

MONEY, THE RATE OF DEVALUATION  
AND INTEREST RATES IN A SEMI-OPEN ECONOMY:  
COLOMBIA 1968-1982\*

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## ABSTRACT

In this paper an empirical model for analyzing the behavior of nominal interest rates in a semi-open economy is developed. The model explicitly incorporates both the role of open economy factors (i.e., world interest rates, expected rate of devaluation) and domestic monetary conditions in explaining interest rates movement. The model is tested using quarterly data for Colombia from 1968-1982. The results obtained indicate that the semi-open characterization is adequate for the case of Colombia, and that world interest rates, the rate of devaluation and domestic monetary conditions have affected domestic nominal interest rates during the period under consideration. The results also indicate that unanticipated increases in the nominal quantity of money have exercised a negative effect on nominal interest rates in Colombia.

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## I. Introduction

Most empirical studies on interest rates behavior have made extreme assumptions regarding the degree of openness of the economy under consideration. Generally, it has been assumed that the economy in question is either completely closed to the rest of the world, or that it is fully open, and that there are no controls to capital movements. In reality, however, most cases — and especially those of developing countries — correspond to an intermediate situation, where the capital account of the balance of payments is partially open, and there exist some controls to capital movements. Under these circumstances it would be expected that in the short-run the domestic rate of interest will respond both to external factors (i.e., world interest rates) and to internal monetary conditions, (i.e., excess supply or demand for money).

The purpose of this paper is to develop an empirical model to analyze the behavior of nominal interest rates in a small semi-open economy. The model presented in this paper specifically considers the role of open economy factors — world rate of interest and expected rate of devaluation, for example —, and the role of more traditional domestic monetary conditions in explaining interest rates behavior. The model is then tested using quarterly data for Colombia for 1968-1982. Colombia is a semi-open economy, with a growing domestic capital market partially integrated to the international financial markets. In that sense, then, the behavior of the interest rate in Colombia cannot be explained by conventional models that assume a fully open or completely closed economy.<sup>1</sup>

The analysis presented in this paper is useful for evaluating two key policy issues. First, the model directly addresses the question of the relationship between the rate of devaluation and the nominal interest rate.

This is particularly important in the Colombian case, where a crawling peg exchange rate system has been in effect since 1967.<sup>2</sup> Recently, however, a number of observers have pointed out that the real exchange rate is overvalued and have recommended to accelerate the rate of devaluation of the Colombian crawling peg. [See, for example, Fedesarrollo (1983), Ocampo (1983), IBRD (1983).] The analysis presented in this paper, then, will be useful to determine the effect of a faster rate of crawling on the nominal interest rate. Second, the model derived in this paper will also be helpful to determine the effect of monetary policy — which during period 1981-1983 has been quite tight in Colombia — on domestic interest rates. Also, the model developed here provides a general framework that should be useful for analyzing interest rate behavior in other semi-open developing economies.

The paper is organized in the following form: Section II presents two alternative empirical formulations for analyzing the determination of interest rates in a small semi-open economy. Section III presents empirical results obtained using quarterly data for 1968 through 1982 for Colombia from these two formulations. It is shown that in the Colombian case world interest rates, the rate of devaluation, and domestic monetary conditions have affected nominal interest rates behavior. In Section IV the analysis of the role of monetary factors in determining the behavior of the interest rate in Colombia is taken one step further. In this section the role of actual vs. unanticipated changes in nominal money is investigated. This section also includes a brief discussion on the role of expected inflation in the semi-open economy framework used in this paper. Finally, in Section V some concluding remarks are presented.

## II. Money, the Rate of Devaluation, and Interest Rates in a Semi-Open Economy

In a fully open economy, where economic agents are risk neutral and foreign and domestic bonds are perfect substitutes, the internal and external interest rates are linked through the interest parity condition (1) (this ignores taxation consideration):

$$i_t = i_t^w + D_t^e \quad (1)$$

where

$i_t$  = domestic nominal interest rate

$i_t^w$  = foreign (world) nominal interest rate, on instruments that have the same maturity as the domestic papers

$D_t^e$  = expected rate of devaluation of the domestic currency between period  $t$  and the period corresponding to the maturity of the financial instruments. The subscript  $t$  refers to the fact that this expectation is formed in period  $t$ . Then, if  $d_t$  is the actual rate of devaluation in period  $t$ , and the maturity of the financial instruments is one period,  $D_t^e = E_t(d_{t+1})$ , where  $E$  is the expectations operator.

