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Exchange Rate Uncertainty in Money-Based Stabilization Programs [1]

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Abstract

Complementing the explanation provided by Calvo and Vegh (1994) for money-based stabilization programs, exchange rate uncertainty introduced to a particular version of the portfolio approach with imperfect competition in the banking system leads to a bias toward appreciation that is directly related to the divergence of expectations and that dampens the interaction between portfolio movements and the real exchange rate. Based on Frankel-Froot, uncertainty exists when the fundamental equilibrium real exchange rate is temporarily unknown in a foreign exchange market with two types of agents: 'parity-guessers,' who expect a jump to a reference parity level, and 'money-followers,' who expect nominal depreciation equal to the monetary rule.

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SUMMARY

Complementing the explanations provided by Calvo and Vegh for money-based stablization programs, this paper shows that exchange rate uncertainty introduced to a particular version of the portfolio approach with imperfect competition in the banking system leads to a bias toward appreciation that is directly related to the divergence of expectations and that dampens the interaction between portfolio movements and the real exchange rate. Based on Frankel-Froot, uncertainty exists when the fundamental equilibrium real exchange rate is temporarily unknown in a foreign exchange market with two types of agents: 'parity-guessers,' who expect a jump to a reference parity level, and 'money-followers,' who expect nominal depreciation equal to the monetary rule.

For the particular version of the portfolio approach used in this paper, volatility is directly related to the magnitude of the initial disequilibrium. Also, stability requires a minimum of foreign currency holdings that must be larger the greater the degree of imperfect competition. Although volatility and instability may bring about uncertainty, they may also exist with perfect foresight.

This paper also includes an analysis of the evidence for recent money-based stabilization episodes in Latin America[1]. It describes the basic features of the framework, as well as its main assumptions, and the system of equations for determining the exchange rate and the interest rates. And the paper gives the alternative formulation for expectations under uncertainty. It concludes by summarizing the main policy implications.

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[1]The cases are taken from Calvo and Vegh (1994), and include: (i) the 1989 plan in Argentina, and (iii) the 1990 programs in Brazil, Perú and the Dominican Republic.The 1975 Chilean program is also included in their work, but not in this paper to limit the analysis to situations facing similar conditions in the international capital markets.

1. EVIDENCE FROM MONEY-BASED STABILIZATION EPISODES

Calvo and Vegh analyze the implications of the choice of a nominal anchor for chronic inflation economies. Among their main conclusions, they find that: (1) lack of credibility is more disruptive under fixed exchange rates than under floating exchange rates, (2) attempting to pursue a disinflationary policy while maintaining a given level of the real exchange rate is likely to be self-defeating and, (3) a high degree of currency substitution favors the exchange rate as the nominal anchor. The suggestive stylized facts [3] specific to money-based programs are (a) slow convergence of inflation to the rate of monetary growth; (b) real appreciation of the domestic currency; (c) initial increase in domestic real interest rates; and (d) no clear-cut response in the trade balance and the current account. Based on a model developed previously[4] they find that lack of credibility in the commitment of the government to reduce inflation is less costly for money-based stabilization programs, and that the same lack of credibility for exchange rate-based stabilization programs leads to an initial consumption boom coming from the anticipation of consumption.

One can expand on the suggestive stylized facts considering one additional particular aspect of these stabilization programs: While two of the selected countries (Brazil and the Dominican Republic) show an almost negligible share of foreign exchange in their asset portfolio, two others (Argentina and Perú) show a significant share of foreign currency with respect to total assets. From the data for this period used by Calvo and Vegh, other differences between these two pairs of countries are that (a) by the last quarter of the program money growth exceeds inflation for Brazil and the Dominican Republic, while it is kept below inflation for Argentina and Perú; (b) real exchange rate appreciation is much higher in Argentina and Perú during the program; (c) lending interest rates in real terms increased significantly more in Argentina and Perú compared to the other two countries in the first four quarters after the program (it declines in Brazil); and, (d) the combination of the reduction in private consumption and real exchange rate appreciation does not explain the evolution of the current account (Table 1).

Some propositions based on this information are the following:

a) For dollarized economies a shift toward domestic currency, even if desired, would be difficult to materialize as long as money growth is kept below inflation.

b) Based on the uncovered interest rate parity hypothesis, in dollarized economies severe exchange rate appreciation coexists with sizable expectations of the opposite sign.

