

**FIXED VERSUS FLEXIBLE EXCHANGE RATES**  
**Preliminaries of a Turn-of-Millennium Rematch**

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**First Draft: April 29, 1999**

**This Draft: May 16, 1999**

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Abstract. This note examines the pros and cons of flexible and fixed exchange rates in terms of a bear-bones model which, however, takes into account features that have played a prominent role in recent currency crises, namely, volatility of capital flows and the real exchange rate, currency substitution and financial fragility, and the Credit Channel.

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\* I wish to thank Sara Calvo, Bob Flood, Enrique Mendoza and Carmen Reinhart for many useful comments, and to Alejandro Izquierdo for able research assistance. Errors, omissions and oversimplifications are entirely my fault.

## I. Introduction

The bumpy financial road the world traveled since the Mexican devaluation of December 1994 is now reverberating in Think Tanks, IFIs and the halls of academia. The key question is: What should emerging market economies, EMs, do to prevent another replay of these crises, and what can advanced countries do to help? In the competition of ideas, the debate about fixed and flexible exchange rates regimes (Fix and Flex, for short) has taken center-stage. The first round has already been won by Flex (“hands down,” I am tempted to say). All crisis episodes involved countries that, in one way or another, pegged their currencies to a hard currency (typically, the US dollar). Crisis forced the authorities in these countries to abandon the peg, completely losing control of the exchange rate, and launching their economies into deep recession. Thus, concluding “the Fix did it” was hard to resist.

Unfortunately, economics is never that simple and, in the second round, the Fix camp came back with a vengeance, claiming that there are bad Fixes and good Fixes, and a good Fix is, for example, full dollarization (see Calvo (1999), Hanke and Schuler (1999)). Actually, Fischer (1999) appears to have declared a temporary “tie” between the two positions. But, I am afraid, the fight will go on.

This note is a presentation of basic theory, inspired by Poole’s (1970) seminal paper, highlighting issues that have acquired great relevance in the wake of recent crises. These issues are: volatility of capital flows and the real exchange rate, currency substitution and financial fragility, and the Credit Channel. The discussion is extended to analyze fiscal and monetary policies that can be used to support Fix and Flex, and help to offset their negative effects. Moreover, the note ventures into the realm of random shocks, discusses downside and upside

risks, and analyzes the possibility that the shocks themselves are a function of the foreign exchange regime, its transparency and credibility. Being basically an academic exercise, there are no winners or losers. However, the note provides some ammunition to make a case for a (strong) Fix.

For the sake of “truth in advertising,” I would like to say that I chose to conduct the discussion in terms of a bear-bones model in which, as much as possible, intertemporal and credibility issues are left out of the analysis. This seems an appropriate research strategy given that the new issues discussed in the note have been largely ignored by the established literature. Once they are well understood, one can safely proceed to study relevant extensions.

The core of the note is in Section II where the main variants of the bare-bones Mundell-Fleming model are presented. Section III discusses attendant policies to firm up Fix and Flex, goes a little deeper on the appropriate way for accounting for downside and upside risks, and examines the possible endogeneity of random shocks.

## **II. Fixed vs. Flexible Exchange Rates: A Simple Framework**

In this section, I will present a series of simple models that can help to select the appropriate exchange rate regime. The approach follows traditional lines but it incorporates some aspects that have surfaced in connection with recent crises. The bear-bones model is presented in Subsection 1, together with the well-known proposition that the ranking between Fix and Flex depends on the nature of shocks (whether they are real or nominal). This ranking is based on a loss function that depends exclusively on output volatility. Subsection 2 shows that the ranking could be different if one were to put weight on real-exchange-rate volatility, a factor which may give rise—and, has, in recent crises, given rise—to serious financial difficulties. In

addition, I will make some brief remarks on price indexation issues. Finally, Subsections 3 and 4 will bring into the analysis issues of Currency Substitution and the Credit Channel. A theme common to the whole section will be international capital mobility. It will be argued that shocks to capital flows (stemming, for instance, from fluctuations in international interest rates) take the form of both nominal and real shocks.

