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Fear of Floating

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Abstract

In recent years, many countries have suffered severe financial crises, producing a staggering toll on their economies, particularly in emerging markets. One view blames fixed exchange rates--"soft pegs"--for these meltdowns. Adherents to that view advise countries to allow their currency to float. We analyze the behavior of exchange rates, reserves, the monetary aggregates, interest rates, and commodity prices across 154 exchange rate arrangements to assess whether "official labels" provide an adequate representation of actual country practice. We find that, countries that say they allow their exchange rate to float mostly do not--there seems to be an epidemic case of "fear of floating." Since countries that are classified as having a free or a managed float mostly resemble noncredible pegs--the so-called "demise of fixed exchange rates" is a myth--the fear of floating is pervasive, even among some of the developed countries. We present an analytical framework that helps to understand why there is fear of floating.

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I. Introduction

During the past few years, many countries have suffered severe currency and banking crises, producing a staggering toll on their economies, particularly in emerging market countries. In many cases, the cost of restructuring the banking sector has been in excess of twenty percent of GDP and output declines in the wake of crisis have been as large as 14 percent. An increasingly popular view blames fixed exchange rates, specifically "soft pegs," for these financial meltdowns.[1] Not surprisingly, adherents to that view advise emerging markets (EMs) to allow their currency to float. [2]

At first glance, the world--with the notable exception of Europe--does seem to be marching steadily toward floating exchange rate arrangements. As shown in Table 1, according to the International Monetary Fund (IMF), ninety-seven percent of its member countries in 1970 were classified as having a pegged exchange rate; by 1980, that share had declined to thirty-nine percent and, in 1999, it was down to only eleven percent. [3] Yet, this much-used IMF classification takes at face value that countries actually do what they say they do. [4] Even a cursory perusal of the Asian crises countries' exchange rates prior to the 1997 crisis would suggest that their exchange rates looked very much like pegs to the U.S. dollar for extended

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[1] See, for example, Goldstein, (1999).

[2] The textbook definition of a floating exchange rate regime posits money as the nominal anchor and assumes that central banks do not intervene in the market for foreign exchange. For a fuller discussion of what fixed versus flexible exchange rates entail, see Calvo (2000).

[3] Obstfeld and Rogoff (1995), make this point as well.

[4] Levy Yeyati and Sturzenegger (1999), who also examine this issue, propose a reclassification.

periods of time. Only Thailand, however, was explicitly classified as a peg--and one to a basket of currencies at that; the Philippines was listed as having a freely-floating exchange rate, while the others were lumped under the catch-all label of managed floating. Today, these countries are classified as floaters, yet, as they vigorously recover from the turmoil of 1997-98, their exchange rates have ceased to fluctuate in any significant way. [5]

In this paper, we analyze the behavior of exchange rates, foreign exchange reserves, the monetary aggregates, interest rates, and commodity prices across the spectrum of exchange rate arrangements to assess whether the "official labels" provide an adequate representation of actual country practice. The data spans monthly observations for thirty-nine countries during the January 1970-November 1999 period. One-hundred-and-fifty-four exchange rate arrangements are covered.

We present an analytical model that suggests that, even in the best of times, when countries retain voluntary access to international capital markets, lack of credibility will lead to fear of floating, high interest rate volatility, and procyclical interest rate policies. [6] We discuss some of the reasons why countries may be reluctant to allow large swings in their exchange rates.

Some of the key empirical findings are as follows: Countries that say they allow their exchange rate to float mostly do not--there seems to be an epidemic case of **"fear of floating."** Relative to more committed floaters--such as the United States, Australia, and Japan--observed

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[5] See McKinnon (2000) for convincing evidence on this issue.

[6] Indeed "fear of floating" is only part of a more general "fear of large exchange rate swings," particularly in EMs. This reluctance to allow the exchange rate to adjust significantly and rapidly is also manifest in the many episodes during which central banks go to great lengths to avoid a devaluation.

exchange rate variability is quite low. The low variability of the nominal exchange rate does not owe to the absence of real or nominal shocks in these economies--indeed, relative to the United States and Japan most of these countries are subject to larger and more frequent shocks to their terms of trade. This is hardly surprising, given the high primary commodity content of their exports in many cases.

The low relative exchange rate variability stems from deliberate policy actions to stabilize the exchange rate. Reserve volatility (contrary both to what would be expected in a floating exchange rate regime or relative to what is observed in the more committed floaters) is very high. Interest rate volatility (both real and nominal) is significantly higher--and in a different league altogether--from that of the "true(r)" floaters. The high volatility in both real and nominal interest rates suggests both that countries are not relying exclusively on foreign exchange market intervention to smooth fluctuations in the exchange rates--interest rate defenses are commonplace--and that there are chronic credibility problems. The monetary aggregates also show a high degree of variability relative to the more committed floaters. As with interest rates, this variability may owe to procyclical monetary policy aimed at smoothing exchange rate fluctuations.

The evidence suggests that commodity prices (in the local currency)--which drive the fluctuations in the terms-of-trade of many commodity exporters in our sample--are far more volatile than the exchange rate. Apparently policy makers allow the exchange rate to adjust as only a partial absorber of these real shocks, at best. Indeed, in most cases there is no correlation between commodity prices and the exchange rate–consistent with the view that the exchange rate may not be allowed to adjust in response to terms of trade shocks.

As to the interaction among these variables, we find that, consistent with the hypothesis of lack of credibility, the correlation between the exchange rate and interest rates is positive in most instances. Furthermore, in two-thirds of the cases, the correlation between reserves and the exchange rate is negative. This may be interpreted as contemporaneous leaning-against-the-wind.

Lastly, because countries that are classified as having a managed float mostly resemble noncredible pegs, the so-called "demise of fixed exchange rates" is a myth. Instead, the fear of exchange rate movements is pervasive, even among some of the developed countries.[7] Our finding, that most of the episodes that come under the heading of floating exchange rates look more like noncredible pegs, may help explain why earlier studies, which relied on the official classifications of regimes, failed to detect important differences in GDP growth rates and inflation, across peg and the "floating" regimes.[8]

In Section II, we present an analytical framework to explain why the authorities may be so reluctant to allow the exchange rate to fluctuate; the model, which stresses credibility problems, provides well-defined predictions for the behavior of exchange rates, the monetary aggregates, and nominal and real interest rates. Section III provides an analysis of the data for the various exchange rate arrangements in our study, while Section IV examines the temporal and contemporaneous interaction among the variables of interest and contrasts these with the predictions of the model. The concluding section touches on some of the implications of our

[7] For evidence on the reasons behind fear of floating, see Calvo and Reinhart (2000b) and Hausmann, Panizza, and Stein (1999).

[8] See, for instance, Baxter and Stockman (1989), Ghosh, Gulde, Ostry, and Wolf (1997) and Edwards and Savastano (1998) for a review of this literature.

findings.

II. Varieties of Fear of Floating

Motivated by the evidence presented in this paper, we first explore in this section why *lack of credibility* may give rise to fear of floating, procyclical policies, and volatile interest rates, even in "normal periods"--when countries maintain voluntary access to international capital markets. We then discuss other reasons why policy makers may dislike large exchange rate swings.

1. Monetary Policy and Lack of Credibility

Despite their heterogeneity, EMs tend to share a common characteristic--they appear to be reluctant to let their currencies fluctuate. This leads us to conjecture that there may be at least one common cause--lack of credibility. If credibility is not conferred–the monetary authority has no authority. Expectations will rule the day. These credibility problems may be manifested in multiple ways, including volatile interest rates and sovereign credit ratings. Furthermore, lack of credibility may give rise to liability dollarization and limit the central bank's ability to act as an effective lender of last resort, all of which feed this fear of large exchange rate swings. [9]

We can use a simple version of a conventional monetary model to put more structure on the lack of credibility conjecture. Let us assume that the demand for money satisfies the following Cagan form:

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[9] For a discussion of these issues, see Calvo and Reinhart (2000b) and Hausmann, Panizza, and Stein (1999).

$$m_t - e_t = \alpha E_t(e_t - e_{t+1}),\ \alpha > 0 \tag{1}$$

where m and e are the logs of the money supply and the nominal exchange rate, and E_t is the mathematical expectations operator conditional on information available in period t (which includes money supply and exchange rate in period t. The interest-semi-elasticity parameter is denoted by α.

For simplicity, consider the case in which money supply in periods 2 onwards takes a constant value $\overline{m}$. Then one can show that in a Rational Expectations equilibrium we have

$$e_1 = \frac{m_1 + \alpha \overline{m}}{1 + \alpha}. \tag{2}$$

Thus, the exchange rate in period 1 (which we could identify with the *present*) is a weighted average of present and future money supply. Moreover, and by the same token, $e_t = \overline{m}$, for $t = 2, 3, \ldots$. On the other hand, assuming (again, for simplicity) perfect capital mobility and that the international interest rate equals zero, we have that the nominal interest rate $i_t = e_{t+1} - e_t$ satisfies

$$i_1 = e_2 - e_1 = \frac{\overline{m} - m_1}{1 + \alpha}. \tag{3}$$

Case 1. Permanent Increase in Present *m*. Suppose that the economy was at steady state (i.e., money supply constant at $\overline{m}$) and it is shocked by an unanticipated once-and-for-all increase in the supply of money in period 1. By (2) and (3), *the exchange rate suffers a permanent devaluation accompanied by **no** interest rate volatility*.

Case 2. Permanent Increase in Future *m*. By (2) and (3), *a permanent increase in future*

money supply $\overline{m}$ (keeping m_1 constant) *results in an increase in both the current exchange rate and interest rate*.

Under circumstances of poor credibility, a policymaker faced with currency depreciation, who does not intend to increase future money supply, faces a serious dilemma: if money supply in period 1 is not adjusted upward, the ex post *real* interest rate will increase, possibly generating difficulties in the real and financial sectors. On the other hand, if m_1 is jacked up to stabilize interest rates, credibility could be impaired and future expectations could become more unruly and arbitrary.[10]

To increase realism, let us assume that the central bank pays interest i^m on money, and that the demand for money satisfies:

$$\tilde{m}_t - e_t = \alpha E_t(e_t - e_{t+1} + i_t^m),\ \alpha > 0, \tag{4}$$

where "~" on variable *m* is a reminder that it refers to interest-earning money. Calvo and Végh (1995) argue, in related models, that this is a simple way to introduce the typically very-short-run interest rate controlled by the monetary authority. It can readily be verified that equations (2) and (3) are still valid for the present version, if one defines

$$m_t = \tilde{m}_t - \alpha i_t^m. \tag{5}$$

Hence, under this interpretation, raising central-bank-controlled (CBC), interest rates would be equivalent to lowering money supply. In this context, the currency devaluation that would be

[10] Moreover, as shown in Sargent and Wallace (1975) and Calvo (1983), interest-rate targeting may leave the system without a nominal anchor, even in the case where credibility is not an issue.

caused by a positive shock on future money supply, $\overline{m}$, could be partially or fully offset by raising CBC interest rates (recall equation (2)), a typical policy followed in EMs when the exchange rate threatens to rise sharply. Interestingly, by (3), the associated fall in m_1 raises market interest rates even more than if the central banks had stayed put. So this analysis suggests that in practice EMs have exhibited a *pro-interest-rate-volatility* bias.