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[3] Calvo and Vegh warn about the limitation of extracting conclusions based on such a small number of money-based programs in chronic inflation countries. The same warning applies to this paper.

[4] Calvo and Vegh (1993).

Table 1. Money-based stabilization programs: Comparative performance

	Share of foreign currency on total assets. (Percent) 1/	Cumulative real exchange rate appreciation (Percent) 2/	Average lending real interest rates in first four quarters (Percent per year) 2/	Money growth minus inflation in last quarter of program (Annual increase) 2/	Shift in average current account balance (Percent of GDP) 3/	Increase in private consumption in first year of program (Annual growth in percent) 2/
Brazil (1990)	negligible	9.7	-2.4	906.1	-1.2	-2.5
Dominican Republic (1990)	negligible	9	15.1	10.7	+0.7	-12.9
Argentina (1989)	0.75	51.2	112.7	-558.6	+5.3	-1.8
Perú (1990)	0.65	25.5	235	-13.2	-0.6	-15.3

1/ Average pre-program and program
2/ During program
3/ Average program minus average three years pre-program.

Source: Calvo and Vegh (1994) and national sources.

c) Current account responses are more consistent in non-dollarized economies: the current account improves in the country showing a higher impact on private consumption (Dominican Republic), while it worsens in the country with higher (although slightly) real exchange rate appreciation. For dollarized economies, the current account deteriorates for the country with the higher reduction in private consumption (Perú) and improves for the country with higher real exchange rate appreciation (and lower impact on private consumption: Argentina). This may reflect differences in the initial disequilibrium of the current account, exchange rate and private consumption, but also differences in expectations.

The paper attempts to illustrate the role of exchange rate uncertainty in these findings, to complement what has been analyzed in terms of the role of credibility in the commitment to fiscal adjustment and income effects. Some caveats resulting from the scant number of floating exchange rate experiences must be mentioned: First, evidence is extremely partial, more considering that only one of the countries in the sample persisted with a money-based stabilization program until the end (Perú). Second, even for the case of Perú, the exchange rate regime is not one of pure floating (The Dominican Republic, considered by Calvo-Vegh as a money-based stabilization experience, did not allow the exchange rate to float until one year into the program)[5]. Third, distortions in capital markets were of different nature in these countries, as Perú and the Dominican Republic eliminated interest rates ceilings and floors during the program,Brazil froze deposits in the context of indexed interest rates, and the Argentina faced particular problems resulting from the behavior of the provincial and state banks, all of which may have had effects of their own.

The simple framework to be developed in this paper addresses the effects of exchange rate uncertainty in the interaction between portfolio movements, the current account and the real exchange rate. For that, it isolates the impact of store-of-value assets shifts, which means that it does not deal with currency substitution effects.[6] The framework incorporates imperfect competition in the banking system to the extent that it can be represented by some power of financial institutions to modify the interest rates spread in the face of shifts in real deposits. It does not address the impact of uncertainty on other variables (investment and exports, for example), nor its effects on the current account.

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[5] See Medeiros (1994).

[6] See Savastano (1994).

2. EXCHANGE RATE AND INTEREST RATE DETERMINATION

2.1 Exchange rate determination

The exchange rate is determined through portfolio balance allocations of store-of-value assets[7], namely interest-bearing deposits in domestic currency and foreign currency. The relevant opportunity cost for the demand for interest-bearing deposits in domestic currency is the difference between the deposit interest rate and inflation, while the relevant opportunity cost for the demand for foreign currency is the difference between the prevalent expected depreciation and the deposit interest rate. The interest rate on foreign currency and foreign inflation are assumed to be zero.

$$\frac{M}{P} = \underset{(-)(+)(+)}{f(\pi, i_m, y)} \qquad (1)$$

$$sM^* = \underset{(-)\ (+)\ (+)}{g\left(i_m, E\frac{\Delta S}{S}, y\right)} \qquad (2)$$

$$a = \frac{M}{P} + sM^* \qquad (3)$$

$\frac{M}{P}$: *real demand for interest-bearing deposits in domestic currency.*
π : *inflation rate.*
i_m : *deposits interest rate.*
y : *real income.*
M^* : *foreign currency holdings expressed in original currency.*
$E\frac{\Delta S}{S}$: *expected depreciation.*
s : *real exchange rate (expressed in domestic currency per unit of foreign currency)*
a : *financial wealth in real terms.*
P : *Consumer price index as weighted average of the price of traded goods and nontraded goods expressed in domestic currency.*

