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**Post-Crisis Exchange Rate Policy In Five Asian Countries:  
Filling in the “Hollow Middle”? †**

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## I. Introduction

The decade of the 1990s witnessed a spate of financial crises in developing countries quite unlike those of the preceding decade. In the 1980s private agents in developing countries had limited access to external financial markets, and most external borrowing was done by sovereigns. The highly visible debt crises that emerged in that decade are probably best interpreted as public sector solvency crises<sup>1</sup>. By contrast, the decade of the 1990s opened with many developing countries suffering from a capital *inflow* “problem,” reflecting greatly enhanced access by private agents in these countries to international capital markets. The severe financial crises undergone later in the decade by some of the most important capital-importing countries have been attributed to a variety of causes, but many observers have emphasized as a contributing element these countries’ attempts to maintain exchange rate regimes (“soft” pegs) that were no longer viable in light of their greatly enhanced integration with international capital markets. In the context of such enhanced integration, it has been argued, only the polar extremes of floating exchange rates or fixed exchange rates supported by very strong commitment mechanisms (i.e., “hard” pegs), can be sustained for extended periods.

Among the crises of the 1990s, the Asian financial crisis of 1997-98 has certainly played a key role in generating the perception of a vanishing middle ground for exchange rate regimes in developing countries, a doctrine that has come to be known as the “hollow middle.” The macroeconomic performance of the Asian economies that later succumbed to currency and banking crises (Indonesia, Korea, Malaysia, the Philippines, and Thailand) had previously been hailed as an economic miracle, and active management of the exchange rate in pursuit of a competitiveness objective had often been credited with making an important contribution to their “miraculous” macroeconomic performance. The crisis forced all of these countries to abandon their *de facto* exchange rate pegs, and the subsequent floats of their currencies were associated with very sharp fluctuations in their values. Thus, if even these economies with such exceptional macroeconomic fundamentals proved unable to sustain a policy of active exchange rate management in the more financially integrated world in which they found themselves during the 1990s, prospects would appear to be bleak for other developing countries to do so.

More recently, doubts have arise about post-crisis exchange rate policies in the Asian crisis countries themselves. Several observers have noted that in the wake of their crises several of these countries may be reverting to exchange rate practices similar to those of the pre-crisis period, in the sense that their authorities have sought to stabilize the values of their currencies against the U.S. dollar without adopting any of the strong commitment mechanisms that would be called for under the doctrine of the “hollow middle.” The worry among such observers is that, in view of the vanishing scope for such pegged arrangements

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<sup>1</sup> Except for Chile among the developing countries.

under current international financial conditions, the adoption of such practices in the former crisis countries may make them vulnerable to a repetition of the events of 1997-98.<sup>2</sup> The implied policy advice is that these countries themselves should opt for one of the extreme currency arrangements that their own past experience suggests as the only viable options as long as they remain highly integrated with world capital markets.

This paper addresses two issues raised by this recent experience. Its narrower objective is to identify and evaluate post-crisis exchange rate policy in five of the countries that suffered most severely from the Asian financial crisis. For this purpose, we seek to determine the extent to which these countries have indeed reverted to their pre-crisis exchange rate practices, to characterize the exchange rate policies they are currently pursuing, and to evaluate the appropriateness of such policies in light of both contemporary international financial conditions as well as of the post-crisis circumstances of those economies. The broader objective is to draw lessons from that experience for the doctrine of the “hollow middle” for exchange rate policies.

The paper is organized as follows: In Sections II and III, we attempt to identify the exchange rate regimes that have prevailed in five former crisis countries –Indonesia, Korea, Malaysia, the Philippines, and Thailand– during the post-crisis period. To eliminate the period of most severe instability associated with the crisis, we define the post-crisis as 1999-2000. Having characterized the exchange rate regimes, we turn in Section IV to a consideration of the possible objectives that may have been driving the formulation of exchange rate policies in the former crisis countries. Our next task, undertaken in Section V, is to evaluate the objectives and conduct of exchange rate policy in light of the post-crisis circumstances faced by these five economies. Section VI takes up some considerations that can be expected to influence post-crisis exchange rate policies in these economies. In our concluding section we summarize our findings and attempt to draw lessons from the post-crisis experience of the Asian crisis countries for exchange rate management in other developing countries.

## **II. Post-crisis Exchange Rate Policies in the Asian Crisis Countries: De Jure**

In evaluating the post-crisis exchange rate policies of the Asian crisis countries, the first issue we face is identifying the exchange rate policies that each of these countries pursued during the post-crisis period. In this section and the next, we address this basic question. Our main concerns are two: first, to identify how exchange rate policy has changed in each of these countries from the pre-crisis to the post-crisis period, and second, to place their post-crisis exchange rate policies in an international context. In other words, given a continuum from hard pegs to cleanly floating exchange rates, we want to identify the direction in which each of these countries has moved along this continuum as well as where they stand on this scale in their post-crisis conduct of exchange rate policies.

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<sup>2</sup> See, for example, Mussa et. al. (2000).

The conventional wisdom regarding the experience of our five crisis countries is that the defense of an official parity in each of them made the Asian financial crisis possible, and that in the aftermath of the crisis, with the exception of Malaysia, these currencies have been forced to float (Fischer (2001)).

The official IMF classifications of exchange rate regimes for our five countries before and after the Asian financial crisis, reported in Table 1, indeed suggests that at least three of the five countries in our group (Indonesia, Korea, and Thailand) underwent a transformation in their officially-declared exchange rate regimes in the direction of greater flexibility as a result of the crisis. However, note that, except for Thailand, none of the crisis countries maintained an exchange rate regime officially classified as “fixed” prior to the crisis. The classification of the remaining pre-crisis regimes as “floating” in some fashion seems to run counter to the conventional wisdom about the role of exchange rate pegs in determining vulnerability to crisis. To the extent that these countries were defending an exchange rate peg prior to the crisis, therefore, their actions were at odds with their officially declared exchange rate regimes.

**Table 1 Official Exchange Rate Regimes in the Asian Crisis Countries**

Indonesia	November 1978-June 1997	Managed Floating
	July 1997- December 2000	Independently Floating
Korea	March 1980-October 1997	Managed Floating
	November 1997- December 2000	Independently Floating
Malaysia	January 1986-February 1990	Limited Flexibility
	March 1990-November 1992	Fixed
	December 1992-September 1998	Managed Floating
	September 1998- December 2000	Pegged Arrangement
Philippines	January 1988- December 2000	Independently Floating
Thailand	January 1970-June 1997	Fixed
	July 1997- December 2000	Independently Floating

The pre-crisis commitment to the defense of a parity by the central banks of each of these countries thus provides an example of the conflict between the exchange rate regime that often prevails *de jure* among emerging markets and the way that exchange rate policy is conducted *de facto*. The contrast between countries’ official declarations concerning their exchange rate regimes and the way they actually conduct exchange rate policy has recently been highlighted by Levy-Yeyati and Sturzenegger (1999), as well as Calvo and Reinhart

(2000a). Of particular relevance to our story, Calvo and Reinhart (2000a) have emphasized that many emerging market economies that officially float their currencies in fact intervene heavily in exchange markets and use monetary policy to stabilize their nominal exchange rates, a phenomenon that they have dubbed “fear of floating.”

This raises an important question: If the official exchange rate regime is often a poor guide to the way that countries actually conduct exchange rate policy, how confident can we be that exchange rate policy has actually changed in a meaningful way in the Asian countries post-crisis?

As noted in the introduction, this question has been made more relevant by a growing perception among knowledgeable observers that the conventional wisdom mentioned earlier about exchange rate policy in the crisis countries may in fact be wrong, and that little may indeed have changed in these countries after the crisis. Calvo and Reinhart (2000a), for example, conclude about our countries: “Indeed, once financial markets settled and capital flowed back into Asia, their currencies are fluctuating much the way they did prior to the crisis—that is to say, they are not fluctuating at all.” (p. 27). Similarly, McKinnon (2000b), states: “In the year 2000, both the crisis and non-crisis countries of East Asia (with Japan remaining the important exception) have returned to formal or informal dollar pegging, which is statistically indistinguishable from what they were doing before the crisis.” (p. 9).<sup>3</sup>

One way to dig beyond official classification of exchange rate regimes is to examine more detailed country-specific information about the evolution of the official exchange rate regimes. The evolution of exchange rate practices in our five countries from the pre- to the post-crisis period is described in Box 1. Four observations follow from these descriptions:

- Except for Thailand, which reported itself as pegged to an (undisclosed) currency basket, none of the Asian crisis countries had maintained an officially announced parity prior to the crisis. This is consistent with the IMF classification of their exchange rate regimes.
- Despite this, however, all five countries had restricted the degree of fluctuation of the bilateral exchange rates of their currencies against the U.S. dollar before the crisis.
- In all five countries, the crisis period was associated with a suspension or substantial scaling back of such practices. The reclassification of the exchange rate regimes of Indonesia, Korea, and Thailand by the IMF after the crisis is presumably associated with the suspension of such practices.

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<sup>3</sup> Since these are important perspectives on exchange rate policies in these countries, we have included two appendices describing the empirical evidence on which these statements are based, and relating it to our results. Appendix 1 considers the Calvo-Reinhart (2000a) study, while Appendix 2 examines the study by McKinnon (2000b).

## **BOX 1: Official Exchange Rate Regimes (*to be completed*)**

### **Indonesia**

After two large step devaluations in the mid 1980s, Bank Indonesia set the value of the rupiah against a basket of currencies, and intervened in the market around that central rate. The central rate was depreciated gradually according to the differential between domestic and foreign inflation, so as to stabilize the real exchange rate. In January 1994, a first step was undertaken to enhance exchange rate flexibility through the introduction of a band. The Bank's exchange rate fluctuation band was widened from 10 to 20 rupiah (a fluctuation range of 1 percent). The band was then progressively widened: to Rp 30 in 1994, Rp 60 (a fluctuation range of 3 percent) in December 1995, Rp 118 (a 5 percent range) in June 1996, Rp \_\_ in September of 1996, and Rp \_\_ in July of 1997, after the Thai devaluation. During the two years preceding the Thai crisis, the rupiah remained near the more appreciated boundary of the band. Indonesia's exchange rate band was abandoned in August 1997.

### **Korea**

In March 1990, Korea adopted an approach to exchange rate management known as the Market Average Exchange Rate System (MAR). Under this system, the daily won/dollar rate was allowed to fluctuate each day within a band centered around the previous day's weighted average spot rate. The band width was initially set at  $\pm 0.2$  percent. The exchange rate was actually tightly managed, however, and between 1990 and 1996 the won depreciated fairly steadily by an annual average rate of 2 percent. The daily fluctuation band was gradually widened in the period before the crisis, reaching  $\pm 2.25$  percent by 1996, and the extent of permitted fluctuation in the won was expanded after mid-1995 to accommodate capital inflows associated with the capital account liberalization. As the crisis unfolded, the daily fluctuation band was widened to  $\pm 10$  percent in November 1997 and was finally abandoned in December that year.

### **Malaysia**

Prior to the Asian crisis, Bank Negara Malaysia did not maintain an official parity for the ringgit. In principle, the exchange rate value of the currency was determined by the market, though the Bank acknowledged intervening to smooth fluctuations that it considered excessive. Thus, although the ringgit depreciated sharply after the Thai devaluation, there was no change in Malaysia's official exchange rate policy at the time of the outbreak of the Asian crisis. On September 1, 1998, however, Malaysia fixed its exchange rate at RM 3.8 per U.S. dollar, representing an appreciation of about 10 percent relative to the ringgit's previous level. The next day, on September 2, Malaysia implemented comprehensive capital controls.

### **Philippines**

After the introduction of the Philippines Dealing System in September of 1992, the Philippines maintained a floating exchange rate system in which the central bank (Bangko Sentral) was just one of many participants. As in Malaysia, there was no announced parity, and the official policy of the central bank was to intervene only to smooth excessive fluctuations. In the wake of the Thai crisis, on July 11, 1997, the central bank decided to allow the peso to move more freely and sharply scaled back its intervention in the foreign exchange market.

### **Thailand**

Unlike the other countries, Thailand explicitly maintained an announced central parity for its currency, allowing only very narrow fluctuations around that value. The central parity was officially set according to an undisclosed basket of currencies, but the behavior of the baht prior to the Asian crisis suggests that the U.S. dollar accounted for over 90 percent of the value of this basket (Frankel and Wei (1994)). The central parity was officially abandoned on July 2, 1997.

- Indonesia, Korea, the Philippines, and Thailand have preserved their immediate post-crisis regimes in which exchange rate movements are –at least in principle– unrestricted.
- Malaysia has made an official commitment to a fixed exchange rate, supported by extensive capital controls.

