FLOATING EXCHANGE AND MONETARY STERILIZATION:
The Experience of Colombia

(Summary)

Our purpose is to analyze the drain of international reserves due to monetary excesses (the so-called "compensation effect"), in the context of increased flexibilization of the exchange rate system in Colombia over the 1990s. During this period the cost of foreign exchange arbitrage has changed considerably: while flotation has increased it, deregulation of the exchange controls has decreased it. We also explore the differential effect of monetary excess depending on their permanent or transitory nature.

Our econometric estimations, under different approaches (monetary, reaction function, portfolio and Keynesian), lead us to conclude that there exists a significant and relatively high (-0,78) "compensation effect", not different from minus one, even in the short-run and in spite of the exchange rate flexibilization. The permanent component of credit provides the main support for this "compensation effect" (except under the portfolio approach), which probably has diminished in about 0,20 with respect to the 1980s.

By: Sergio Clavijo and Carlos Varela */

August of 2003

<u>JEL Classification</u>: Monetary Policy (E52), Central Banking (E58), Exchange Rates (F31).

---

*/ Member of the Board of Directors of the Central bank of Colombia (Banco de la República) and Director of the Technical and Economic Information Division, respectively. These views are not necessarily shared by the Board of Directors. The authors thank J.M. Lima, F. Cepeda, and F. Gamboa, all staff-members, for able assistance with statistics and econometric issues. E-Mail: sclavive@banrep.gov.co and cvarelba@banrep.gov.co

I. Introduction.

During the 1980s, it was in vogue to analyze the portion of monetary excesses that ended-up diminishing the net international reserves (NIR). At that time, many Latin American countries operated under fixed exchange rate regimes, most likely under crawling-peg systems. The preferred exchange rate rule was to induce nominal depreciation of the local currency in the amount required to close the gap between the local and the external rate of inflation.

The target was to maintain the real exchange rate at a competitive level. However, this was hardly achieved, since central banks were not independent and were pressed to finance local private projects and fiscal deficits. Furthermore, a rent seeking attitude prevailed and led, in several occasions, to establish multiple exchange rate practices under complex arrangements.

In the case of Colombia, the preferred mechanism was the use of the central bank rediscount window in order to finance, at subsidized interest rates, all sorts of private projects, including the agricultural, energetic, and even urban sectors. The funding was provided by the imposition of quasi-fiscal obligations to the private banking system and the monetization of the exchange rate effect on the stock of the NIR (Hommes, 1988; Jaramillo y Montenegro, 1982).

These unorthodox monetary practices were abolished under the new Constitutional Mandate of 1991, in which a relatively independent Central Bank Charter was adopted (Hernandez, 1997; Urrutia, 1999; Clavijo, 2000; Kalmanovitz, 2001;). The central bank was provided with instrumental independence for managing financial, monetary, and foreign exchange policies. The allocation of managing the foreign exchange policy given to the central bank was one of the reasons provided for the inclusion of the Minister of Finance as one of the seven board members, without any veto power.

Money excess explain the persistent moderate-inflation of the period 1970-90, where CPI-inflation averaged 22%, and the important changes that occurred in asset portfolios (Johnson, 1972; Frenkel and Johnson, 1976; Krugman, 1979). However, in the case of Colombia the existence of exchange controls and a parallel market for foreign exchange was consistent with finding a rather low "compensation effect" in the short-term, when a crawling peg arrangement prevailed (Clavijo, 1986).

Under Law 9 of 1991, such exchange controls have been significantly relaxed and the premium of the official/parallel markets has narrowed in Colombia. Since the late 1990s, flotation regimes have been adopted in Brazil, Chile, Peru, and Colombia, among others. There seems to be a wide believe that, under flotation, "speculative attacks" practically disappear and, in consequence, one would expect to find low "compensation effects". The logic is that the cost of arbitrage tends to be large under clean flotation.

However, what happens when flotation is not that clean and exchange controls are removed? Intuition would tell us that under a managed-float, with known rules, the cost of arbitrage would diminish with respect to a clean-flotation system. Such cost would be further reduced if capital controls are relaxed or abolished. Hence, it is possible to experience significant "off-set coefficients" in the presence of monetary excess, even under a managed float system with high capital mobility.

The implications for monetary policy in emerging markets are important: central banks targeting inflation through repo-rate management, while floating exchange rates, can not loose track of monetary excess because these excesses affect the asset composition of the central bank, diminishing NIR while increasing net domestic assets (NDA). Furthermore, if sterilization policies are adopted by providing permanent liquidity to the money market, the "compensation effect" can be exacerbated. Keeping track of possible monetary excess has indeed become more complex as many emerging markets have adopted "financial transaction taxes". Such taxes lead to the creation of monetary innovations, rendering obsolete traditional money demand estimations (Arrau, et. al. 1995; Clavijo, 2002).

The recent capital flows literature tracks this problem by attempting to estimate directly the effect of local interest rates on the exchange rates. The traditional view focuses on the effect of the NDA or broad credit (M3 minus Monetary Base) over the NIR. Interestingly, exchange rate models have not performed any better than traditional models dealing with NDA and NIR, based on the monetary approach to the balanced of payments (MABP). (Montiel, 2003 p.8-10).

The purpose of this paper is to analyze the drain of international reserves due to monetary excesses (the so-called "compensation effect"), in the context of the increasing flexibilization of the exchange rate in Colombia over the 1990s and the adoption of a managed-float system since September 1999. Section two is devoted to a historical recount of the Latin American experience over the 1970-1980s regarding foreign exchange attacks and the size of the "offset coefficients" in the short and the long-run. Section three briefly explains the monetary history of Colombia, regarding asset composition and the partition between permanent and temporary liquidity. Section four discusses the models and the econometric estimations. The last section presents conclusions.

Our econometric estimations, under different approaches (monetary, reaction function, portfolio and Keynesian), lead us to conclude that there exists a significant and relatively high (-0,78) "compensation effect", not different from minus one, even in the short-run and in spite of the exchange rate flexibilization. The permanent component of credit provides the main support to this "compensation effect" (except under the portfolio approach), which probably has diminished in about 0,20 with respect to the 1980s.

II. Monetary Excess and the Offset Coefficient: Historical Recount

The hypothesis under the MABP was that there existed a full "compensation effect" between excess in money supply and the NIR, implicating an "offset coefficient" close to minus one, provided that there was high capital mobility and a system of fixed exchange rates. Empirical evidence for Latin America over the 1970-1980s provide ample support for this hypothesis, although such coefficient could differ from minus one in the short-run.

Table 1 summarizes the main results obtained for selected countries in Latin America. In the case of Venezuela, it was found that the "offset coefficient" was close to -0,82 over the period 1970-82. In the case of Mexico, such estimate was in the range -0,88 to -1,02, computed for the period 1951-74 (Kamas, 1985; 1986).

Table 1: Estimated "Offset Coefficients" in Selected Latin American Countries

(Net International Reserves Elasticities to "Monetary Excess")

Country / Authors / Period	Monetary Approach to the Balance of Payments (MABP)	Portfolio Approach	Keynesian Approach
Venezuela			
Kamas (1970-82)	-0,82	-0,79	-0,65 to -1,11
México			
Blejer (1950-73)	-0,46		
Gomez & Oliver (1956-73)	-0,61		
Wilford & Zecher (1955-74)	-1,02		
Kamas (1970-82)	+0,04	+0,04	+0,09
(1951-81)	-0,10		
(1951-70)	-0,88		
Brazil			
Blejer & Leiderman (1968-77)	-0,25 to -0,96		
Colombia			
Kamas (1970-80)		-0,90	-0,43 to -0,82
Kamas (1975-89), VAR Model		-0,51 to -1,62	
Clavijo (1974-84)		-0,03	
Clavijo (1957-85), VAR Model		-0,46 to -0,93	
Rennhack & Mondino (1975-84)		-0,39 to -0,70	

Source: Our conception based on Blejer & Leiderman (1981), Kamas (1985, 1986), Clavijo (1986, 1987) and Rennhack & Mondino (1989).