Nominal and real exchange rates are determined simultaneously from (1) and (2):

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[7] By dealing only with store-of-value assets, the possibility of currency substitution is excluded.

$$s = \frac{m}{M^*} h(i_m, E\frac{\Delta S}{S}, \pi, y) \quad (4)$$
$$\qquad (-) \quad (+) \ (+)(?)$$
$$S = \frac{M}{M^*} h(i_m, E\frac{\Delta S}{S}, \pi, y) \quad (5)$$
$$\qquad (-) \quad (+) \ (+)(?)$$
$$where: \ m = \frac{M}{P}$$

These expressions show, in the absence of portfolio shifts, that the exchange rate will appreciate as a result of a lower opportunity cost of holding interest-bearing deposits in domestic currency or a higher opportunity cost of holding foreign currency. The impact of real income would depend on the relative income elasticity of the demand for interest-bearing deposits in domestic currency versus the demand for foreign currency. The conditions for equilibrium in the goods market are characterized as follows:

$$\underset{(-)}{Q_{NT}(s)} = \underset{(+)(+)}{C_{NT}(s,a)}$$
$$\underset{(+)}{Q_T(s)} - \underset{(-)(+)}{C_T(s,a)} = \frac{dM^*}{dt}$$

where:

Q_{NT} : *supply of non-traded goods.*
C_{NT} : *demand for non-traded goods.*
Q_T : *supply of traded goods.*
C_T : *demand for traded goods.*
$\frac{dM^*}{dt}$: *accumulation of foreign exchange.*

As in standard models, for equilibrium of supply and demand of non traded goods, it is assumed that prices are flexible in such a way that if s increases (decreases), the price of non traded goods will increase (decrease) to the extent necessary to bring down (up) the real value of total financial wealth until the excess (shortage of) demand in the market for non traded goods is cleared. On the contrary, equilibrium of supply and demand of foreign exchange does not require equilibrium of supply and demand of traded goods, to the extent that an increase (decrease) in s reflects a higher (lower) demand of foreign currency holdings, which is satisfied through the positive (negative) accumulation of foreign exchange brought about by a shortage of (excess) demand for traded goods. In other words, equilibrium in the market for non traded goods determines the dynamics of prices and equilibrium in the market of traded goods determines the dynamics of foreign exchange accumulation. The corresponding reduced equations are:

$$a = \underset{(-)}{v(s)} \qquad (6)$$

$$\frac{dM^*}{dt} = \underset{(+)}{l(s)} \qquad (7)$$

2.2 Interest rates determination

Interest rates are assumed to be flexibly determined under imperfect competition in the banking system reflecting restricted entry and exit of firms, with two consequences: the interest rate differential between credit and deposits is an endogenous variable inversely related to real holdings of interest-bearing deposits in domestic currency;[8] and, correspondingly, the financial system imposes a wedge between domestic and foreign deposit interest rates. As a result, the uncovered interest parity condition holds only for credit interest rates.[9] The corresponding equations are (under the assumption of foreign interest rates and foreign inflation equal to zero):

$$i_c = E\frac{\Delta S}{S} \qquad (8)$$

$$i_m = i_c - \theta \qquad (9)$$

$$\theta = \underset{(-)}{j(m)} \qquad (10)$$

where:

i_c : *domestic credit interest rate.*
i_m: *domestic deposits interest rate*
θ : *domestic interest rate spread.*

The model can be closed and solved once a given formulation of expected depreciation is specified.

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[8] Higher intermediation explains lower unit fixed-costs for the financial sector. See Tanzi and Blejer (1982).

[9] The international rate is the one that a local firm may obtain in the international market, and therefore, a risk premium may be included. It is implicitly assumed that, unlike depositors, borrowers have access to arbitrage.