If in the economy in question there are no impediments to capital movements, equation (1) will tend to hold both in the short- and in the long-run. The empirical evidence available suggests that a slightly revised version of equation (1) — which replaces  $D^e$  by the forward premium, incorporates transaction costs, and considers off-shore interest rates — holds closely for the case of industrialized countries [see Frenkel and Levich, 1975 and 1977].

In the case of semi-open economies expression (1), however, clearly does not hold. Quite on the contrary, the recent experience of the countries of the cone of South-America (Argentina, Chile, Uruguay) suggests that in semi-industrialized, semi-open economies the divergences from (1) can be

substantial.<sup>3</sup> The case of Colombia also shows important deviations from equation (1) [see IBRD (1983), Montes and Candelo (1982)].

Equation (1) can be modified in several ways, in order to incorporate the fact that we are dealing with a semi-open economy. In particular, it is possible to write an expression that indicates that the domestic interest rate tends to equate the world rate of interest rates plus the rate of devaluation and a risk premium in the long-run, but that it can differ from it in the short-run. If we denote the risk premium in period  $t$  by  $\beta_t$ , equation (1) can then be replaced by the following expression:

$$\Delta i_t = \theta[(i_t^w + D_t^e + \beta_t) - i_{t-1}] \quad (2)$$

where  $0 < \theta < 1$ . This equation states that movements of the domestic nominal interest rate will respond to discrepancies between  $(i_t^w + D_t^e + \beta_t)$  and the domestic rate in the previous period. According to (2), then, in the long-run the domestic interest rate will tend to be equal to the foreign rate, plus the expected devaluation and the risk premium. In the short-run, however,  $(i_t^w + D_t^e + \beta_t)$  and  $i_t$  can differ. The coefficient  $\theta$  is a measure of the speed at which discrepancies between  $(i_t^w + D_t^e + \beta_t)$  and  $i_{t-1}$  will tend to be corrected. If for example, it only takes one period for these interest rates differentials to disappear,  $\theta$  will be equal to 1.0.

Even though equation (2) captures an important characteristic of a semi-open economy — the fact that it takes time for the interest parity condition to hold — it does not allow for domestic monetary conditions to play any role in the behavior of the domestic interest rate. In a semi-open economy, however, where capital movements are subject to a number of controls, it is conceivable that domestic monetary policy will have some effect on the short-run behavior of the interest rate. Specifically, it can be postulated that

disequilibria in the money market will have an effect on interest rates movements, with situations of excess liquidity -- an excess supply for money -- driving the interest rate down (i.e., a liquidity effect), and with excess demands for money resulting in an increase in the domestic interest rate. This possible role of the conditions prevailing in the domestic money market on interest rate behavior in a semi-open economy can be captured by the following expression:

$$\Delta i_t = \theta[(i_t^w + D_t^e + \beta_t) - i_{t-1}] - \lambda[\log m_t - \log m_t^d] \quad (3)$$

where  $m_t$  is the real quantity of money in  $t$ , and where  $m_t^d$  is the quantity of money demanded in that period. This equation differs from equation (2) in that it explicitly allows for internal monetary disequilibria to affect interest rates movements. The parameter  $\lambda$  measures the importance of these disequilibria, and the negative sign reflects the hypothesis that an excess supply (demand) for real money will generate a decline (increase) in the nominal interest rate.<sup>4</sup> A very important property of (3) is that the extreme situations of fully open, or completely closed economies are particular cases of this expression. If the economy under study is fully open to the rest of the world, we would expect that  $\theta = 1.0$  and  $\lambda = 0$ . If, on the other hand, the economy is completely closed to foreign influences, the interest rate will only respond to domestic monetary conditions. In this case it would be expected that  $\theta = 0$  and  $\lambda > 0$ . In the case of a semi-open economy, however, it would be expected that both  $\theta$  and  $\lambda$  would be significantly different from zero.