We note, therefore, that there was indeed a difference between the *de jure* classification of exchange rate regimes in the crisis countries before the crisis and the way that exchange rate policy was conducted in these countries *de facto*. We also note that there is a basis in the officially announced post-crisis exchange rate practices of these countries for the reclassification of their regimes. Something clearly changed. However, the pre-crisis experience suggests that we should not be too hasty to draw conclusions about changes in exchange rate practices from official announcements. In particular, the conflict between official announcements and the conclusions drawn by knowledgeable observers about actual post-crisis exchange rate policies in these countries raises the possibility that the gap between *de jure* and *de facto* exchange rate regimes that existed in these countries before the crisis may have reasserted itself after the crisis.

### **III. Identifying Exchange Rate Regimes *De Facto***

The acknowledged gap between *de jure* and *de facto* exchange rate policies in many countries has recently given rise to a new literature identifying how exchange rate policies have actually been conducted in emerging markets, based on observed outcomes for exchange rates, foreign exchange reserves, and domestic interest rates. Of course, the polar opposite cases of bilateral pegs with very narrow bands, on the one hand, and clean floats, on the other, are in principle easy to identify. A fixed bilateral peg would exhibit no exchange rate variation outside a very narrow band (conventionally taken as +/- 2.25 percent), while a clean float would exhibit no foreign-exchange market intervention –i.e., no variation in an appropriately-measured stock of foreign exchange reserves.<sup>4</sup>

Beyond these extreme exchange rate arrangements, what is of interest is the degree of commitment to a “soft peg.” The preceding observation suggests that it may be possible to assess this degree of commitment on the basis of the observed volatilities of financial variables such as exchange rates and stocks of foreign exchange reserves. This degree of commitment could then be gauged on the basis of cross-country comparisons of such volatilities, or by comparisons of the behavior of such variables in the same country over different periods of time.

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<sup>4</sup> We would need to correct, of course, for the ‘natural’ or exogenous rate of change in reserves, caused by interest earnings and valuation changes; only the remaining change in reserves captures the volatility that we are interested in.

However, inferences about the degree of commitment to exchange rate stability based on the observed volatilities of exchange rates or foreign exchange reserves is complicated by the need to control for three factors:

- The severity of shocks to the foreign exchange market.
- The possibility of a policy response to such shocks through instruments other than foreign exchange market intervention (i.e., through domestic interest rates).
- The sources of shocks, which may complicate the links between observed volatilities and the degree of commitment to an exchange rate parity.

To begin with, suppose the source of shocks consists only of credibility problems (expected future exchange rate changes), and that the variance of these shocks is uniform both across countries and over time. Then, using a simple monetary exchange rate model, as in Calvo and Reinhart (2000a), in the absence of policy intervention (i.e., with no attempt to defend an existing parity) such shocks would affect the volatility of the exchange rate and domestic interest rates, but would have no effect on foreign exchange reserves. On the other hand, if the government is committed to defend the existing parity in the face of such shocks, it can do so by intervening in the foreign exchange market or in the domestic bond market. In either case, the volatility of the exchange rate would be reduced, and those of *both* foreign exchange reserves and domestic interest rates would be increased.<sup>5</sup>

Under these conditions, therefore, the degree of commitment to a nominal parity can be inferred from the volatility of the exchange rate, of the stock of foreign exchange reserves, and of domestic interest rates. Comparing across countries, those that exhibit relatively more volatile exchange rates, and relatively less volatile reserves and interest rates, can be judged as floating to a greater extent than others. Moreover, given a benchmark established by countries whose exchange rate regimes we can confidently classify as “pure floaters”, the degree to which other countries deviate from such a regime can be assessed by comparing the volatility of these financial variables relative to those of the benchmark. Similarly, the change in the degree of commitment to a specific peg by a given country can be assessed by changes in these volatilities over time.

#### *a. Exchange rate volatility*

Figure 1 shows the bilateral exchange rate against the U.S. dollar for the five countries in our group, both before and after the crisis. To eliminate the influence of the crisis itself, we have defined the post-crisis period as beginning in January 1999, and have defined the pre-crisis period as a period of equal length ending in June 1997. From Figure 1, it is evident that Malaysia and Indonesia are outliers in our sample. Malaysia has announced and implemented a fixed exchange rate in the post-crisis period, while the exchange rate for

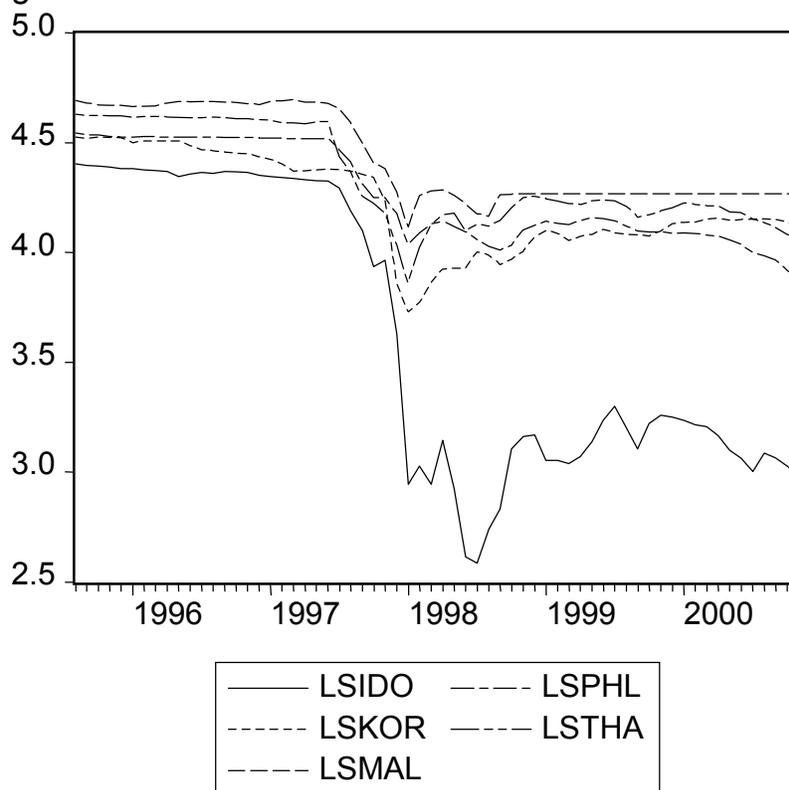
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<sup>5</sup> The increased volatility of domestic interest rates follows directly from uncovered interest parity. Given a change in the expected future exchange rate, the smaller the movement in today’s exchange rate in the same direction, the larger must be the change in the domestic interest rate.

the Indonesian rupiah has quite clearly been significantly more variable in the post- than in the pre-crisis period. For the other countries the visual evidence suggests more variability post-crisis, but is not so clear-cut.

In Table 2, we complement this graphical evidence with some statistical measures of exchange rate volatility: the range of variation in monthly percentage exchange rate changes as well as their standard deviation. Notice from the table that, in the pre-crisis period, all five of the Asian crisis countries had much more stable exchange rates than the “clean” floaters (the U.S., Germany, and Japan), as well as Mexico, which had floated its exchange rate six months before the inception of the period we have labeled “pre-crisis.” Indeed, the bilateral exchange rate against the U.S. dollar during the pre-crisis period was more stable than that of Chile, which explicitly maintained an exchange rate band during this period. These results are consistent with the conventional wisdom that, despite the official designations of their exchange rate regimes prior to the crisis, all five of these countries actively defended an exchange rate peg.

Figure 1 Bilateral Exchange Rates for Five Asian Countries, August 1995 to November 2000



The table confirms the sharp modifications that have taken place between the pre- and post-crisis periods in the behavior of the exchange rate in both Indonesia and Malaysia. Indeed, Indonesia’s bilateral exchange rate against the U.S. dollar has been much more

volatile than the bilateral rates among “clean” floaters such as the United States, Germany (the Euro) and Japan. With respect to the other countries, it is obvious from the table that the volatility of monthly exchange rate changes has indeed increased after the crisis in all of them, though in the case of Korea, which exhibited the greatest degree of exchange rate variability before the crisis, the change is not as pronounced as for the Philippines and Thailand. The post-crisis volatility in these currencies has been comparable to that between the U.S. dollar and the Euro, as well as to that of Chile, which officially floated its currency during this period. However, for these three countries volatility remained less than that which characterized the yen-dollar rate, or the bilateral exchange rate between the Mexican peso and the U.S. dollar. This evidence suggests that there has indeed been a fundamental change in the exchange rate policies of the Asian countries pre- and post-crisis, but is consistent with the Calvo-Reinhart view that, outside of Indonesia, none of the countries that describe themselves as independently floating have become “clean” floaters.

	<b>Period</b>	<b>Range</b>	<b>Standard deviation</b>
<b>U.S. \$/DM</b>	Pre-crisis	0.083	0.024
	Post-crisis	0.078	0.021
<b>U.S.\$/Yen</b>	Pre-crisis	0.147	0.030
	Post-crisis	0.084	0.028
<b>Chile</b>	Pre-crisis	0.050	0.012
	Post-crisis	0.059	0.020
<b>Mexico</b>	Pre-crisis	0.068	0.019
	Post-crisis	0.104	0.029
<b>Indonesia</b>	Pre-crisis	0.033	0.007
	Post-crisis	0.230	0.063
<b>Korea</b>	Pre-crisis	0.043	0.011
	Post-crisis	0.066	0.017
<b>Malaysia</b>	Pre-crisis	0.027	0.007
	Post-crisis	0.00	0.00
<b>Philippines</b>	Pre-crisis	0.012	0.003
	Post-crisis	0.068	0.017
<b>Thailand</b>	Pre-crisis	0.016	0.004
	Post-crisis	0.070	0.018

*b. Foreign exchange reserve volatility*

A second indicator of exchange rate policy is the volatility in a country’s foreign exchange reserves. Intervention in the foreign exchange market involves changes in the stocks of foreign exchange reserves held by central banks, so we might expect countries that intervene less, allowing the market exchange rate to absorb the effects of shocks, to have more stable reserve stocks than those that stabilize the exchange rate by allowing shocks in the foreign exchange market to be reflected in reserve stocks. Table 3 shows two measures of reserve volatility for the same countries listed in Table 2. The measures are the mean absolute monthly percentage change in reserves, and the standard deviation of monthly

reserve percentage changes. As one might expect, in the pre-crisis period, the known “clean” floaters in the group (Germany and Japan) exhibited the smallest average monthly changes in reserves. By contrast, mean absolute reserve changes were substantially larger for all the developing countries in the table, including our five Asian crisis countries. Consistent with the results on exchange rate volatility, this suggests that, relative to the “clean” floaters, these countries permitted much less flexibility to their exchange rates during the pre-crisis period. The conclusions are exactly the same when reserve volatility is measured as the standard deviation of monthly reserve changes (column 4 in the table).

	<b>Period</b>	<b>Mean Absolute Change</b>	<b>Standard deviation</b>
<b>Germany</b>	Pre-crisis	1.082	1.325
	Post-crisis	1.225	1.535
<b>Japan</b>	Pre-crisis	1.488	2.469
	Post-crisis	2.193	2.948
<b>Chile</b>	Pre-crisis	2.274	2.948
	Post-crisis	2.083	3.086
<b>Mexico</b>	Pre-crisis	5.059	5.911
	Post-crisis	2.341	3.175
<b>Indonesia</b>	Pre-crisis	2.038	2.892
	Post-crisis	3.169	5.335
<b>Korea</b>	Pre-crisis	3.046	3.756
	Post-crisis	2.631	1.808
<b>Malaysia</b>	Pre-crisis	2.118	2.803
	Post-crisis	2.643	3.183
<b>Philippines</b>	Pre-crisis	3.859	4.479
	Post-crisis	3.458	4.470
<b>Thailand</b>	Pre-crisis	1.850	2.927
	Post-crisis	1.552	2.281

Reserve volatility increased for the “clean” floaters in the post-crisis period, whether measured by the mean absolute change or the standard deviation of monthly changes. Among the developing comparator countries, reserve volatility showed little change in Chile, but decreased substantially in Mexico. The latter is consistent with the evidence of Table 2 suggesting an enhanced degree of exchange rate flexibility in Mexico during this period.