2.3 Perfect foresight solution

In order to simplify the presentation, a Cagan-type specification is used to express the demand for assets, for constant real income.[10] The corresponding expression for the real exchange rate will be:

$$s = K \frac{m}{M^*} e^{[b(\pi - E\frac{\Delta s}{S}) + (b+f)j(m)]} \qquad (11)$$

where:

b: Opportunity cost semi-elasticity of the demand for interest-bearing deposits in domestic currency (b > 0).
f: Opportunity cost semi-elasticity of the demand for foreign currency holdings (f > 0).

The equation can be rearranged in the following way:

$$E\frac{\Delta S}{S} = \frac{(b+f)}{b} j(m) - \frac{1}{b} Log(\frac{1}{K} \frac{sM^*}{m}) + \pi \qquad (12)$$

Expected depreciation will be higher the higher the domestic interest rate spread (because the deposit interest rate will be lower), the lower the share of foreign currency holdings in the portfolio (because of potential asset reallocation), and the higher the inflation rate. For perfect foresight, the following expression holds:

$$E\frac{\Delta S}{S} = \dot{s} + \pi$$

$$For \ \frac{dx}{x} = \dot{x}$$

And therefore, substituting in equation (12):

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[10] Needless to say, this simplification bears the risk of reducing generality, but simplifies tractability. For Cagan-type asset demand functions, it may be assumed either a constant real income or the same income elasticity of the demand for interest-bearing deposits in domestic currency and foreign currency holdings.

$$\frac{ds}{dt} = \frac{(b+f)}{b} j(a - sM^*)s - \frac{s}{b} Log \left[\frac{1}{K} \frac{sM^*}{(a - sM^*)}\right] \qquad (13)$$

Equation (13) together with equation (7) describes the dynamics of the real exchange rate and the accumulation of foreign exchange as in the traditional models.The solution to the system corresponds to one of complex characteristic roots (see Figure 1). The first implication of this is that volatility of the real exchange rate (and the current account) is directly related to the magnitude of the initial disequilibrium. Second, appreciation under perfect foresight occurs when foreign currency holdings exceed those required in equilibrium. This implies that, under perfect foresight, the framework does not help to explain the suggestive stylzed facts shown in the second section. Even when appreciation can be explained, the perfect foresight assumption in combination with the uncovered interest parity condition does not justify increases in the interest rate during the period of exchange rate appreciation.

Linearizing around the steady-state by Taylor expansion, one can find the corresponding eigenvalues and the condition for convergence of the time path (namely negative real parts of the complex roots). For dynamic stability, the following condition must hold:

$$log\left[\frac{1}{K}\frac{\hat{s}\hat{M}*}{a(\hat{s}) - \hat{s}\hat{M}*}\right] > [b + f][j'(a' - \hat{M}*)\hat{s} + j] - [1-\gamma] \qquad (14)$$

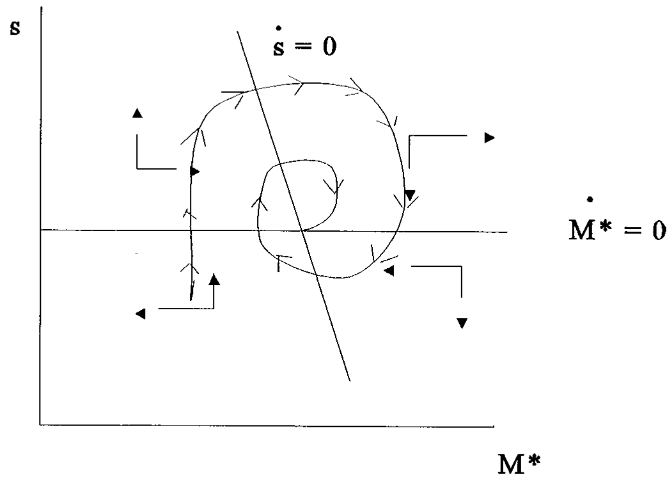
where:

$\hat{x}$: *values at steady state.*

γ : *elasticity of interest-bearing deposits with respect to the real exchange rate.*

This condition means that there must be a minimum level of the ratio of foreign currency holdings to interest-bearing deposits in equilibrium, determined by the expression on the right-hand side (neither holdings of domestic deposits nor foreign currency must be zero). However, it has an additional implication related to the degree of imperfection competition in the banking system: Notice that the second term in this expression is negative (the elasticity of interest-bearing deposits with respect to the real exchange rate is negative for the same reasons that a' is negative). Thus, this minimum value is likely to be small if j and j' are small. Conversely, a high spread and a high elasticity of the spread with respect to changes in interest-bearing deposits will require a higher ratio of foreign currency holdings to interest-bearing deposits in equilibrium, for this equilibrium to be stable. Instability results from the combination of a low share of foreign currency holdings under imperfect competition in the banking system.

