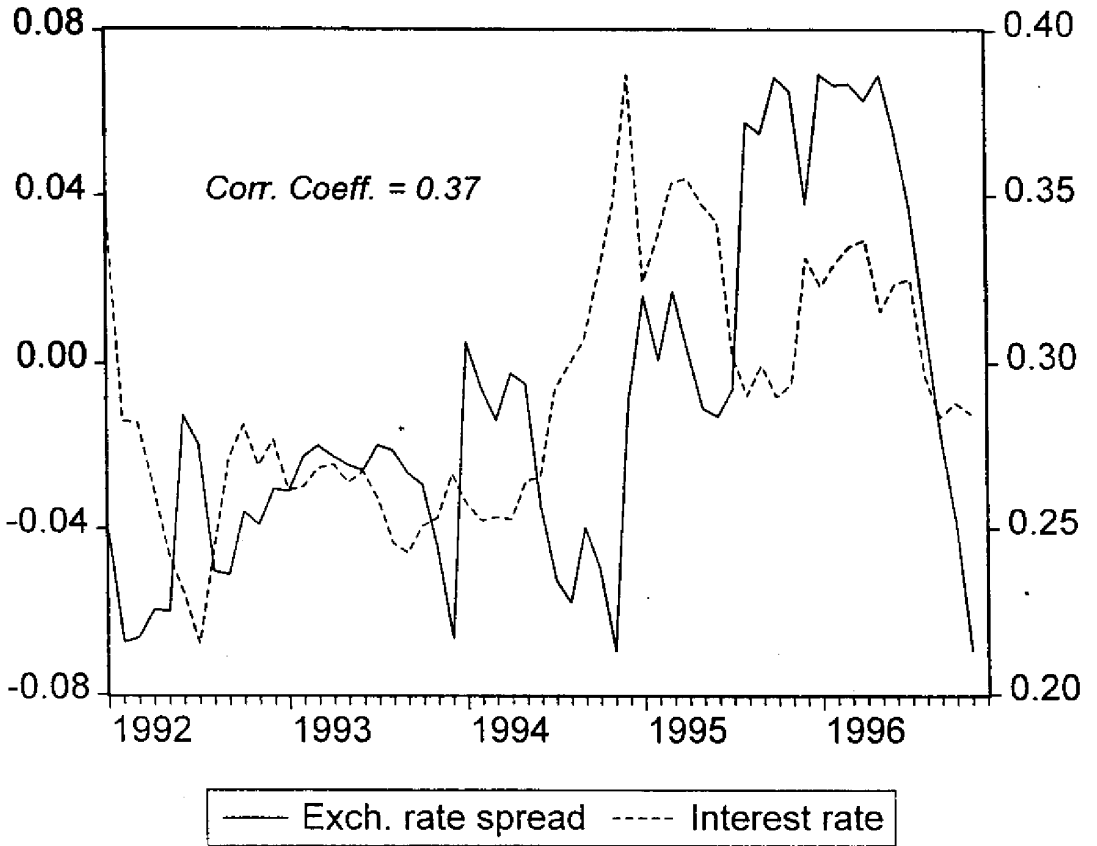
Our sample includes two realignments, in January and in December, 1994, and it is worthwhile examining them. The issue of realignment predictability has been the subject to considerable research since the episodes of 1992 and 1993 in Europe and 1994 in Mexico. Though the thrust of this research is certain frustration with the ability of macroeconomic data to adequately predict the occurrence of a realignment, many authors have argued that the relative position of the current exchange rate with respect to the edge of the band largely defines the probability of realignment.

Mizrach (1993) studies the case of FF/DM and IL/DM exchange rates and uses the relative position of the exchange rate and the yield curve to estimate realignment probabilities using daily data. He finds that, up to a month before the realignment, probabilities are at usual levels and concludes that market participants were taken by surprise.

Werner (1995) studies the case of 6 European countries using daily data for 1979-1990 and examining the hypothesis that the relative position of the exchange rate, with respect to central parity, plays a role in defining realignment. His conclusion is that "to some extent" (pg.366), data seem to be consistent with the model.

Bekaert and Gray (1996) estimate these probabilities in the case of FF/DM for the period 1979-92 using 4 variables; the relative level of reserves, measured as the deviation of current to the moving average of the stock, the position within the band, interest rate differentials and the cumulative price level differentials and report success in predicting realignment.