In equation (3) the monetary disequilibrium term is written as the discrepancy between the actual quantity of money and the quantity of money demanded in period  $t$ . However, an alternative way to write this term would

include the contemporaneous value of the actual quantity of money and the lagged quantity demanded. In this case the interest rate equation can be rewritten as:

$$\Delta i_t = \theta[(1_t^w + D_t^e + \beta_t) - i_{t-1}] - \lambda[\log m_t - \log m_{t-1}^d] \quad (4)$$

In general there are no a-priori reasons for preferring equations (2) or (3). This is an empirical question that will be tackled in the next section where these equations are estimated using Colombian quarterly data from 1968-1982.<sup>5</sup>

### III. Empirical Results

In this section results obtained from the estimation of reduced forms of equations (3) and (4) using quarterly data for 1968-1982 for Colombia are presented. In the estimation it is assumed that the expected rate of devaluation of the Colombian peso in period  $t+1$ , as formed in period  $t$  ( $D_t^e$ ), is equal to the actual rate of devaluation in period  $t$  ( $d_t$ ). This corresponds to the (plausible) assumption that during 1968-1982 the rate of devaluation in Colombia can be represented by a random walk with a zero drift term. In fact, the time series analysis of the rate of devaluation for this period suggests that the random walk with zero drift hypothesis cannot be rejected.<sup>6</sup>

With respect to the risk premium ( $\beta_t$ ) it is assumed, in order to simplify the analysis, that it can be represented by a constant  $k$  plus a normally distributed random term  $\varepsilon_t$  with zero mean and variance  $\sigma^2$ , ( $\beta_t = k + \varepsilon_t$ ).<sup>7</sup> Regarding the demand for money function, it is assumed that it has a conventional Cagan form:

$$\log m_t^d = b_0 + b_1 \log y_t - b_2 i_t \quad (5)$$



for  $y_t$  = real income.

Equations (6) and (7) below are the reduced forms actually estimated. Combining equations (3) and (5) and using the assumption for the risk premium  $\beta_t$ , the following reduced form for equation (3) is obtained:<sup>8</sup>

$$i_t = \gamma_0 + \gamma_1(i_t^w + d_t) + \gamma_2 i_{t-1} + \gamma_3 \log m_t + \gamma_4 \log y_t + \omega_t \quad (6)$$

where  $\omega_t$  is an error term, and it is expected that  $\gamma_1 > 0$ ,  $\gamma_2 > 0$ ,  $\gamma_3 < 0$  and  $\gamma_4 > 0$ . The expressions for the  $\gamma$ 's in terms of the parameters of the structural equations (3) and (5) are:  $\gamma_1 = \theta/(1+\lambda b_2)$ ;  $\gamma_2 = (1-\theta)/(1+\lambda b_2)$ ;  $\gamma_3 = -\lambda/(1+\gamma b_2)$ ;  $\gamma_4 = \lambda b_1/(1+\lambda b_2)$ .

The reduced form of equation (4), on the other hand, is given by:

$$i_t = \delta_0 + \delta_1(i_t^w + d_t) + \delta_2 i_{t-1} + \delta_3 \log m_t + \delta_4 \log y_{t-1} + \omega_t \quad (7)$$

This expression only differs from (6) in that  $\log y$  now enters with a one period lag. The interpretation of the reduced form parameters ( $\delta$ 's) in terms of the structural parameters, however, is quite different:  $\delta_1 = \theta$ ;  $\delta_2 = (1-\theta+\lambda b_2)$ ;  $\delta_3 = -\lambda$ ;  $\delta_4 = \lambda b_1$ .

Equations (6) and (7) were estimated using OLS and instrumental variables methods. The reason for using instrumental variables is that  $m_t$  and  $y_t$  might not be exogenous in a small semi-open economy like Colombia. Table 1 contains the results obtained from the estimation of the reduced form equations (6) and (7). Table 2, on the other hand, presents the estimated structural coefficients computed from equations (6.1), (6.2), (7.1) and (7.2) in Table 1. (See the appendix for a description of the data and sources).