However, several studies underscored that the MABP was rather restrictive in assuming exogeneity of key variables (such as domestic real income and interest rates). Additionally, such approach assumed the existence of high capital factor mobility, especially of financial capital, which was at counter with capital controls used, for instance, in Chile and Colombia. In fact, it has been found that such capital controls have played an important role in deterring capital inflows in the short-run, although it is also true that their efficacy over the longer-term is much weaker (Banco de la República, 1987; Villar y Rincon, 2001; French-Davis y Villar, 2003).

Hence, after endogenaizing some of these variables and allowing for the effect of capital controls, it was found that the "offset coefficient" was lower in absolute terms. This meant that the drain of NIR due to money supply excess was lower than initially expected. For example, in the case of Venezuela the "offset coefficient" in the short-run could have been -0,65 (instead of the -0,79) over 1970-82. Nevertheless, when considering other transmission mechanisms that effect could worsen and reach -1,1 in the long-run (see Table 1). In the case of Mexico, large depreciations of the peso affected endogenously such macroeconomic relations and turned positive the "offset coefficient" (+0,04 a +0,09) during the period 1970-82. In the longer term, however, the forecast of the MABP prevailed, maintaining coefficients close to minus one.

The case of Colombia is of particular interest during the years 1967-91, when a rather strict exchange control system was in place. When allowing for the endogeneity of some variables and for the effect financial capital restrictions, it was found that the "offset coefficient" in the short-run was moderate (-0,43) over the years 1970-80, according to Kamas (1985).

Furthermore, when introducing the effect of the parallel exchange market, it was found that such effect was nil during the period 1974-84. A key factor that help explain these results in the case of Colombia has to do with the sterilization capacity developed at the Banco de la Republica, using dollar-denominated titles (Clavijo, 1986).

However, even in the case of Colombia the medium-term results differed substantially from the short-term results. For instance, Kamas (1985) estimated that, during the period 1970-80, the medium-term effect was in the range -0,82 to -0,90, depending on the alternative approaches provided by the portfolio and Keynesian models (see Table 1).

Modern approaches that allow for the dynamics of the series to play a role, under Vector Autoregressive Regressions (VAR), confirmed these significant differences between short and long-run estimates. For instance, in the case of Colombia Leiderman (1984), Clavijo (1987), and Kamas (1994) found, using different models, that during the 1970-1980s the short-run "offset coefficient" was in the range -0,46 to -0,51. However, in the medium-term it was not significantly different from minus one, even under the presence of capital controls.

Interestingly, this result was consistent with finding a rather low *pass-through*, estimated in the range 0,25 to 0,30 during the 1970s, whenever the monetary excesses tended to reduce the level of NIR (Edwards, 1985 p.1115). Put differently, part of the monetary excess was eliminated through the depletion of NIR, avoiding higher inflation, but affecting the composition of the asset portfolio of the central bank.

These values were confirmed when using simultaneous estimations, derived from structural models that allow for the monetary reaction function of the central bank to play a role. Indeed, Rennhack and Mondino (1989 p.41) estimated that the short-term "offset coefficient" for Colombia was in the range -0,39 to -0,46 during the period 1975-84. However, in the long-run such estimate converged to -0,70 (measured through the uncovered interest rate parity condition).

In short, all this debate shows a high sensitivity of the "offset coefficient" to models, periods of deep exchange controls (1966-1991), and peculiarities of some Latin American countries. We are left with the idea that in the short-run there was scope for avoiding full compensation of the monetary excess by depletion of the NIR. In this, exchange controls and imaginative ways to sterilize money effects did play a role. However, in the medium and long-run the tendency was to experience full compensation, at a time when fixing the exchange rates in Latin America was the norm.

In the next section we will inquire about how this conclusion could have been altered in the case of Colombia due to the flexibilization of the foreign exchange system. During the years 1991-1998 a system of crawling-bands was adopted in Colombia, which ended-up in the flotation of the peso at the beginning of September 1999. This flotation certainly works towards increasing the cost of the peso/dollar arbitrage, leading us to expect a lower "offset coefficient". However, at the same time Colombia decided to reduce the system of foreign exchange controls, beginning in 1991, acting in the opposite direction of decreasing the cost of the peso/dollar arbitrage. This effect alone would tend to increase the "offset coefficient". By recurring to several econometric estimates, we attempt to establish the net effect of these actions (exchange rate flexibilization and exchange controls reductions) in the relation between the net domestic assets and net international reserves.

III. Monetary Behavior in Colombia

Before presenting the models and the econometric estimates, let us briefly review the monetary evolution over the 1980-1990s. We will also highlight the changes in permanent and temporary liquidity, since it is expected that the permanent component is the one that gives support to the "offset effect" between net domestic assets (NDA) and the net international reserves (NIR).

A. Monetary Evolution in Colombia

Table 2 shows the evolution of the monetary base, M1, and M3 in Colombia over the period 1980-2002 (selected years). Note how the monetary base represented about 9% of GDP in 1980 and recently it has decreased to 6-7% of GDP, reflecting economies of scale in the use of more liquid money.

Table 2
Main Monetary Aggregates
Million of Pesos and Share in GDP

Years	Monetary Base		M1	
	Million of Pesos	% of GDP	Million of Pesos	% of GDP
Dic-80	179.407	9,6	220.144	11,8
Dic.85	429.273	7,3	640.443	10,9
Dic.90	1.493.454	6,2	2.122.489	8,8
Dic.95	6.267.087	7,4	7.717.836	9,1
Dic.00	10.710.351	6,2	16.720.782	9,6
Dic.02	14.107.395	7,0	21.635.642	10,7

Years	M3		Potential Credit (M3 - base)	
	Million of Pesos	% of GDP	Million of Pesos	% of GDP
Dic-80	484.800	25,9	305.393	16,3
Dic.85	1.749.962	29,7	1.320.689	22,4
Dic.90	6.482.994	27,0	4.989.540	20,8
Dic.95	32.034.417	37,9	25.767.330	30,5
Dic.00	62.761.360	36,1	52.051.008	30,0
Dic.02	74.199.587	36,7	60.092.193	29,7

Source: Our Computations based on Banco de la Republica

Something similar occurs with the ratio M1/GDP, which passed from 11% in the 1980s to 9% in 2000. This ratio is the inverse of the means of payments velocity, where its secular reductions is in line with the medium term increase in the market interest rates. However, in recent years such velocity has decreased due to the drastic reduction in interest rates and inflation, particularly during 2001-2002.

On the other hand, the ratio M3/GDP has increased significantly from 26-29% over 1980-1990 to 36-38% over 1995-2002. This trend denotes financial capital deepening, with slight correction after the 1998-99 crises. The financial savings, however, show only a moderate increase when compared to the South-East Asian or Chilean trends, where these ratios reach 60-70% in the late 1990s.

One way to assess the evolution of credit is by computing credit potential, as measured by the difference between M3 and money base. As reserve requirements decreased over-time, the monetary multiplier increased. In Colombia, the effective reserve requirement has been reduced from near 25% in the early 1980s to about 5% in recent years and potential credit (= M3 - Base) has jumped from 16% of GDP in 1980 to nearly 30% over the years 1995-2002. We will use this variable to measure the impact of credit upon international liquidity (NIR). In annex 1 we further explain how this variable can be decomposed between their permanent and temporary components in order to better judge their differential effect on NIR.

For the sake of brevity, we skip in this version the historical analysis on how the flow of sources and uses of the monetary base has been affected since instituting the independence of the central bank. It suffices to record here that Law 31 of 1992 ordered the central bank to stop the transfer of seigniorage to the government (as profits), caused by valuation of NIR at a more depreciated exchange rate. This peso-asset valuation effect is now compensated by an increase of the accounted capital in the same amount, avoiding the expansion of the monetary base. Hence, one would expect *ex-ante* a lower "offset coefficient" during the 1990s than in the 1980s as automatic credit expansion is now being controlled.