We examined the two realignment episodes with the intent of assessing the relative power of macroeconomic variables. Table 2 presents some descriptive statistics on the issue. we examined central bank purchases of foreign assets, the lagged location of the exchange rate within the band and some monetary variables.

Table 2 - Descriptive Statistics

Variable	Realignment	No Realignment
Lagged Distance to Margin	0.03%	6.1%
Reserve Accumulation	196.5	45.5
Lagged Reserves Deviation	49.6	1.25
Lagged Interest rate	30.7%	28.8%
Lagged Inflation	22.4	22.6
Lagged M1 Growth	30.3%	26.6%

Firstly, there is a clear difference in the three usual suspects: the position within

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[5]Campa and Chang (1996), for example, examine three exchange rates target zones (Lira, Pound, FFranc with respect to DM) for the turbulent 1991-94 period and assess credibility based on cross-rate option prices. Lack of credibility for the Lira is found one year before the crash, and for the Pound, a few weeks.

the band inmediately before realignment and reserve accumulation. We take two indicators of the latter variable; the first is contemporary purchases by the central bank and the second is a lagged deviation from a Hodrick Prescott filtered series.

Second, there is no significant difference in the other macro variables we examine.

4. Summary

In this section we have presented some salient features of the band. The basic point to emphasize is the extent to which appreciation has permeated exchange rate developments in Colombia.

Experience does not match the basic predictions of the target zone literature. Marginal frequency distributions exhibit very different shapes from those expected, and this does not depend on the period of analysis. Interest rate differentials, with respect to within band exchange rates do not conform to predictions.

Finally, on the issue of realignments we find some important differences in two basic variables: reserve accumualtion and position within the band. This matches the results obtained elsewhere. It is important to note that using a simple linear model which incorporates these variables, the latter part of 1996 is associated with realignment expectations.

The failure of the basic theoretical models to match facts has been attributed to several causes; intramarginal interventions, for example, have been singled out as responsible for mean reversion and lack of credibility as responsible for interest rate anomalies.

In Colombia the fundamental reason seems to be the persistence of real appreciation. Marginal frequency distributions are tilted to the strong part of the nominal exchange rate band and interest rates have exhibited a positive association with the deviation of the exchange rate with respect to central parity.

# IV. The 1995-96 Political Shock

A. Description

Having established the fact that in a medium term context the fundamental force driving the Colombian economy has been an appreciation of the real exchange rate, we now turn to the nominal depreciation of 1995 which can be seen in Graph 9, which is simply a close up of Graph 2, above. Graph 9 presents end of month data for the period 94[12]-96[12].

Clearly, the sample can be divided into three distinct subperiods; an initial phase of exchange rate stability at around the central parity (until July, 1995), followed by a sharp devaluation (August-October, 1995) and a period of stress at the weak part of the band (November, 1995- May, 1996). During the last part of the sample (June-