If policy makers were faced with the choice between stabilizing *i* or stabilizing *e*, then the decision would be clear: stabilize the exchange rate. Exchange rate stabilization provides the economy with a clear-cut nominal anchor, while stabilizing interest rates does not. In general, policymakers will find it optimal to allow for some volatility in both variables, but always steering clear from perfect interest rate stability. This simple exercise illustrates why credibility problems may bias the outcome towards lower exchange rate and higher interest rate volatility, as borne by the facts.

2. Other Reasons for Fear of Floating

The preceding discussion illustrated why lack of credibility may lead to a situation where policy makers wind up stabilizing the exchange rate even at the expense of engaging in procyclical policies. However, there are numerous other reasons why exchange rate stability may be highly sought. [11] In EMs devaluations (or large depreciations) tend to be associated with recessions–not the kind of benign outcome stressed in standard textbooks. This is hardly surprising in light of the fact that in EMs there is pervasive liability dollarization. Defaults and

[11] For empirical evidence on this issues see Calvo and Reinhart (2000b).

general debt servicing difficulties mount if the exchange rate is allowed slide significantly. The adjustments in the current account following these large exchange rate swings are far more acute and abrupt in EM. Credit market access is adversely affected by currency instability. Exchange rate volatility appears to by more damaging to trade in EMs; perhaps because trade is predominantly invoiced in US dollars and hedging opportunities are more limited. The passthrough from exchange rate swings to inflation is far higher in EMs than in developed economies. This latter observation suggests that if policy makers are concerned about inflation, there will be a tendency to cap exchange rate swings. All these factors may help explain why, at least historically there has been a marked tendency in most of the countries in our sample to confine exchange rate movements to relatively narrow bands–an issue we turn to next.

III. Fear of Floating: The Evidence

The preceding analysis suggested that, if lack of credibility is a serious problem, we should expect more volatile interest rates and monetary aggregates in most EMs; we should also expect less volatile exchange rates, as policymakers fear that efforts to smooth interest rates may unhinge expectations. The implied procyclicality of monetary policy suggests that the authorities may tighten in response to adverse shocks, such as a decline in the terms of trade. Furthermore, if these variables are partly driven by changes in *expected* (as opposed to *actual*) money supply we should observe a positive correlation between exchange and interest rates. In this section and the next, we confront these predictions with the data.

Our data is monthly for thirty-nine countries in Africa, Asia, Europe, and the Western Hemisphere during the January, 1970-April 1999 period. The countries are Argentina, Australia,

Bolivia, Brazil, Bulgaria, Canada, Chile, Colombia, Cote D'Ivoire, Egypt, Estonia, France, Germany, Greece, India, Indonesia, Israel, Japan, Kenya, Korea, Lithuania, Malaysia, Mexico, New Zealand, Nigeria, Norway, Pakistan, Peru, Philippines, Singapore, South Africa, Spain, Sweden, Thailand, Turkey, Uganda, Uruguay, the United States, and Venezuela. One-hundred-and-fifty-four exchange rate arrangements are covered in this sample. [12]

In addition to the variables stressed in the analytical framework (exchange rates, nominal and real interest rates, and money), we also focus on the time series properties of international reserves and a broad array of commodity prices (converted to the local currency) that are relevant for specific countries.[13] The motivation for including these two variables is straightforward. In the context of less-than-freely-floating exchange rates, purchases and sales of international reserves are routinely a means for smoothing exchange rate fluctuations (often, alongside interest rate policy, as discussed). As regards commodity prices, we wish to examine the extent to which the exchange rate is allowed to buffer commodity price shocks. If the exchange rate is allowed to accommodate these shocks in countercyclical fashion--as the textbook models suggest when there are asymmetric shocks and flexible exchange rates--then commodity prices in the local currency should be relatively stable. By contrast, if interest rate policy is procyclical, as suggested earlier, and the exchange rate is not allowed to adjust in response to the terms of trade

[12] Our analysis, however, does not give equal attention to all these regimes. In most of the regimes in the earlier part of the sample, there are pervasive capital controls which are less relevant for today's environment. Also, a few of the floating exchange rate episodes occur during hyperinflation, which makes it difficult to interpret and compare the results to other episodes.

[13] The exchange rate is end-of-period. Whenever possible interbank interest rates are used; if these are not available a treasury bill rate is used. All the comparable results for the broader monetary aggregates money and quasi-money in the IMF's definitions are not reported here but available from the authors.

shock, then commodity prices in the local currency will be volatile. The interactions among these variables are examined in Section IV.

It is widely agreed upon that the "pure float" is an artifact of economics textbooks. Yet, despite occasional instances of foreign exchange market intervention, sometimes even in co-ordinated fashion, the United States dollar, US $, floated about as freely against the German Deutschemark, DM, (and now the euro) and the Japanese Yen, ¥, as any currency is allowed to float. For this reason, we compare countries that have regimes that are classified as freely-floating or managed-floating against this "G-3" benchmark. We next examine the behavior of monthly percent changes (unless otherwise noted) of each variable, one at a time. [14]

We can glean what actual policy practices are by analyzing the frequency distributions of exchange rates, foreign exchange reserves, interest rates (real and nominal), and the monetary aggregates around chosen intervals and comparing these across regimes.

According to the IMF's classification scheme, countries are grouped into four types of exchange rate arrangements: peg, limited flexibility, managed floating and, freely-floating. Limited flexibility has, almost exclusively, been used to classify European countries (prior to the monetary union) with exchange rate arrangements vìs-a-vìs one another (i.e., the Snake, the Exchange Rate Mechanism, etc.). Hence, it is possible to evaluate the probability of a particular change or changes in the exchange rate, reserves, etc. conditional on the announced exchange rate regime.

Unless otherwise noted, the bilateral rates reported are with respect to the DM for the European countries and with respect to the United States dollar for everyone else. The choice of

[14] See, for instance, Calvo (1999) and Reinhart (2000).

the DM was owing to the fact that this was the most prominent reserve currency in Europe and, as Germany was the low inflation country for many years, currencies in Europe were largely tied to the DM. For the remaining countries the dollar is the usual anchor currency of choice, as the largest share of EM's external debt is denominated in US dollars and world trade is predominantly dollar invoiced.

We denote the absolute value of the percent change in the exchange rate, foreign exchange reserves, and base money by ε, $\Delta R/R$, $\Delta m/m$, respectively. The change in the interest rate, $i_t - i_{t-1}$, is given by Δi.[15] Letting x^c denote the absolute value for some critical threshold, we can estimate the probability that the variable in question, x, (where x, can be ε, $\Delta R/R$, $\Delta m/m$, and Δi), falls within some pre-specified bounds, conditional on a particular exchange rate arrangement.

For example, if $x^c = 1$ %, (i.e., x lies within a plus/minus one percent band), then $P(x < x^c \mid \text{Peg}) > P(x < x^c \mid \text{Float})$ for $x = \varepsilon$. In the textbook case, the probability that the monthly exchange rate change falls within the one percent band should be greatest for the fixed exchange regime and lowest for the freely floating arrangement, with the other two types of arrangements spread in the middle. Because shocks to money demand and expectations when the exchange rate is fixed, are accommodated through purchases and sales of foreign exchange reserves, the opposite pattern should prevail for changes in foreign exchange reserves and base money. Hence, for $x = \Delta R/R$ and $\Delta m/m$, $P(x < x^c \mid \text{Peg}) < P(x < x^c \mid \text{Float})$. Thus, the probability that changes in reserves and the monetary base fall within a relatively narrow band is a decreasing function of the degree of exchange rate rigidity, as money demand shocks and

[15] Real interest rates will be denoted by r.

changes in expectations are accommodated to smooth the exchange rate.

As regards interest rates, the predictions are less clear cut running strictly along the lines of the extent of exchange rate flexibility . As shown in Section II, the variability of interest rates is more closely aligned with the extent of credibility. If the authorities lack credibility and there is fear of floating, then, irrespective of whether the regime is classified as a peg or as a float, interest rate volatility is likely to be higher than when policies are credible. Hence, the likelihood of observing relatively large fluctuations in interest rates will depend on both lack the credibility of the exchange rate regime and on the willingness of the monetary authorities to use interest rate policy as a means of stabilizing the exchange rate.

1. Measuring Volatility: Exchange Rates

Table 2 presents evidence of the frequency distribution of monthly exchange rate changes (in percent) for recent or current episodes that are classified as freely floating regimes. Our chosen threshold values are, x^c = 1 %, and x^c = 2.5 %, which is a comparatively narrow band.[16] For the United States, for example, there is about a 59 percent probability that the monthly US $/DM exchange rate change falls within a relatively narrow plus/minus 2½ percent band. For the $/¥ exchange rate, that probability is slightly higher at 61 percent. By contrast, for Bolivia, Canada, and India (all declared floaters during that period), that probability falls in the 94-to-96 percent range.[5] An alternative way of stating the same facts is that there is only about a 5 percent

[16] For instance following the ERM crisis many European countries adopted (at least, in principle) +/- 15 percent bands for the exchange rate. Similarly, until recently Chile had comparably wide bands. Other examples include Mexico prior to December 1994 which had an "ever-widening" band, as the lower end (appreciation) of the band was fixed and the upper ceiling (depreciation) was crawling, Israel and Colombia during 1994-1998.

probability in those countries that the exchange rate will change more than two-and-a-half percent on any given month (versus more than forty percent for the US $/DM). On average, for the current crop of recent floaters, the probability that the exchange rate change is contained in this moderate plus/minus two-and-a-half-percent band is over 79 percent--significantly above that for the U.S. and Japan.[17] By this metric, post-crisis Mexico approximates a float more closely than any of the others--including Canada. [18], [19]

Moderate-to-large monthly fluctuations in the exchange rate are even rarer among the so-called "managed float" episodes (Table 3). For Egypt and Bolivia, the probability of a monthly exchange rate change greater than two-and-a-half percent is nil--this was also the case for Indonesia and Korea up to the 1997 crisis. Even for self-proclaimed flexible-rate advocates, such as Chile and Singapore, the frequency distribution of their monthly exchange rate fluctuations relative to the U.S. dollar do not vaguely resemble that of the US $/DM or US $/¥, with a significantly higher proportion of observations falling within a narrow band; in the case of Singapore, there is an 89 percent probability that monthly exchange rate changes are within a 2½ percent band, while for Chile that probability is only moderately lower. On average, there is an 88 percent probability that managed floaters' monthly changes in the exchange rate are confined to this narrow band. This exchange rate stability versus the US dollar (or DM if it is a European

[17] The *t-statistic* for the difference in means test is 3.38 with a probability value of (0.00) under the null hypothesis of no difference.