B. Permanent vs. Transitory Liquidity

Over the years 1980-92, the main source of permanent liquidity was the accumulation of NIR and the "promotional funds" (*fondos financieros*) used by the government to channel subsidized credit to especial sectors. By contrast, during the years 1993-2003, the main source has been the variations of the NIR and the (firm) repurchase of Treasury Notes (*TES-B*). Since 1998, treasuries are the only paper used to carry-out Open Market Operations (OMOs).

The transitory sources correspond to the repo operations based on *TES-B* and the "discount window" operations that provide short-term liquidity to the financial system. The latter operations (known as *apoyos*) are designed to counteract temporary shortfalls in demand and savings deposits that could trigger bank-runs (Banco de la Republica, 2003).

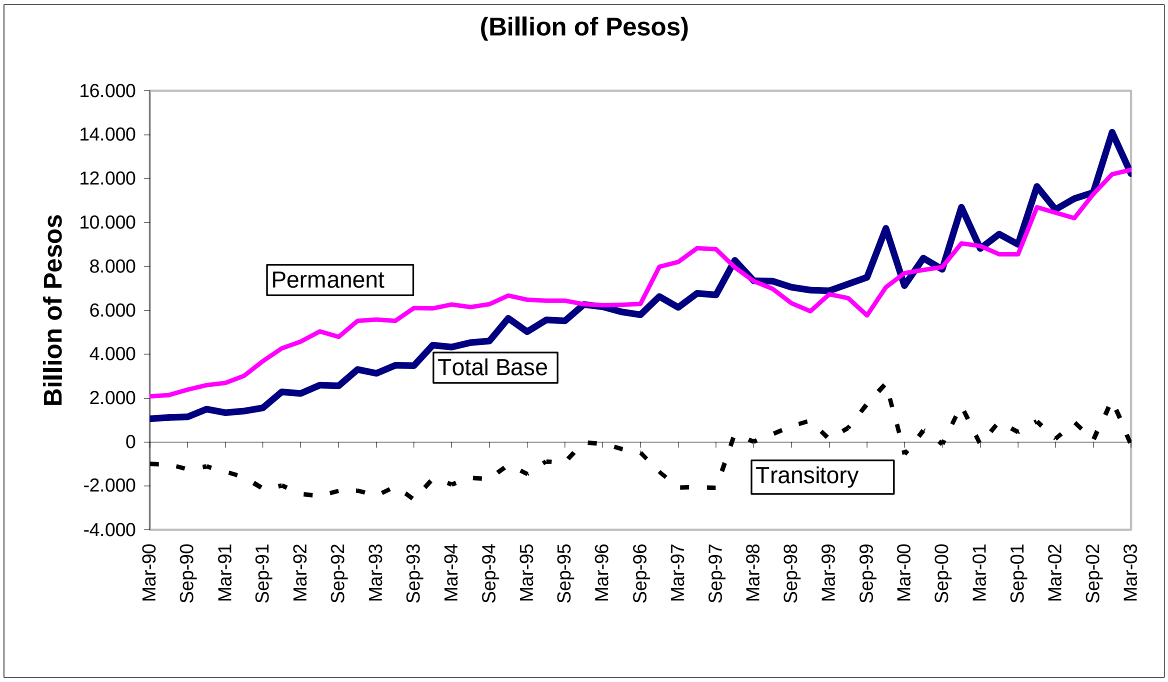
Graph 1 illustrates the decomposition between permanent and temporary sources of the monetary base. Note how the former dominates the evolution of the series. The temporary component, however, shows an interesting change, passing from a contractionary role during the fabrication of the "financial bubble" (1990-97) to an expansionary role during the financial crisis (1998-2001).

Graph 2 highlights the participation of the transitory component, which fluctuated between -90 and -140% of the money base. This short-term operations were designed to sterilize significant capital inflows during 1990-93, although at a high cuasi-fiscal cost. These figures are very large when compared to the -5% and +25% of the years 1998-2003, characterized as a more stable period.

C. ¿How to Measure NIR in Local Currency?

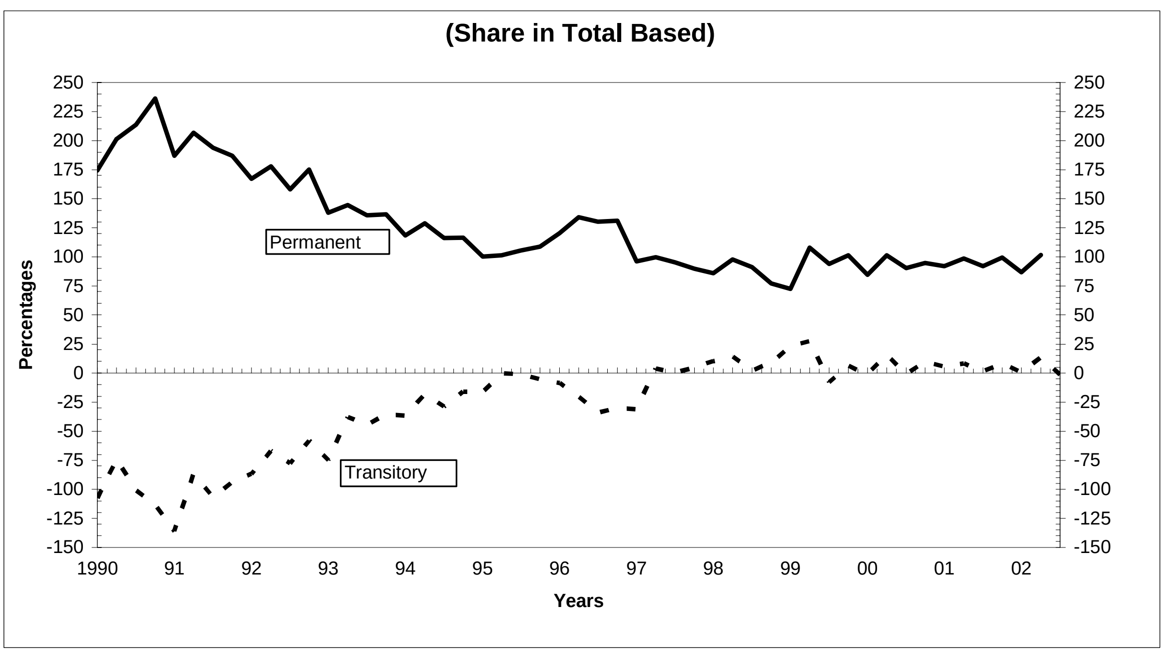
Once the permanent and temporary components of the monetary base have been identified, the next step consists of relating these components to changes in the NIR. This is a complex accounting issue, since credit variations are measured necessarily in local currency, but NIR are dollar denominated. If the latter is simply turn into local currency by multiplying the NIR in dollars by the current exchange rate, then an overestimation of the monetary effect of the NIR changes is likely to occur. The reason for this is that, in practice, the pure valuation effect is sterilized by the central bank by affecting in the same amount the capital valuation component (which does not represent an increase of the money base).