GRAPH 9

Spread: Dec.94-Dec.9696
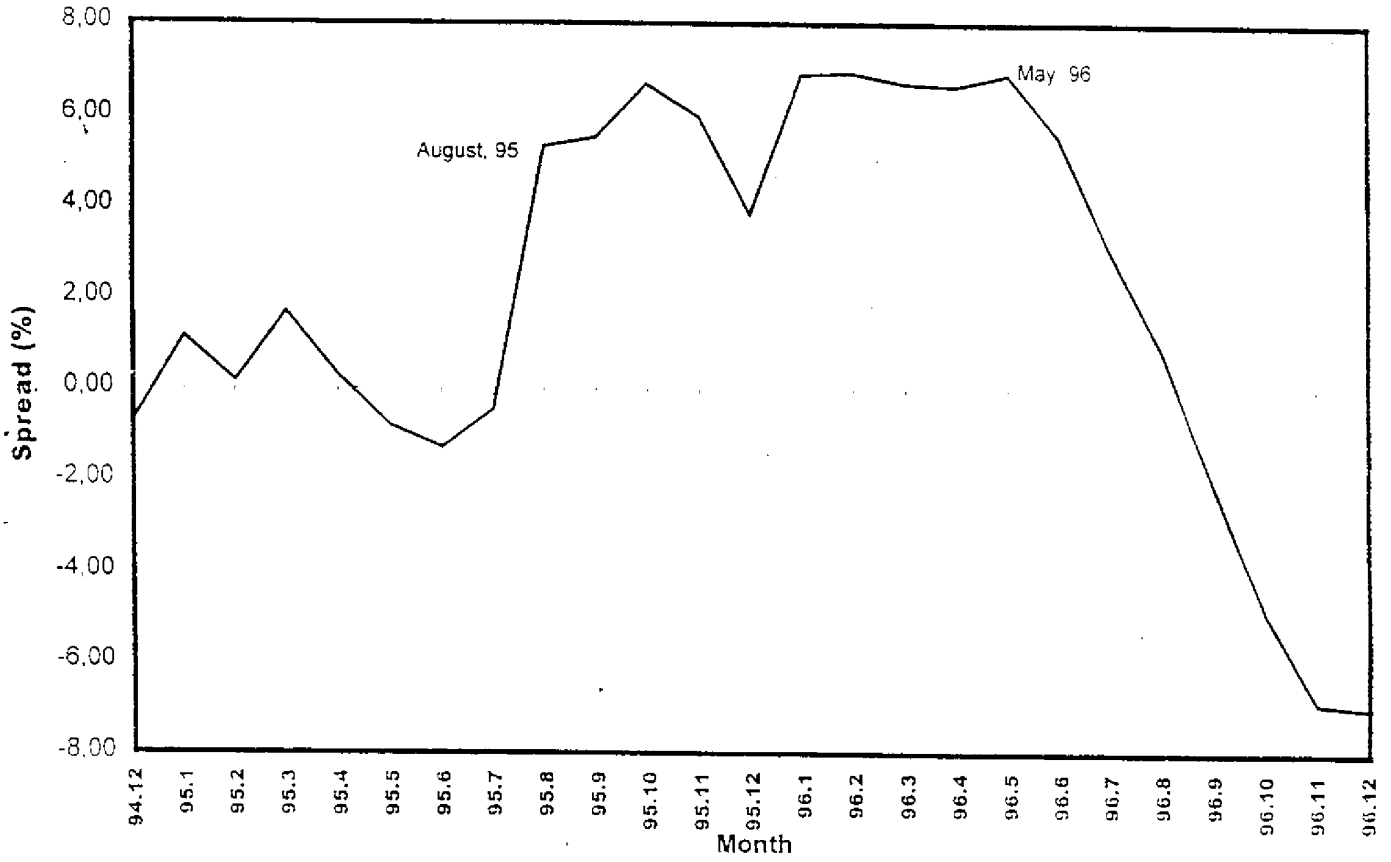
December, 1996) there is a revaluation which implies renewed stress, this time, as was the case before 1995, at the strong part of the band.

The dynamics of the nominal exchange rate are very clearly associated with the political turmoil which began when a former campaign administrator to the President declared that illegal funds were received in the course of the election process. The nominal exchange rate quickly jumped to the ceiling of the band. The timid revaluation which occured in the final two months of 1995 was reversed when another campaign official made further declarations in the same sense in January, 1996. Turmoil continued during the first quarter when several additional and related episodes occured; decertification by the U.S government, on the issue of the nation´s efforts on drug policy in 1995, a decision which occured in March, being most prominent. Two months later, the nominal exchange rate reversed its course and, by the end of the third quarter, it was well below the middle of the band. During the last quarter, the fundamental medium term process of appreciation once again came to the forefront of the public debate.

The argument of this section is that the rules governing the exchange rate band was an essential part of the relatively smooth macroeconomic adjustment which followed the political shock. Firstly, when the shock occured, the economy was in the midst of a process of adjustment to the type of "overborrowing syndrome" we discussed above. In this context, the issue of credibility regarding the adjustment itself became crucial and the political shock was adverse. Second, public debate became very politicized and a broad based coalition was formed arguing in favor of devaluation beyond the edge of the band, despite the empirical evidence showing strong appreciation forces. The existence of a rule made it easier to resist this political pressure. As Williamson(1996) recently noted "the band functioned as it should" and this was very important in reestablishing confidence in the adjustment process.

B.   A simple model

In this section I seek to study the issue regarding the choice of exchange rate regime when appreciation is the dominant medium term force and a political shock occurs. There are two central concepts; the first is a time horizon H over which agents make decisions, and in which debt can be accumulated up to a certain point. the second central concept is a *debt ceiling* $\overline{D}$ which measures the end of horizon maximum feasible stock of debt available to the economy.