Among the Asian crisis countries, reserve volatility decreased noticeably in Korea and Thailand, and very slightly in the Philippines, but increased in Indonesia and Malaysia. These results are consistent with the adoption of more flexible exchange rate arrangements in the first three countries, though reserve volatility remained much higher during the post-crisis

period in the Philippines than in the “clean” floaters.<sup>6</sup> The results are also consistent with *reduced* exchange rate flexibility in Malaysia, which also exhibited greater reserve volatility than either of the “clean” floaters. In the case of Indonesia, however, volatility seems to have increased during the post-crisis period, and remains much higher than that of the “clean floaters”. The clear suggestion is that the assumption of a uniform volatility of shocks, both across countries and over time, is likely to have been violated in the case of Indonesia. We will return to this below.

### *c. Interest rate volatility*

Our final indicator of exchange rate policy in this section will rely on the volatility of interest rates. Under our maintained assumptions that shocks are uniform across countries and over time, and that shocks arise from credibility effects, countries may seek to stabilize their exchange rates by intervening in domestic securities markets rather than by buying or selling reserves. In that case, greater exchange rate flexibility would be associated with *smaller* domestic interest rate volatility.

However, this association between commitment to exchange rate stability and interest rate volatility does not hold if shocks to foreign exchange markets arise from other sources. In Appendix 3 we explore this problem in more detail and present some (weak) evidence that credibility shocks may indeed have been dominant during the post-crisis period in most of our countries (the evidence is least consistent with this hypothesis in the case of Indonesia). We proceed on the assumption that increased interest rate volatility indicates a stronger commitment to exchange rate stability, though we put less weight on this type of evidence than on exchange rate and reserve volatility.

In Table 4, we measure interest rate volatility by examining the range of nominal interest rates, the mean absolute monthly change in interest rates, and the standard deviation of monthly interest rate changes. The patterns in the data can be summarized as follows:

- i. In the cases of Korea and Thailand, monthly interest rate volatility decreased in the post-crisis relative to the pre-crisis period by all of our measures. As with the previous indicators, this result is consistent with a decreased commitment to exchange rate stability during the post-crisis period in both of these countries. Nonetheless, in comparison with Germany and Japan, interest rates remained more volatile in these two countries, suggesting that their commitment to exchange rate stability in the post-crisis period remained stronger than in the “pure floaters”.
- ii. As we have seen previously, Malaysia adopted a fixed exchange rate in September 1998. Under our provisional assumption of uniform credibility shocks across countries, this would suggest that in defending this rate, Malaysia should have experienced an *increase* in interest rate volatility relative to the pre-crisis period, when the country allowed more

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<sup>6</sup> The degree of volatility in Korea and Thailand is bracketed by that of Germany and Japan.

flexibility in its exchange rate. This is the opposite of what we find in Table 4. A possible explanation is that Malaysia’s capital controls may have dampened the effects of confidence shocks in the foreign exchange market. However, we saw in Table 3 that reserve volatility has actually increased in Malaysia during the post-crisis period, suggesting the alternative explanation that reduced interest rate volatility may arise from defense of the exchange rate through sterilized –rather than unsterilized– intervention in the foreign exchange market.

- iii. Finally, interest rate volatility increased in the post-crisis period for both Indonesia and the Philippines, by all three of our measures. Recall that in Indonesia both exchange rate as well as reserve volatility increased sharply in the post-crisis, while in the Philippines exchange rate volatility increased and reserve volatility was little changed. The strong suggestion is that for these two countries, what we have dubbed the “post-crisis” period has not been a tranquil one in the foreign exchange market –that is, that our assumption of uniform shocks across countries is not tenable in the case of Indonesia and the Philippines.

<b>Table 4. Monthly Interest Rate Volatility in Five Asian Crisis Countries</b>				
	<b>Period</b>	<b>Range</b>	<b>Mean Absolute Change</b>	<b>Standard Deviation</b>
<b>Germany</b>	Pre-crisis	0.53	0.08	0.12
	Post-crisis	0.68	0.13	0.16
<b>Japan</b>	Pre-crisis	0.34	0.03	0.07
	Post-crisis	0.27	0.02	0.05
<b>Chile</b>	Pre-crisis	11.94	2.37	3.08
	Post-crisis	11.36	1.96	2.59
<b>Mexico</b>	Pre-crisis	23.52	4.24	5.23
	Post-crisis	6.86	1.45	1.84
<b>Indonesia</b>	Pre-crisis	4.97	0.87	1.21
	Post-crisis	12.19	2.01	3.12
<b>Korea</b>	Pre-crisis	4.35	0.79	1.05
	Post-crisis	0.93	0.13	0.24
<b>Malaysia</b>	Pre-crisis	5.67	0.53	0.95
	Post-crisis	1.87	0.16	0.37
<b>Philippines</b>	Pre-crisis	3.26	0.53	0.79
	Post-crisis	8.58	0.63	1.48
<b>Thailand</b>	Pre-crisis	10.89	2.13	2.58
	Post-crisis	1.45	0.30	0.38

*d. Severity of Shocks*

To examine whether this may have been the case, we have computed an index of monthly changes in “exchange market pressure” for each of our five countries. This index, due to Girton and Roper (197\_), is a weighted average of monthly changes in the exchange

rate (in percent), in the stock of international reserves (in percent), and in domestic interest rates.<sup>7</sup> The absolute monthly changes in the index can help determine whether the post-crisis period was more volatile than the pre-crisis one.<sup>8</sup> Table 5 below shows the number of observations that exceeded a certain threshold (2 percent) during both periods.<sup>9</sup> These results suggest that, with the exception of Malaysia and Korea, the post crisis period may have been a more volatile one for the Asian crisis countries than the pre-crisis one, and especially so for the Philippines and Indonesia.

	<b>Share of observations (months) above 2.0</b>	
	<b>Pre-crisis</b>	<b>Post-crisis</b>
<b>Indonesia</b>	4.55%	68.18%
<b>Korea</b>	22.73%	22.73%
<b>Malaysia</b>	4.55%	0.00%
<b>Philippines</b>	4.55%	31.82%
<b>Thailand</b>	4.55%	9.09%

Accordingly, to correct for the possibility that changes in volatilities in the previous section could just reflect the violation of one of our assumptions –i.e., that shocks have been uniformly severe across countries and periods– we look at the *relative* volatility of the exchange rate compared to those of reserves and interest rates in each of our countries. Because this provides a crude measure of the relative extent to which foreign exchange market shocks have been absorbed by the exchange rate instead of by changes in reserves or in domestic interest rates, it is in principle independent of the volatility of the environment. The results of these comparisons are reported in Table 6.

The results are consistent with our previous findings for Korea, Malaysia, and Thailand. As in the earlier results, Korea and Thailand appear to clearly be floating more actively in the post-crisis period, in the sense that foreign exchange market shocks tend to be reflected to a greater extent in exchange rate movements than in movements in reserves or domestic interest rates after the crisis than before (the relative volatility of the exchange rate increases after the crisis for both measures). Since the exchange rate has been fixed during our post-crisis period in Malaysia, the results are trivially consistent with our previous ones as well.

For the cases of Indonesia and the Philippines, we had previously attributed across-the-board increases in volatility to a less stable environment in the post-crisis than in the pre-

<sup>7</sup> The weights are inversely proportional to the relative variances of the three individual indicators of exchange market pressure, so that each component contributes the same amount of volatility to the index.

<sup>8</sup> Actually, we calculate a weighted average of the absolute changes in each of the series that compound the index. We do this because the movements in the series can compensate with each other, not properly reflecting the size of the shocks.

<sup>9</sup> The threshold resulted from looking at a plot of the absolute monthly changes in the indices during both periods. We present the table here for simplicity since the corresponding charts are more difficult to interpret.

crisis period. Correcting for this effect by using the relative volatility measure, we find that these countries also tended to allow greater scope for exchange rate responses to shocks after the crisis than before. In both countries the volatility of the exchange rate relative to that of both interest rates and reserves increased sharply in the post-crisis period. It is worth noting, however, that in all four of the Asian countries that apparently moved to more flexible exchange rates after the crisis, the relative volatility of the exchange rate compared to domestic interest rates was significantly less than that for the “pure floaters.” These countries also had relatively greater reserve volatility than Germany, though somewhat less than Japan.<sup>10</sup>

		<b>Exchange rate changes relative to interest rate changes</b>	<b>Exchange rate changes relative to reserve changes</b>
<b>Germany</b>	Pre-crisis	20.92	1.87
	Post-crisis	14.72	1.98
<b>Japan</b>	Pre-crisis	39.16	1.42
	Post-crisis	56.15	0.85
<b>Chile</b>	Pre-crisis	0.49	0.52
	Post-crisis	1.27	1.05
<b>México</b>	Pre-crisis	0.62	0.37
	Post-crisis	1.53	0.94
<b>Indonesia</b>	Pre-crisis	0.30	0.13
	Post-crisis	2.43	1.39
<b>Korea</b>	Pre-crisis	1.08	0.28
	Post-crisis	10.80	1.44
<b>Malaysia</b>	Pre-crisis	0.89	0.30
	Post-crisis	0.00	0.00
<b>Philippines</b>	Pre-crisis	0.41	0.06
	Post-crisis	1.98	0.65
<b>Thailand</b>	Pre-crisis	0.19	0.17
	Post-crisis	7.56	1.26

*e. Summary*

In short, our results so far suggest that our Asian crisis countries can be divided into three groups:

- i. For Korea and Thailand, the post-crisis period was a relatively tranquil one. These countries moved to substantially greater exchange rate flexibility in the post-crisis period

<sup>10</sup> In the case of Japan, the relatively high measured reserve volatility was due to a few large spikes – presumably associated with isolated episodes of intervention by the Japanese central bank that turned out to be relatively large in the context of a small reserve stock.

than in the pre-crisis period, though they appear to have attempted to influence their bilateral exchange rates against the U.S. dollar to a significantly greater extent than have industrial-country “pure floaters.” These countries have thus moved in the direction of more flexible rates, but have not moved to the extreme pole of pure (clean) floating.

- ii. Malaysia has quite openly fixed its bilateral U.S. dollar exchange rate since September 1998, and has defended this parity primarily through sterilized foreign exchange market intervention, rather than by assigning the task of stabilizing the exchange rate to monetary policy. This approach to exchange rate policy may have been facilitated by the country’s imposition of restrictions on capital movements.
- iii. For Indonesia and the Philippines, the post-crisis period has proved to be more turbulent in foreign exchange markets than the pre-crisis one. These countries have responded by allowing the exchange rate to move, by intervening in foreign exchange markets, as well as by using domestic monetary policies to defend the value of the exchange rate. However, the relative weight placed on exchange rate movements as endogenous responses to shocks increased greatly in the post-crisis period, implying that these countries, like Korea and Thailand, have also moved toward more flexible exchange rate regimes. However, like Korea and Thailand as well, they have targeted the exchange rate to an extent that appears to be substantially greater than that practiced in the industrial-country “pure floaters.”

In short, all five of our countries have occupied the “hollow middle” of exchange rate policy. While none of them have adopted “soft pegs” with unfettered capital movements, neither have they moved to the extremes of “hard” pegs or clean floats. In other words, all of them have continued to manage their exchange rates. The next question we address is: to what ends?

#### **IV. Objectives of Post-Crisis Exchange Rate Policy**

The basic conclusion of the previous section is that, with the exception of Malaysia, the Asian crisis countries have moved toward allowing greater floating of their exchange rates during the post-crisis period. However, they do not float to the same extent as do the “pure floaters” among industrial countries, as there is substantial evidence that these countries have both intervened in foreign exchange markets as well as adopted domestic monetary policies to influence the exchange rate. The question that we address in this section is why these countries have adopted such practices –i.e. , what have been the objectives of post-crisis exchange rate policy in the Asian crisis countries? Our approach will be to consider a variety of possible rationales for the authorities’ behavior and examine whether each of them is consistent with the evidence.

*a. Fear of volatility.*

A possible reason for “dirty” floating on the part of four of our economies is to stabilize high-frequency exchange rate movements. Indeed, one can argue that exchange rate smoothing may be an appropriate response in the post-crisis period from a Bayesian perspective. Because of the large exchange rate movements that were associated with the crisis (see Figure 1), economic agents may have only very weak prior beliefs about the equilibrium level of the nominal (and thus real) exchange rate in these economies in the immediate post-crisis period. Under these circumstances, their exchange rate expectations may be excessively sensitive to the exchange rates that they observe in the market. In other words, “extrapolative” expectations may be more likely to emerge under these conditions.

In the absence of an explicit commitment on the part of the authorities to defend a specific parity, intervention to smooth high-frequency exchange rate movements may thus help to anchor agents’ expectations about the path of the real and nominal exchange rates by removing much of the “noise” from the exchange rate series. This is the conventional argument for exchange rate smoothing. We add to it only the belief that it would appear to be particularly pertinent in post-crisis circumstances. This means allowing the nominal bilateral rate to move to its equilibrium level, and intervening only to prevent excessive (stationary) volatility around that level.