[18] The variance of the monthly changes Mexican peso/US $ is about twice as large as the variance of the monthly changes in the ¥/US $ exchange rate (see Calvo and Reinhart, 2000b).

[19] For a study of Peru's fear of floating, see Morón, Goñi, and Ormeño, 1999, who estimate an implicit intervention band. For a discussion on East Asia's Dollar Standard, see McKinnon, 1999.

country) is surprising in light of the fact that for many of the emerging market countries during these episodes, inflation rates have been well above those observed for the United States and terms-of-trade shocks have been frequent and large. [20]

Not surprisingly, the evidence presented in Tables 4 and 5 shows that for limited flexibility arrangements and for pegs the probabilities that exchange rate changes are confined to this band are even greater, at 92 and 95 percent respectively. Hence, the observed behavior according the change rate regime accords with the priors that exchange rate variability is least for pegs and greatest for floaters. [21]

What is most surprising is the narrowness of variation across regimes. While the mean probability that the exchange rate is contained inside a two-and-a-half band is significantly different when comparing the fixed exchange rate regime with the "freely" floating, other differences across regimes are blurred. For example, the average probability that $\varepsilon < 2.5$ percent for "freely" floating regimes is not significantly different from that for managed floating, which, in turn, is not significantly different from the "limited flexibility" arrangement. There is also no statistically significant difference between the limited flexibility category and the pegged exchange rate.[22]

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[20] An issue we take up later in this section.

[21] From Tables 2-5 we have, $P(\varepsilon < x^c \mid \text{Peg}) = 95.3 > P(\varepsilon < x^c \mid \text{Limited flexibility}) = 92.0 > P(\varepsilon < x^c \mid \text{Managed Floating}) = 87.5 > P(\varepsilon < x^c \mid \text{Float}) = 79.3$.

[22] For the Float-Peg difference, the means test the probability value is (0.00); for the Float-Managed, it is (0.04); for the Managed-Limited flexibility, the means test the probability value is (0.32) while for the Limited flexibility-Peg it is (0.44).

2. Measuring Volatility: International Reserves

Yet, exchange rates tell only part of the story of policy preferences. We cannot glean from exchange rates alone what would have been the extent of exchange rate fluctuations in the absence of policy interventions--that is, we do not observe the counterfactual. To assess the extent of policy intervention to smooth out exchange rate fluctuations, we next examine the behavior of foreign exchange reserves. In principle, the variance of reserves should be zero in a pure float. The reality, however, it is not that simple, as reserves may change owing to fluctuations in valuation and the accrual of interest earnings. However, even absent these, there are other factors that influence changes in reserves. First, there are "hidden" foreign exchange reserves transactions. Credit lines may be used to defend the exchange rate during periods of speculative pressures. Indeed, several European countries, and particularly Ireland, made ample use of their lines of credit during the Exchange Rate Mechanism (ERM) crisis of 1992-93. Central banks may engage in derivative transactions, much along the lines of Thailand in 1997, which borrowed dollars in the futures market, or issue debt denominated in a foreign currency, such as Brazil continues to do. These transactions hide the true level and variation in reserves. Secondly, even in the absence of any "hidden" reserve transactions, countries may rely more heavily on open market operations and interest rate changes to limit exchange rate, as discussed in Section II.

Tables 6-9 summarizes the frequency distribution of monthly reserve changes (in U.S. dollars). With the exception of the United States and the few European countries in the sample, most countries in Table 7 hold the lion's share of their foreign exchange reserve holdings in

dollar-denominated assets, hence, for this group valuation changes are not an issue.[23] As Table 7 shows, there is about a 74 percent probability that Japan's monthly changes in foreign exchange reserves falls in a plus/minus two-and-a-half percent band. In the case of Mexico, there is only a 28 percent probability that changes are that small, while in the case of Bolivia that probability is even lower; note that for post crisis Korea there is only a 6 percent probability that reserves changes are inside the band.[24] Indeed, for all other countries, large swings in foreign exchange reserves appear to be commonplace, consistent with a higher extent of intervention in the foreign exchange market--even relative to what is to be expected a priori from a freely floating exchange rate regime.[25] For the group of "floaters" the average probability is 16.2 percent--less that one-half the Japan-U.S. average.[26] Indeed, the observed behavior of international reserves runs counter to our priors--$P(\Delta R/R, < x^c \mid \text{Peg}) < P(\Delta R/R, < x^c \mid \text{Float})$. Indeed, for the 2.5 percent band, we find that reserve variability is highest for the "floaters" and least for the limited flexibility arrangements.

3. Interest Rate Volatility, Lack of Credibility, and Procyclical Policies

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[23] One may also want to construct an estimate of interest earned by the reserve holdings and adjust the reported stocks accordingly. This is work in progress.

[24] So while monthly changes in the Mexican peso/US $ exchange rate are almost twice as variable as monthly changes in the ¥/US $ rate--changes in Mexico's reserves are 18 times as volatile as changes in U.S. reserves and 25 times as variable as changes in Japan's reserves and more than four times as volatile as Argentina's reserves.

[25] Nor is this exclusively an emerging market phenomenon--Canada's and New Zealand's reserve changes are about seven times and five times, respectively, as volatile as that of the United States.

[26] The difference is statistically significant.

As discussed in Section II, policy intervention to smooth exchange rate fluctuations need not be limited to transactions in foreign exchange markets. While interest rates in the United States and Japan are predominantly set with domestic policy objectives in mind, interest rate policy in many of the other countries in our sample accords a much higher weight to the stabilization of the exchange rate–particularly when there are credibility problems. It would be difficult to justify the very high relative volatility of nominal and real interest rates in these countries exclusively on the basis of changes in domestic "policy fundamentals," as Tables 11-12 make plain. The probability that interest rate changes will be confined to a plus/minus fifty-basis-point band for the United States is about eighty-two percent--even including the historically turbulent inflation stabilization period of the early 1980s. For Japan, that probability is even higher. By contrast, during Mexico's "floating exchange rate" regime, there is only a nine percent probability that interest rate changes will be less-than or equal-to fifty basis points. Such stability in interest rates seems to elude most emerging markets--even some of those with capital controls (such as India).[27]

As is evident in Table 12, major interest rate changes (by G-3 standards) appear to be the rule. While the probability that interest rates change 500 basis points (five percent) on any given month is about zero for the United States and Japan, that probability is close to thirty percent for Mexico, Peru and India (among the floaters). Nominal and real interest rates in India are about four times as variable as in the U.S.; for Mexico, interest rates are about twenty times as variable, but Peru holds the record.[28] A recent example of Mexico's use of high interest rates as a means

[27] Egypt and Singapore are interesting exceptions

[28] See Calvo and Reinhart (2000b) for details.

to limiting exchange rate pressures (despite a slowing economy and an adverse terms-of-trade shock) comes from the aftermath of the Russian crisis in August of 1998.

Nor is Mexico unique in this regard among EMs. Turning to the managed floaters (Tables 13-14), other emerging markets, including Brazil, Chile, Turkey and Uruguay have an equally high or higher incidence of large fluctuations in interest rates (Table 14). While in the case of Turkey and Uruguay, it is at least partially owing to their comparatively high inflation rates, that is not the case for the others. The picture painted by the volatility of real interest rates (Appendix Tables 5 and 6) is quite similar.

When comparing interest rate behavior across the four types of exchange rate regimes, interest rates are the most stable for the limited flexibility group--which is almost exclusively made up of European industrial countries--and least stable for the managed floating group, which is predominantly comprised of EMs.[29] Indeed, Calvo and Reinhart (2000b) show that the variance of interest rates in low inflation in EMs is about four times that of developed economies–that gap is far greater for countries with a history of inflation.

Moreover, such interest volatility is not the result of adhering to strict monetary targets in the face of large and frequent money demand shocks. In reality, most of these countries do not have explicit or implicit money supply rules. Interest rate volatility would appear to be the byproduct of a combination of trying to stabilize the exchange rate through open market operations and lack of credibility.

The possible procyclicality of monetary policy, as discussed in the context of the model

[29] It is important to note that some countries with a highly regulated financial sector and limited capital mobility simultaneously show exchange rate and interest rate stability; examples include, Egypt, India (in the earlier managed floating period), Kenya, and Nigeria.

presented in Section II, is also evident in the high volatility of base money both relative to the United States and relative to the exchange rate (Tables 19-22). Other monetary aggregates show similar volatility.[30] In the case of a float with a money supply rule we should expect to see, $P(\Delta m/m < x^c \mid \text{Peg}) < P(\Delta m/m < x^c \mid \text{Float})$. Instead, we find that the variability of the monetary aggregates is highest for the floaters, particularly EMs.

3. Exchange rates, commodity prices, and fear of floating

Since the early literature on optimum currency areas, a compelling case for floating versus fixing was made for the cases where idiosyncratic shocks were known to be frequent and large. For countries where a large share of exports is concentrated in a handful of commodities, such idiosyncratic shocks are not difficult to identify. In many EMs, swings in commodity prices are a recurring source of disturbances. These real shocks, it is argued, require an adjustment in the real exchange rate. It follows logically that if the exchange rate is allowed to adjust when these shocks occur, one should observe a similar degree of volatility in commodity prices and the exchange rate. Put differently, commodity prices (which are usually quoted in dollars) when converted to the local currency should be relatively stable–as periods when the commodity price goes down (up) the exchange rate depreciates (appreciates). Of course, if there is fear of floating, the exchange rate adjustment does not occur and the domestic currency price of the commodity also falls.