The sequence of observed debt levels consistent with the constraint begins at time zero and ends at time H and can be formalized as:

$$D(t) = \left[\overline{D} - D_0\right] \left(\frac{2}{\pi}\right) \arctan(t) + D_0 \qquad (27)$$

Plot 1 presents an illustration; the initial stock of debt is 100 units and there are two alternative ceilings, one at 500 units and the other at 250 units.

Plot 1: *Debt Dynamics with differing ceilings*
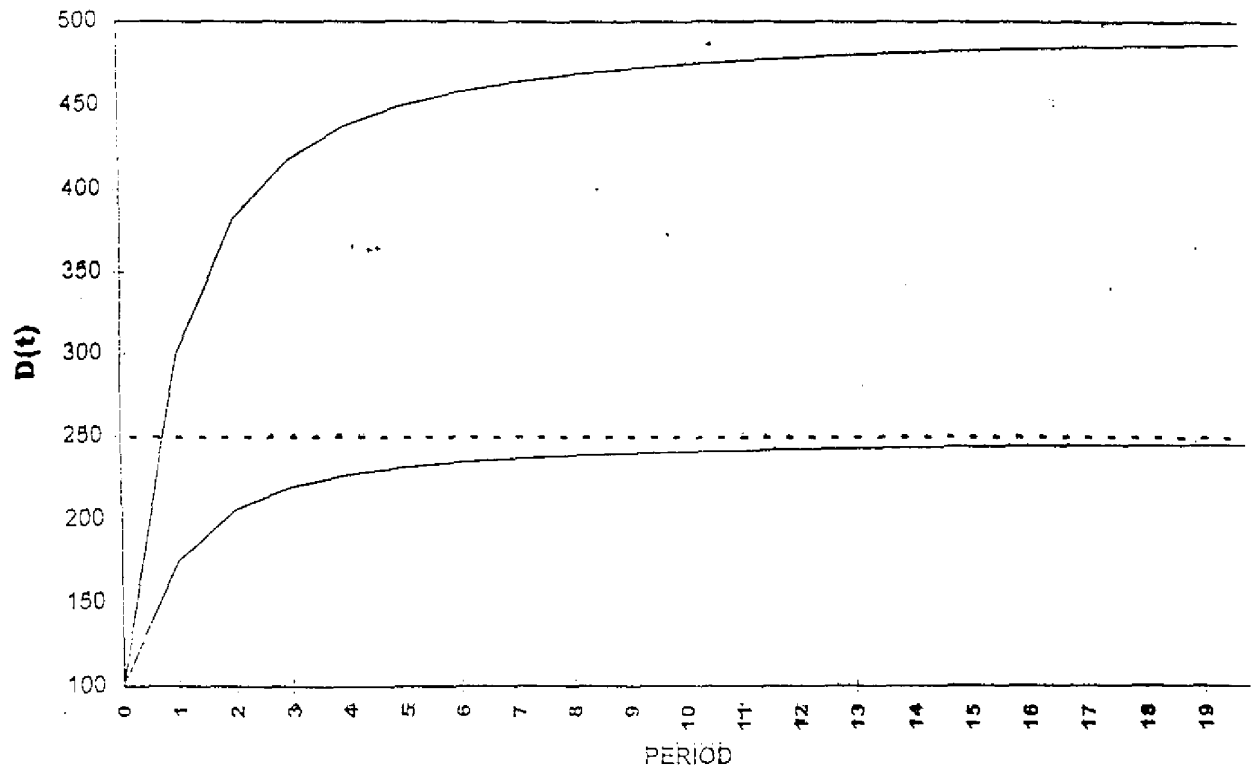
Begin with an agent who receives a wealth endowment at time zero. The agent's problem is to distribute this endowment, at each moment of time, among two assets, domestic and foreign.

A medium term appreciation process is observed (i.e one that aplies for the relevant time horizon), so that, all else equal, there is a premium to holding domestic assets. Formally, let $\tilde{\alpha}$ represent a sequence measuring the domestic asset component of the endowment for each moment in the time horizon, and let $R(\tilde{\alpha})$ be the total return, over the relevant horizon, on the chosen portfolio, where $R'(\tilde{\alpha}) > 0$.