As may be seen these results are very satisfactory. In the reduced form estimates reported in Table 1 all the coefficients have the expected sign, and with the exception of some constants and the coefficient of  $\log m_t$  in

Table 1

Interest Rates Behavior in Colombia, Quarterly Data 1968-1982:  
Reduced From Estimates

Equation Number	Method	Constant	$(i_t^w + d_t)$	$i_{t-1}$	$\log m_t$	$\log y_t$	$\log y_{t-1}$	D.W.	S.E.
(6.1)	OLS	-0.434 (-1.832)	0.402 (2.405)	0.363 (2.845)	-0.389 (-2.536)	0.171 (4.171)	--	2.112	0.062
(6.2)	INST	-0.135 (-0.349)	0.405 (2.291)	0.262 (1.709)	-0.791 (-2.106)	0.710 (3.044)	--	1.858	0.064
(7.1)	OLS	-0.489 (-1.990)	0.404 (2.337)	0.383 (2.847)	-0.275 (-1.963)	--	0.379 (3.539)	2.211	0.069
(7.2)	INST	-0.386 (-0.972)	0.405 (2.329)	0.356 (2.232)	-0.394 (-1.137)	--	0.450 (1.874)	2.203	0.063

Notes: The numbers in parentheses refer to the t-statistics. D.W. is the Durbin-Watson statistic. S.E. is the standard error of the regression.

Table 2

## Estimated Structural Parameters

From Interest Rates Equations For Colombia

<u>Equation</u>	<u><math>\theta</math></u>	<u><math>\lambda</math></u>	<u><math>b_1</math></u>	<u><math>b_2</math></u>
(6.1)	0.525	0.509	1.176	0.607
(6.2)	0.608	1.184	0.898	0.421
(7.1)	0.404	0.275	1.378	0.775
(7.2)	0.405	0.394	1.143	0.607

equation (7.2), they are all significant at the conventional levels. In all of the estimated versions of equations (6) and (7) both  $\hat{\theta}$  and  $\hat{\lambda}$  were statistically significant, indicating that the semi-open economy representation adopted in this paper is adequate for the case of Colombia.<sup>9</sup>

One of the most important results reported in these tables refer to the estimated values of  $\theta$ . This coefficient measures the speed at which uncovered interest rate differentials will be corrected. As can be seen,  $\hat{\theta}$  is fairly high, indicating that in one quarter between 40 and 60 percent of a unitary discrepancy between  $(i_t^w + d_t)$  and  $i_{t-1}$  will tend to be corrected. This coefficient suggest, for example, that higher world interest rates will be quickly translated into higher interest rates in Colombia. This seems to have been the case in Colombia during the early 1980's where the higher world interest rates were quickly reflected domestically [see IBRD, 1983].

The estimated coefficients of  $(i_t^w + d_t)$ ,  $\hat{\theta}$ , can also be used to simulate the effect of an increase of the rate of devaluation of the crawling peg on the nominal interest rate. This is an important policy question that usually arises in discussions concerning "unwanted" effects of accelerating the rate of devaluation. [See Fedesarrollo, (1983) and Montenegro 1983]. Consider, for example, the case of equation (7.1), where  $\hat{\theta} = 0.404$ . Assume that in period 0 the domestic nominal interest rate is 40% and that the rate of devaluation of the crawling peg is 22% per annum. Assume now that in period 1 the rate of devaluation of the crawling peg is increased to 32%, and maintained at this higher level. Assume also that the monetary authorities manipulated monetary policy in a way such that  $[\log m_t - \log m_{t-1}^d]$  remains constant. In this case the evolution of the domestic interest rate, using the estimated parameters from equation (7.1), is given in Table 3. As may be seen, these results show a high speed of adjustment of the domestic interest

Table 3

Simulation Of The Effect Of A Higher Rate Of Devaluation  
Of The Crawling Peg On The Domestic Interest Rate

<u>Quarter</u>	<u>Nominal Domestic Interest Rate (i)</u>	<u>Rate of Devaluation</u>
0	40.0%	22%
1	44.0%	32%
2	46.5%	32%
3	47.9%	32%
4	48.7%	32%
5	49.2%	32%
6	49.5%	32%
7	49.7%	32%
8	49.8%	32%

rate to the higher rate of devaluation of the crawling peg.<sup>10</sup> After 6 quarters the domestic rate of interest has almost completely reflected the higher rate of devaluation of the crawling peg.