For the countries in the sample where primary commodities loom large in exports, we have culled information on commodity prices (converted to the local currency) on their top

[30] These results are not presented here but are available from the author upon request.

exports. The volatility of commodity prices for the various exchange rate arrangements is then compared to that of the exchange rate. Tables 22-25 provide the details. The uniform message from these tables is that commodity prices in the local currency are far more volatile than the exchange rate. For the group of floaters, the probability of a monthly fluctuations in excess of five percent is about 38 percent while the comparable probability of a change in the exchange rate of that magnitude is about 9 percent. The gap between commodity prices and exchange rate volatility is even wider for the managed floaters, which is comprised entirely of EMs. For that group, the probability of a change in excess of five percent is only about 4 percent for the exchange rate and 39 percent for commodity prices. Furthermore, as shown in Appendix Tables 3-6, in the overwhelming majority of cases the correlations between commodity prices and the exchange rate are low and not statistically significant. Indeed, in many cases they have the wrong sign (i.e., positive).

These observations suggest that, despite the rationale for accommodating real terms of trade shocks that the literature on optimum currency areas provides, countries (including many of the floaters) often choose not to accommodate shocks. Fear of an abrupt exchange rate swing in these cases may dominate the perceived need to allow for the nominal and real exchange rate to adjust.

4. General Observations About the Findings

In this section, we have presented evidence that the variability in international reserves, base money, and interest rates, is high relative to the variance of the exchange rate. The particularly high variability in interest rates and money in EMs is consistent with the presence of

credibility problems and procyclical policies of the type discussed earlier. We also find that commodity prices in the local currency are far more variable than the exchange rate and that there is little correlation among the two. This may suggest that the exchange rate is not often allowed to play the shock absorber role textbooks assign to it. Taken together, these findings would suggest that in many cases the authorities are attempting to stabilize the exchange rate through both direct intervention in the foreign exchange market and open market operations–nor is fear of floating limited to a particular region. Indeed, in EMs has largely been confined to brief periods following currency crisis or chaotic episodes of hyperinflation. Furthermore, the far greater variability of interest rates in EMs is a possible indication that lack of credibility is a fairly common problem even in normal periods. As suggested in Section II, the credibility problems faced in many EMs may be so severe so as lead to the periodic loss of access to international capital markets.[31]

IV. Interest Rate and Exchange Rate Dynamics

In the preceding section, we examined the time series properties of the variables of interest individually. In this section, we examine the lack of credibility hypothesis by focusing on the interaction between exchange rates and interest rates. The simple model developed in Section II suggests that a permanent increase in future money supply (keeping the current money supply constant) results in an increase in both the current exchange rate and interest rate. The interest rate increase is even greater if the central bank increases its policy rate. This implies that,

[31] For evidence on the vast differences between EMs and developed economies in the capital flow reversals during devaluations and the incidence and severity of the downgrades in sovereign credit ratings following these events see Calvo and Reinhart (2000a and 2000b).

if these variables are partly driven by changes in *expected* (as opposed to *actual*) money supply we should observe a positive correlation between the level of the exchange and the interest rate. However, as shown in Section III we also find ample evidence to suggest that there is considerable intervention in the foreign exchange market in many of the cases under study. For this reason, we also include reserves in our analysis.

Since the three variables in question are nonstationary almost without exception in the cases we analyze, we work with first differences. As before, exchange rates, reserves, and interest rates are denoted by ε, $\Delta R/R$, and Δi, respectively. To examine both temporal and contemporaneous links among the variables, we opt for estimating a vector autoregression (VAR). The estimation is over the period spanned by an exchange rate regime; these are the episodes shown in Tables 2-4. Owing to insufficient variability in the exchange rate, we do not include in this part of the analysis the cases where there is a peg.[32] This method of defining the sample has the appealing feature that it reduces the Lucas-critique-type problem, as we do not sample variables accross a regime switch, where their interaction may change. The lag length was chosen on a case-by-case basis using the Schwartz criteria.

We are interested in two sets of results. The first of these focuses on the temporal relationships, the standard block-exogeneity tests. The second examines the contemporaneous relationship among the residuals.

Given the large number of cases in our sample, we summarize the results as much as

[32] Despite the fact that some pegs are actually narrow bands that allow for modest variability.

possible.[33] Turning to the temporal causality results first, top panel of Table 26 presents a summary for each of the three equations in the VAR of the proportion of cases where a particular coefficient takes on a positive or negative sign and information of which these are statistically significant at a five percent confidence level. Not surprisingly, in most of the cases, the exchange rate equations have the poorest fit while the interest rate equation has the best.[34]

We focus our attention on the exchange rate-interest rate link. As regards how interest rate changes temporally affect the exchange rate (the exchange rate equation), no clear or compelling pattern emerges. In 46 percent of the cases, the coefficient on the interest rate change is positive, which is what can be expected when there are credibility problems and interest rate increases signal future depreciations. In the remaining 54 percent of the cases, the coefficient is negative. This would be the case when tight monetary policies (raising interest rates) lead to a future appreciation. However, recalling the model in Section II (when the central bank controls a policy interest rate), a rise in interest rates *that is an offset to an expected permanent increase in the money supply* may only be intended to prevent most or all of the depreciation--not engineer an appreciation. At any rate, only in twenty percent of the cases are the coefficients significant. Reserve changes do not appear to temporally cause exchange rate changes in one direction or another.

Turning to the interest rate equation, the most common pattern revealed in the data (68 percent), column (4), is that exchange rate changes are positively related to subsequent interest

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[33] The results on a country-by-country basis are available from the authors.

[34] See, for example, the well-known results of Meese and Rogoff (1984) on the poor track record of exchange rate models.

rate changes. A depreciation leads to higher interest rates, as discussed earlier this may be the case if either the central bank stays put (unchanged m_1 or a less than full offset by the central bank). In thirty one percent of the cases, the coefficients were significant.[35] Reserve accumulation, most often, leads to a decline in interest rate, which is what can be expected if there is only partial or no sterilization. In the reserves equation, it is worth noting that in twenty percent of the cases there is evidence of systematic temporal leaning-against-the wind feedback rule, with reserves falling as a result of depreciation.

We next turn to the contemporaneous correlations among the residuals. The bottom panel shows the correlation patterns among the three pairs of residuals ε and Δi, ε and $\Delta R/R$, and Δi and $\Delta R/R$. Three broad patterns prevail in the data. First, consistent with the lack of credibility hypothesis, in most instances, the correlation between the exchange rate and interest rates is positive. Secondly, in two-thirds of the cases the correlation between reserves and the exchange rate is negative. This may be interpreted as contemporaneous leaning-against-the-wind, an it is in line with the high degree of reserve variability and fear of floating discussed earlier. Thirdly, in nearly three-quarters of the cases, interest changes and reserve changes are negatively correlated. This has, at least, two possible interpretations. One explanation, is that reserve changes are largely unsterilized--this is at odds with widespread practices of EMs and developed economies alike. [36] The other, more plausible (in our view), is that reserves are built up in good states of

[35] Note that, this case has the highest proportion of cases where a coefficient was statistically significant. It is followed closely by a positive autoregressive parameter in the interest rate equation, column (5).

[36] See Reinhart and Montiel (1999) and Reinhart and Reinhart (1999) on the evidence on sterilization policies in EMs.

nature (i.e., lower international interest rates, higher credibility, inflation stabilization) that are associated with declining interest rates and capital inflows.

In sum, while more work is clearly needed to identify credibility problems and its attendant fear of floating, this analysis is broadly consistent with several of its implications. Interest rates and exchange rates move in the same direction, more often than not, and reserves do not turn a blind eye to exchange rate fluctuations.

V. Concluding Remarks

Since the Asian financial crisis and the subsequent crises in Russia and Brazil, many observers have suggested that intermediate exchange rate regimes are vanishing and countries around the world are moving toward corner solutions--hard pegs, such as currency boards, dollarization, or currency unions, or, at the other end, freely-floating exchange rate regimes. [37] On the surface, at least, this statement appears to accurately depict recent trends. Eleven countries in Europe chose to give up their national currencies, while Ecuador was the first of what may be several countries in Latin America to adopt the United States dollar as its official national tender. At the other end of the spectrum, Korea, Thailand, Brazil, Russia, Chile, Colombia, and, more recently, Poland have announced their intentions to allow their currencies to float freely. On the basis of labels, at least, it would appear that currency arrangements at the outset of the new millennium will be very different. If countries have either hard pegs or floating exchange rates, some have argued, speculative attacks and currency crises will be a relic of the past.[38]

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[37] For interesting discussion of these issues, see Frankel, Schmukler, and Servén (2000).

[38] See Goldstein (2000), for example.

Yet, a careful reading of the evidence on exchange rate policy presents a strikingly different picture. Announcements of "intentions" to float, to be sure, are not new. The Philippines announced it would float on January 1988, yet less than ten years later, following its 1997 currency crises, its exchange rate policy would be lumped together with the rest of the affected Asian countries, under the commonly-used (but ill-defined) label of a "soft peg." Bolivia announced it would float on September 1985, owing to its hyperinflation--despite this announcement its exchange rate so closely tracked the United States dollar that the regime was reclassified as a managed float on January 1998. [39] Korea and Thailand, despite their new floating status, are amassing reserves at a hectic pace at the time of this writing. [40] Indeed, once financial markets settled and capital flowed back to Asia, their currencies are fluctuating much the way they did prior to the crisis--that is to say, they are not fluctuating at all.

Is the middle disappearing? We don't think so. Fear of floating–or more generally, of large currency swings-- is pervasive, particularly among EMs. The supposedly disappearing middle accounts for the lion's share of country practices. Indeed, one of the hardest challenges that a researcher or policy maker that is trying to draw lessons from the experiences of countries that are at the corners faces is that there are hardly any countries there to study. The experiences of some of the floaters like the United States and Japan are not particularly relevant for EMs. Similarly, the number of countries with hard pegs are so few (excluding small islands), that it is

[39] Managed indeed, as **all** exchange rate movements versus the US dollar are contained within a one percent band.

[40]Of course, one interpretation of these developments is that, burnt the serious liquidity shortage faced during the 1997-1998 crisis, these countries are seeking to build a "war chest" of international reserves so as to avoid having similar problems in the future.

difficult to draw generalized conclusions.