Figure 1. Exchange rate dynamics in perfect foresight



3. EXPECTATIONS FORMATION UNDER UNCERTAINTY

When actual and expected depreciation are allowed to differ, the evolution of the real exchange rate will depend on the comparison of changes in the spread and changes in expected depreciation affecting the interest rates. This will depend on the formulation for expected depreciation.

Expected depreciation is stated in terms of the fundamentalist vs. chartist model of Frankel and Froot (1986).[11] In the Frankel-Froot model, economic agents merge information from fundamentalist and chartist sources, assigning them a variable weight through time. In the framework presented here, the corresponding agents are those who follow a real reference rate (parity-guessers) and those who follow a nominal reference rate (money-followers). Uncertainty stems from the fact that none of the groups knows the fundamentals to determine the exchange rate. Portfolio-mergers combine both kinds of expectations. The corresponding equation is:

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[11]The model was developed to explain the behavior of US dollar in the period 1980-1985, when expected depreciation did not appear to have been driven by fundamentals.

$$E\left(\frac{\Delta S}{S}\right) = \omega \int_{t_0}^{t_1} - \frac{ds}{s} + (1-\omega)\mu \qquad (15)$$

where:

ω : *weight of parity-guessers on the formation of expectations.*
$(1-\omega)$: *weight of money-followers on the formation of expectations.*
μ : *money supply growth rate (exogenous).*

The expected exchange rate adjustment toward its parity level by the 'parity-guessers' comes from the following expression:

$$\int\left(\frac{dP}{P}-\frac{dS}{S}\right) = \int\left(\frac{dP}{P}-\frac{ds}{s}-\frac{dP}{P}\right) = \int -\frac{ds}{s}$$

There is an important difference between the framework proposed here and that developed by Frankel and Froot. In Frankel-Froot, only chartist agents ignore the relevant fundamentals, and believe instead in simple extrapolation, with the time series of the exchange rate as the only information taken into account from the information set. In the framework proposed here, both groups temporarily ignore fundamentals, and use the parity level or the money rule as different choices of relevant information from the information set.

Expected depreciation would coincide with the perfect foresight solution if the weight of 'parity-guessers' in the expectations formation is as follows:

$$\omega = \frac{\dot{s}+\pi-\mu}{\log \bar{s}-\log s-\mu} \qquad (16)$$

$$\textit{for } E\left(\frac{\Delta S}{S}\right) = \dot{s}+\pi$$

$$\textit{and } \int -\dot{s} = \log \bar{s}-\log s$$

The weight of parity-guessers on expected depreciation would be equal to one for the exchange rate to recover the real value that parity-guessers predict. If this were true, nominal depreciation would be equal to zero. If instead nominal money supply increases at the same rate as nominal depreciation, the weight of 'parity-guessers' turns to zero. Besides these two extreme cases, the weights cannot remain stable, as both agents will adjust their behavior. Moreover, the weights cannot be higher than one or lower than zero (nor one or zero, because the exchange rate explained by fundamentals would have been discovered before); for this restriction to hold:[12]

$$\dot{s}+\pi>\mu$$
$$\log \bar{s}-\log s>\mu$$
$$\dot{s}+\pi<\log \bar{s}-\log s$$

Following the Frankel-Froot model, portfolio managers use the principles of Bayesian inference to combine prior information with actual realizations, allowing the adaptation coefficient to be constant and taking the limit of the solution to continuous time. The adaptation process is given by the following equation:

$$\Delta\omega_t = \delta[\hat{\omega}_{(t-1)}-\omega_{(t-1)}] \quad (17)$$

where:

$\hat{\omega}$: weight attributed ex-post to 'parity-guessers' if the exchange rate had behaved as under perfect foresight.