Graph 1
Monetary Base Descomposition: Permanent and Transitory Liquidity



Source: Our Computations based on Banco de la Republica

Graph 2
Monetary Base Decomposition: Permanent and Transitory Liquidity



Source: Our Computations based on Banco de la Republica

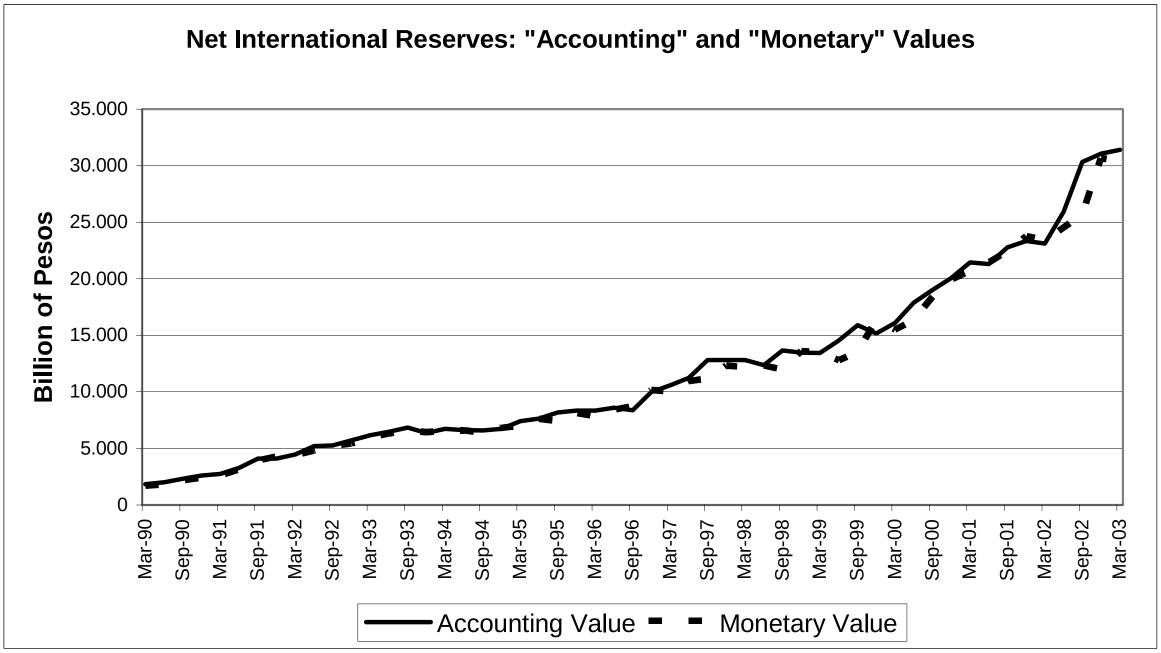
In the case of the Banco de la Republica, this seigniorage was handed-out to the government before Law 31 of 1992. Thereafter, the central bank has distinguished between the NIR-local currency component that appears in valuations, as a capital-item, and the NIR- monetary component, which actually causes monetary expansion due to the effective increases of the NIR in dollar-terms.

Let us call total NIR (including the valuation effect) the "accounting value" of NIR. By subtracting this valuation effect from total NIR in local currency, one is left with the "monetary value" of the NIR. Graph 3 depicts the historical trend of the "accounting value" of the NIR and compares it to the "monetary value" of the NIR, where the difference between them is just the "valuation effect" = $NIR_{t-1} * (E_t - E_{t-1})$, given E = Local Currency per Dollar.

In graph 4 we relate the transitory component of the money base with the changes in the "monetary value" of the NIR (i.e. net of the "valuation effect"). In it the role played by the transitory component in sterilizing the monetary effect due to the NIR variations becomes clear

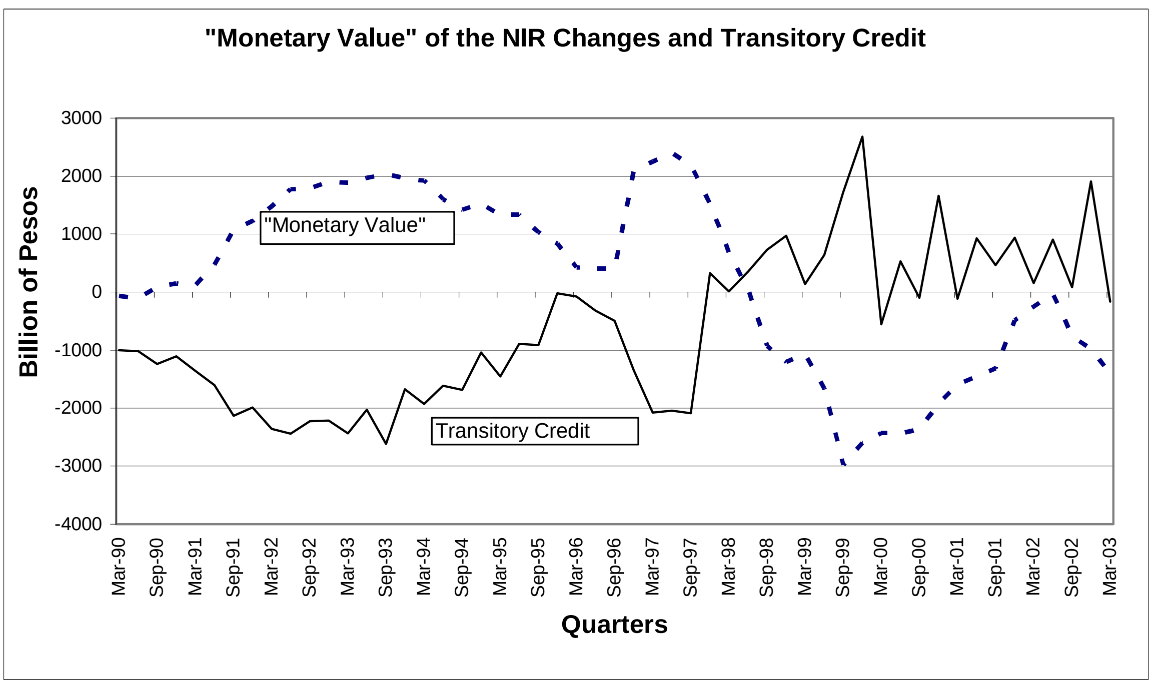
For instance, during the period of NIR accumulations (1990-97) the transitory component was negative, while in the period of NIR decumulations (1998-2000) it turned to positive. As mentioned before, this transitory component of the base corresponds mainly to repo operations.

Graph 3



Source: Our Computations based on Banco de la Republica

Graph 4



Source: Our Computations based on Banco de la Republica

In synthesis, monetary trends in Colombia point to the importance of assessing two interesting phenomena regarding the calculations of the “offset coefficient”:

1. One has to do with the importance of distinguishing between the potential impact of the permanent component of credit vis-à-vis the transitory component, where our hypothesis is that the former is the one that plays the main role in draining NIR, whereas the transitory component does not permit the financial system to take a net position to affect the asset composition of the central bank (NDA vs. NIR);
2. The second issue, which might be a novelty regarding capital flows in LDCs, is related to the fact that NIR in local money often relates to the “accounting value” of the NIR, which is different and often larger than the “monetary value” of the NIR. We expect the “offset coefficient” to be overestimated when computed on the “accounting value” of the NIR and to reveal the “true” value when computed on the “monetary value” of the NIR. Indeed, we shall demonstrate that in the case of Colombia the “offset coefficient” of -0,78 stemming from the “accounting value” (the official figure in local currency) is overstated in about 0,20 when compared to the one computed over the “monetary value” of the NIR.

IV. The “Offset Coefficient” under Floating Exchange Rate in Colombia

A. The Hypothesis

What has been the impact of monetary excess over NIR in Colombia during this period of increasing exchange rate flexibility over the 1990s? The MABP would tell us that under clean flotation such “offset coefficient” would have been either very low or non-existent, since flotation turns the peso/dollar arbitrage very risky and/or expensive (even if using forwards).

However, the relaxation of the exchange controls regime after Law 9 of 1991 has facilitated such arbitrage, although some forms of “Tobin Tax” were in place in the mid-1990s. Furthermore, if flotation is not clean and the central bank has known rules of foreign exchange intervention, we might be under a system of managed-float that in practice allows for this kind of arbitrage. Apparently, this is the situation that has experienced Colombia while turning from the crawling-bands in 1995-98 into the managed-float of the 1999-2003.