The results presented in Tables 1 and 2 also provide some information regarding the role of monetary conditions on interest rate behavior. These estimates provide semi-elasticities, of the interest rates with respect to real money ranging from -0.275 to -0.791. The corresponding elasticities, of course, will be variable and will depend on the level of the interest rate. Consider again the case of equation (7.1), and assume that the nominal interest rate is 40%. Then, the corresponding elasticity of  $i$  with respect to  $m$  will be -0.688, indicating that with other things given an increase in the real quantity of money of 10% will reduce the nominal interest rate by 6.9%. However, from a policy perspective this result should be interpreted with caution. The problem, of course, is that according to our model in order to reduce the interest rate it is necessary to increase the real quantity of money. That is, we require an increase in the rate of growth of nominal money that will not be matched by higher equiproportional inflation. In the next section the role of actual vs. unanticipated changes in nominal money on interest rate behavior in Colombia is explicitly investigated.

The different equations presented in Table 1 also provide plausible and reasonable estimates for the parameters in the demand for money equation in Colombia. As may be seen from Table 2, the estimated long-run income elasticity of the demand for money in Colombia ranges from 0.898 to 1.379. The semi-elasticity of the demand for money relative to the nominal interest rate, on the other hand, ranges from -0.421 to -0.607. These numbers roughly correspond to what has been previously estimated for Colombia [see, Montes and Candelo, 1982].

#### IV. Unanticipated Money and Interest Rates in Colombia

The analysis presented in the previous section uses actual real money to investigate the relationship between monetary conditions and nominal interest rates in Colombia. Most of the recent work on macroeconomics, however, has emphasized the importance of unexpected monetary shocks as opposed to actual changes in money. [See for example Darby and Stockman 1983]. In this section the role of unexpected changes in the nominal quantity of money in explaining the behavior of the interest rate in Colombia is investigated. This is done in two ways. First a measure of unexpected nominal money shocks ( $DMR_t$ ) is added to previous explanatory variables in the estimation of equations (6) and (7). Second, in equations (6) and (7)  $\log m_t$  is replaced by  $DMR_t$ . The series for unexpected changes in the nominal quantity of money were constructed as the residuals from the estimation of an autoregressive process of order 7 for changes in the nominal quantity of money. After running this AR process the corresponding residuals were checked to make sure that they were white noise.<sup>11</sup> The results obtained from estimation of the interest rate equations that include unexpected monetary shocks are presented in Table 4.

As may be seen from these results, in all cases  $DMR_t$  has the expected sign (negative) and in 5 of the 7 regressions it is significant at the conventional levels. It is interesting to note that in equations (6.3), (7.3) and (7.4) the inclusion of  $DMR_t$  results in a decline in the level of significance of the coefficients of  $\log m_t$ . Also, in all the regressions where  $DMR_t$  replaced  $\log m_t$  [equations (6.5), (6.6) and (6.4)], the coefficients of unexpected nominal money were significantly negative as expected. In general, the evidence presented in Table 4 suggests that unexpected changes in the nominal quantity of money have exercised a negative effect on the nominal interest rate in Colombia. Another important result is

Table 4  
Unanticipated Nominal Money and the Interest Rate in Colombia

Equation Number	Method	Constant	$(i_t^w + d_t)$	$i_{t-1}$	$\log m_t$	$\log y_t$	$\log y_{t-1}$	$DMR_t$	D.W.	S.E.
(6.3)	OLS	-0.666 (-2.008)	0.426 (2.403)	0.347 (2.587)	-0.285 (-1.571)	0.434 (3.792)	--	-0.539 (-1.968)	2.205	0.061
(6.4)	INST	0.014 (0.020)	0.414 (2.100)	0.257 (1.639)	-0.871 (-1.743)	0.736 (2.907)	--	-0.262 (-0.673)	2.259	0.067
(6.5)	OLS	-1.013 (-4.028)	0.434 (2.412)	0.384 (2.870)	--	0.292 (4.110)	--	-0.675 (-2.418)	2.228	0.062
(6.6)	INST	-1.102 (-4.272)	0.445 (2.464)	0.351 (2.593)	--	0.317 (4.353)	--	-0.686 (-2.454)	2.164	0.062
(7.3)	OLS	-0.775 (-2.267)	0.436 (2.371)	0.360 (2.540)	-0.154 (-0.897)	--	0.356 (3.232)	-0.590 (-1.990)	2.209	0.063
(7.4)	INST	-0.626 (-0.932)	0.433 (2.343)	0.345 (2.246)	-0.269 (-0.565)	--	0.412 (1.718)	-0.533 (-1.438)	2.227	0.064
(7.5)	OLS	-0.975 (-3.774)	2.439 (2.395)	0.380 (2.720)	--	--	0.283 (3.853)	-0.666 (-2.350)	2.228	0.063

Notes: See Table 1.



that the estimates of  $\theta$  and  $\lambda$  are not affected by the inclusions of  $DMR_t$ . This provides further support to the hypothesis that models of a semi-open economy are appropriate for explaining interest rate behavior in Colombia.