One change that does appear to be taking place (Asia exempted) is that interest rate policy, such as that discussed in Section II, is replacing foreign exchange intervention as the preferred means of smoothing exchange rates. This is evident in the high variability of interest rates in EMs and in the practices of countries like Mexico and Peru. Does this make countries less vulnerable to currency crisis? It is possible, but not probable. As long as there is fear of floating (irrespective of how exchange rate fluctuations are smoothed) the incentives for liability dollarization will remain. Furthermore, in the context of the framework discussed earlier, the procyclicality in interest rate policy will have its limits (just as international reserves have their limit), as interest rate hikes to defend the currency take their toll on the economy and the financial sector. Economic theory provides us with well-defined distinctions between fixed and flexible exchange rate regimes, but we are not aware of any criteria that allows us to discriminate as to when a managed float starts to look like a soft peg. Indeed, the evidence presented here suggests it is often quite difficult to distinguish among the two. All that we can say is that, when it comes to exchange rate policy, discretion rules the day.

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Table 1. Exchange Rate Classification over the Years

Year	Percent of countries in the sample which were classified by the IMF as having a:			
	Peg	Limited flexibility	Managed	Flexible
1970	97.2	0.0	0.0	2.8
1975	63.9	11.1	13.9	11.1
1980	38.9	5.6	47.2	8.3
1985	33.3	5.6	36.1	25.0
1990	19.4	13.9	30.6	36.1
1995	13.9	8.3	38.9	38.9
1999	11.1	11.1	33.3	44.5

Table 2. Exchange Rate Volatility in Recent or Current **"Floating**" Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in nominal exchange rate falls within:	
		+/- 1 percent band	+/- 2.5 percent band
United States $/DM	**February 1973-April 1999**	**26.8**	**58.7**
Japan	**February 1973-April 1999**	**33.8**	**61.2**
Australia	January 1984-April 1999	28	70.3
Bolivia	September 1985-December 1997	72.8	93.9
Canada	June 1970-April 1999	68.2	93.6
India	March 1993-April 1999	82.2	93.4
Kenya	October 1993-December 1997	50	72.2
Mexico	December 1994-April 1999	34.6	63.5
New Zealand	March 1985-April 1999	39.1	72.2
Nigeria	October 1986-March 1993	36.4	74.5
Norway	December 1992-December 1994	79.2	95.8
Peru	August 1990-April 1999	45.2	71.4
Philippines	January 1988-April 1999	60.7	74.9
South Africa	January 1983-April 1999	32.8	66.2
Spain	January 1984-May 1989	57.8	93.8
Sweden	November 1992-April 1999	35.1	75.5
Uganda	January 1992-April 1999	52.9	77.9
Average, excluding U.S. and Japan		51.67	79.27
Standard deviation, excluding U.S. and Japan		17.83	11.41
Memorandum: The Post-Asian-crisis "floaters"			
Indonesia	July 1997-April 1999	9.5	14.3
Korea	November 1997-April 1999	5.9	17.7
Thailand	July 1997-April 1999	14.3	38.1

Table 3. Exchange Rate Volatility in Recent or Current **"Managed Floating**" Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in nominal exchange rate falls within:	
		+/- 1 percent band	+/- 2.5 percent band
United States $/DM	**February 1973-April 1999**	**26.8**	**58.7**
Japan	**February 1973-April 1999**	**33.8**	**61.2**
Bolivia	January 1998-April 1999	100	100
Brazil	July 1994-December 1998	83.1	94.3
Chile	October 1982-April 1999	45.5	83.8
Colombia	January 1979-April 1999	15.6	86.8
Egypt	February 1991-December 1998	95.7	98.9
Greece	January 1977-December 1997	58.6	85.3
India	February 1979-February 1993	53.6	84.5
Indonesia	November 1978-June 1997	96.4	99.1
Israel	December 1991-April 1999	45.5	90.9
Kenya	January 1998-April 1999	51	70.6
Korea	March 1980-October 1997	80.1	97.6
Malaysia	December 1992-September 1998	59.4	81.2
Mexico	January 1989-November 1994	64.3	95.7
Norway	January 1995-April 1999	56.9	90.2
Pakistan	January 1982-April 1999	77.8	92.8
Singapore	January 1988-April 1999	61.5	88.9
Turkey	January 1980-April 1999	12.6	36.8
Uruguay	January 1993-April 1999	22.7	92
Venezuela	April 1996-April 1999	60.6	93.9
Average, excluding U.S. and Japan		60.05	87.54
Standard deviation, excluding U.S. and Japan		25.43	14.28

Table 4. Exchange Rate Volatility in Recent or Current **"Limited Flexibility**" Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in nominal exchange rate falls within:	
		+/- 1 percent band	+/- 2.5 percent band
United States $/DM	**February 1973-April 1999**	**26.8**	**58.7**
Japan	**February 1973-April 1999**	**33.8**	**61.2**
France	March 1979-April 1999	86.7	97.5
Greece	January 1998-April 1999	40	80
Malaysia	January 1986-February 1990	71.4	98.1
Spain	June 1989-April 1999	67	92.4
Sweden	June 1985-October 1992	58.1	92.1
Average, excluding U.S. and Japan		64.64	92.02
Standard deviation, excluding U.S. and Japan		17.23	7.27

Table 5. Exchange Rate Volatility in Recent or Current **"Fixed"** Exchange Rate Regimes[1]

Country	Period	Probability that the monthly percent change in nominal exchange rate falls within:	
		+/- 1 percent band	+/- 2.5 percent band
United States $/DM	**February 1973-April 1999**	**26.8**	**58.7**
Japan	**February 1973-April 1999**	**33.8**	**61.2**
Argentina	March 1991-April 1999	97.9	100
Bulgaria	June 1997-November 1999	65.5	93.1
Cote D'Ivoire	January 1970-April 1999	97.7	99.4
Estonia	June 1992-November 1999	85.4	100.0
Kenya	January 1970-September 1993	56.7	85.6
Lithuania	April 1994-November 1999	100.0	100.0
Malaysia	March 1990-November 1992	84.4	96.9
Nigeria	April 1993-April 1999	98.6	98.6
Norway	December 1978-November 1992	55.7	86.8
Singapore	January 983-December 1987	66.1	96.6
Thailand	January 1970-June 1997	93.6	98.5
Venezuela	July 1994-March 1996	95	95
Average, excluding U.S. and Japan		83.05	95.88
Standard deviation, excluding U.S. and Japan		17.22	5.01

1 Recent pegs with few monthly observations are Malaysia in September 1998 and Egypt in January 1999.

Table 6. Foreign Exchange Reserve Volatility in Recent or Current "**Floating"** Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in foreign exchange reserves falls within:	
		+/- 1 percent band	+/- 2.5 percent band
United States	**February 1973-April 1999**	**28.6**	**62.2**
Japan	**February 1973-April 1999**	**44.8**	**74.3**
Australia	January 1984-April 1999	23.9	50
Bolivia	September 1985-December 1997	8.1	19.6
Canada	June 1970-April 1999	15.9	36.6
India	March 1993-April 1999	21.6	50
Kenya	October 1993-December 1997	13.7	27.4
Mexico	December 1994-April 1999	13.2	28.3
New Zealand	March 1985-April 1999	11.8	31.4
Nigeria	October 1986-March 1993	7.7	12.8
Norway	December 1992-December 1994	36.1	51.9
Peru	August 1990-April 1999	23.1	48.1
Philippines	January 1988-April 1999	9.7	26.1
South Africa	January 1983-April 1999	8.7	17.4
Spain	January 1984-May 1989	18.5	40.1
Sweden	November 1992-April 1999	8.9	33.3
Uganda	January 1992-April 1999	17.7	32.9
Venezuela	March 1989-June 1994	20.3	35.9
Average, excluding U.S. and Japan		16.18	33.86
Standard deviation, excluding U.S. and Japan		7.66	11.99
Memorandum: The Post-Asian-crisis "floaters"			
Indonesia	July 1997-April 1999	10	29.9
Korea	November 1997-April 1999	0	5.6
Thailand	July 1997-April 1999	9.1	40.9

1 Reserves are in US dollars. Since the US holds its reserves in foreign currencies, much of the fluctuations in these simply reflect valuation changes arising from fluctuations in the dollar.

Table 7. Foreign Exchange Reserve Volatility in Recent or Current "**Managed Floating"** Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in foreign exchange reserves falls within:	
		+/- 1 percent band	+/- 2.5 percent band
United States	**February 1973-April 1999**	**28.6**	**62.2**
Japan	**February 1973-April 1999**	**44.8**	**74.3**
Bolivia	January 1998-April 1999	6.3	12.5
Brazil	July 1994-December 1998	22.2	51.8
Chile	October 1982-April 1999	21.3	48.2
Colombia	January 1979-April 1999	28.4	54.2
Egypt	February 1991-December 1998	37.8	69.4
Greece	January 1977-December 1997	13.1	28.9
India	February 1979-February 1993	13	36.7
Indonesia	November 1978-June 1997	22.8	41.5
Israel	December 1991-April 1999	19.1	43.8
Kenya	January 1998-April 1999	0	14.3
Korea	March 1980-October 1997	16.1	37.7
Malaysia	December 1992-September 1998	34.3	55.7
Mexico	January 1989-November 1994	15.3	31.9
Norway	January 1995-April 1999	15.4	42.3
Pakistan	January 1982-April 1999	3.9	12.1
Singapore	January 1988-April 1999	31.1	74.8
Turkey	January 1980-April 1999	10.3	23.3
Uruguay	January 1993-April 1999	16.2	36.5
Venezuela	April 1996-April 1999	11.8	29.4
Average, excluding U.S. and Japan		17.81	39.21
Standard deviation, excluding U.S. and Japan		10.05	17.55

1 Reserves are in US dollars. Since the US holds its reserves in foreign currencies, much of the fluctuations in these simply reflect valuation changes arising from fluctuations in the dollar.