We hypothesize that, even under floating systems, the "offset coefficient" could take place in a significant manner under the following situation:

1. Monetary excess;
2. Low levels of exchange controls;
3. Exchange rate interventions, specially if acting according to well known "option" rules; and
4. A high grade of monetary sterilization that leads to the drain of NIR by increasing permanent liquidity, generating a vicious circle.

Regarding sterilization, we shall test the sensitivity of NIR depletion to the form that takes such sterilization, either through permanent or temporary liquidity. Previous studies have shown that permanent liquidity is prone to pressure NIR depletion, as in the 1980s in Germany (Von Hagen, 1989).

B. Models and Estimations

Capital flows literature provides at least four approaches to estimating the "offset coefficient". Their reduced forms and rationale can be summarized as follows.

1. *Monetarist Approach*, where there exists a strong link between monetary excess (D) and the current account of the balance of payments and/or the stock of net international reserves (R). The key assumption under equation [1] is the exogeneity of real income (Y_t), local prices (P_t), and of the local interest rate (i), the main components of the demand for money. The hypothesis is that under a fixed exchange rate (e), the elasticity of net international reserves will be close to minus one, meaning, $a_1 \approx -1$. It is also assumed that (uncovered) interest rate parity condition holds, so that $i_t = i_t^* + e_t$. The instrumental variable u_{1t} is intended to capture wealth effects and Δ denotes variations.

$$\Delta R_t = a_o + a_1 \Delta D_t + a_2 \Delta Y_t + a_3 \Delta P_t + a_4 \Delta i_t + u_{1t} \qquad [1]$$

This framework is also useful to test our hypothesis that the “offset coefficient” is mainly supported by the permanent component of credit excesses. This will be the case if we find empirically that, under $a_1 \approx (a_{Permanent} + a_{Transitory})$, it happens that $a_P > a_T$ (in absolute values).

Table 3 illustrates the results of our econometric estimations for Colombia over the period 1990-2003 (quarterly data) and annex 2 explains the dynamics of the series regarding order of integration and long-term convergence. The first two columns are related to the cases where the dependent variable NIR was measured as the “accounting value”, which includes the valuation effect caused by the depreciation of the local currency (as discussed in the previous section).

Note in the first column how the “offset coefficient” is significant and has a relatively high value of -0,75, implicating that the effect of credit over NIR is not very different from minus one, even in the short-run and under increased flexibilization of the exchange rate system. Furthermore, when considering the implicit dynamics of the model, the long-term value of the “offset coefficient” tends to converge to -1,5 (given that Rho ≈ 0.52). The other components of the money demand equation (income, prices, and interest rates) are also significant and their signs are as expected. The combined set of variables explains about 82% of the variation of the NIR.

The second column tested the hypothesis that the permanent component of credit plays a more important role than the transitory component of credit. Indeed, we found that it is the permanent component that provides support to the “offset coefficient”, given that $a_P = -0.73$, while the transitory component apparently plays no role, since $a_T = -0.002$ and is not significant. This interesting result for Colombian is in line, for example, with the findings of Von Hagen (1989) in the case of the German BundesBank during the 1980s. The rest of the regressors did not change much, although the income variable lost significance.

Table 3
MONETARIST APPROACH
(1991:1 - 2003:1, Quarterly Data)

(Dependent Variable = Annual Rate of Growth of Net International Reserves)

Independent Variables	Accounting Value (1)		(2)		Monetary Value (3)		(4)	
Constant	0,17 (2.94)	*	0,19 (2.12)	*	0,16 (1.63)	**	0,16 (1.32)	
Growth Rate of Total Credit (dD/D_{t-4})	-0,75 (5.79)	*			-0,55 (3.95)	*		
Growth Rate of Permanent Credit (dDP/DP_{t-4})			-0,73 (2.19)	*			-0,58 (1.80)	**
Growth Rate of Transitory Credit (dDT/DT_{t-4})			-0,002 (1.31)				-0,0006 (0.52)	
Growth Rate of Real-GDP (dY/Y_{t-4})	1,79 (1.67)	**	0,28 (0.19)		1,29 (1.12)		0,39 (0.30)	
Local Inflation (dP/P_{t-4})	3,01 (5.96)	*	2,93 (3.74)	*	1,51 (2.52)	*	1,59 (2.06)	*
Local Interest Rate (DTF)	-1,20 (3.46)	*	-1,17 (2.59)	*	-0,18 (0.53)		-0,20 (0.52)	
Fitting Values:								
R2-Bar	0,819		0,733		0,866		0,834	
Degrees of Freedom	43		42		43		42	
S.E.	0,080		0,099		0,071		0,080	
Rho	0,521	*	0,625	*	0,795	*	0,833	*
DW	1,754		1,741		1,869		1,517	
Q	0,004		0,027		0,070		0,007	

Note: (*) Significant at more than 5%; "t-Statistics" in parenthesis (absolute value)
(**) Significant at more than 10%; DW: Durbin-Watson; Q: Ljung-Box Statistics

Columns three and four report the estimations while measuring the NIR as the "monetary value", which leaves-out the valuation effect of the depreciation of the local currency, as explained before. Column three presents the case of total credit estimation, where the "offset coefficient" is now reduced to -0,55 from the -0,75 obtained under the "accounting value" of the NIR. Hence, we here confirm that the "offset coefficient" is likely to be overestimated, unless one controls the "devaluation effect" of the NIR accounting, which we feel has been somehow neglected.

The differential effect of the permanent (-0,58) and temporary (-0,00) components of the credit variable also holds under the "monetary value" of the NIR. Furthermore, the overestimation of the "offset coefficient" under the "accounting value" with respect to the "monetary value" also shows when the differential effect of the credit components are tested: -0,58 represents a lower absolute value than -0,73 (see column four).

These econometric results lead us to highlight two novel results regarding capital flows in LDCs:

A. We have found that the "compensation effect" leading to a depletion of NIR seems to have support mainly in the monetary excess that take the form of permanent liquidity (e.g. the one resulting from firm-acquisitions of treasuries from the central bank) than the ones that have only a transitory character (e.g. funds supporting overnight repo-operations). Our hypothesis of $a_P > a_T$ (in absolute values) found ample empirical support for the Colombian case, and;
B. By distinguishing the "accounting value" from the "monetary value" of the NIR, we were able to infer that the "offset coefficient" values might have been overestimated in many previous studies. This occurs because the former includes a pure "price effect", caused by valuating the dollar-NIR at a more depreciated exchange rate. This practice somehow disregards the fact that such valuation effect does not imply higher money emission, since in modern central banks this effect is sterilized by increasing the valuation item of the central bank capital component.

The amount of this overestimation for the case of Colombia is in the range 0,15 to 0,20 (≈ 0,75 – 0,55 ≈ 0,73 – 0,58).[1/]

2. *Monetary Reaction Function*. One way to overcome the difficulties that simultaneity represent for estimating the "true value" of the "offset coefficient" under the monetarist approach, previously analyzed, is to include a second equation dealing with the reaction function of the central bank, in terms of its "sterilization power". The main idea is to complement equation [1] with equation [2], where we postulate that the reaction of the central bank to the "offset coefficient" ($a_1 D_t$) is such that there exists also a "sterilization effect", given by $f_1 \Delta R_t$. We would expect then that $f_{1,2,3,4} < 0$, since the central bank would contract total credit whenever NIR increases (ΔR_t), there is an increase in the local/external price gap ($p - p^*$) or the local product gap ($Y - Y^*$). In the same fashion, we also expect that local interest rates (i) to react negatively with respect to credit behavior. As before, u_{4t} is intended to capture other residual effects.

$$\Delta D_t = f_o + f_1 \Delta R_t + f_2 (p - p^*)_{t-1} + f_3 (Y - Y^*)_{t-1} + f_4 i + u_{4t} \qquad [2]$$

Table 4 reports the simultaneous estimation of [1] and [2], where the dependent variables correspond to the "accounting value" of the NIR and the total credit (= M3 – Money Base + Transitory Credit, as discussed in annex 1). The first column shows that the "offset coefficient" is significant and not different from the value found under the non-simultaneous estimation (-0,78 vs. -0,75), while the elements of the demand for money exhibit the expected sign, although real income is now only significant at the margin.