1. Basic Model. The main points can be made in the context of a Mundell-Fleming model that focuses on the markets for domestic output and money. Thus,

$$y = \alpha e + u, \quad (1)$$

and

$$m = y + v, \quad (2)$$

where  $y$ ,  $e$ , and  $m$  are, respectively, domestic output, the nominal exchange rate, and the nominal stock of domestic money, all expressed in logs. Moreover,  $u$  and  $v$  are stochastic variables (assumed exogenous, for the time being), and  $\alpha$  is a positive parameter. The price level is identified with the nominal price of domestic output. For the sake of simplicity, and unless it is explicitly acknowledged, I will assume the price of domestic output to be a constant. Thus, without loss of generality I will normalize it to unity (and, hence, 0 in logs). Equation (1) is the IS curve where, for simplicity, interest-rate effects are lumped together with the stochastic term  $u$ . In turn, equation (2) is the LM curve where, to economize on notation, the demand for money is assumed unit-elastic with respect to domestic output and, again, interest-rate effects are collected in the stochastic term  $v$ . I will consider two polar systems: fixed exchange rate (Fix),  $e$

= a constant, and  $y$  and  $m$  endogenous; and floating exchange rate (Flex),  $m$  = a constant, and  $y$  and  $e$  endogenous. Section III will examine some common variants of these regimes.

Therefore, under fixed exchange rates, we have

$$\text{var } y = \sigma_u^2, \text{ and, } \text{var } e = 0; \quad (3)$$

and, under floating exchange rates, we have

$$\text{var } y = \sigma_v^2, \text{ and, } \text{var } e = \frac{1}{\alpha^2} (\sigma_u^2 + \sigma_v^2 + 2\rho\sigma_u\sigma_v), \quad (4)$$

where  $\sigma_i, i = u, v$ , is the standard deviation of stochastic variable  $i$ , and  $\rho$  is the correlation coefficient between  $u$  and  $v$ .

Following Poole (1970), most of the literature in this field assumes a loss function which is either the variance of domestic output,  $\text{var } y$ , or some related yardstick.<sup>1</sup> Thus, if the objective is to select the foreign exchange regime that minimizes  $\text{var } y$ , it follows from expressions (3) and (4) that the optimal solution depends on  $\sigma_u^2$  and  $\sigma_v^2$ , which are usually referred to as the volatilities of *real* and *nominal* shocks, respectively. By (3) and (4), one can prove the following proposition that every well-trained economist carries on the tip of her tongue:

Proposition 1. Let us assume that the loss function is  $\text{var } y$ . Then, Fix is better (alt. worse) than Flex, if the volatility of nominal shocks is larger (alt. smaller) than the volatility of real shocks.

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<sup>1</sup> See, for instance, Flood and Marion (1982) and Aizenman and Frenkel (1985).

2. Volatility of the Real Exchange Rate. Recent financial crisis episodes show that sharp changes in the real exchange rate can cause serious financial damage, especially when those changes reflect a large *unanticipated* component (see Calvo (1998 and 1999 a), and the discussion in Subsection 3, below). In terms of our simple model, this implies that we should also include  $\text{var } e$  in the loss function. Clearly, if one were to focus exclusively on  $\text{var } e$ , it trivially follows from (3) and (4) that Fix always dominates Flex. Moreover, the attractiveness of Fix increases as the correlation coefficient between real and nominal shocks,  $\rho$ , goes up. This formal statement, has an interesting real-life counterpart. I will elaborate on that next.

It is fair to say that much of the International Finance literature from the 1970s has given a prominent role to capital mobility. However, papers were mostly motivated by trying to understand shocks involving terms of trade (e.g., the oil shock), i.e., shocks that stemmed from the Current Account not the Capital Account. To be true, the 1980s saw the development of the Debt Crisis literature, dealing with a situation in which countries were virtually rationed out of the capital market. But the view behind those models was that debt-ridden countries had overstepped the boundaries of their (credible) budget constraints, and the literature focused on how best to restore their access to the capital market. Thus, the Debt Crisis literature offers no guidance about the case in which shocks originate in the Capital Market. Those are the kinds of shocks with which we have become familiar today, and which have given rise to a large and growing literature on issues like *contagion* and *herding* (see IMF (1995 and 1999 b)).

Typically, a capital-account shock affects both the IS and the LM curves. For instance, a fall in the international interest rate will likely give a boost to aggregate demand *and* the demand for money, and after a financial crisis, both aggregate demand *and* monetary aggregates fall (for a

discussion of this positive association, see Calvo, Leiderman and Reinhart (1996)). Thus, theory and evidence point out to a positive correlation between real and nominal shocks, i.e.,  $\rho > 0$ . Consequently, as Capital Account shocks become more prominent, the volatility of the real exchange rate goes up, tilting the balance towards Fix.