If foreign exchange market intervention were solely intended to smooth out high-frequency exchange rate fluctuations, then central banks would be obliged to maintain a stock of foreign exchange reserves to facilitate intervention. The stock of reserves should fluctuate randomly around the level that is judged sufficient for the central bank to retain the option to intervene in the foreign exchange market at its discretion, and it should not exhibit a systematic tendency to increase or decrease over time. Thus, one way to assess whether intervention has been designed *only* to smooth high-frequency exchange rate fluctuations is to examine the behavior of the stock of reserves over time.

Table 7 shows the pattern of reserve holding over time in the five crisis countries. All of the countries reached lows in officially recorded reserves within a few months of allowing their exchange rate systems to change, and subsequently they all undertook a substantial accumulation of reserves. Reserve accumulation peaked in most cases during the year 2000 (though in Korea it continued until the end of our sample period). Compared to their minimum levels, at their maximum values reserve stocks approximately doubled in Indonesia, Malaysia, and the Philippines, and they more than quadrupled in Korea. While reserve accumulation seems milder in Thailand (their maximum value exceeded their minimum one by just short of 40 percent), when the unwinding of the central bank’s forward position in dollars is taken into account, the rate of reserve accumulation in that country may be at least as large as any of the others.<sup>11</sup>

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<sup>11</sup> The imperfection of our reserves measure should be noted. In particular, it does not take into account central bank obligations in forward markets. As is now well known, Thailand defended the baht during the year prior

(continued)

The upshot is that post-crisis foreign exchange market intervention in the five crisis countries was not what one might expect either from a clean float or from a “dirty” float with intervention designed *only* to smooth out high-frequency exchange rate fluctuations. If these countries were smoothing the exchange rate, they were also systematically affecting its level through cumulative purchases of foreign exchange, at least into the year 2000.

<b>Table 7 Post-Crisis Reserve Accumulation In the Asian Crisis Countries</b>					
	<b>Indonesia</b>	<b>Korea</b>	<b>Malaysia</b>	<b>Philippines</b>	<b>Thailand</b>
Ratio of maximum to minimum reserve stock	2.06	4.86	1.75	2.02	1.38
Date of reserve minimum	February 1998	December 1997	July 1998	January 1998	August 1997
Date of reserve maximum	August 2000	December 2000	April 2000	March 2000	December 1999
Implicit monthly growth rate: min.-max.	2.44	4.49	2.69	2.74	1.16
Implicit monthly growth rate: min.- December 2000	1.17	4.49	1.47	1.75	0.67

*b. Stabilization of the nominal effective exchange rate.*

We have already seen that, except for Malaysia after September 1998, the Asian crisis countries have not chosen to stabilize their bilateral exchange rates against the U.S. dollar. However, we have also seen that the exchange values of their currencies have not been a matter of indifference to these countries, as evidenced by the volatility of their reserves and domestic interest rates –that is, they have not been “clean” floaters. To this we have now added that intervention has not simply been designed to smooth the exchange rate.

What, then, has been the objective of intervention? One possibility is that these countries may have been seeking to stabilize the path of the nominal *effective* exchange rate (NEER). In other words, they may have been pegging to a currency basket. One can imagine at least two reasons why they might choose to do so:

First, stabilizing the NEER might represent an attempt to use the exchange rate as a nominal anchor after the crisis. Given that trade with the United States has been decreasing over time as a share of the total trade of the crisis countries, that their other trading partners have been characterized by low and stable inflation rates, and that the value of the US dollar

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to the float largely by intervening in forward markets, thereby incurring future dollar liabilities that have not been netted out from the officially reported reserves that we use here.

has at times fluctuated sharply against the currencies of their other trading partners during the post-crisis years, using the exchange rate as a nominal anchor would suggest that the appropriate variable to stabilize would be the NEER.

Second, to the extent that the crisis in each of these countries was in part triggered by exchange rate overvaluation, many analysts have attributed this overvaluation to an excessively rigid pre-crisis peg against the U.S. dollar at a time when the dollar was appreciating relative to the Japanese yen. Thus, one lesson that these countries could have drawn from the crisis would have been that, to the extent that they wish to stabilize some version of their nominal exchange rates, the appropriate version should be one that gives greater weight to the currencies of their other trading partners. This suggests a shift from stabilizing the bilateral rate against the US dollar toward stabilizing something like the NEER.

Note, by the way, that maintaining stability in the NEER could be compatible with a fluctuating exchange rate against the U.S. dollar, with variability in both reserves and domestic interest rates, and even with substantial reserve accumulation over short periods of times. All of these have been characteristic of our economies.

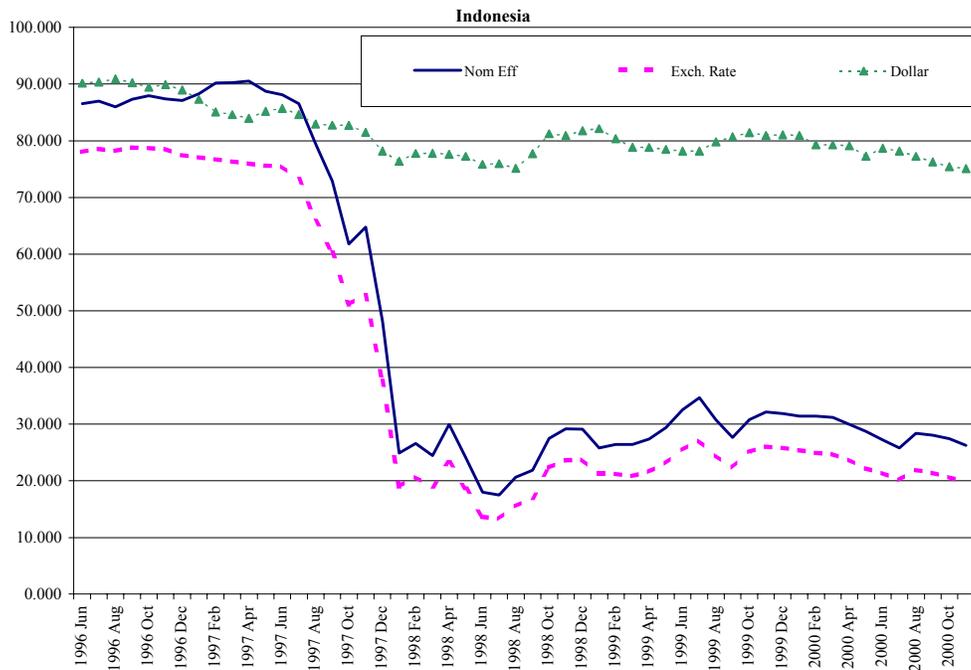
Figure 2 displays the behavior of the NEER index in each of our economies after June 1996. If the bilateral exchange rates against the US dollar were being managed to offset fluctuations in the exchange value of the dollar against the currencies of other trading partners, we would expect the NEER curve to be relatively flat and the bilateral dollar exchange rate (EXCH) and the external value of the dollar relative to trading-partner currencies (DOLLAR) to move in opposite directions. It is easy to verify visually that this pattern has not emerged in any of the countries in the post-crisis period. Thus, in none of them does the nominal effective exchange rate appear to have been stabilized after the crisis.

This can be confirmed in Table 8, which reports post-crisis correlations among NEER, EXCH, and DOLLAR in each of the five countries. If the bilateral nominal exchange rate against the US dollar had been used to stabilize the nominal effective exchange rate in these countries, the correlation between EXCH and DOLLAR should approach negative one, and those between NEER and both EXCH as well as DOLLAR should be zero. As Table 8 shows, this has clearly not been the case. In Indonesia, the Philippines, and Thailand, movements in the bilateral exchange rate against the US dollar have actually been positively correlated with changes in the external value of the U.S. dollar – i.e., changes in the bilateral exchange rates against the U.S. dollar have tended to *reinforce* the effects on each country's NEER of fluctuations in the external value of the U.S. dollar (Column 2). On the other hand, for Korea and Malaysia we cannot reject the null hypothesis that the two variables have moved independently, though the correlation between them is negative. The upshot is that in none of our five countries has the NEER been simultaneously uncorrelated with movements in bilateral U.S. dollar exchange rates and the external value of the dollar (Columns 3 and 4), as would tend to be the case under a policy of NEER stabilization.

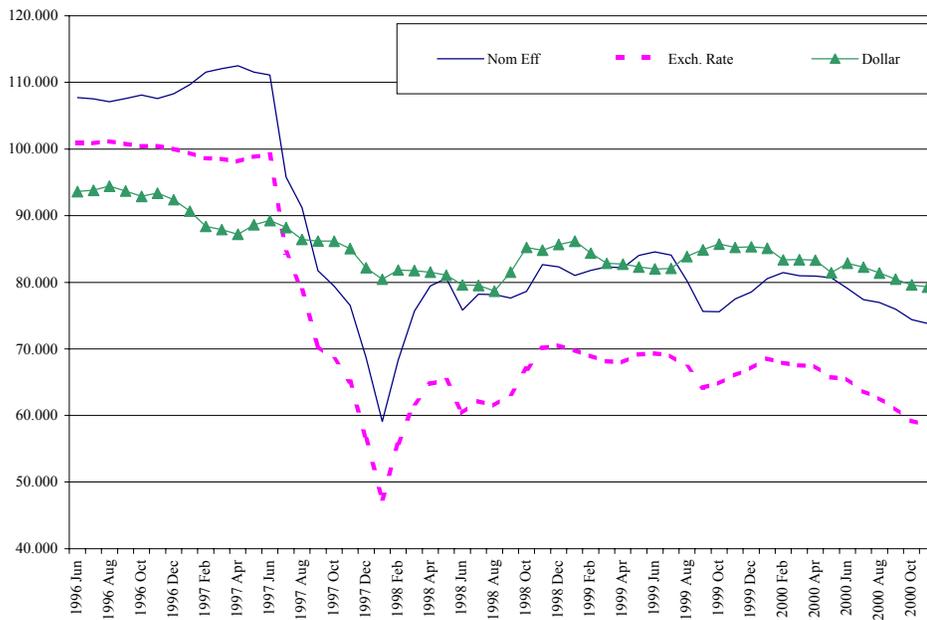
<b>Table 8 Bi-variate Correlations Among Nominal Exchange Rates in Five Asian Countries</b>			
	<b>Correlation between EXCH and DOLLAR</b>	<b>Correlation of NEER with:</b>	
		<b>EXCH</b>	<b>DOLLAR</b>
<b>Indonesia</b>	0.46*	0.97*	0.24
<b>Korea</b>	-0.25	0.88*	-0.67*
<b>Malaysia</b>	-0.21	0.21	-0.99*
<b>Philippines</b>	0.71*	0.97*	0.53*
<b>Thailand</b>	0.61*	0.89*	0.19

\* sig. at standard levels

**Figure 2: Nominal Effective Exchange Rates, Bilateral Rates, and U.S. Dollar Exchange Rates Against Partner Countries for Five Asian Economies, 1996-2000**