[1/] We also intended to test this effect by directly computing the "offset coefficient" over the 1980s in Colombia, when (interestingly) the "price effect" was not being sterilized, but automatically passed to the government as profits stemming from the quasi-fiscal operations of the central bank. Our estimations (not shown here) revealed that the "offset coefficient" was significant and of the order of -0,84 during the years 1982-1989. This result further supports our idea that "offset coefficients" computed on the "accounting value" of the NIR, like in the 1980s in Colombia, tend to increase the compensation effect. Unfortunately, the differential effect of the permanent and temporary components of credit did not yield good econometric results due to accounting problems with such distinction during the 1980s.

Table 4
MONETARY REACTION FUNCTION
(1991:1-2003:1, Quarterly Data)

	Dependent Variables:			
	Rate of Growth of Net Internationl Reserves		Rate of Growth of Total Credit	
Independent Variables	Accounting Value		Reaction Function	
Constant	0,16 (2.60)	*	0,39 (2.04)	*
Growth Rate of Total Credit (dD/D_{t-4})	-0,78 (5.83)	*		
Growth Rate of Net International Reserves ($dRIN/RIN_{t-4}$)			-0,42 (4.53)	*
Growth Rate of Real-GDP (dY/Y_{t-4})	1.74 (1.62)	**		
Local Inflation (dP/P_{t-4})	3,18 (5.66)	*		
Local Interest Rate (DTF)	-1,22 (3.51)	*		
International Price Gap (p-p*)			-0,37 (0.46)	
Lagged International Price Gap $(p-p^*)_{(-1)}$			0,10 (0.13)	
Local Product Gap (Y-Y*)			0,98 (1.20)	
Lagged Local Product Gap $(Y-Y^*)_{(-1)}$			1,66 (2.02)	*
Fitting Values:				
R2-Bar	0,812		0,932	
Degrees of Freedom	43		42	
S.E.	0,081		0,064	
Rho	0,500	*	0,941	*
DW	1,695		1,706	
Q	0,004		0,422	

Note: (*) Significant at more than 5%; "t-Statistics" in parenthesis (absolute value)
(**) Significant at more than 10%; DW: Durbin-Watson; Q: Ljung-Box Statistics

The second column indicates that "monetary sterilization" of the NIR is significant and of the order of -0,42. This means that the Banco de la Republica has been able to accumulate NIR in a significant portion, while partially controlling the liquidity effect caused by such accumulation. The NIR variations seem to explain the core of credit variations, while price or product gaps seem to have played a minor role during the 1990s. One possible explanation for this result is that "inflation targeting" in Colombia was adopted formally in the late 1990s and that Taylor Rule-Types have been assessed only after floating the peso in September 1999, as explained in Clavijo (2002).

Recent literature relating "offset coefficients" and "monetary sterilization" show additional efforts to come-out with a "unified" framework" (Brissimis, et.al. 2002), but at a relatively high cost in terms of econometric identification and computations. We do not pursue this task here and feel relatively confident that our estimations might not be too far away from the "true estimates", judging by the slight variations we found in the simultaneous framework just commented.

3. *The Portfolio Approach* is characterized by including several assets: money, local bonds, and external bonds, where the (uncovered) interest rate parity plays a key role in affecting the capital account of the balance of payments (K). The NIR draining has K as a cushion with regards to the "compensation effect". This occurs either because of the existence of exchange controls or due to the fact that asset arbitrage faces high transactional costs, especially in LDCs (Kouri y Porter, 1974; Krugman, 1979). The expected exchange rate depreciation also plays a role (Δe_t) and tends to produce the well-known overshooting phenomenon in presence of sticky prices (Dornbusch, 1976; Rogoff 2002). Note that equation [1] is a particular case of equation [3], resulting from assuming that capital movements permit to finance balance of payments deficits (C), such that $\Delta R_t = C + K$. The parameter u_{2t} is expected to capture other effects.

$$K_t = b_o + b_1\Delta D_t + b_2C_t + b_3\Delta Y_t + b_4\Delta P_t + b_5\Delta i_t^* + b_6\Delta e_t + u_{2t} \quad [3]$$

Table 5 shows the econometric estimations under this approach for Colombia during the period 1990-2002 (quarterly data). To control for volatility of the capital and the current account of the balance of payments, we scaled "level variables" of equation [3] by GDP (including credit). In this case we observed that the "offset coefficient" was reduced significantly to just -0,26, leading us to conclude that it was mainly the current account the one that explained the capital account behavior (-0,99).

This means that the direct impact of the credit excess over the capital account is low, while the current account plays a key role in determining capital flows, with no mayor role being played by the NIR. The effect of the rest of the variables (including the rate of depreciation) is rather low. Close to 96% of the capital account behavior is explained by these variables, including a high first-order autoregressive component.

Something similar occurred when measuring the differential effect of the permanent and transitory credit components: it was the current account that determined the behavior of the capital account (-0,87). However, against our expectations, now it was the transitory component that passed to play a significant role in explaining the capital account (-0,49), while the permanent component was insignificant (see column two in table 5).

We do not have a good economic explanation for this outcome. One possibility is that the permanent component of credit does affect directly NIR (as supported by our previous estimations), but at the same time it is possible that only the transitory component is related to capital movements. In this case, the transmission mechanism of credit pressures directly over NIR and is quite different from the one operating (indirectly) over the capital account.

4. *The Keynesian Approach* includes the effect of the real exchange rate and the real public deficit over NIR. Equation [4] indicates that international reserves depend on its recent value (R_{t-1}), credit (D), the real fiscal deficit (G), and the level of the exchange rate (E), all scale variables that affect the trade balance. On the other hand, expectations regarding inflation and the rate of depreciation would affect the capital account, as well as the exogenous external variables (P*, Y*, i*), which help determine the final outcome of the balance of payments.

$$R_t = c_o + c_1 R_{t-1} + c_2 D_t + c_3 G_t + c_4 E_t + c_5 P_t^* + c_6 Y_t^* + c_7 i_t^* + c_8 p_t + c_9 e_t + u_{3t} \qquad [4]$$

Table 5
PORTFOLIO APPROACH
(1991:1-2002:4, Quarterly Data)

(Dependent = External Capital Account / GDP)

Independent Variables	(1)		(2)	
Constant	0,04	*	0,04	*
	(3.04)		(3.27)	
Total Credit Increase / GDP (dD/PIB)	-0,26	*		
	(2.50)			
Permanent Credit Increase / GDP (dDP/PIB)			0.02	
			(0.15)	
Transitory Credit Increase / GDP (dDT/PIB)			-0.49	*
			(4.48)	
External Current Account / GDP (C/PIB)	-0,99	*	-0,87	*
	(7.82)		(7.83)	
Growth Rate of Real-GDP (dY/Y_{t-4})	0,19		0,21	**
	(1.34)		(1.78)	
Inflation (dP/P_{t-4})	-0,04		-0,07	
	(0.59)		(1.44)	
Local Interest Rate (i*)	-0.23		-0.28	
	(0.94)		(1.43)	
Nominal Depreciation (dE/E_{t-4})	-0.05	*	-0.02	
	(2.16)		(1.37)	
Fitting Values:				
R2-Bar	0,957		0,968	
Degrees of Freedom	40		39	
S.E.	0,009		0,007	
Rho	0,79	*	0,73	*
DW	1,690		2,052	
Q	0,116		0,056	

Note: (*) Significant at more than 5%; "t-Statistics" in parenthesis (absolute value)
(**) Significant at more than 10%; DW: Durbin-Watson; Q: Ljung-Box Statistics

In table 6 we report the econometric estimations under this approach. The first two columns use as a dependent variable the “accounting value” of the NIR. The results resemble very much those obtained under the monetarist approach of equation [1], where the “offset coefficient” is highly significant and in the order of -0,55 in the short-run and as high as -1,22 in the long-term (after considering the NIR lagged value of 0,28).