By keeping the price of domestic goods constant, our model has completely ignored the possibility of indexation. This is an issue that has received a great deal of attention in the literature which, among other things, shows that indexation can radically change some of the standard propositions in International Finance (see, Sachs (1980), Flood and Marion (1983), Aizenman and Frenkel (1985)).

Consider the case in which the price of domestic output is fully indexed to the nominal exchange rate. Thus, the real exchange rate will be constant independently of the nominal exchange rate. Under this assumption, system (1) and (2) boils down to:

$$y = u, \tag{5}$$

and,

$$m = y + e - v. \tag{6}$$

Therefore, under both Fix and Flex,  $\text{var } y = \sigma_u^2$ . Moreover, the variance of  $e$  is obviously lower under Fix (although full indexation may make its variability totally irrelevant). Consequently, full indexation makes both systems either equivalent, in a welfare sense, or gives Fix an edge.

In summary, this subsection shows that if variability of the real exchange rate is an issue, Fix appears to welfare-dominate Flex. This dominance weakens but does not disappear with full

indexation to the exchange rate.<sup>2</sup>

3. Currency Substitution. Unanticipated changes in  $e$  are costly because they disrupt production by affecting the relative price of inputs and outputs but also because of their possible impact on the performance of foreign-exchange-denominated loans, an issue that I will discuss next. What are the sources of currency-denomination mismatch? One source is currency substitution, i.e., the use of foreign currencies as mediums of exchange, especially when it is associated with the existence of a large stock of foreign-exchange deposits, FXD, a widespread phenomenon, as recently documented in IMF (1999 a).<sup>3</sup> Banks are typically subject to regulations that require them, on average, to lend in the same currency in which they are funded. So FXD leads to foreign-exchange-denominated loans, FXL. Will those loans be made to domestic nonindexed sectors, or to indexed sectors, including the rest of the world? It depends on the circumstances. If the nominal exchange rate is highly volatile, then nonindexed sectors are likely to be excluded from FXL and, on those grounds, volatility of  $e$  need not be costly. However, if individuals expect Fix, a larger share of loans is likely to be made to nonindexed sectors, making it costly to switch to Flex (on account of the volatility of  $e$ ).<sup>4</sup>

The above analysis gives the upper hand to (credible) Flex but has ignored 'scale' effects. In fact, our discussion suggests that under FXD net capital inflows may be greater under Fix than

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<sup>2</sup> Flood and Marion (1982) and Aizenman and Frenkel (1985) study situations in which indexation is optimally chosen by the private sector and, thus, may vary with the foreign exchange regime.

<sup>3</sup> For a survey of the currency substitution literature, see Calvo (1996, Chapter 8).

<sup>4</sup> Thus, expectations take center-stage, despite my strenuous efforts to keep them out of the discussion.

under Flex, because loans to nonindexed sectors will be more expensive under Flex than under Fix. Although scale effects lie outside our simple model, the presumption is that capital inflows are welfare enhancing. Hence, scale effects seem to favor Flex. However, the analysis does not end here, because currency substitution could lower Flex's overall volatility (i.e., some weighted average of  $y$  and  $e$  volatilities) relative to Fix, if the smaller capital inflows associated with Flex imply a lower correlation coefficient  $\rho$  between nominal and real shocks. Thus, the answer is ambiguous.<sup>5</sup> It should be clear, however, that a definitely bad scenario is one in which individuals expect Fix and it turns out Flex (as a result of a currency crisis, for example). Since Fix requires being able to sustain the system with enough reserves or contingent loans, the implication would then be that a weak Fix is likely to be a bad system.

So far, I have conducted the analysis under the assumption that the basic random shocks are independent of currency substitution. However, a popular conjecture is that currency substitution increases the variance of nominal shocks (i.e., increases  $\sigma_v^2$ ). Behind this conjecture is the assumption that currency substitution entails close substitutability between domestic and foreign monies (see IMF (1999 a)). Thus, slight parameter changes would have a large impact on the demand for domestic money. Consequently, it follows from the previous analysis that, under this interpretation, currency substitution tilts the balance in favor of Fix.