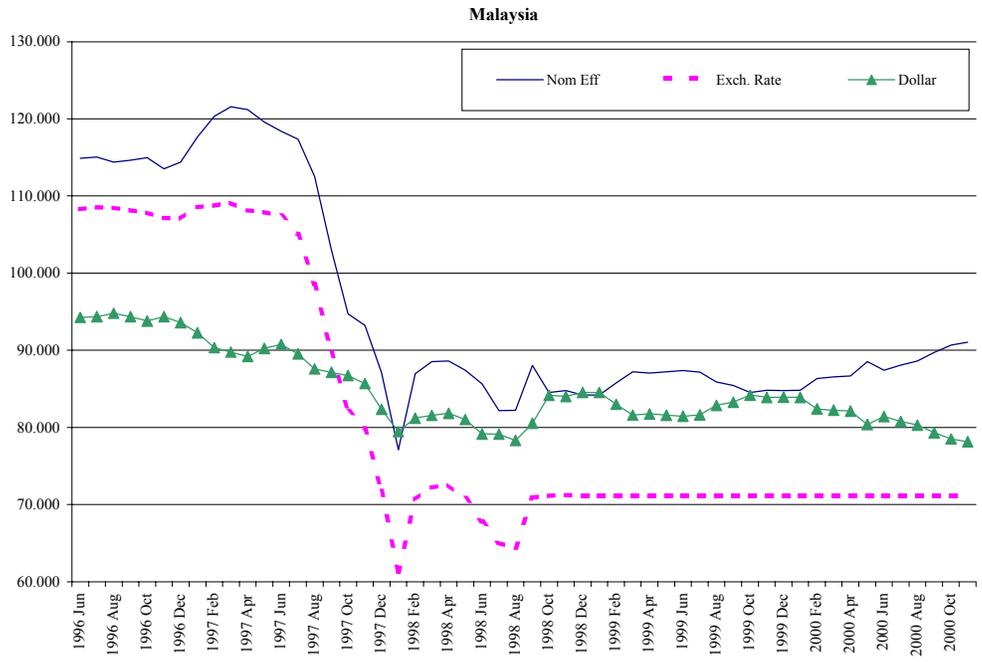
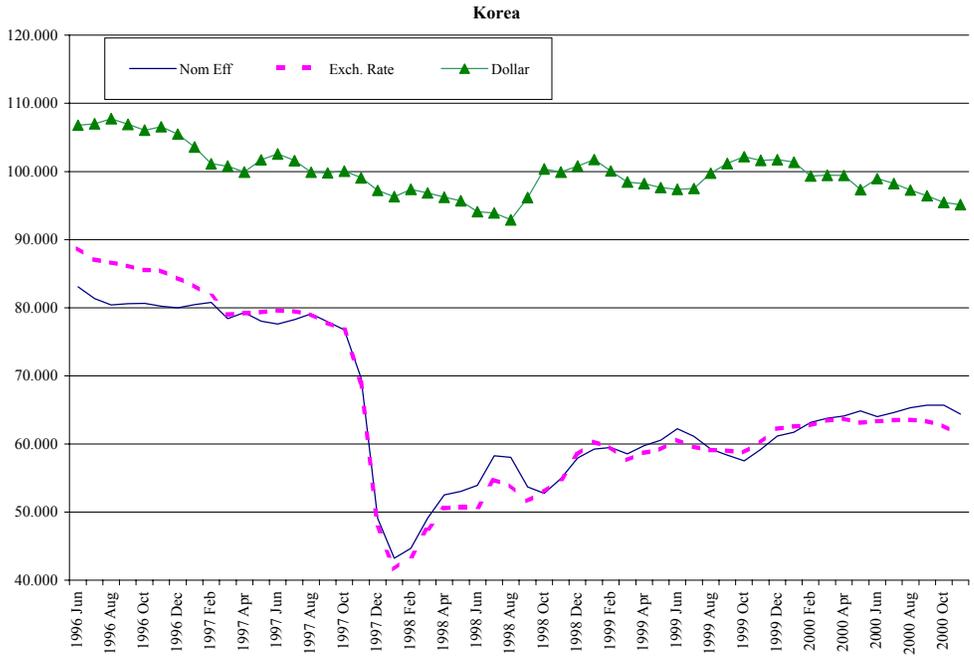


### Thailand



### Philippines





*c. Stabilization of the real effective exchange rate.*

Countries may care about the behavior of their nominal exchange rates not just because of the potential role of the exchange rate as a nominal anchor, but also because, at least in the short run, the behavior of the nominal exchange rate will influence that of the *real* exchange rate, which is a key macroeconomic relative price guiding the composition of production and absorption between traded and non-traded goods. Indeed, in the outward-oriented development strategies that all five of these formerly “miracle” economies followed up to the time of the crisis, the behavior of the real exchange rate played an important role, as the avoidance of overvalued real exchange rates, and the achieving of a stable and predictable path of the real exchange rate, were central components of that strategy.

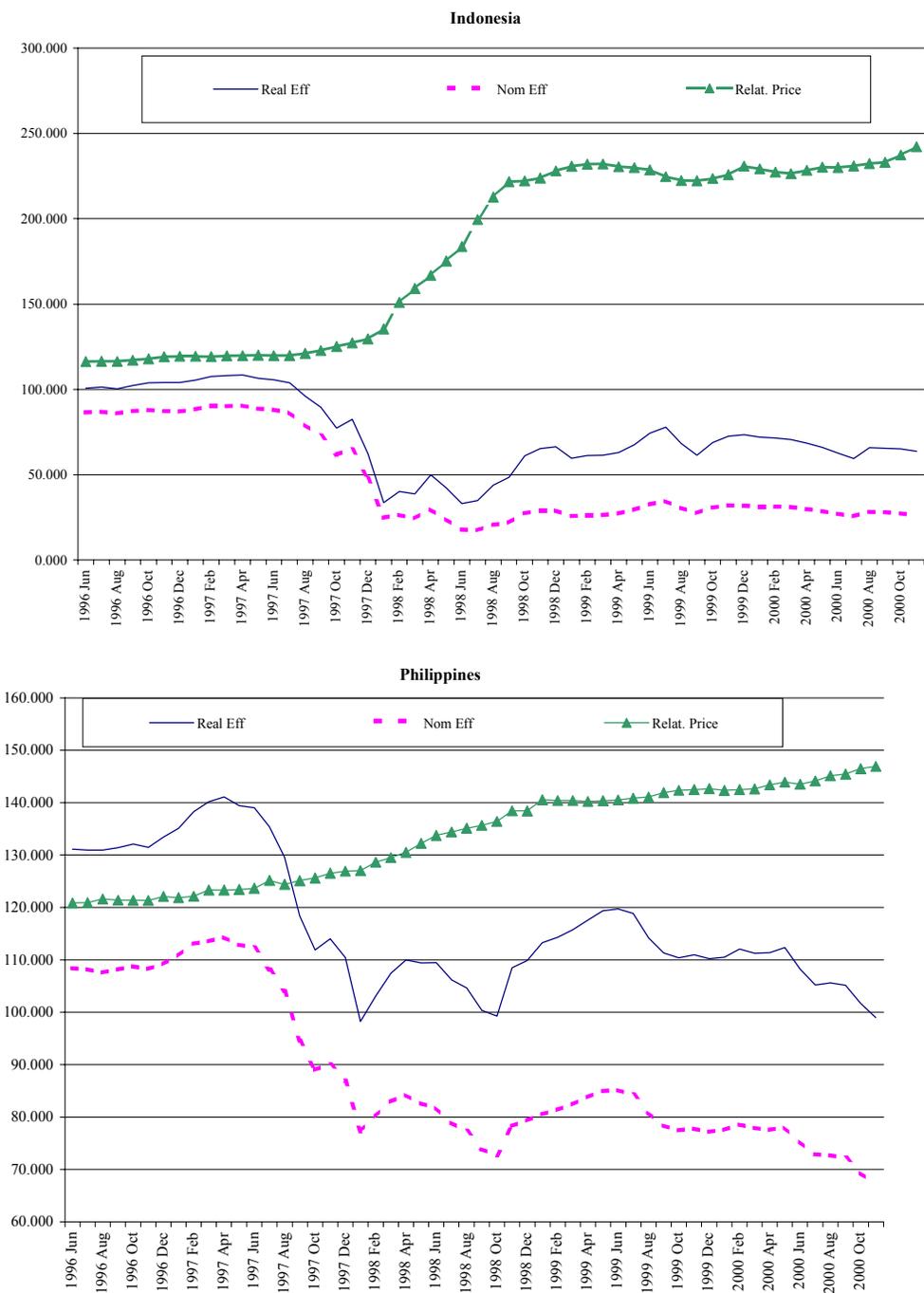
Accordingly, it would not be surprising for post-crisis exchange rate policies in these countries to revert to a concern with the behavior of the real exchange rate, and in particular for it to be the case that, in the wake of the turbulence created in exchange markets by the crisis itself, the authorities in these countries would find it desirable to intervene in support of real exchange rate stability.

Have they indeed done so? Notice first that our previous finding that stabilizing the *nominal* effective exchange rate has *not* been an obvious concern of policy does not preclude this possibility, since nominal effective exchange rate variability may be required to stabilize the real effective exchange rate when the domestic price level becomes unstable relative to those of the country’s trading partners. Figure 3 below shows the behavior of the real effective exchange rate (REER) for each of our five crisis countries during mid-1996 thru end-2000, as well as that of its two constituent series: the nominal effective exchange rate (NEER) and the ratio between domestic and weighted trade-partner-country price levels (REL). Based on coefficients of variation, the volatility of the REER has increased substantially in Indonesia and Korea, has fallen in Malaysia, and has remained about the same in the Philippines and Thailand.<sup>12</sup>

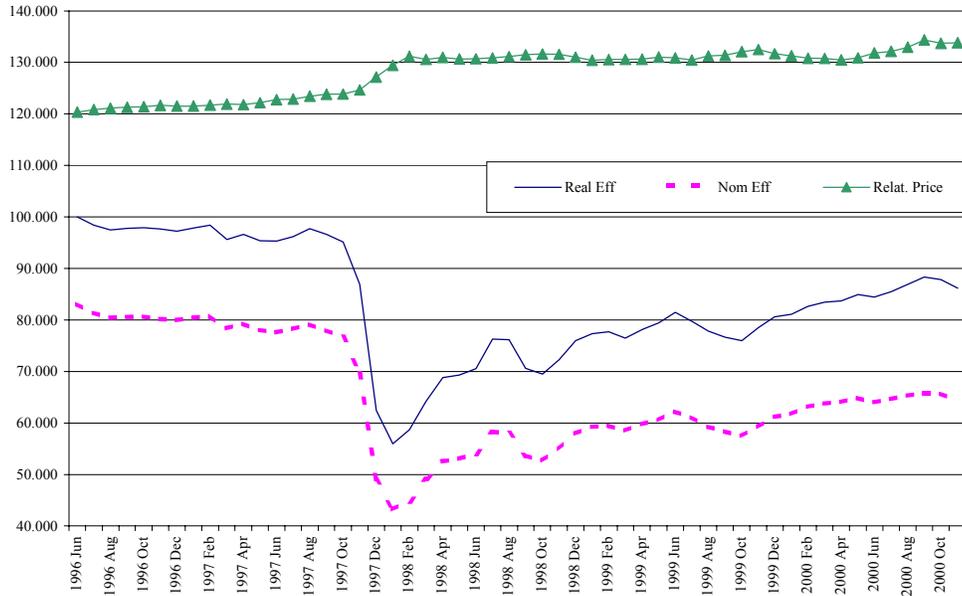
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<sup>12</sup> Coefficients of variation, pre- and post-crisis, are 0.032 and 0.076 for Indonesia, 0.016 and 0.048 for Korea, 0.034 and 0.021 for Malaysia, 0.048 and 0.049 for the Philippines, and 0.036 and 0.039 for Thailand.

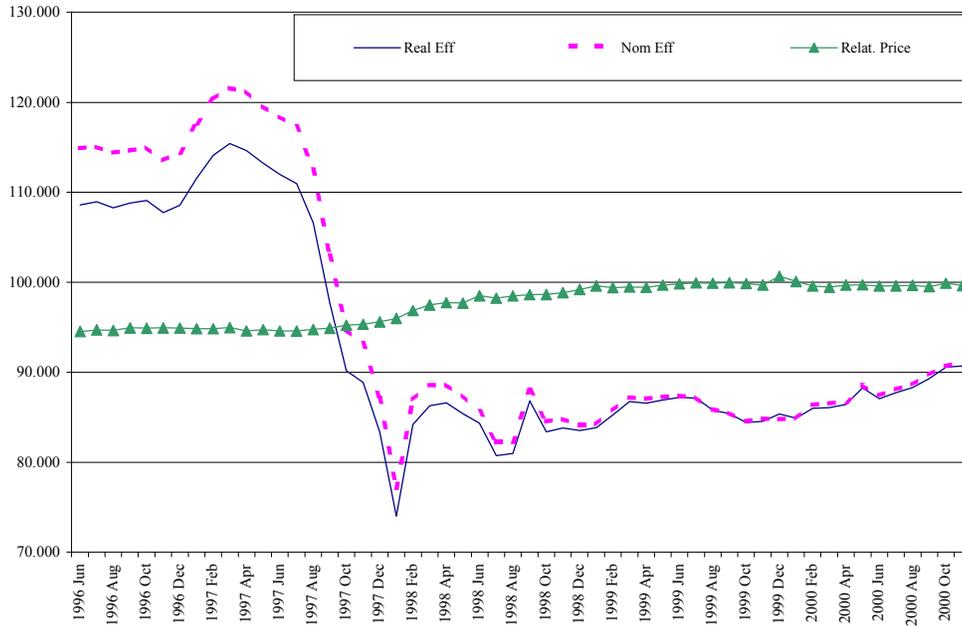
**Figure 3: Real Effective Exchange Rates, Nominal Effective Exchange Rates, and Ratio Between Domestic and Weighted Trade-Partners Price Indices**