The expression for the evolution of ω over time is:

$$\frac{d\omega}{dt} = \delta\left[\frac{\dot{s}+\pi-\mu}{\log \bar{s}-\log s-\mu} - \omega\right] \quad (18)$$

Therefore, changes in the value of the real exchange rate, the rate of inflation and the monetary rule affect the dynamics of the weights assigned to different sources of expectations. Notice that uncertainty affects the dynamics to equilibrium, but not the steady state, that remains the same as under perfect foresight [13]. Thus, uncertainty in this framework has only a short-term impact on the dynamics of the exchange rate. Differentiating equations (11) and (15), incorporating the dynamics of expectations stated in equation (18), and rearranging terms, one obtains an equation for the evolution of the exchange rate for short-term equilibrium:

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[12]The reader may notice that there is another combination of inequalities that could apply, but it lacks analytical interest.

[13] The value of ω in steady state doe not need to be determined, as uncertainty would not prevail in steady state. In any case, even if one of type of agents were right, only values of zero or one make sense, and therefor the dynamics of ω are irrelevant for the steady state.

$$\dot{s} = \frac{(1 + \frac{1}{B} + (b+f)\ m\ j' + b\delta)}{\Delta} (\mu - \pi) + \frac{b}{\Delta} d\pi + \frac{b\delta\omega}{\Delta} [\log\bar{s} - \log s - \mu] \quad (19)$$

Where:

$$\Delta = \frac{a's}{Bm} + b\ (\delta - \omega)$$

For:

$$B = \frac{sM*}{m} \qquad and \qquad \dot{M} = \mu$$

In principle, the expressions (μ-π) and dπ could be substituted to find an analytical solution. In this case, however, one obtains a second-order differential equation without a closed analytical solution. But equation (19) shows a useful expression that can be compared with an equivalent expression for the case of perfect foresight:

$$\dot{s} = \frac{(\ 1 + \frac{1}{B} + (b\ + f)\ mj'\ )}{\Delta'} (\ \mu - \pi\ ) + \frac{b\ \frac{1}{\lambda}}{\Delta'} d\pi \quad (20)$$

where:

$$\Delta' = \frac{a's}{Bm}$$

The impact of uncertainty is given by the differences between equations (19) and (20). From the comparison of both equations, the following observations result:

a) The denominator (Δ') in perfect foresight is always negative, while there is a possibility for this term to be positive with uncertainty, if the speed of adjustment (δ) is high enough and/or the share of the expectation of parity-guessers (ω) in the market is low enough. However, this case is not of particular interest because it corresponds to a situation where uncertainty would not last long before the true exchange rate were discovered.

b) Thus, the most likely outcome brought about by uncertainty is that the denominator becomes more negative (higher in absolute value) for a low δ and a high ω. This means that the impact of changes in the real value of deposits and in the rate of inflation will be dampened in the presence of uncertainty.

c) From the first expression on the right-hand side of equation (20), in money-based stabilization programs ($\mu<\pi$) the impact on the exchange rate will depend on the level of dollarization (B): if it is small enough ($B^{-1}+1 > ABS[(b+f)mj']$), the real exchange rate would depreciate, while if it is high ($B^{-1}+1 < ABS[(b+f)mj']$), the real exchange rate would appreciate. Uncertainty reinforces the first impact (through the addition of the term $b\delta$ in the numerator), and dampens the second one (for the same reason).

d) From the second term on the right-hand side of equations (19) and (20), a reduction of inflation will have different impacts comparing a situation of perfect foresight against uncertainty. In perfect foresight, this reduction would lead to a real exchange rate appreciation [as $\gamma < 0$, see equation (14)]. In periods of uncertainty, it contributes to a real exchange rate depreciation.

e) The last term on the right-hand side of equation (19) implies a bias toward appreciation under uncertainty, the more severe the higher the divergence of expectations

f) The introduction of uncertainty helps to sustain a case for a positive expected depreciation and high real credit interest rates while the real exchange rate appreciates regardless of the level of dollarization. This bias could be offset partially only if inflation is reduced quickly and significantly. Additionally, there is a dampening effect on the transmission of effects between portfolio shifts, inflation, interest rates and the real exchange rate. In general, the framework gives arguments to expect periods of more sizable appreciation and interest rates for dollarized countries. Interest rates will decline in the process of adaptation of expectations, but will remain higher than under perfect foresight as long as uncertainty persists.