Now let there be a government setting economic policy. The cost of implementing policy is covered by two sources, debt and a devaluation tax δ levied on holdings of domestic assets. The present value cost of the policy sequence is $PV(\tilde{p}) = Q$ with $\tilde{p}$ the sequence of per period costs associated the policy sequence.

The budget constraint, for the relevant non infinite horizon, is given by:

$$Q = [\overline{D} - D_0] + \tilde{\delta}'\tilde{\alpha} \tag{28}$$

where $\overline{D}$ is debt ceiling. Vectors $\tilde{\delta}$ and $\tilde{\alpha}$ correspond to the devaluation and domestic asset holding sequences and have dimension H, where H is the time horizon.

The government budget constraint implies that the agent's utility over the relevant horizon can be written, in present value, as:

$$U(\tilde{\alpha}) = R(\tilde{\alpha}) - \tilde{\delta}'\tilde{\alpha} \tag{29}$$

The problem is that 28 , strictly speaking, is an ex post relation and the agent must make plans ex ante. Therefore, the agent takes as information an estimate of the policy path Q, and of the debt ceiling $\overline{D}$ and forms an expectation regarding what the financing structure will be. Let this expectation be given by a vector $\tilde{\delta}^E$. It is clear that expected devaluation taxes are given by:

$$(\tilde{\delta}^E)'\tilde{\alpha} = Q^E - [\overline{D}^E - D_0] \tag{30}$$

Now we introduce a political shock. We take the view that a political shock affects agent's expectation regarding the debt ceiling. At the moment which the shock occurs, the agent reduces his/her previous estimate of the ceiling and, thus, expected devaluation increases. There occurs a downward jump in the perceived feasible debt sequence.

The first order condition in [29], maximized over α, implies that the agent holds domestic assets to the point where the premium obtained at the margin equals the expected devaluation tax, also at the margin. The political shock increases expected taxes. Hence, the initial portfolio is suboptimal and the agent will, all else equal, shift away from domestic assets. As holdings of domestic assets largely determine the debt ceiling and, in turn, holdings of domestic assetes depend on the perceived debt ceiling, the dynamics of the situation can easiliy generate a self fulfilling prophecy.

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C. The Colombian case

1. Three Stylized facts

In the Colombian context there was a clear rise in devaluation expectations which dominated nominal exchange rate dynamics from August, 1995 to May, 1996. In the terms of the model, there occured a fall in perceived debt ceiling. The argument of this section is that this fall was small and very quickly reversed.

First, let us look at foreign exchange reserves (Graph 10). In July, 1995, before the onset of the crisis, the stock stood at US$8.8 billon. It fell by 5.2% in August and remained there until December. A further drop of 4.9% (with respect to the initial stock) occured between December and the end of the first quarter of 1996, where it remained until November. The total fall in reserves during the crisis is about 10%, a figure which stands in contrast with, for example, the fall observed in Mexico between March, 1994 (when a political shock hit the nation) and April-November of the same year: around 37.5%.

Second, market interest rates remained very stable until December, when a 4 point (11%) increase occured (Graph 11). Two things clearly stand out. First, the fact that if one accepts some sort of interest rate parity, the *expectation* of devaluation must not have risen by as much as the *observed* exchange rate devaluation itself. Second, it is very surprising and remains to be explained that the modest interest rate hike occured well after the nominal devaluation had occured.

Third, markets for Colombian dollar denominated debt must incorporate default risk. If we examine the spreads with respect to US treasury bonds of same maturity, for a particular Colombian issue, we should be able, under certain assumptions, to identify movements in these expectations. A very crude approximation is the movement of the spread itself (Graph 12). Clearly, there is a rise in the spread at the outset of the political shock; spreads rose by around 25% in August. However, the spread tightened starting in November, 1995 and returned to pre shock levels in the first quarter of 1996.

In summary, the indicators we have used point to the following general conclusion: the macroeconomic effect of the political crisis was quite unsubstantial and was reversed quickly.