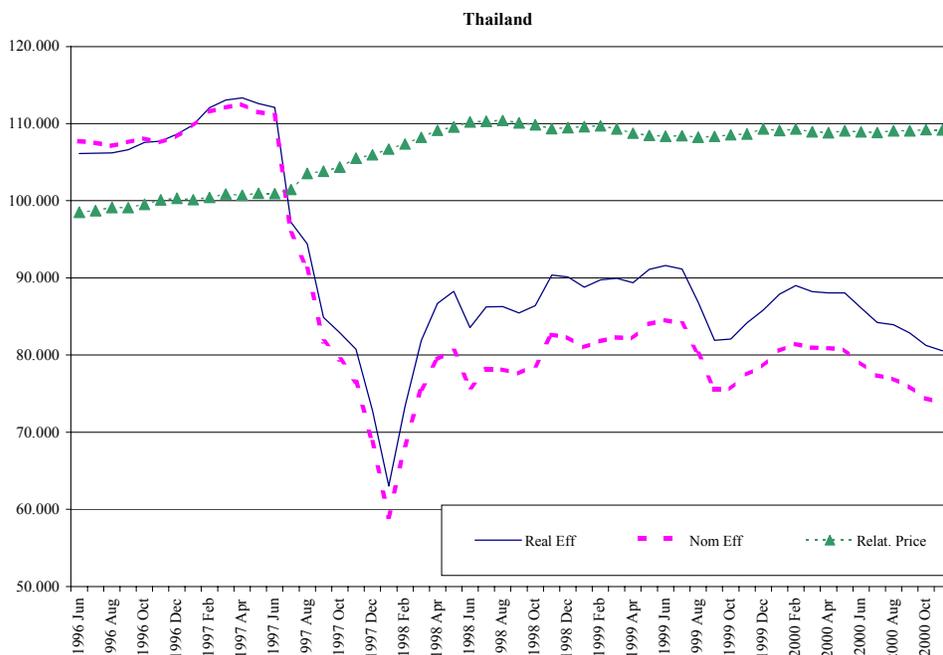


### Korea



### Malaysia





Has the variability in the NEER played the role of offsetting variability in relative prices? As in the previous section, if it had, we would expect NEER and REL to be negatively correlated, and REER to be uncorrelated both with NEER as well as with REL. These correlations are presented in Table 9. Negative and statistically significant correlation coefficients are evident only in the cases of Indonesia and the Philippines, and the hypothesis that this coefficient is minus one fails to be rejected only in the case of the Philippines. However, even in that case, NEER turns out to be substantially more volatile than REL. The result is that REER is highly and significantly correlated with NEER in every case, and with REL as well in the cases of Indonesia, the Philippines, and Korea. In short, there is no evidence here that stabilization of the real effective exchange rate has been the guiding principle of post-crisis exchange rate policy in any of our five countries.

<b>Table 9: Bivariate Correlations Among the Real Exchange Rate and its Components in Five Asian Countries</b>			
	<b>Correlation between NEER and REL</b>	<b>Correlation of REER with:</b>	
		<b>NEER</b>	<b>REL</b>
<b>Indonesia</b>	-0.57*	0.98*	-0.39*
<b>Korea</b>	0.49*	0.99*	0.63*
<b>Malaysia</b>	-0.30	0.99*	-0.18
<b>Philippines</b>	-0.96*	0.99*	-0.93*
<b>Thailand</b>	-0.10	0.99*	-0.01

#### *d. Fear of depreciation*

If exchange rate policy was not used to offset the effects of changes in the external value of the US dollar on each country's NEER, or the effects of changes in relative price levels on each country's REER, then what was it used for? One possibility is that it may have been intended to influence the "central tendencies" of the NEER and REER –i.e., the paths around which the NEER and REER have fluctuated on a monthly basis.

We saw in Table 9 that the real effective exchange rate has been very strongly correlated with the nominal effective exchange rate during the post-crisis period in all of our countries. Moreover, except for Malaysia, the nominal effective exchange rate has been highly correlated with the bilateral exchange rate against the U.S. dollar. This suggests that movements in the *real* effective exchange rate in these countries after the crisis have been driven by changes in their *bilateral* exchange rates against the U.S. dollar, and this turns out to be the case. Correlations between the REER and the bilateral exchange rate against the U.S. dollar were 0.92 for Indonesia, 0.85 for Korea, 0.21 for Malaysia, 0.96 for the Philippines, and 0.89 for Thailand, all of them statistically significant except for Malaysia. The strong links between the REER and bilateral exchange rates in the four floating-rate countries raises the possibility that exchange market intervention may have been intended to influence the path of the real effective exchange rate.

In what direction might these countries have wished to see the REER move? A logical *ex ante* possibility is that they may have suffered from "fear of depreciation." We know that the crisis was associated with extreme exchange rate depreciations in all of these countries, and that these depreciations had cataclysmic real consequences because of the severe currency mismatches that characterized the balance sheets of financial institutions and firms. Moreover, we also know that, in consequence, supporting the values of these currencies was an important objective of macroeconomic policy during the crisis in all of these countries. It is reasonable, then, to suppose that exchange rate policy in the post-crisis period may have been directed to the same end.

However, this logical supposition is not supported by the facts. In particular, if exchange rate policy had been influenced by a "fear of depreciation" during the post-crisis period, we would have expected the central banks of the former crisis countries to have expended reserves in sustaining the values of their currencies. But as we have seen, just the opposite has been true.

#### *e. Fear of Appreciation*

The accumulation of reserves by the former crisis countries suggests that, to the extent that foreign exchange intervention was conducted with a view to influencing the path of the real effective exchange rate, the intended result may have been exactly the opposite one –i.e., these countries may have suffered from a fear of *appreciation*, rather than depreciation. If the crisis-induced collapse of their currencies caused their nominal exchange rates to overshoot their equilibrium values, then these currencies would have had a tendency

to appreciate in real effective terms during the post-crisis period, to something like their pre-crisis levels or to levels that are only moderately depreciated compared to the pre-crisis levels, depending on whether these currencies tended to be overvalued before the crisis. Intervention would then be intended to resist this appreciation, either by maintaining real effective exchange rates at levels below their equilibrium values or by slowing the rate of return of the real exchange rate to its equilibrium value. An exchange rate policy of this type would be consistent with the substantial accumulation of foreign exchange reserves during the post-crisis period that we documented earlier in this section.

Why might this be a reasonable objective of policy? First, as we have already indicated, a competitive real exchange rate had long been a linchpin of development policy in these outward-oriented economies. The concern with competitiveness has been evident throughout the region, as even non-crisis countries such as Singapore and Taiwan floated their currencies in response to the sharp depreciations undergone by the currencies of the crisis countries, with an eye to preserving their competitive positions in export markets. Second, the crisis had very severe real effects in these economies, as each of the crisis countries underwent a sharp contraction in real GDP. The maintenance of relatively depreciated real exchange rates would thus also have played a stabilization role by encouraging exports and discouraging imports, thereby helping to stimulate aggregate demand and foster an economic recovery. A similar strategy was followed by Chile after its “twin crises” in the early eighties, as well as by Mexico in the aftermath of the 1994-95 crisis in that country. On the basis of the available evidence, we cannot reject this interpretation of the objectives of post-crisis exchange rate policy among the Asian crisis countries.

*f. Accumulation of a reserve “war chest”*

Nonetheless, “fear of appreciation” does not represent the only feasible interpretation of the objectives of exchange rate policy in these countries. An alternative interpretation is that the post-crisis moderation of real exchange rate appreciation, rather than representing the ultimate objective of policy, was simply the byproduct of policies undertaken with another purpose in mind, in particular, the accumulation of a “war chest” of international reserves.

At this point, the jury is still out on whether the Asian financial crisis is best interpreted as a solvency or a liquidity crisis. The inability of crisis countries to raise funds on private capital markets is consistent with either interpretation. This inability to raise funds, however, meant that the liquid resources available to each of these countries for the purpose of conducting foreign exchange market intervention were limited to their stocks of usable foreign exchange reserves. Countries in the region that avoided the worst effects of the crisis had in common either a limited degree of integration with international capital markets (China, India, Vietnam), or truly massive foreign exchange reserves (China, Singapore, Taiwan). Indeed, even Hong Kong SAR, which did not escape a severe attack on

its currency in October of 1997, was able to successfully weather that attack partly as a result of its truly enormous stock of foreign exchange reserves.<sup>13</sup>

Thus, the desire to accumulate reserves so as to secure a liquidity buffer against future shocks provides an alternative explanation of exchange rate policy in the post-crisis period. Because reserve accumulation tends to sustain a depreciated value of the currency relative to what would have happened otherwise, while the desire to resist currency appreciation implies foreign exchange market intervention in the form of reserve accumulation, we cannot distinguish between these possible motivations on the basis of the observation that these countries have been engaged in substantial reserve accumulation. However, we have some direct evidence that reserve accumulation was an explicit objective of policy, rather than simply a byproduct of an attempt to moderate the appreciation of the real effective exchange rate. The Korean Letter of Intent of November 1999, for example, stipulated an exchange rate policy consisting of “smoothing operations consistent with a further build-up of usable reserves,” and a reserve floor was established as part of the Korean program which envisioned a build-up of reserves over time.

*g. Summary*

In short, as we saw in the previous section, the four post-crisis “floaters” among the five Asian crisis countries have allowed substantially more flexibility to their nominal exchange rates than they did before the crisis, but not nearly as much as have the industrial-country “clean” floaters. They moderated exchange rate movements triggered by foreign exchange market shocks through foreign exchange market intervention as well as by conducting domestic monetary policy with an eye toward external objectives.

What were they seeking to achieve in doing so? In this section we have argued that, while they may have intended to smooth high-frequency exchange-rate fluctuations, this could not have been the only objective guiding the behavior of the monetary authorities. In addition, their systematic accumulation of reserves during the post crisis period suggests that, consistent with their long-term development strategies as well as with the short-term need to reactivate their economies, they may have been trying to moderate the appreciation of their real effective exchange rates after the overshooting associated with the crisis, and/or may have been engaging in the accumulation of a reserve “war chest” to employ in the future stabilization of the exchange rate. Note that these arguments apply both to the four “floaters,” as well as to the non-floater case of Malaysia during the post-crisis. Though we cannot distinguish between these objectives on the basis of the cumulative behavior of reserves during the post-crisis period, there is some direct evidence indicating that reserve accumulation was an independent objective of policy.

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<sup>13</sup> Obviously, Hong Kong SAR also operated a currency board system which may have greatly enhanced the credibility of its commitment to defend the parity of the Hong Kong dollar.

## V. An Evaluation: Exchange Rate Policy and Post-crisis Economics

The post-crisis exchange rate policies of our five countries can thus be characterized as containing three common features: limited flexibility, resistance of real exchange rate appreciation, and reserve accumulation. Is a policy featuring these three components appropriate for these economies? In this section we will consider possible rationales for these policies in the specific post-crisis context of our five Asian crisis countries.

### *a. Limited flexibility*

It is worth emphasizing that, while the former crisis countries may have been forced to float in the context of the crisis by their limited ability to resist the substantial pressures that emerged against their currencies, they have had significantly more discretion about their exchange rate policies during the post-crisis period. Nevertheless, though they have intervened to smooth exchange rate fluctuations, with the exception of Malaysia they have *not* reintroduced predictable pegs against the U.S. dollar. Thus, what needs to be evaluated, at least for four of these countries, is the apparent policy of limited –but nonzero– exchange rate variability.

Permitting a greater degree of flexibility to nominal exchange rates while eschewing pre-announced parities has two potential virtues in the post-crisis context:

- Enhanced exchange rate flexibility presumably helps to align perceived *de facto* exchange rate policy with the *de jure* exchange rate regime, thus preventing the emergence of an implicit commitment to an exchange rate parity. By not committing the government to defending a fixed parity, and therefore not compromising the government’s prestige in any market-induced depreciation of the exchange rate, this policy reduces the incentives for the government to commit resources to a defense of the rate, and thus reduces potential profit opportunities in speculation against the currency. This is simply the standard argument for the view that currency crises (in the form of sharp exchange rate movements) are less likely to occur under floating exchange rates.
- By explicitly creating uncertainty about the future course of the exchange rate, exchange rate variability may discourage the assumption of additional foreign currency risk by reducing moral hazard problems associated with the perception of implicit government exchange guarantees.