Notice that we have analyzed the case for the initial phase of a money-based stabilization program, for money growing below the inflation rate. If later into the program this relationship is reversed,appreciation may be observed in subsequent stages of money-based stabilization, even for countries with low dollarization.

Needless to say, all of the above does not apply if the program is abandoned or the exchange rate regime modified again. Also, like Calvo and Vegh, it does not incorporate the shock effects coming from bringing down inflation from almost hyper inflationary levels.

4. CONCLUSIONS AND POLICY IMPLICATIONS

A simple framework helps to explain some regularities observed in money-based stabilization programs, for uncertainty coming from the modification of the exchange rate regime. The main conclusion is that uncertainty introduces a bias toward appreciation directly related to the divergence of expectations and dampens the interaction between portfolio movements and the real exchange rate. The bias toward appreciation could only be compensated by a quick disinflation.

Dollarized economies seem to be more exposed to the impact of uncertainty, to the extent that uncertainty magnifies the tendency toward a real exchange rate appreciation. It could be added that dollarization itself and volatility coming from an initial point distant from equilibrium could bring about uncertainty more easily, but that is not proved in this paper. But if it is considered that volatility may bring about uncertainty, allowing for some accumulation of foreign currency holdings anticipating the change in regime may be desirable only as long as the portfolio gets closer to the one that would prevail in equilibrium. Also, waiting for a speculative attack resulting in an excessive accumulation of foreign exchange with respect to equilibrium is not advisable if the authorities want to avoid volatility.

Instability may be more likely in the presence of imperfect competition in the banking system, as long as deposits interest rates do not adjust to the extent necessary to allow for portfolio adjustments that bring the real exchange rate to equilibrium. This possibility is higher for countries with no significant foreign currency in their portfolio. If instability wants to be avoided (for its own consequences, or because it is considered that it brings about uncertainty) competition in the banking system must be enhanced.

The framework has many caveats that add to the limitation in the number of observations. To name a few, a particular demand for money specification is used, a fixed share of quasi money over broad money is assumed, there are no currency substitution effects and it does not introduce uncertainty to the determination of the current account. The findings that it helps to explain cannot be generalized until the framework is incorporated into a general model. But it helps to complement the conclusions of more general models that explain the regularities observed in these episodes.

Bibliography

Blackburn, Keith. "Interest parity, the degree of capital mobility and the information contents of the exchange rate and the interest rate". Manchester School of Social Studies. 1986.

Calvo, G. and Rodriguez, C.A. "A model of exchange rate determination under currency substitution and rational expectations". Journal of Political Economy. 85:3, 1977, 617-625.

Calvo, G. and Vegh, Carlos. "Inflation Stabilization and nominal anchors". Contemporary Economic Policy. April 1994.

Calvo G. and Vegh, Carlos. "Exchange-rate based stabilization under imperfect credibility". In "Open-Economy Macroeconomics", edited by Frisch and Worgotter, 1993, 3-28.

Frankel, J. and Froot, K. "The Dollar as a speculative bubble: A tale of fundamentalists and chartists". NBER Working Paper Series, N° 1854. 1986.

Guidotti, P. and Rodriguez, C. "Dollarization in Latin America: Gresham Law in reverse?. IMF Working Paper, December 1991.

Kamin, S.B. and Spigelman, D.F. "Real interest rates during the disinflation process in developing countries". International Finance Discussion Papers. 331, August 1988.

Medeiros, Carlos. "A case of a Monetary Stabilization Program: The Dominican Republic Economic Program, 1990-1993", mimeo 1994.

Mc Kinnon, Ronald. "Tasas de interés domésticos y flujos de capital extranjero". Estudios de Economía. August 1988.

Morales, R. and Tedesco, M. "Currency Substitution and exchange rate determination in economies under adjustment". Kiel Advanced Studies Working Papers, 225, March 1992.

Savastano, Miguel. "Dollarization in Latin America: Recent evidence and some policy issues". IMF Working Paper WP/96/4. 1996

Tanzi, V. and Blejer, M. "Inflation, interest rate policy and currency substitution in developing economies: A discussion of some major issues". World Development Vol. 10 N° 9. 1982 p. 781-789.