An important question is what will happen to the result reported in table 4 if unexpected changes in nominal money ( $DMR_t$ ) are replaced by actual changes in the nominal quantity of money. When this is done the coefficients of actual changes in nominal money are in all cases statistically insignificant, and in five of the seven regressions they have the "wrong" (positive) sign.<sup>12</sup> This indicates that in the case of a semi-open economy, while unanticipated changes in the nominal quantity will have a negative (i.e., liquidity) effect on nominal interest rates, actual changes in nominal money (with other things given) will tend to leave interest rates unaffected.

Up to now there has been no mention of the possible role of expected inflation in determining interest rate behavior in Colombia. The reason for this is that in the semi-open economy framework of this paper the traditional role of expected inflation is captured by expected devaluation  $D_t^e$ . As long as there is a close relationship between the rate of devaluation and inflation, as it has been the case in Colombia, the expected rate of devaluation will reflect the expectations of inflation.<sup>13</sup> However, in order to test for a possible independent role for the expected rate of inflation, the equations reported in tables 1 and 4 were also estimated adding a proxy for expected inflation as a possible additional explanatory variables. However, in the results obtained the coefficient for expected rate of inflation were in all cases very small and insignificant.

## V. Concluding Remarks

In this paper an empirical model for analyzing interest rates behavior in a semi-open economy was presented. The model was tested for the case of Colombia using quarterly data for 1968-1982. The results obtained were remarkably good, and indicated that: (a) differential between domestic nominal interest rates and world interest rates plus expected devaluation and risk premiums will tend to be corrected quite fast. The estimates obtained indicate that in one quarter, between one-third and one-half of a unitary discrepancy between the domestic rate and the world rate plus the expected rate of devaluation will be corrected. (b) In 6 quarters an acceleration of the rate of devaluation of the crawling peg, will be almost completely translated into an equivalent increase in the domestic rate of interest. (c) An excess supply for real money will exercise significant negative pressures on the nominal interest rate (i.e., there is a liquidity effect). (d) Unexpected changes in the nominal quantity of money will also exercise a negative pressure on nominal interest rates. On the other hand anticipated increases in the rate of growth of nominal money will leave the rate of interest unaffected.

Footnotes

<sup>1</sup>For a general discussion on the Colombian economy see Diaz-Alejandro (1976) and the various reports published by the World Bank. On the Colombian financial sector see, for example, Jaramillo (1982). On the regulations and controls to capital flows in Colombia see the various issues of the IMF's Annual Report on Exchange Rate Arrangements and Exchange Rate Restrictions and of Pick's Currency Yearbook.

<sup>2</sup>For descriptions of Colombia's exchange rate policies see, for example, Diaz-Alejandro (1976), Wiesner (1978) and IBRD (1983).

<sup>3</sup>On the recent experiences of these countries see the collection of papers in Blejer and Landau (Eds.) (1984).

<sup>4</sup>It should be noted that even if it is assumed that the domestic money market is permanently in equilibrium, domestic monetary policy can still affect interest rates behavior, through its effect on capital flows. See, for example, the analysis in Darby and Stockman (1983).

<sup>5</sup>During 1978-1982 the Colombia capital market has become increasingly dynamic. The data on interest rates used in this study corresponds to the non-regulated (i.e., free) sector of the Colombian capital market (see Montes and Candelo, 1982). The empirical analysis presented here was also performed for different subperiods. The results obtained in these cases -- available from the author upon request -- did not affect the conclusions reached in this paper.