4. The Credit Channel. Credit market segmentation is a major issue in EMs. In particular,

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<sup>5</sup> My own inclination is to vote for Fix because numerical simulations suggest that volatility has low cost compared with the benefits of scale effects, unless volatility impinges directly upon scale, as in the Sudden Stop case discussed in Calvo (1998). However, scale effect might be insignificant in advanced countries where currency substitution is not an issue, like Japan and the US, in which case Flex might dominate.

nonindexed and nontradable sectors are heavily dependent on bank credit. Thus, changes in  $m$  directly impinge upon output and aggregate demand. Thus, with a constant base money multiplier, the credit channel can be captured by changing the IS curve as follows:

$$y = \alpha e + \delta m + u, \quad 0 < \delta < 1. \quad (7)$$

parameter  $\delta$  is constrained to be less than unity to ensure that real currency depreciation is expansionary (in line with previous analysis).

Consequently, for Fix

$$\text{var } y = \left( \sigma_u^2 + \delta^2 \sigma_v^2 + 2\delta\rho\sigma_u\sigma_v \right) \frac{1}{1-\delta^2}, \text{ and, } \text{var } e = 0; \quad (8)$$

moreover, expression (4) holds unchanged for Flex. As a result, the credit channel tilts the balance in favor of Flex. This implication has to be qualified because it is predicated upon the assumption of a constant money multiplier. For instance, are bank-runs (which change the base money multiplier) more or less likely under Flex than under Fix? This issue will not be studied here but must be kept in mind in any application of the above model.

### III. Supporting Policies and Endogenous Shocks

The models discussed in previous section compare Fix and Flex in isolation from other policies (e.g., fiscal and banking policies), have nothing to say about feasibility (e.g., having enough reserves to fend off a currency run, under Fix) and credibility, and do not discuss the economics behind the random shocks. These are all key questions in the implementation of any

foreign exchange system. This section will consider two of them:<sup>6</sup> (1) supporting policies, and (2) nature of random shocks.

1. Supporting Policies. By this I mean policies that can be employed to improve the performance of a foreign exchange system. Let us first focus on Fix. The major potential weakness of Fix that was detected in the above analysis concerned the Credit Channel. Unanticipated changes in bank deposits, for example, have an immediate impact on bank credit or, at the very least, bank liquidity. Thus, a contraction in bank deposits might either result in a credit crunch (particularly on credit-segmented sectors) or greater vulnerability of the banking sector. The shocks that we are referring to are “stock” shocks, not flow shocks, and, thus, supporting policies should operate on stocks. Fiscal policy, for example, would be ineffective, unless, of course, it helps to reverse the original stock shock (but this issue belongs to the second part of this section). A stock policy *par excellence* is expansion or contraction of central bank credit. Thus, the central bank could expand credit to offset the credit-contraction effect of a decline in bank deposits.<sup>7</sup> This policy faces one fundamental problem, namely, that credit expansion under Fix results, as a general rule, in reserve losses. If the probability distribution of nominal shocks were known, however, the central bank could, in principle, obtain contingent credit lines and thus avoid a balance-of-payments crisis with high probability. Unfortunately,

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<sup>6</sup> The issue of credibility will also be covered, but only tangentially. See Flood and Garber (1994) and Calvo (1996) for a series of papers dealing with the credibility issue in the context of EMs.

<sup>7</sup> Argentina is interesting in this respect because bank deposits shrank by about 18 percent in the first quarter of 1995, while the exchange rate was pegged to the dollar. The central bank substantially lowered deposit reserve requirements to try to offset the contractionary effect on bank credit.

this policy may not suffice if the negative liquidity shock is accompanied by the *expectation* that Fix will be abandoned. For, in that case, nominal interest rates will be high on account of expected devaluation. Thus, even though total bank credit remains constant, interest rates will be high, provoking deleterious output effects, similar to those created by credit contraction (unless, possibly but not necessarily, if monetary authorities give in to pressure and devalue). Expanding central bank credit will not necessarily stabilize the situation because it may exacerbate devaluation expectations.<sup>8</sup> This is a fundamental weakness of Fix that has led to the idea that central banks must have tight credit limits. One such proposal is Currency Boards in which the central bank must keep a certain proportion of the money base in the form of international reserves. However, although systems like that may save the Fix from collapse, they cannot completely offset the effect of the credit channel.

Another concern about Fix is its inability to cushion real shocks. Real shocks impact the IS curve and are, thus, essentially “flow” shocks. One offsetting policy, for example, would be fiscal policy. However, as a general rule, fiscal policy requires Congress approval, impairing its timeliness. A way out of this conundrum, albeit imperfect, is state-contingent fiscal policy. An example is the Copper Stabilization Fund in Chile which must grow when copper prices are high, but is allowed to fall if copper prices are low.<sup>9</sup>

Let us now turn to Flex. A major drawback of Flex is high volatility of the real exchange

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<sup>8</sup> Soros and his brothers-in-arms’ recent coups owe, in no small measure, to futile attempts to lower interest rates under Fix.