Table 8. Foreign Exchange Reserve Volatility in Recent or Current **"Limited Flexibility**" Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in nominal exchange rate falls within:	
		+/- 1 percent band	+/- 2.5 percent band
United States $/DM	**February 1973-April 1999**	**26.8**	**58.7**
Japan	**February 1973-April 1999**	**33.8**	**61.2**
France	March 1979-April 1999	31.4	54.9
Germany	March 1973-April 1999	16.9	49.4
Greece	January 1998-April 1999	6.3	31.3
Malaysia	January 1986-February 1990	20	35.9
Spain	June 1989-April 1999	36.9	64.7
Sweden	June 1985-October 1992	13.5	39.3
Average, excluding U.S. and Japan		20.83	45.92
Standard deviation, excluding U.S. and Japan		11.41	12.68

Table 9. Foreign Exchange Reserve Volatility in Recent or Current "**Fixed"** Exchange Rate Regimes [1,2]

Country	Period	Probability that the monthly percent change in foreign exchange reserves falls within:	
		+/- 1 percent band	+/- 2.5 percent band
United States	**February 1973-April 1999**	**28.6**	**62.2**
Japan	**February 1973-April 1999**	**44.8**	**74.3**
Argentina	March 1991-April 1999	15.3	36.7
Bulgaria	June 1997-November 1999	20.7	48.2
Cote D'Ivoire	January 1970-April 1999	2.3	8.7
Estonia	June 1992-November 1999	12.4	32.6
Kenya	January 1970-September 1993	7.8	20.8
Lithuania	April 1994-November 1999	10.5	37.3
Malaysia	March 1990-November 1992	9.1	39.4
Nigeria	April 1993-April 1999	4.4	8.9
Norway	December 1978-November 1992	14.3	35.1
Singapore	January 1983-December 1987	51.7	83.3
Thailand	January 1970-June 1997	21.3	50.2
Average, excluding U.S. and Japan		15.44	36.47
Standard deviation, excluding U.S. and Japan		13.43	20.79

1 Reserves are in US dollars. Since the US holds its reserves in foreign currencies, much of the fluctuations in these simply reflect valuation changes arising from fluctuations in the dollar.

2 Recent pegs with few monthly observations are Malaysia in September 1998 and Egypt in January 1999.

Table 10. Nominal Interest Rate Volatility in Recent or Current **"Floating"** Exchange Rate Regimes

Country	Period	Probability that the monthly change in nominal interest rate falls within:	
		+/- 0.25 percent (25 basis points)	+/- 0.5 percent (50 basis points)
United States	**February 1973-April 1999**	59.7	80.7
Japan	**February 1973-April 1999**	67.9	86.4
Australia	January 1984-April 1999	28.1	53.9
Bolivia	September 1985-December 1997	16.3	25.9
Canada	June 1970-April 1999	36.1	61.9
India	March 1993-April 1999	6.4	15.9
Kenya	October 1993-December 1997	19.6	25.5
Mexico	December 1994-April 1999	5.7	9.4
New Zealand	March 1985-April 1999	40	59.4
Nigeria	October 1986-March 1993	89.7	91
Norway	December 1992-December 1994	32.1	51.9
Peru	August 1990-April 1999	24.8	32.3
Philippines	January 1988-April 1999	22.1	38.9
South Africa	January 1983-April 1999	35.6	53.1
Spain	January 1984-May 1989	30.8	41.5
Sweden	November 1992-April 1999	71.8	91.1
Uganda	January 1992-April 1999	11.6	32.6
Venezuela	March 1989-June 1994	62.5	62.5
Average, excluding U.S. and Japan		33.33	46.68
Standard deviation, excluding U.S. and Japan		23.44	23.68
Memorandum: The Post-Asian-crisis "floaters"			
Indonesia	July 1997-April 1999	0	0
Korea	November 1997-April 1999	13.3	19.9
Thailand	July 1997-April 1999	4.6	9.1

Table 11. Nominal Interest Rate Volatility in Recent or Current **"Floating"** Exchange Rate Regimes (continued)

Country	Period	Probability that the monthly change in nominal interest rate is greater than:	
		+/- 4 percent (400 basis points)	+/- 5 percent (500 basis points)
United States	**February 1973-April 1999**	**0.3**	**0.3**
Japan	**February 1973-April 1999**	**0**	**0**
Australia	January 1984-April 1999	0	0
Bolivia	September 1985-December 1997	14.8	11.8
Canada	June 1970-April 1999	2.8	2.1
India	March 1993-April 1999	23.8	30.6
Kenya	October 1993-December 1997	15.7	11.8
Mexico	December 1994-April 1999	37.7	28.3
New Zealand	March 1985-April 1999	1.8	0.6
Nigeria	October 1986-March 1993	1.4	1.4
Norway	December 1992-December 1994	4.1	4.1
Peru	August 1990-April 1999	31.4	29.5
Philippines	January 1988-April 1999	1.5	0.7
South Africa	January 1983-April 1999	0.5	0
Spain	January 1984-May 1989	4.1	4.1
Sweden	November 1992-April 1999	1.3	0
Uganda	January 1992-April 1999	3.6	3.6
Venezuela	March 1989-June 1994	18.7	17.2
Average, excluding U.S. and Japan		10.20	9.11
Standard deviation, excluding U.S. and Japan		12.08	11.28
Memorandum: The Post-Asian-crisis "floaters"			
Indonesia	July 1997-April 1999	75	70.1
Korea	November 1997-April 1999	13.3	6.7
Thailand	July 1997-April 1999	22.7	22.7

Table 12. Nominal Interest Rate Volatility in Recent or Current **"Managed Floating"** Exchange Rate Regimes

Country	Period	Probability that the monthly change in nominal interest rate falls within:	
		+/- 0.25 percent (25 basis points)	+/- 0.5 percent (50 basis points)
United States	**February 1973-April 1999**	**59.7**	**80.7**
Japan	**February 1973-April 1999**	**67.9**	**86.4**
Bolivia	January 1998-April 1999	31.1	43.8
Brazil	July 1994-December 1998	11.1	20.4
Chile	October 1982-April 1999	5	11.1
Colombia	January 1979-April 1999	50.6	62.6
Egypt	February 1991-December 1998	78.9	93.7
Greece	January 1977-December 1997	75.7	93.8
India	February 1979-February 1993	49.7	60.9
Indonesia	November 1978-June 1997	30.6	46.8
Israel	December 1991-April 1999	26.4	44.8
Kenya	January 1998-April 1999	28.6	42.8
Korea	March 1980-October 1997	31.1	51.9
Malaysia	December 1992-September 1998	66.7	83.3
Mexico	January 1989-November 1994	8.3	16.7
Norway	January 1995-April 1999	65.9	85.1
Pakistan	January 1982-April 1999	34.8	43.5
Singapore	January 1988-April 1999	51.9	75.6
Turkey	January 1980-April 1999	3.4	5.1
Uruguay	January 1993-April 1999	2.7	8
Venezuela	April 1996-April 1999	n.a.	n.a.
Average, excluding U.S. and Japan		36.25	49.44
Standard deviation, excluding U.S. and Japan		25.03	29.25

Table 13. Nominal Interest Rate Volatility in Recent or Current **"Managed Floating"** Exchange Rate Regimes (continued)

Country	Period	Probability that the monthly change in nominal interest rate is greater than:	
		+/- 4 percent (400 basis points)	+/- 5 percent (500 basis points)
United States	**February 1973-April 1999**	**0.3**	**0.3**
Japan	**February 1973-April 1999**	**0**	**0**
Bolivia	January 1998-April 1999	0	0
Brazil	July 1994-December 1998	25.9	22.2
Chile	October 1982-April 1999	51.2	43.2
Colombia	January 1979-April 1999	2.9	1.6
Egypt	February 1991-December 1998	0	0
Greece	January 1977-December 1997	0.7	0.7
India	February 1979-February 1993	11.2	7.7
Indonesia	November 1978-June 1997	5.2	4
Israel	December 1991-April 1999	1.1	1.1
Kenya	January 1998-April 1999	1.1	0
Korea	March 1980-October 1997	0	0
Malaysia	December 1992-September 1998	2.9	1.4
Mexico	January 1989-November 1994	13.9	8.3
Norway	January 1995-April 1999	0	0
Pakistan	January 1982-April 1999	14.1	7.7
Singapore	January 1988-April 1999	0	0
Turkey	January 1980-April 1999	61.4	55.7
Uruguay	January 1993-April 1999	60.1	52.3
Venezuela	April 1996-April 1999	n.a.	n.a.
Average, excluding U.S. and Japan		13.98	11.44
Standard deviation, excluding U.S. and Japan		21.31	18.87

Table 14. Nominal Interest Rate Volatility in Recent or Current **"Limited Flexibility"** Exchange Rate Regimes

Country	Period	Probability that the monthly change in nominal interest rate falls within:	
		+/- 0.25 percent (25 basis points)	+/- 0.5 percent (50 basis points)
United States	**February 1973-April 1999**	**59.7**	**80.7**
Japan	**February 1973-April 1999**	**67.9**	**86.4**
France	March 1979-April 1999	60.5	78.2
Germany	March 1973-April 1999	63.1	80.6
Greece	January 1998-April 1999	14.3	42.9
Malaysia	January 1986-February 1990	52.1	68
Spain	June 1989-April 1999	58.1	81.5
Sweden	June 1985-October 1992	37.1	60.7
Average, excluding U.S. and Japan		47.53	68.65
Standard deviation, excluding U.S. and Japan		18.74	15.01

Table 15. Nominal Interest Rate Volatility in Recent or Current **"Limited Flexibility"** Exchange Rate Regimes (continued)

Country	Period	Probability that the monthly change in nominal interest rate is greater than:	
		+/- 4 percent (400 basis points)	+/- 5 percent (500 basis points)
United States	**February 1973-April 1999**	**0.3**	**0.3**
Japan	**February 1973-April 1999**	**0**	**0**
France	March 1979-April 1999	0.8	0.8
Germany	March 1973-April 1999	1.6	1.3
Greece	January 1998-April 1999	0	0
Malaysia	January 1986-February 1990	3.9	2.1
Spain	June 1989-April 1999	0	0
Sweden	June 1985-October 1992	3.4	2.2
Average, excluding U.S. and Japan		1.62	1.07
Standard deviation, excluding U.S. and Japan		1.69	0.98

Table 16. Nominal Interest Rate Volatility in Recent or Current **"Fixed"** Exchange Rate Regimes

Country	Period	Probability that the monthly change in nominal interest rate falls within:	
		+/- 0.25 percent (25 basis points)	+/- 0.5 percent (50 basis points)
United States	**February 1973-April 1999**	**59.7**	**80.7**
Japan	**February 1973-April 1999**	**67.9**	**86.4**
Argentina	March 1991-April 1999	14.3	31.6
Bulgaria	June 1997-November 1999	57.2	89.3
Cote D'Ivoire	January 1970-April 1999	93.4	95.7
Estonia	June 1992-November 1999	40.0	64.3
Kenya	January 1970-September 1993	53.1	69.2
Lithuania	April 1994-November 1999	14.9	20.9
Malaysia	March 1990-November 1992	72.7	96.9
Nigeria	April 1993-April 1999	97.2	97.2
Norway	December 1978-November 1992	30.4	51.2
Singapore	January 1983-December 1987	50.1	76.7
Thailand	January 1970-June 1997	24.1	41.2
Average, excluding U.S. and Japan		52.33	69.30
Standard deviation, excluding U.S. and Japan		29.11	27.50