<sup>6</sup>If the rate of devaluation follows a random walk with zero drift,  $d_t = d_{t-1} + w_t$ . Then  $D_t^e = E_t(d_{t+1}) = d_t$ . The following result was obtained from the estimation of an AR representation for the rate of devaluation in Colombia using quarterly data from 1968-1982 (t-statistics in parenthesis).

$$d_t = 0.928 d_{t-1} + 0.001 d_{t-2}, \quad D.W. = 2.02$$

(15.318)                      (0.010)

Notice that while the assumption of  $d_t$  following a random walk is appropriate for Colombia, it may be inadequate for other developing semi-open economies. Specifically it is possible that other developing economies are subject to the "peso-problem".

<sup>7</sup>From a theoretical perspective the risk premium  $b_t$  will depend on variables like the stocks of outside government assets. Empirical studies on the subject, however, have generally failed to find this kind of relationship (see, for example, Frankel 1982). For this reason in this paper a more simple approach has been taken with respect to the representation of  $b_t$ .

<sup>8</sup>An important property of equation (3) is that even in the long-run the domestic rate of interest will not be necessarily equal to the world interest rate plus the rate of devaluation. In fact, according to (3) and the assumptions regarding  $D_t^e$  and  $b_t$ , in the long-run the domestic interest rate will be equal to:

$$i_t = (i_t^w + d_t) + [k + e_t + w_t].$$

<sup>9</sup>These equations were also estimated using non-linear methods (i.e., Amemiya's , 1974 two-step procedure). The results from these estimates -- available upon request -- indicate that most of the structural parameters are statistically significant.

<sup>10</sup>This, of course, assumes that  $d_t$  follows a random walk and that the actual rate of devaluation captures the expected rate of devaluation.

<sup>11</sup>An AR(7) was chosen to represent  $DM_t$  because it was the lower order autoregressive process that generated white-noise residuals.

<sup>12</sup>These results have not been reported here due to space considerations. However, they are available from the author on request.

<sup>13</sup>In their recent article Montes and Candelo (1982) found a coefficient of 0.974 in an equation that relates the rate of devaluation to domestic inflation in Colombia during 1968-1980.

Appendix

- (a) All the data, except world interest rates, for 1968-1980 were taken from Montes and Candelo (1982).
- (b) The U.S. three month treasury bill interest rates were used as a proxy for "world" interest rates. The data for 1968-1982 was obtained from the International Financial Statistics.
- (c) The data for the Colombian variables for 1981-1982 is compatible with the Montes and Candelo (1982) data and was provided by the Departamento Nacional de Planeacion.

References

- Amemiya, T., "The Nonlinear Two-Stage Least Square Estimator," Journal of Econometrics, 2, (1974), 105-110.
- Blejer, M. and L. Landau (eds.), Economic Liberalization and Stabilization in Argentina, Chile and Uruguay (The World Bank), forthcoming 1984.
- Darby, M., and A. Stockman, "The Mark III International Transmission Model: Specification," in M. Darby et al. The International Transmission of Inflation (Chicago: University of Chicago Press, 1983).
- Díaz-Alejandro, C.F., Colombia (Ballinger, 1976).
- Fedesarrollo, "Coyuntura Economica," (March 1983).
- Frankel, J., "In Search of the Exchange Rate Premium: A Six-Currency Test Assuming Mean-Variance Optimization," Journal of International Money and Finance, 1, (December 1982).
- Frenkel, J.A., and R. Levich, "Covered Interest Arbitrage: Unexpected Profits?" Journal of Political Economy (April 1975).
- \_\_\_\_\_ and \_\_\_\_\_, "Transaction Costs and Interest Arbitrage: Tranquil versus Turbulent Periods," Journal of Political Economy (December 1977).
- IBRD, "Colombia: Economic Development and Policy Under Changing Conditions," (April 1983).
- Jaramillo, J.C., "El Proceso de Liberación del Mercado Financiero en Colombia," in Ensayos de Política Económica (1982).
- Montenegro, A., "La Sobrevaluación del Peso," mimeo, CEDE, Universidad de los Andes, April 1983.

Montes, G. and R. Candelo, "El Enfoque Monetario de la Balanza de Pagos: El Caso de Colombia 1968-1980," Revista de Planeacion y Desarrollo (Mayo-Agosto 1982).

Ocampo, A., "En Defensa de la Continuidad del Regimen Cambiario," Coyuntura Economica (Marzo, 1983).

Wiesner, E., "Devaluacion y Mecanismo de Ajuste en Colombia," in Politica Economica Externa Colombiana (Bogota, 1978).