<sup>9</sup> Argentina’s Congress is presently working on a law, labeled Fiscal Convertibility Law, that would create a Fund with the following characteristics: It grows when fiscal *revenue* is high, and falls when it is low.

rate. Obvious solutions are Fix-Flex hybrids like Target Zones, i.e., a system of exchange rate bands within which the exchange rate is free to float (target zone), but the central bank intervenes if the no-intervention exchange rate would otherwise leave the target zone. Recalling our previous discussion, the system might be attractive if the Credit Channel is not a serious threat. Unfortunately, however, Target Zones have not prevented high interest rates and excessive credit tightening, as shown in the Mexico 1994/95 and Brazil 1999 crises, for example (see Calvo and Mendoza (1996)).

A very popular policy under Flex is attempting to smooth out sharp fluctuation in the exchange rate by means of open-market operations. At some level, this policy is equivalent to intervention in the foreign exchange market. An open-market purchase implies an expansion of domestic public debt, i.e., higher government indebtedness. The same cut in money supply done through a swap of foreign for domestic money implies the same increase in government indebtedness. Thus, at that level, open market operations lead to a hybrid system which, in practice, is even less transparent than target zones. To be true, the above-mentioned equivalence would break down if domestic and foreign bonds are not perfect substitutes. But imperfect substitution does not invalidate the proposition that open-market operations have a lot in common with foreign exchange market intervention. The lack of transparency in EMs invites suspicion that the exchange rate may suffer sharp devaluation and, as a result, *peso* problems arise, i.e., high ex-post real interest rates.<sup>10</sup>

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<sup>10</sup> This is not an appropriate place to discuss the deeper economics of the peso problem. Suffice it to say that a common problem in EMs is tax evasion. The latter creates a strong tension between (politically motivated) government expenditure targets and their fiscal funding. Thus, as long as the inflation-tax lever is not deactivated, the private sector may be in constant fear that the currency is sharply devalued, a phenomenon that would be reflected in high nominal

2. Nature of Random Shocks. In line with the literature on Fix vs. Flex, I have focused on second moments (variances and volatilities), and assumed shocks are independent of the foreign exchange regime. This will now be modified. In the first place, focusing on second moments is a reasonable procedure if the shocks are symmetric, and upward and downward risks are equally costly. Symmetry is not a very questionable assumption for variables like the terms of trade (in logs), but even in that case cost-symmetry is objectionable. This is especially so for highly indebted EMs. An improvement in the terms of trade puts them inside their incentive-compatible budget constraint, while a deterioration may call for major fiscal adjustment (especially if, as in most cases, terms-of-trade shocks are highly persistent). The same applies (even more strongly) when shocks come from the capital account. In fact, I would conjecture that capital account shocks exhibit the highest downward risks, because of considerations like imperfect information and the costs of sudden stops in capital inflows (see Calvo (1998, 1999 a)). Therefore, by previous section's analysis, these considerations tilt the balance in favor of Fix.

A more radical observation which, quite surprisingly, has not been picked up by the Lucas-Critique generation, is that *random shocks are likely to be a function of the foreign exchange regime*.<sup>11</sup> In fact, in policy discussions it is well recognized that transparency and credibility may help to insulate a country from contagion and false rumors. The current interest in countries like Argentina and Mexico for Dollarization is a case in point. It has been argued, for example, that Dollarization may lower the volatility of capital account shocks (see Calvo (1999 b), Hanke and Schuler (1999)). Dollarization is, of course, a special type of Fix.

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interest rates.

<sup>11</sup> However, for progress in that direction, see Mendoza and Uribe (1999).

Therefore, there is no contradiction in supporting Dollarization while, at the same time, opposing, say, a non-credible Fix—because the latter would be vulnerable to rumors and, thus, subject to possibly large downside risks. Furthermore, on these grounds it would not be contradictory for a Dollarization hawk to also favor a clean Flex, if the rules of the game are credible and well understood. Incidentally, this helps to explain why opinion in policy circles seems to be converging to the view that the optimal choice of a foreign exchange rate regime is either a clean and credible Flex or something akin to Dollarization.

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