Table 17. Nominal Interest Rate Volatility in Recent or Current **"Fixed"**
Exchange Rate Regimes (continued)

Country	Period	Probability that the monthly change in nominal interest rate is greater than:	
		+/- 4 percent (400 basis points)	+/- 5 percent (500 basis points)
United States	**February 1973-April 1999**	**0.3**	**0.3**
Japan	**February 1973-April 1999**	**0**	**0**
Argentina	March 1991-April 1999	18.4	17.3
Bulgaria	June 1997-November 1999	3.57	3.57
Cote D'Ivoire	January 1970-April 1999	0	0
Estonia	June 1992-November 1999	5.7	2.9
Kenya	January 1970-September 1993	1.5	1.5
Lithuania	April 1994-November 1999	19.4	11.9
Malaysia	March 1990-November 1992	0	0
Nigeria	April 1993-April 1999	1.4	1.4
Norway	December 1978-November 1992	6.5	2.4
Singapore	January 1983-December 1987	0	0
Thailand	January 1970-June 1997	2.4	0.8
Average, excluding U.S. and Japan		5.35	3.80
Standard deviation, excluding U.S. and Japan		7.05	5.60

Table 18. Volatility in Base Money Recent or Current **"Floating**" Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in nominal monetary base rate falls within:	
		+/- 1 percent band	+/- 2 percent band
United States $/DM	**February 1973-April 1999**	**42.1**	**67.2**
Japan	**February 1973-April 1999**	**22.7**	**41.9**
Australia	January 1984-April 1999	43.7	72.1
Bolivia	September 1985-December 1997	19.1	33.8
Canada	June 1970-April 1999	32.9	60.7
India	March 1993-April 1999	27.4	53.4
Kenya	October 1993-December 1997	13.7	31.4
Mexico	December 1994-April 1999	5.7	22.7
New Zealand	March 1985-April 1999	18.9	37.9
Nigeria	October 1986-March 1993	14.1	18
Norway	December 1992-December 1994	16	20
Peru	August 1990-April 1999	22.9	34.3
Philippines	January 1988-April 1999	12.5	27.9
South Africa	January 1983-April 1999	45.4	75
Spain	January 1984-May 1989	15.4	32.3
Sweden	November 1992-April 1999	21.8	29.5
Uganda	January 1992-April 1999	15.6	25.9
Venezuela	March 1989-June 1994	10.9	25
	Average, excluding U.S. and Japan	21.00	37.49
	Standard deviation, excluding U.S. and Japan	11.26	17.95
Memorandum: The Post-Asian-crisis "floaters"			
Indonesia	July 1997-April 1999	4.8	9.5
Korea	November 1997-April 1999	6.3	12.5
Thailand	July 1997-April 1999	22.7	45.5

Table 19. Volatility in Base Money Recent or Current **"Managed Floating**" Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in nominal monetary base rate falls within:	
		+/- 1 percent band	+/- 2 percent band
United States $/DM	**February 1973-April 1999**	**42.1**	**67.2**
Japan	**February 1973-April 1999**	**22.7**	**41.9**
Bolivia	January 1998-April 1999	0	0
Brazil	July 1994-December 1998	16.7	27.8
Chile	October 1982-April 1999	29.2	53.8
Colombia	January 1979-April 1999	24.1	40.5
Egypt	February 1991-December 1998	30.5	52.6
Greece	January 1977-December 1997	18.7	33.7
India	February 1979-February 1993	23.7	46.8
Indonesia	November 1978-June 1997	16.9	33.9
Israel	December 1991-April 1999	23.8	39.3
Kenya	January 1998-April 1999	35.7	71.4
Korea	March 1980-October 1997	12.3	24.1
Malaysia	December 1992-September 1998	24.3	47.2
Mexico	January 1989-November 1994	15.3	27.8
Norway	January 1995-April 1999	11.8	17.7
Pakistan	January 1982-April 1999	20.6	40.2
Singapore	January 1988-April 1999	27.4	51.1
Turkey	January 1980-April 1999	12.2	21.7
Uruguay	January 1993-April 1999	17.1	39.5
Venezuela	April 1996-April 1999	17.7	23.5
	Average, excluding U.S. and Japan	19.89	36.45
	Standard deviation, excluding U.S. and Japan	8.18	16.07

Table 20. Volatility in Base Money Recent or Current **"Limited Flexibility**" Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in nominal monetary base rate falls within:	
		+/- 1 percent band	+/- 2 percent band
United States $/DM	**February 1973-April 1999**	**42.1**	**67.2**
Japan	**February 1973-April 1999**	**22.7**	**41.9**
France	March 1979-April 1999	18.5	35.7
Germany	March 1973-April 1999	15.3	37.1
Greece	January 1998-April 1999	0	6.3
Malaysia	January 1986-February 1990	30	46
Spain	June 1989-April 1999	9.6	17.4
Sweden	June 1985-October 1992	33.7	50.6
	Average, excluding U.S. and Japan	17.85	32.18
	Standard deviation, excluding U.S. and Japan	12.59	17.06

Table 21 Volatility in Base Money Recent or Current **"Fixed"** Exchange Rate Regimes

Country	Period	Probability that the monthly percent change in nominal monetary base rate falls within:	
		+/- 1 percent band	+/- 2 percent band
United States $/DM	**February 1973-April 1999**	**42.1**	**67.2**
Japan	**February 1973-April 1999**	**22.7**	**41.9**
Argentina	March 1991-April 1999	14.3	31.6
Bulgaria	June 1997-November 1999	14.3	32.1
Cote D'Ivoire	January 1970-April 1999	9.2	20.8
Estonia	June 1992-November 1999	12.4	31.5
Kenya	January 1970-September 1993	11.6	23.6
Lithuania	April 1994-November 1999	14.9	29.9
Malaysia	March 1990-November 1992	36.4	60.6
Nigeria	April 1993-April 1999	14.5	24.6
Norway	December 1978-November 1992	16.1	26.8
Singapore	January 983-December 1987	30	50
Thailand	January 1970-June 1997	19.8	44.7
Average, excluding U.S. and Japan		17.59	34.20
Standard deviation, excluding U.S. and Japan		8.29	12.38

Table 22. Commodity Price Volatility in Recent or Current **"Floating**" Exchange Rate Regimes

Country and relevant commodity (ies)	Period	Probability that the monthly percent change falls within:		
		Relevant commodity price(s)		exchange rate
		+/- 1 percent band	+/- 5 percent band	+/- 5 percent band
Australia: Wheat Wool Coal	January 1984-April 1999	17.6 11.9 22.7	59.0 68.8 84.1	92.3
Bolivia: Tin Zinc	September 1985-December 1997	23.9 14.8	75.3 66.8	98.1
Canada: Wheat Softwood Newsprint Logs Aluminum	June 1970-April 1999	19.7 18.8 50.4 12.9 23.5	73.0 66.8 93.8 62.4 71.9	99.7
India: Cotton Tea Manganese	March 1993-April 1999	24.6 8.7 72.5	73.3 49.2 89.8	99.4
Kenya: Beverages Tea	October 1993-December 1997	7.8 7.8	52.9 54.9	78
Mexico: Oil	December 1994-April 1999	10.4	37.5	84.6
New Zealand: Wool Lamb	March 1985-April 1999	20.3 19.8	79.1 63.7	89.9
Nigeria: Oil Groundnut oil Groundnut	October 1986-March 1993	10.3 12.8 19.2	37.1 55.1 55.1	74.5
Norway: Oil Aluminum Fish	December 1992-December 1994	4.0 10.7 16.0	52.0 53.0 68.0	100
Peru: Metals Fish	August 1990-April 1999	21.0 18.0	74.0 71.0	86.5
Philippines: Coconut oil Sugar	January 1988-April 1999	 16.5 13.5	 65.3 54.0	91.1
South Africa	January 1983-April 1999			85.6
Sweden: Pulp	November 1992-April 1999	19.2	76.9	96.1
Uganda: Coffee Tea Cotton	January 1992-April 1999	11.1 13.3 21.7	46.9 53.0 68.7	94.1
Average		15.90	61.77	90.71
Standard deviation		6.49	15.10	8.07

Table 23. Exchange Rate Volatility in Recent or Current **"Managed Floating**" Exchange Rate Regimes

Country and relevant commodity (ies)	Period	Probability that the monthly percent change falls within:		
		Relevant commodity price(s)		Exchange rate
		+/- 1 percent band	+/- 5 percent band	+/- 5 percent band
Bolivia: Tin Zinc	January 1998-April 1999	14.3 0.0	85.7 71.4	100
Brazil: Coffee Sugar Cacao	July 1994-December 1998	5.9 5.9 12.8	52.9 43.1 46.8	96.3
Chile: Copper	October 1982-April 1999	13.4	65.9	98.1
Colombia: Coffee Oil	January 1979-April 1999	14.4 12.6	55.0 57.7	96.7
India: Cotton Tea Manganese	February 1979-February 1993	12.4 11.2 47.9	71.0 53.2 94.1	99.4
Indonesia: Crude oil	November 1978-June 1997	49.5	79.7	99.1
Kenya: Beverages Tea	January 1998-April 1999	16.7 8.3	75.0 33.3	70.6
Malaysia: Palm oil Rubber Tin	December 1992-September 1998	8.6 23.3 24.6	51.4 70.1 78.9	87.1
Mexico: Oil	January 1989-November 1994	15.3	48.6	100
Norway: Oil Aluminum Fish	January 1995-April 1999	6.4 17.0 19.2	51.1 74.5 78.7	100
Pakistan: Cotton Rice	January 1982-April 1999	18.2 13.5	69.4 57.8	97.6
Uruguay: Meat Wool	January 1993-April 1999	6.3 11.4	40.6 62.9	100
Venezuela: Oil Metals	April 1996-April 1999	3.1 27.5	43.8 82.9	100
Average		14.21	60.82	95.76
Standard deviation		12.51	14.45	8.33

Table 24. Exchange Rate Volatility in Recent or Current **"Limited Flexibility**" Exchange Rate Regimes

Country and relevant commodity (ies)	Period	Probability that the monthly percent change falls within:		
		Relevant commodity price(s)		Exchange rate
		+/- 1 percent band	+/- 5 percent band	+/- 5 percent band
Sweden: Pulp	June 1985-October 1992	23.6	92.1	100

Table 25. Exchange Rate Volatility in Recent or Current **"Fixed"** Exchange Rate Regimes[1]