2. Interpretation: The role of the exchange rate band

The stylized facts are consistent with the idea that what we call the estimated debt ceiling did not fall substantially during the political crisis. If anything, expected devaluation seems to have increased by less than the observed devaluation within the band. The argument in this section is that real appreciation remained the fundamental medium term process and that agents understand this quite well. Second, the exchange rate band was important in resolving a political economy dilemma which surfaced with the shock.
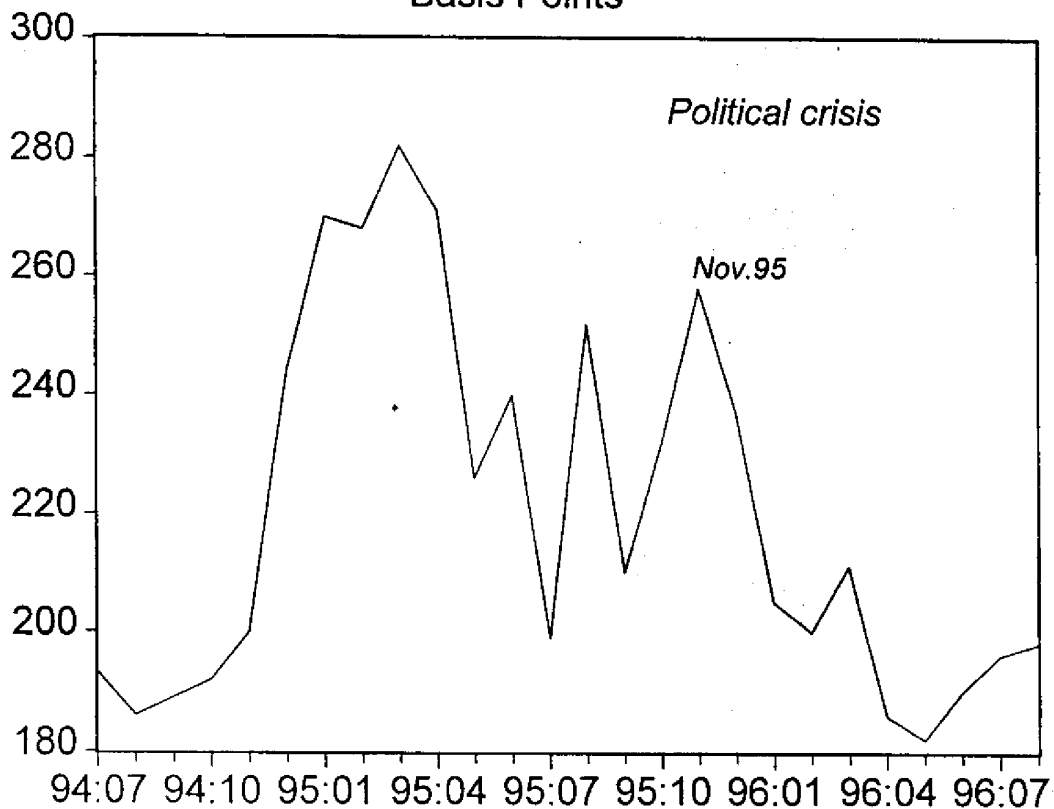
Distance to top edge of the band
and Stock of reserves:
July, 1995 - June, 1996
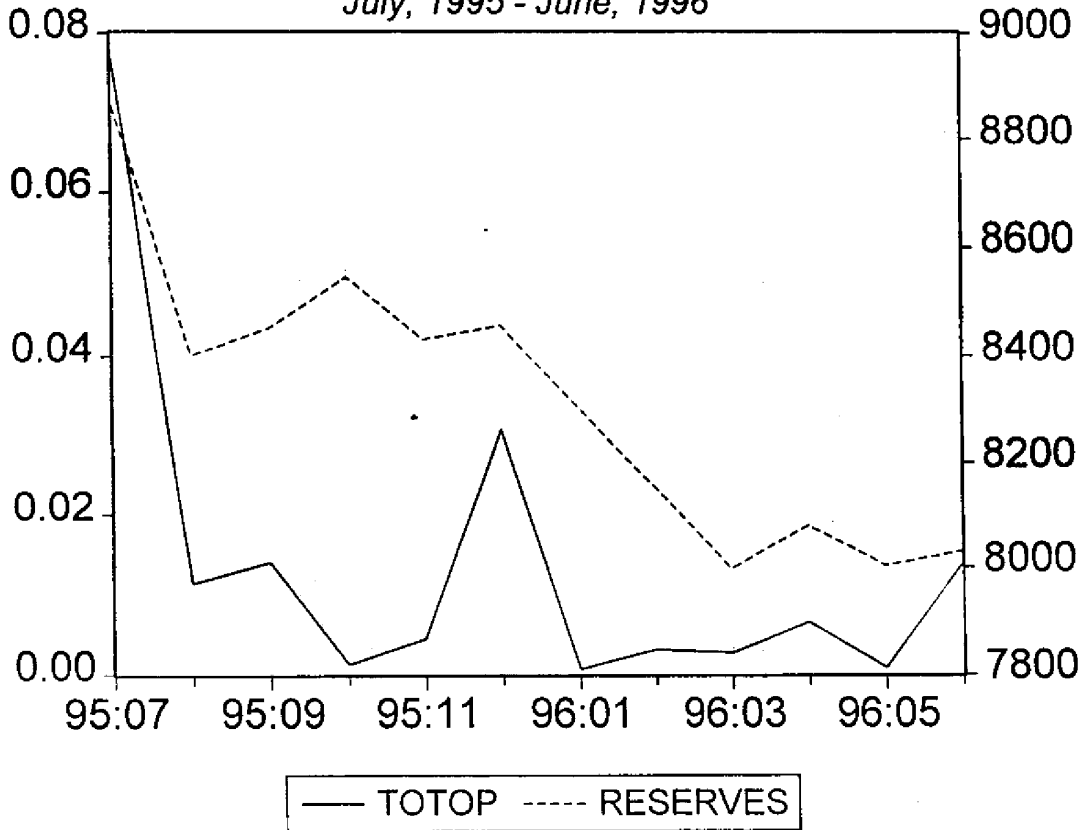
Distance to top edge of the band
and 90 day deposit interest rate
July 95 - June 96
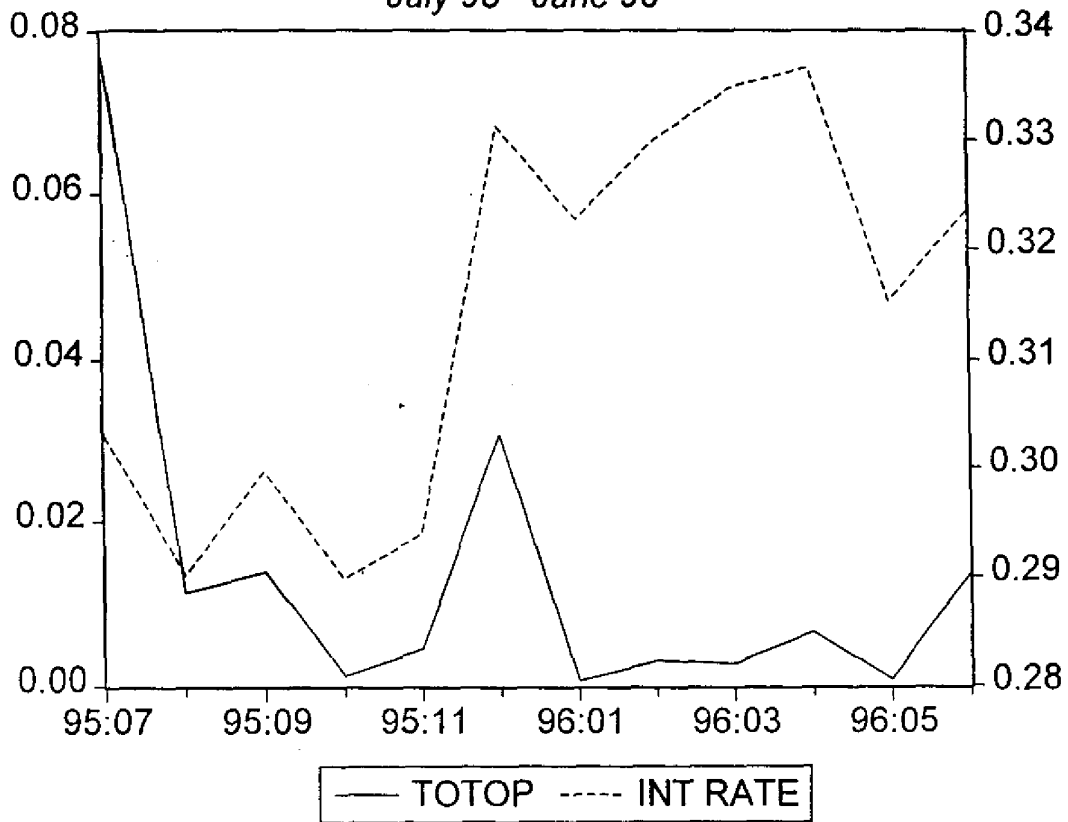
Spread: Colombian debt issue/Same maturity US Treasury Basis Points