Although nominal depreciation in this case was significant and positively correlated with the NIR, the fiscal deficit was not. When considering the differential effect of the credit components, we found that it is the permanent one that is relevant for NIR (-0,86), while the transitory component is not (see column two).

When using the “monetary value” of the NIR, we were able to ratify the “overestimation” of the “offset coefficient” brought about by the “price effect”. Again, this “overestimation” is around 0,20 (≈ 0,55 – 0,38), resulting from the comparisons between the estimate under the “accounting value” with respect to the “monetary value” of the NIR estimation (see third and fourth columns).

In short, the different approaches (except the portfolio) have permitted us to establish a negative and significant correlation between credit and NIR movements during the years 1990-2003, indicating the existence of a compensation effect between them. Additionally, we also found that monetary authorities were able to “sterilize” this NIR movements by moving in the opposite direction money aggregates.

During the years 1998-2000 and again during 2002-2003, there have been episodes of NIR depletion, supported mainly by the permanent component of aggregate credit. This indicates that the central bank should be on-guard of monetary excess, even in periods of increased exchange rate flotation. In theory, floating should reduce (or abolish) the “compensation effect”, but in practice the combination of exchange controls elimination with ruled-based exchange interventions (based in options) show that these effect, although lower than in the periods of fixed exchange rates of the 1980s, has not disappeared.

Table 6
KEYNESIAN APPROACH
(1990:1 - 2002:4, Quarterly Data)

(Dependent Variable = Rate of Annual Growth of the Net International Reserves)

Independent Variables	Accounting Value (1)		Accounting Value (2)		Monetary Value (3)		Monetary Value (4)	
Constant	0,06 (1.24)		0,04 (0.65)		-0,01 (0.33)		-0,03 (0.66)	
Growth Rate of Lagged Net International Reserves ($dRIN/RIN_{t-4}$)	0,28 (2.77)	*	0,42 (3.44)	*	0,52 (5.88)	*	0,63 (7.08)	*
Growth Rate of Total Credit (dD/D_{t-4})	-0,55 (6.31)	*			-0,38 (4.59)	*		
Growth Rate of Permanent Credit (dDP/DP_{t-4})			-0,86 (3.66)	*			-0,60 (3.16)	*
Growth Rate of Transitory Credit (dDT/DT_{t-4})			-0,002 (1.92)	**			-0,0007 (0.69)	
Growth Rate Real Fiscal Deficit (dG/G_{t-4})	0,0013 (1.35)		0,001 (1.60)		0,001 (1.31)		0,001 (1.62)	
Nominal Depreciation (dE/E_{t-4})	0,84 (4.11)	*	0,82 (3.32)	*	0,11 (0.73)		0,09 (0.55)	
External Inflation (dP^*/P^*_{t-4})	5,53 (3.15)	*	4,31 (2.04)	*	5,20 (3.41)	*	4,22 (2.49)	*
Growth Rate of Real External GDP (dY^*/Y^*_{t-4})	-1,2 (5.09)	*	-1,38 (4.18)	*	-0,27 (1.41)		-0,43 (1.78)	**
External Interest Rate (i^*)	-0,96 (0.94)		0,44 (0.37)		-1,06 (1.19)		0,17 (0.18)	
Local Inflation (dP/P_{t-4})	1,43 (4.80)	*	1,66 (3.10)	*	1,03 (3.61)	*	1,17 (2.69)	*
Fitting Values:								
R2-Bar	0,875		0,827		0,914		0,896	
Degrees of Freedom	38		37		38		37	
S.E.	0,069		0,083		0,059		0,066	
Rho	0,082		-0,115		-0,021		0,041	
DH	0,813		-1,492		-0,185		0,37	
Q	0,103		0,125		0,092		0,088	

Note: (*) Significant at more than 5%; "t-Statistics" in parenthesis (absolute value)
(**) Significant at more than 10%; DW: Durbin-Watson; Q: Ljung-Box Statistics

IV. Conclusions

In this paper we have analyzed the drain of international reserves due to monetary excesses (the so-called “compensation effect”), in the context of increased flexibilization of the exchange rate system in Colombia over the 1990s. During this period the cost of foreign exchange arbitrage has changed considerably: while flotation has increased it, deregulation of the exchange controls has decreased it. We also explore the differential effect of monetary excess depending on their permanent or transitory nature.

Our econometric estimations, under different approaches (monetary, reaction function, portfolio and Keynesian), lead us to conclude that there exists a significant and relatively high (-0,78) “compensation effect”, not different from minus one, even in the short-run and in spite of the exchange rate flexibilization. The permanent component of credit provides the main support to this “compensation effect” (except under the portfolio approach), which probably has diminished in about 0,20 with respect to the 1980s.

By distinguishing the “accounting value” from the “monetary value” of the NIR, we were able to infer that the “offset coefficient” might have been overestimated in many previous studies. This occurs because the former includes a pure “price effect”, caused by valuating the dollar-NIR at a more depreciated exchange rate. However, this accounting somehow disregarding the fact that such valuation effect does not imply higher money emission, since in modern central banks this effect is sterilized by increasing the valuation item of the central bank capital component.

The overall implications of our findings for monetary policy in emerging markets are important: central banks targeting inflation through repo-rate management, while floating exchange rates, can not loose track of monetary excess because these excesses affect the asset composition of the central bank, diminishing NIR while increasing net domestic assets (NDA). Furthermore, if sterilization policies are adopted by providing permanent liquidity to the money market, the “compensation effect” can be exacerbated.

It is not true, as some analysts have proposed, that floating exchange rate arrangements would render the "compensation effect" between NIR and NDA irrelevant. In the late 1990s, Brazil, Chile, Peru, and Colombia, among others, flexibilized the exchange rate systems, but their central banks are still obliged to continue to monitor the required consistency between local credit and the level of NIR, on the one hand, the local interest rates and the exchange rate depreciation, on the other.

References

Arrau, P. et. al. (1995) "The Demand for Money in Developing Countries" Journal of Development Economics (Vol. 46).

Banco de la República (1987) Colombia 20 años del régimen de Cambios y de Comercio Exterior (Colección Bibliográfica: Historia y teoría económica).

Banco de la República (2003) "Esterilización de la Intervención en el Mercado Cambiario" (Sub-Gerencia de Estudios económicos, Marzo).

Blejer, M.I. and L. Leiderman (1981) "A Monetary Approach to the Crawling-Peg System: Theory and Evidence" Journal of Political Economy (No. 89).

Brissimis, S.N., H.D. Gibson, and E. Tsakalotos (2002) "A Unifying Framework for Analysing Offsetting Capital Flows and Sterilization: Germany and The ERM" International Journal of Finance and Economics (No.7).

Carrasquilla, A. (1995) "Exchange Rate Bands and Shifts in the Stabilization Policy Regime: Issues Suggested by the Experience of Colombia" (IMF Working Paper No.42, April).

Clavijo, S. (1986) "International Reserves and Foreign Exchange Black-Market Under 'Crawling-Peg': Theoretical and Empirical Issues" National Bureau of Economic Research Working Paper No.8, Special-Series, Department of Economics, University of Illinois at Urbana-Champaign

Clavijo, S. (1987) "Macroeconometrics of a Small Open Economy Using Vector Autoregression Analysis" (Doctoral Dissertation, Chapter III, University of Illinois, Urbana-Champaign).

Clavijo, S. (2000) "Central Banking and Macroeconomic Coordination: The Case of Colombia" Quaterly Journal of Central Banking (November).