Country and relevant commodity (ies)	Period	Probability that the monthly percent change falls within:		
		Relevant commodity price(s)		Exchange rate
		+/- 1 percent band	+/- 5 percent band	+/- 5 percent band
Argentina: Wheat Frozen beef	March 1991-April 1999	11.7 14.3	54.6 37.7	100
Cote D'Ivoire: Beverages (Coffee/Cacao)	January 1970-April 1999	14.5	60.4	99.7
Kenya: Beverages Tea	January 1970-September 1993	19.0 14.8	66.6 59.2	95.4
Malaysia: Palm oil Rubber Tin	March 1990-November 1992	16.2 42.1 28.0	66.5 **100.0** 84.0	100.0
Nigeria: Oil Groundnut oil Groundnut	April 1993-April 1999	12.3 49.1 19.3	50.9 87.7 70.2	98.6
Norway: Oil Aluminum Fish	December 1978-November 1992	19.1 10.7 20.2	59.5 53.0 69.1	99.4
Thailand: Maize Rubber Rice Tin	January 1970-June 1997	11.3 25.2 13.1 24.6	48.9 79.0 57.8 72.6	99.4
Venezuela: Oil Metals	July 1994-March 1996	14.3 9.5	61.9 66.7	95.0
Average, excluding U.S. and Japan		14.83	58.71	98.44
Standard deviation, excluding U.S. and Japan		3.08	6.65	2.05

1 Recent pegs with few monthly observations are Malaysia in September 1998 and Egypt in January 1999.

Table 26. The Temporal and Contemporaneous Interaction Patterns

Temporal Causality Proportion of the cases in which the coefficients are:									
	Exchange rate equation, ε			**Interest rate equation, Δi_t**			**Reserves Equation, $\Delta R/R$**		
	ε	**Δi_t**	**$\Delta R/R$**	**ε**	**Δi_t**	**$\Delta R/R$**	**ε**	**Δi_t**	**$\Delta R/R$**
Positive	0.66	0.46	0.32	0.68	0.44	0.3	0.46	0.56	0.5
Positive and significant	0.1	0.12	0	**0.3**	0.26	0.06	0.06	0.12	0.26
Negative	0.34	0.54	0.68	0.32	0.56	0.7	0.54	0.44	0.5
Negative and significant	0.04	0.08	0.04	0.12	0.3	**0.22**	**0.2**	0.14	0.14

Contemporaneous correlations Proportion of the cases in which the correlation coefficients of the residuals are:			
	Corr (ε,Δi_t)	**Corr (ε,$\Delta R/R$)**	**Corr(Δi_t,$\Delta R/R$)**
Positive	0.62	0.34	0.26
Positive and significant	0.14	0.08	0.0
Negative	0.38	0.66	0.74
Negative and significant	0.04	0.24	0.24

Appendix Table 1. Real Interest Rate Volatility in Recent or Current **"Floating"** Exchange Rate Regimes

Country	Period	Probability that the monthly change in real interest rate falls within:	
		+/- 0.25 percent (25 basis points)	+/- 0.5 percent (50 basis points)
United States	**February 1973-April 1999**	**48.2**	**75.4**
Japan	**February 1973-April 1999**	**25**	**49.7**
Australia	January 1984-April 1999	25.5	41.6
Bolivia	September 1985-December 1997	5.9	12.6
Canada	June 1970-April 1999	33.8	51.4
India	March 1993-April 1999	6.4	15.9
Kenya	October 1993-December 1997	7.8	15.7
Mexico	December 1994-April 1999	8.7	13
New Zealand	March 1985-April 1999	21.6	37.7
Nigeria	October 1986-March 1993	23.1	30.8
Norway	December 1992-December 1994	24.1	44.1
Peru	August 1990-April 1999	7.1	16.3
Philippines	January 1988-April 1999	14.1	28.2
South Africa	January 1983-April 1999	21.7	40.7
Spain	January 1984-May 1989	12.3	24.6
Sweden	November 1992-April 1999	36.6	66.2
Uganda	January 1992-April 1999	8.6	13.6
Venezuela	March 1989-June 1994	10.9	25
Memorandum: The Post-Asian-crisis "floaters"			
Indonesia	July 1997-April 1999	0	0
Korea	November 1997-April 1999	8.3	25
Thailand	July 1997-April 1999	7.1	7.1

Appendix Table 2. Nominal Interest Rate Volatility in Recent or Current **"Floating"** Exchange Rate Regimes (continued)

Country	Period	Probability that the monthly change in nominal interest rate is greater than:	
		+/- 4 percent (400 basis points)	+/- 5 percent (500 basis points)
United States	**February 1973-April 1999**	**0.3**	**0.3**
Japan	**February 1973-April 1999**	**0**	**0**
Australia	January 1984-April 1999	0.7	0
Bolivia	September 1985-December 1997	24.5	15.6
Canada	June 1970-April 1999	3.5	1.8
India	March 1993-April 1999	21.8	19
Kenya	October 1993-December 1997	12.5	12.5
Mexico	December 1994-April 1999	32.6	30.5
New Zealand	March 1985-April 1999	6.4	4.9
Nigeria	October 1986-March 1993	14.1	9.1
Norway	December 1992-December 1994	4.1	4.1
Peru	August 1990-April 1999	47.8	47.8
Philippines	January 1988-April 1999	5.2	5.2
South Africa	January 1983-April 1999	0	0
Spain	January 1984-May 1989	3.1	3.1
Sweden	November 1992-April 1999	1.4	0
Uganda	January 1992-April 1999	22.2	11.1
Venezuela	March 1989-June 1994	27.2	25
Memorandum: The Post-Asian-crisis "floaters"			
Indonesia	July 1997-April 1999	92.9	85.7
Korea	November 1997-April 1999	16.7	8.2
Thailand	July 1997-April 1999	35.8	35.8

Appendix Table 3. Correlation between Changes in Commodity Prices and Changes in the Exchange Rate:

Floating Exchange Rates

Country	Commodity	Period	Correlation	Standard Error
Australia	Wheat	January 1984 to April 1999	-0.016	0.076
	Wool		-0.236	0.074
	Coal		-0.265	0.073
Bolivia	Tin	September 1985 to December 1997	-0.040	0.084
	Zinc		-0.020	0.083
Canada	Wheat	June 1970 to April 1999	-0.040	0.054
	Softwood		0.010	0.073
	Newsprint		-0.041	0.054
	Logs		-0.027	0.073
	Aluminum		-0.061	0.054
India	Cotton	March 1993 to April 1999	0.043	0.127
	Tea		-0.083	0.126
	Manganese		0.064	0.126
Kenya	Beverages	October 1993 to December 1997	-0.257	0.138
	Tea		-0.042	0.143
Mexico	Oil	Dec.94 to Apr. 99	-0.149	0.148
New Zealand	Wool	March 1985 to April 1999	-0.425	0.081
	Lamb		-0.149	0.089
Nigeria	Oil	October 1986 to March 1993	0.002	0.115
	Groundnut Oil		0.134	0.114
	Groundnut		0.165	0.113
Norway	Oil	December 1992 to December 1994	-0.123	0.207
	Aluminum		0.167	0.206
	Fish		-0.142	0.206
Peru	Metals	August 1990 to April 1999	0.237	0.122
	Fish		0.175	0.124
Philippines	Coconut Oil	January 1988 to April 1999	-0.018	0.089
	Sugar		0.010	0.103
Sweden	Pulp	Nov.92 to Apr.99	-0.735	missing data
Uganda	Coffee	January 1992 to April 1999	-0.180	0.113
	Tea		0.038	0.113
	Cotton		-0.164	0.112

Appendix Table 4. Correlation between Changes in Commodity Prices and Changes in the Exchange Rate: Managed Floating

Country	Commodity	Period	Correlation	Standard Error
Bolivia	Tin	January 1998 to April 1999	0.373	0.448
	Zinc		0.127	0.475
Brazil	Coffee	July 1994 to December 1998	-0.489	0.129
	Sugar		-0.040	0.147
	Cacao		0.001	0.160
Chile	Copper	Oct.82 to Apr.99	0.021	0.073
Colombia	Coffee	January 1979 to April 1999	0.016	0.056
	Oil		0.002	0.063
India	Cotton	February 1979 to February 1993	-0.011	0.077
	Tea		-0.022	0.077
	Manganese		-0.024	0.077
Indonesia	Crude Oil	Nov.78 to Jun.97	-0.014	0.066
Kenya	Beverages	January 198 to April 1999	-0.149	0.343
	Tea		-0.775	0.230
Malaysia	Palm Oil	December 1992 to September 1998	0.023	0.061
	Rubber		-0.626	0.111
	Tin		-0.372	0.130
Mexico	Oil	Jan.89 to Nov.94	0.059	0.121
Norway	Oil	January 1995 to April 1999	-0.394	0.139
	Aluminum		-0.091	0.150
	Fish		-0.157	0.149
Pakistan	Cotton	January 1982 to April 1999	0.037	0.071
	Rice		-0.042	0.074
Uruguay	Meat	January 1993 to April 1999	-0.086	0.123
	Wool		-0.095	0.121
Venezuela	Oil	April 1996 to April 1999	0.217	0.192
	Metals		0.030	0.196

Appendix Table 5. Correlation between Changes in Commodity Prices and Changes in the Exchange Rate: Limited Flexibility

Country	Commodity	Period	Correlation	Standard Error
Sweden	Pulp	Jun.85 to Oct.92	-0.550	0.089

Appendix Table 6. Correlation between Changes in Commodity Prices and Changes in the Exchange Rate: Fixed Exchange Rates

Country	Commodity	Period	Correlation	Standard Error
Argentina	Wheat	March 1991 to April 1999	-0.073	0.130
	Frozen Beef		0.076	0.130
Cote D'Ivoire	Beverages	Jan.70 to Apr.99	N/A	N/A
Kenya	Beverages	January 1970 to September 1993	-0.061	0.059
	Tea		-0.091	0.059
Malaysia	Palm Oil	March 1990 to November 1992	-0.179	0.212
	Rubber		-0.202	0.279
	Tin		-0.135	0.213
Nigeria	Oil	April 1993 to April 1999	Ver	
	Groundnut Oil			
	Groundnut			
Norway	Oil	December 1978 to November 1992	-0.036	0.078
	Aluminum		0.009	0.078
	Fish		-0.233	0.075
Thailand	Maize	January 1970 to June 1997	-0.012	0.056
	Rubber		-0.132	0.055
	Rice		0.027	0.055
	Tin		-0.029	0.056
Venezuela	Oil	July 1994 to March 1996	0.223	0.224
	Metals		-0.120	0.228