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First, the medium term outlook. The persistence of appreciation forces in the economy implies a medium term premium on the before tax expected returns on domestic assets. The real fall in asset prices associated with the interest rate hike might even have partially offset the increase in expected devaluation taxes.

Second, the political economy. Substantial pressure was created in favor of devaluation at the outset of the crisis and analysts were quick to hint that devaluation was going to be the basic feature for the following year. After the devaluation of August, 95, then Minister of Finance Perry argued that: *"(..) we have left behind us the phantom of the appreciation process"*[6]. One of the most important and influential business publications in the country ran a cover story in which it argued in the sense that: *"After three years of peso revaluation (..) a shift of trend occured in 1995 accelerated by the political crisis. This shift of trend will last during 1996 and, possibly, the first semester of 1997"*[7]. The President of the financial sector professional association, himself a highly influential opinion maker, remarked in December, 1995, that: *"ANIF believes that there is a high probability that the (current) exchange rate band will be modified in the near future and does not disregard the possibility that it will be abandoned completely"*[8]. This type of analysis was still present as of August, 1996. The same prominent business publication we quoted before, ran another cover story in which it argues that: *"(...) everything seems to indicate that towards the middle of 1997 the board of the central bank would be forced to modify the band and allow a more rapid rate of devaluation than at present"*[9].

The basic conclusion is that, from perhaps different points of departure, a wide based argument in the sense that the devaluation of August, 1995, implied the need to allow further depreciation of the currency. Had the exchange rate been managed, it would have been much more difficult to dismiss these arguments. The existence of the band allowed the political shock to play itself out against the fundamental real forces and, as discussed above, several types of indicators allows one to conclude, ex post facto, that the macroeconomic effects of the crisis were much overstated in public discourse with respect to what economic data shows.

V. Conclusions

- The 1990's have, by historical standards, been a turbulent time in Colombia. The fundamental macroeconomic process has been a real exchange rate appreciation with close ties to microeconomic and macroeconomic factors.

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[6]Guillermo Perry in *Estrategia Económica y Financiera*, No. 227; December 31, 1995.

[7]*Dinero*, No. 31, December, 1995-January, 1996. Page 34-35.

[8]*Guia Empresarial ANIF*, October - December, 1995, pg. 50. Surprisingly, in the next paragraph we read: *"However, it would be a grave mistake to identify the modification of the band or its abandonment with the perspective of greater devaluation"*. Seemingly, the idea was that the band would abandoned, despite the absence of any exchange rate pressure in the market.

[9]*Dinero*, No. 38, August, 1996, pg. 28.

- The exchange rate band which has operated during the period under analysis has been affected by this fundamental force. An initial appreciation and two realignments of the band are evidence of this.

- Moreover, the functioning of the band itself has been affected to the point in which there is a departure with respect to the predictions of basic theoretical models.

- In the context of this medium term process a political shock occured. The argument of this paper is that the band was a useful device which gave monetary authorities room to allow the shock to play itself out with respect to fundamentals. This was important from a political economy point of view.

- The appreciation of the real exchange rate is a problem which must be dealt with at the fundamental level. It is a problem in itself as well a symptom of other problems, including fiscal rigidities, regulatory issues and private savings rates.

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Appendix

Table A.1 - Parametrization

Parameter	Period 0	Period 1	Period 2
A_t^T	0.5	0.5	0.5
A_t^N	0.5	0.5	0.5
B^T	4.7	4.7	4.7
B^N	3	3	3
γ	0.51	0.51	0.51
ρ	0.53	0.53	0.53
Y_t^P	0.4	0.4	0.4
P_t	1	1	1
g_t	1.1	1.1	1.1
α	0.65	0.65	0.65
r	0.06	0.06	0.06
ϕ	0.9433	0.9433	0.9433
δ	0.06	0.06	0.06