On the other hand, as argued earlier, some degree of exchange rate smoothing may be an appropriate response in the immediate post-crisis period from a Bayesian perspective, mainly because under such circumstances economic agents may have weak prior beliefs about the equilibrium level of the nominal (and real) exchange rate, thus making “extrapolative” expectations more likely to arise. Intervention to smooth high-frequency exchange rate movements may thus help to anchor agents’ expectations about the path of the

real and nominal exchange rates, which may be particularly pertinent in post-crisis circumstances.<sup>14</sup>

Preserving the perception that the exchange rate is free to move requires the central bank to abstain from targeting the exchange rate through intervention in the foreign exchange market or monetary policy, while ensuring that the exchange rate does not embark on extreme, self-reinforcing fluctuations may require it to do the opposite. These objectives are thus potentially in conflict. The behavior of the four “floaters” among our five countries can be interpreted as an attempt to strike a balance between these objectives. As mentioned above, eschewing an announced parity while allowing the exchange rate substantial latitude to move in both directions avoids the perception of a *de facto* peg, such as existed before the crisis. Within that framework, a policy of “leaning against the wind” may help to safeguard against destabilizing speculation based on actual exchange rate movements without jeopardizing the perception of exchange rate flexibility. Thus, the limited but nonzero exchange rate variability allowed by the four “floaters” may represent an attempt to strike a compromise between desirable but potentially conflicting objectives in the post-crisis context.

In contrast to the compromise between these objectives apparently sought by the other crisis countries, Malaysia opted for the benefits of stability, while completely foregoing those of flexibility. If an intermediate position within the “hollow middle” was optimal for the other countries, why was the same choice not optimal for Malaysia?

One hypothesis is that Malaysia’s choice to opt for a corner solution was driven by the fact that, in view of the decision taken by that country in mid-1998 to attempt to recover from the crisis by reflating outside the context of a Fund-supported adjustment program, and given the political dimensions of that decision in that country, it may have faced a much less favorable flexibility-stability tradeoff than other countries in the region. The decision to reflate without a Fund program would itself have unsettled the foreign exchange market, and the associated implied replacement of Finance Minister Abraham, the former heir-apparent to Prime Minister Mahathir, would have compounded the effect through the political uncertainty it created. In that context exchange market pressures would have become very severe, and may have dictated the choice to fix the rate and impose capital controls.

In sum, it can be argued that post-crisis exchange rate policies at neither extreme of the exchange regime spectrum may have been appropriate under post-crisis circumstances in all five crisis countries. However, the policies chosen may have helped to anchor agents’ expectations in all of the countries while, at the same time, introducing some degree of uncertainty in four of them.

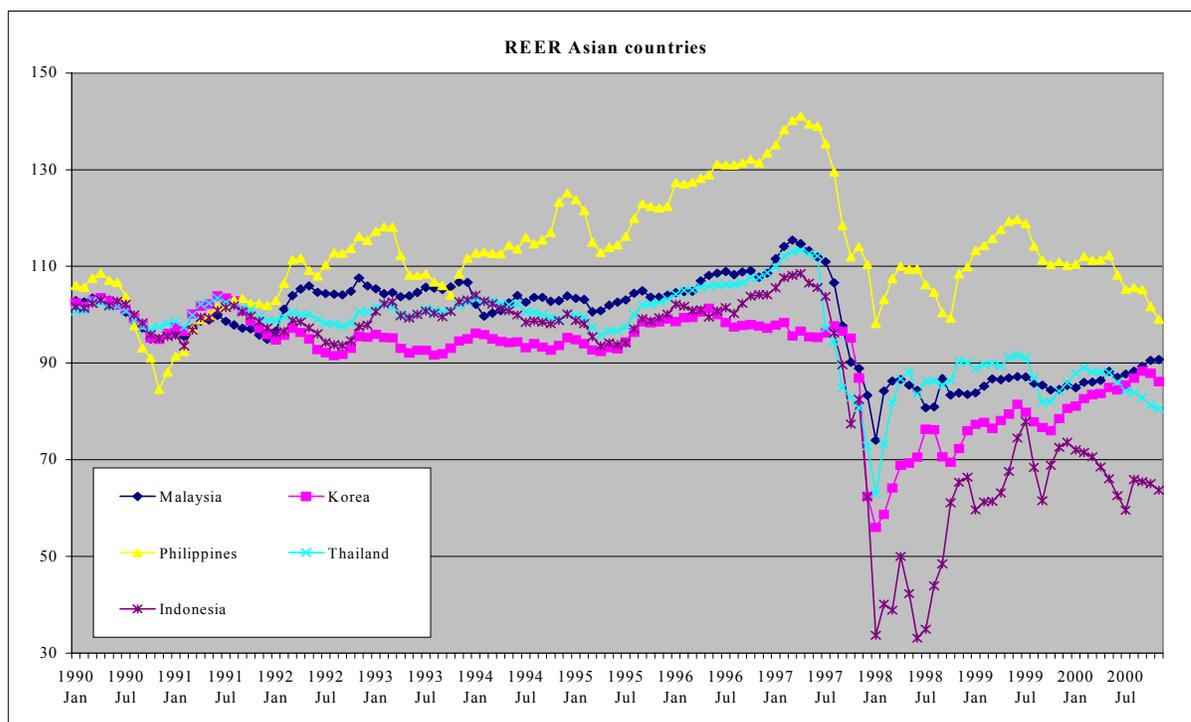
#### *b. Fear of appreciation*

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<sup>14</sup> If so, as we have noted, it would justify the “smoothing” component of exchange market intervention, but not the systematic reserve accumulation that we actually observe in the five Asian crisis countries.

As we have discussed, a byproduct of reserve accumulation is to moderate the appreciation of the nominal exchange rate in the wake of the overshooting associated with the crisis. The resulting relative depreciation of the real exchange rate enhances the competitiveness of these economies, and has thus contributed to the recovery of real activity by encouraging exports and discouraging imports. Figure 4 shows the behavior of the real effective exchange rate in our five countries both before and after the crisis.

**Figure 4**



In each case, the average real effective exchange rate was more appreciated on average during 1999-2000 than the minimum values reached in early 1998, but more depreciated than its pre-crisis level. This pattern, in which a large part of the real exchange rate depreciation associated with the crisis is sustained for several years after the crisis, was also characteristic of post-crisis recoveries in Chile (after the crisis of 1982) and Mexico (after the crisis of 1994). As shown in Table 10, in all of these cases the crisis was associated with a short and sharp contraction in real economic activity, and the recovery in real economic activity was accompanied by a rapid acceleration in export growth, fueled in part by improved competitiveness.

One way to interpret what these countries have done in the area of exchange rate policy, then, is as a component of a recovery strategy for real economic activity, other components of which have included a loosening of both fiscal and monetary policies after an initial tightening in the immediate aftermath of the crisis intended to restore creditor

confidence. Given that an excessive loosening of fiscal and monetary policies to reactivate these economies may have threatened a fragile restoration of confidence, relative real exchange rate depreciation may have had an advantage as an instrument of policy that could promote recovery without undermining confidence. Moreover, the outward orientation that characterized the development strategies of all of these economies –and the consequent large size of the traded goods sector– may have made real exchange rate depreciation a relatively powerful tool in stimulating domestic economic activity.

<b>Table 10 Export Growth Post-Crisis Recovery in Seven Crisis Countries</b>		
<b>Chile</b>	<b>1983</b>	<b>1984-88</b>
Average growth in Exports	0.07	8.59
Average growth in GDP	-3.49	5.81
<b>Mexico</b>	<b>1995</b>	<b>1996-99</b>
Average growth in Exports	30.19	13.73
Average growth in GDP	-6.17	5.09
<b>Thailand</b>	<b>1998</b>	<b>1999-00</b>
Average growth in Exports	6.72	10.42
Average growth in GDP	-10.17	4.59
<b>Philippines</b>	<b>1998</b>	<b>1999-00</b>
Average growth in Exports	-21.03	9.14
Average growth in GDP	-0.59	3.66
<b>Malaysia</b>	<b>1998</b>	<b>1999-00</b>
Average growth in Exports	-0.21	11.87
Average growth in GDP	-7.37	5.85
<b>Korea</b>	<b>1998</b>	<b>1999-00</b>
Average growth in Exports	13.25	17.42
Average growth in GDP	-6.69	9.71
<b>Indonesia</b>	<b>1998</b>	<b>1999-00</b>
Average growth in Exports	11.18	-14.74
Average growth in GDP	-13.01	2.17

*c. Reserve accumulation*

Third, and perhaps most importantly, reserve accumulation may actually be an important component of a natural transition to a new regime of floating exchange rates. In recent years, we have become increasingly aware that countries that do not announce fixed exchange rate parities tend to float very differently from each other. In particular, Hausmann et. al. (1999) have noted that among floaters, some countries maintain much larger stocks of reserves than others, and use them to intervene much more actively in the foreign exchange market, thus providing much more stability to the nominal exchange rate than would have been observed otherwise. They have identified two systematic influences on countries’ decisions to intervene more or less actively, and thus to maintain larger or smaller stocks of reserves: the degree of exchange rate “pass-through” in their economies, and the extent to which agents in these economies are able to borrow externally in their own currencies. The inability of many developing country agents to borrow in their own currencies was dubbed

“original sin” by Eichengreen and Hausmann (1999). Empirically, the severity of “original sin” proved to be the most important factor in explaining the size of the reserve stocks maintained by floaters.

While Hausmann et. al. have documented an empirical regularity in the way that countries float, McKinnon (2000b) has provided an explicit argument linking “original sin” to optimal exchange rate policy that actually goes much further. Essentially his point is that, unless countries credibly commit to a fixed long-run value of their nominal exchange rates, expectations of devaluation will create interest rate differentials that will make it very expensive for domestic residents to hedge foreign exchange rate risk. Thus, if “original sin” prevails, currency mismatches will be the rule in emerging market economies that are open to capital flows. Such mismatches will aggravate the real consequences of exchange rate crises, as they evidently have done in the Asian countries. It is possible to add to this that such mismatches will also make currency crises more likely to happen (see Montiel (1999)). The upshot is that in the presence of “original sin,” countries should credibly commit themselves to permanent exchange values of their currencies.

Whether for the purpose of managing floats or to secure a permanent long-run value for the currency, being in the position to intervene extensively in the foreign exchange market requires the accumulation of a sufficiently large stock of reserves by countries that are subject to “original sin.” As it happens, the five countries that concern us are among those included in the original study by Hausmann et. al., and according to the indicators used in that paper, all of them fit this description. Since all of them went through currency crises that featured substantial depletion of their reserve stocks, one justification of their post-crisis exchange rate policies is that these policies represent a transitory period of reserve accumulation intended to put these countries in the position to manage their exchange rates much more actively over the indefinite future, and thus provide the protection against currency mismatches in the presence of “original sin” that would be expected by Hausmann et. al. as well as by McKinnon.

These arguments suggest that a policy of smoothing-cum-reserve accumulation may actually have been optimal for these five Asian countries in the post-crisis period. This policy simultaneously achieves three goals:

- By reducing the noise content in exchange rate movements, it makes it easier for economic agents to extract information from exchange rate movements, and thus promotes the efficient allocation of resources.
- By temporarily preserving an overly depreciated real exchange rate, it promotes economic recovery in these heavily outwardly-oriented economies.
- By accumulating a reserve cushion, it provides the means through which these victims of “original sin” can protect themselves in the future from the disruptive consequences of currency mismatches.

These *ex ante* considerations, coupled with a very strong macroeconomic performance in the crisis countries during the post-crisis period (not only the large reserve accumulation itself, but also a large current account adjustment achieved with a rapid growth recovery and without inflation) give grounds for a favorable verdict on exchange rate policies in the Asian countries during the post-crisis period.