Clavijo, S. (2002) "Monetary and Exchange Rate Policies in Colombia: Progress and Challanges (1991-2002)" Ensayos Sobre Política económica (Summary, June; Also available in Internet at: http://www.banrep.gov.co/junta/publicaciones/Clavijo/polmonen0303.pdf).

Correa, P. (1987) "Comentarios a: Reservas Internacionales y el Mercado Paralelo de Divisas" Ensayos sobre Política Económica (Diciembre).

Dornbusch, R. (1976) "Expectations and Exchange Rate Dynamics" Journal of Political Economy (December).

Edwards, S. (1984) "Coffee, Money and Inflation in Colombia" World Development (Vol.12 No.11 and 12).

Ffrench-Davis, R. and L. Villar (2003) "The Capital Account and Real Macroeconomic Stabilization: Chile and Colombia" (Paper presented at ECLA, April).

Frenkel, J.A. and H.G. Johnson (1976) "The Monetary Approach to the Balance of Payments: Essential Concepts and Historical Origins" The Monetary Approach to the Balance of Payments (eds.) J. A. Frenkel and H. G. Johnson (University of Toronto Press).

Hernández, G. (1997) "El Banco de la República como Banco Central Independiente" en La Banca Central en América Latina E. Aguirre et. al. (Coordinadores), TM Editores y Banco de la República.

Hommes, R. (1988) "La Insoportable Oscuridad del Emisor" Estrategia Económica y Financiera (Septiembre, No. 125).

Jaramillo, J.C. y A. Montenegro (1982) "La Cuenta Especial de Cambios" Ensayos Sobre Política Económica (Septiembre).

Johnson, H. (1972) "The Monetary Approach to the Balance of Payments" in The Monetary Approach to the Balance of Payments (eds.) J. A. Frenkel and H. G. Johnson (University of Toronto Press, l976).

Kalmanovitz, S. (2001) "El Banco de la República como Institución Independiente" Borradores de Economía (Septiembre, No. 190).

Kamas, L. (1985) "External Disturbances and the Independence of Monetary Policy under the Crawling Peg in Colombia" Journal of International Economics (November).

Kamas, L. (1986) "The Balance of Payments Offset to Monetary Policy" Journal of Money, Credit, and Banking (November).

Kamas, L. (1994) "Inflación y Política Monetaria bajo un Régimen de Mini-devaluaciones: El caso Colombiano" Ensayos sobre Política económica (Junio).

Kouri, P. and M.G. Porter (1974) "International Capital Flows and Portfolio Equilibrium" Journal of Political Economy, 82.

Krugman, P. (1979) "A Model of Balance of Payments Crises" Journal of Money, Credit and Banking (No. 11).

Leiderman, L. (1984) "On the Monetary-Macro Dynamics of Colombia and Mexico" Journal of Development Economics (No.14).

Montiel, P.J. (2003) "Tight Money in a Post-Crisis Defense of the Exchange Rate: What Have We Learned?" The World Bank Research Observer (Spring).

Rennhack, R. y G. Mondino (1989) "Movilidad de Capitales y Política Monetaria en Colombia" Ensayos sobre Política Económica (Junio).

Rogoff, K. (2002) "Dornbusch's Overshooting Model After Twenty-Five Years" IMF-Staff Papers (Special Issue, Vol. 49).

Urrutia, M. (1999) "La Autonomía del Banco de la República y el Reciente Fallo de la Corte Constitucional" Revista del Banco de la República (Agosto).

Villar, L. y H. Rincón (2001) "Flujos de Capital y Regímenes Cambiarios en la década de los Años Noventa" Ensayos Sobre Política Económica (Junio).

Von Hagen, J. (1989) "Monetary Targeting with Exchange Rate Constraints: The Bundesbank in the 1980s" Economic Review (Federal Reserve Bank of Sto. Louis, September-October).

Annex 1: Measuring Credit and their Permanent and Transitory Components

A key variable to assess the “compensation effect” (i.e. the negative relation between net international reserves, NIR, and net domestic assets, NDA) is aggregate domestic credit. By recurring to basic financial accounting, we will establish this relation between NIR and NDA, on the one hand, and, this is a novelty, a partition between permanent and transitory credit, on the other hand. Equation [1] shows the basic accounting identity:

Assets = Liabilities + Capital [1]

In the specific case of the financial system, such identity can be spelled-out as in [2].

Reserve Requirements (R) + Credit (C) =
Deposits (D) + Repos (O) + Capital (K) [2]

By adding currency (E) to both sides of equation [2], we obtain [3]

$$R + E + C = D + E + O + K \quad [3]$$

Since R+E= Base (B) and since D+E = M3, equation [3] can be written as [4]:

$$B + C = M3 + O + K \quad [4]$$

Here B is the money base, C is total credit, M3 is the largest money aggregate, O stands for REPOs operations of the central bank and K for the capital of the financial system. Let us assume now the existence of a permanent component of credit in the money base (Bp) and a transitory component (B_T), such that we define [5]:

$$B = B_P + B_T \quad [5]$$

We now associate the transitory component of B with the “borrowed reserves” (O) and the permanent component with the “non-borrowed reserves” coming from the NIR, Treasuries held by the central bank, and the “internal” expenditures of the central bank. Hence, we would expect the “borrowed reserves” not to be able to support permanent operations of the financial system, like providing credit. Only the “non-borrowed reserves” would provide leverage for multiplying money through the banking system. Assuming then that the transitory component has a multiplier of just unity, we can define the permanent and the transitory components as follows:

Transitory Credit: $C_T = O$ [6]
Permanent Credit : $C_P = M3 – B + K$ [7]

Since total credit is the sum of [6] and [7], we obtain:

$$C = M3 – B + O = M3 - B_P + K \quad [8]$$

Here K is a constant, since the central bank does not regularly alter its capital.

Annex 3: Dynamics of the Series and Long-Term Convergence

We used the conventional Augmented Dickey-Fuller (ADF) test for finding if the series were stationary in time. Under the null-hypothesis (Ho) of having a unit root and at the 5% confidence interval, the results were:

Unit Roots: Augmented Dickey Fuller Test
(1991:1-2003:1, Quarterly Data)

Variable	Unit Root?	Type ofl Test
Growth Rate of Total Credit (dD/D_{t-4})	No	Drift and Trend
Growth Rate of Permanent Credit (dDP/DP_{t-4})	No	Drift and Trend
Growth Rate of Transitory Credit (dDT/DT_{t-4})	No	Drift
Real Economic Growth Rate (dY/Y_{t-4})	No	Drift and Trend
Inflation (dP/P_{t-4})	Yes	Drift and Trend
Local Interest Rate (DTF)	Yes	Drift
Growth Rate of "Accounting Value" of NIR ($dRIN/RIN_{t-4}$)	No	Drift
Growth Rate of "Money Value" of NIR ($dRIN1/RIN1_{t-4}$)	No	Drift
Growth Rate of Real Fiscal Deficit (dG/G_{t-4})	No	Drift
Nominal Depreciation (dE/E_{t-4})	No	Drift
External Real Economic Growth (dY^*/Y^*_{t-4})	Yes	Drift
External Inflation (dP^*/P^*_{t-4})	No	Drift
External Rate of Interest (i*)	Yes	Drift

These results indicate that the local inflation (dP/dP_{t-4}), the local interest rate, the GDP-growth rate (dY/dY_{t-4}), the external (USA) GDP-growth rate (dY^*/dY^*_{t-4}), and the external interest rate (i*) are non-stationary series of the type I(1). This results calls for some caution while interpreting results in table 5, as the dependent variable is a series I(0), under both "accounting" and "monetary" values of NIR, but inflation and the local interest rate are I(1). Although the sample is finite, we performed additional test regarding these two variables, of a different order of integration with respect to the dependent variable, and found that a combination of them would show them as cointegrated. Hence, our estimations are not likely to show problems of time-inconsistency.