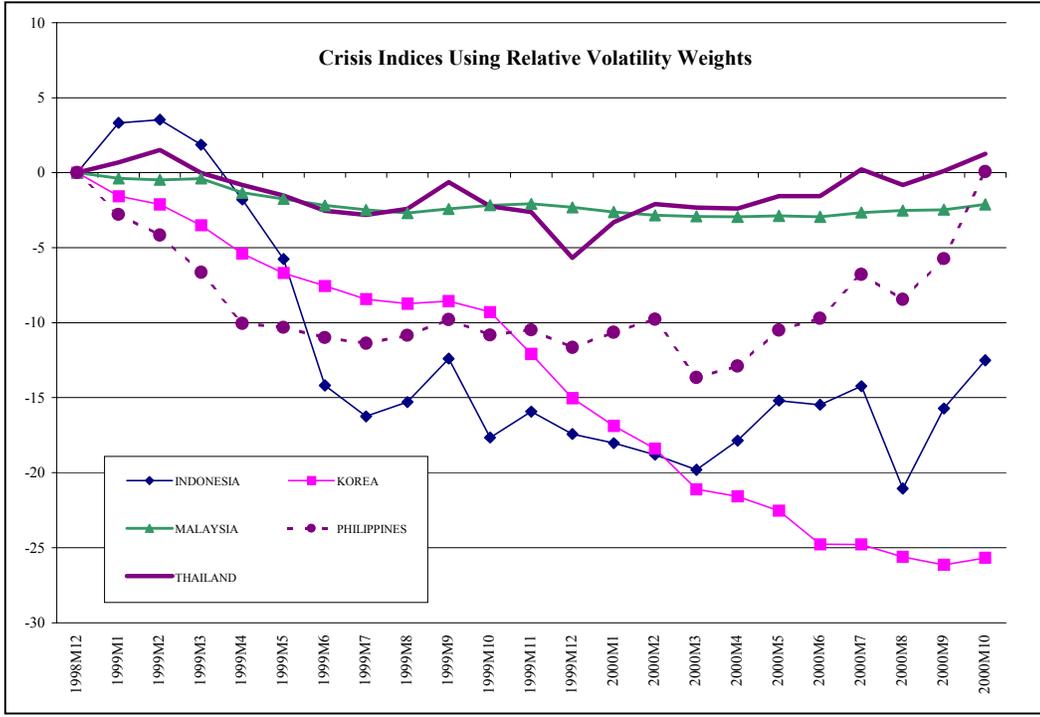
Moreover, from a narrower perspective that focuses on the sustainability of the exchange rate regime itself, these policies also appear to have been successful. Because the “dirty floats” in which these countries have engaged imply that the exchange rate has explicitly or implicitly been a target of macroeconomic policies (that is, these countries have not been at the extreme end of “pure floating” in the exchange regime distribution), their currencies are in principle vulnerable to speculative attacks that would force the authorities away from their exchange-market intervention rules. Such attacks, whether successful or not, would manifest themselves in extreme observations of the components of “exchange market pressure” indices –reserve changes, interest rates, and/or exchange rate changes. Yet, as shown in Figure 5, all of these indicators have been relatively tranquil (non-positive) in the post-crisis period.<sup>15</sup>

These results suggest that the total policy package in these countries has been a credible one, perceived as sustainable by the markets. In other words, although these countries have moved along the exchange regime continuum away from the ‘fixed’ toward the ‘flexible’ end, they have not gone all the way. Yet, up to the present, at least, they do not appear to have been penalized by the markets for not having done so.

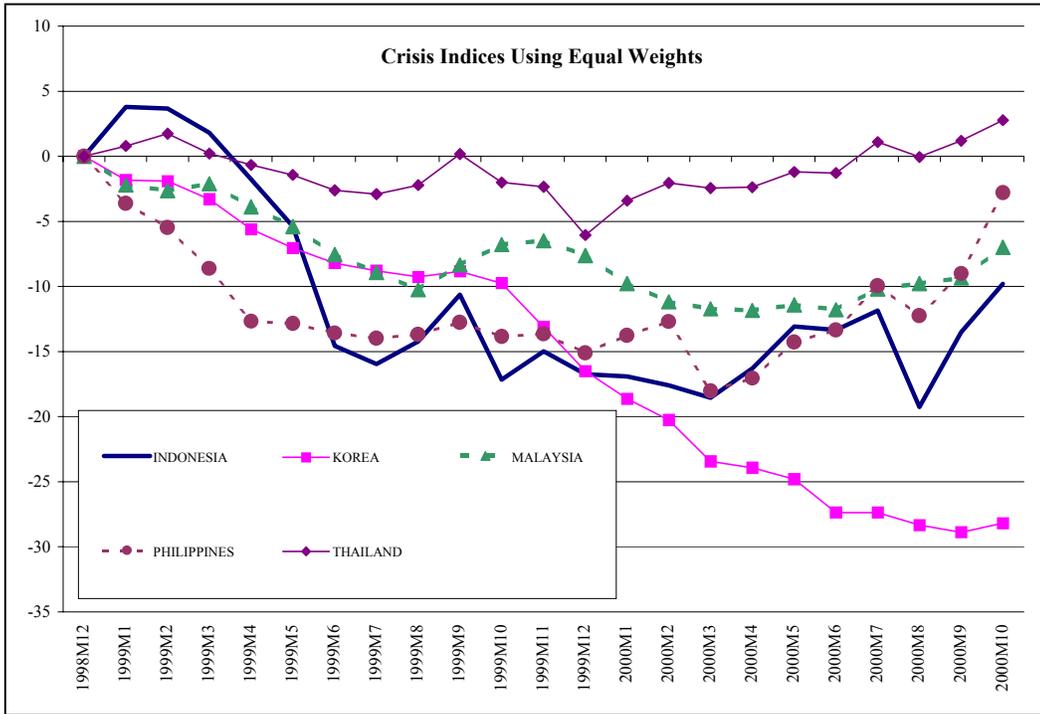
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<sup>15</sup> Figure 5 computes two indicators of exchange market pressure for each country, using December 1998 as a benchmark. In the top panel, changes in reserves, exchange rates, and interest rates are weighted by the inverse of their volatilities during the sample period. In the bottom panel, the three components are given equal weights.

**Figure 5**  
**(A)**



**(B)**



## VI. Looking Ahead: Some Qualifications

While these considerations would seem to suggest that exchange rate policy has been conducted in a fairly benign fashion in these countries, given their post-crisis circumstances, these conclusions are subject to some qualifications. In particular, there is an alternative perspective that puts matters in a somewhat less favorable light, suggesting that the post-crisis exchange rate policies pursued in the five countries we have studied constitute at best a second-best policy response to the persistence of some important domestic distortions, the removal of which has been the explicit objective of policy after the Asian financial crisis. Thus, the exchange rate policies that have been pursued in these countries in effect recognize the incomplete success of policies directed to the removal of such distortions, and can thus be interpreted as transitory in nature. As policy succeeds in diminishing the severity of these distortions, exchange rate policy should be modified accordingly.

This alternative perspective begins by questioning the role of nominal exchange rate stability in avoiding the consequences of currency mismatches. The key point here is that the presence of “original sin” does not imply that the consequences of currency mismatches can be avoided *only* through stabilization of the nominal exchange rate. If this link is broken, then “original sin” cannot be used to justify the maintenance of large reserve stocks by the Asian crisis countries.

Countries tend to hold large amounts of reserves while floating in order to retain the option of preventing large depreciations of the domestic currency. They do this, according to Hausmann et. al. (1999), precisely because the monetary authorities are aware of the presence of severe currency mismatches in the balance sheets of domestic economic agents. In a Barro-Gordon framework, these mismatches increase the costs –as perceived by the authorities– that are associated with large exchange rate movements. But why do large policy-relevant mismatches arise in the first place? Both Hausmann et. al. as well as McKinnon (2000b) attribute them to “original sin.” McKinnon argues that the link between “original sin” and exchange rate stabilization operates through the disincentives for the financial hedging of exchange rate risk created by interest rate differentials that arise from the risk of currency devaluation. Currency mismatches arise simply because it is too expensive to hedge exchange rate risk in such a situation. Thus, “original sin” is linked to large policy-relevant currency mismatches, which gives rise to an optimal desire for exchange rate stabilization on the part of the authorities, which in turn causes them to wish to hold large amounts of reserves.

But, taking “original sin” as a given, it is not obvious that “excessive” currency mismatches should result, for two reasons:

- a. First, many agents in open economies possess natural “real” hedges against exchange rate risk, in the form of assets devoted to the production of traded goods. Agents whose assets and liabilities are both effectively denominated in foreign currency are obviously not vulnerable to exchange rate risk. For such agents, “original sin” does not give rise to

currency mismatches. The potential scope for external borrowing in foreign exchange without incurring currency risk in a given economy depends on the size of that economy's traded goods sector. For relatively open economies, such as the five Asian crisis countries studied here, this scope is potentially quite large.<sup>16</sup>

- b. The problem is, of course, that under "original sin" foreign currency debt may be incurred by agents that do *not* possess such natural hedges, giving rise to currency mismatches. But in principle this is just among many economic risks that markets allocate. This source of risk, like any other, would presumably raise the cost of capital to the agents undertaking it, and thus be efficiently allocated by the market. In the presence of "original sin," then, the extent of external borrowing in foreign currency by agents for whom such borrowing would tend to create currency mismatches should be naturally restricted by the market, leaving no argument for policy intervention in the form of exchange rate stabilization.

Thus, both because currency mismatches may not arise and because if they do they may not be sub-optimal, the link between "original sin" and the optimality of exchange rate stabilization may be a tenuous one, simply because "original sin" may not give rise to policy-relevant currency mismatches.

However, this raises the issue of whether agents may not be induced to undertake *excessive* currency risk in the presence of "original sin" by market distortions such as the moral hazard problems that arise in the context of poorly capitalized and supervised financial intermediaries, or by the expectation of bailouts among well-connected firms in the real sector. When such distortions are important, currency mismatches can indeed become excessive, and this suggests a *second-best* argument for stabilizing the exchange rate.<sup>17</sup> Just such a situation is typically blamed for the severity of the financial crisis in Asia (and other crises in the past), and indeed is probably implicit in the analyses by Hausmann et.al. and by McKinnon. It is quite likely that it accounts for the "fear of floating" that characterized the Asian countries prior to the crisis.

The key question, of course, concerns the relevance of this analysis for *post-crisis* Asia. Much of the post-crisis restructuring of these economies has been designed precisely to reduce the incidence of such moral hazard problems by improving the regulatory and

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<sup>16</sup> If the traded goods sector accounts for 30-40 percent of GDP, for example, and the capital-output ratio is approximately 3, the entire capital stock of the traded goods sector could be financed with foreign currency borrowing of around 90-120 percent of GDP without incurring currency mismatches, a figure that is greater than the foreign-currency debt of all the Asian crisis countries except for Indonesia—in 1998, Indonesia's foreign debt was about 172 percent of GDP, while for the other four countries this ratio fluctuated between 44 and 77 percent (source: World Debt Tables).

<sup>17</sup> Some observers have argued that stabilizing the exchange rate may itself create excessive currency mismatches, but it is hard to see why this should occur in the absence of the distortions discussed previously—i.e., stabilizing the exchange rate should not increase external borrowing unless agents believe (*ex-ante*) that associated with it there is a greater chance of a bail-out.

supervisory framework for the financial sector, capitalizing banks, and addressing problems of corporate governance. To the extent that this process is incomplete, and that incentives remain in place for domestic agents to take on excessive currency risk, then the reserve accumulation objective for future exchange rate stabilization purposes would appear to be justified, but only as a transitory, second-best policy response to the persistence of domestic distortions. Since holding foreign exchange reserves is a costly activity, as these problems are addressed and resolved, the maintenance of large stocks of foreign reserves by Asian central banks would no longer be justified on the basis of “original sin.”

Has reserve accumulation already proceeded beyond the optimal point, given the circumstances of these economies? Unfortunately, this is a question on which we can shed little light. The reason is that, in the presence of currency mismatches, the level of reserves required to protect a country against a successful speculative attack in theory depends on a variety of characteristics of the economy, so no simple benchmark that ignores such country-specific characteristics would be appropriate to judge the adequacy of reserve levels.<sup>18</sup>

## VII. Summary and Conclusions

The basic questions we have addressed in this paper are: what exchange rate policies have the Asian crisis countries pursued in the post-crisis period, why have they done so, and how do we evaluate these policies? Moreover, we would ideally like to use the post-crisis experience of these countries to draw lessons about exchange rate policies under conditions of high financial integration in other countries.

In summarizing our results, it is useful to begin with a rather obvious observation: the simple classification of exchange rate regimes into “hard pegs,” “soft pegs,” and “floating” is a fiction. In practice, exchange rate regimes operate along a continuum. The crisis simply caused the Asian crisis countries to move along this continuum. But this move has not been uniform within the region:

- a. Malaysia moved in the direction of much greater fixity and less integration with world capital markets.
- b. Korea and Thailand appear to have entered a post-crisis (i.e., tranquil) period in 1999-2000. During this period, they have maintained or increased their degree of integration with world capital markets and moved in the direction of greater flexibility, but not to the extreme pole of clean floating.
- c. Because of domestic political uncertainties, it is not so clear that the Philippines and Indonesia truly moved into a post-crisis period during 1999-2000 (see table 5 and figure

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<sup>18</sup> These characteristics include the extent of currency mismatches, the amount of economic damage that their presence can do in the event of a sharp depreciation, the economy’s current account deficit, and its stock of short-term external obligations. See Montiel (1999).

A1 in the appendix). Indeed, it is clear from figure A.1 that in the case of Indonesia this has not been the case.<sup>19</sup> Relative to the pre-crisis period, both countries have altered their exchange rate regimes in the direction of greater flexibility, however.

While all of these countries have moved along the exchange rate regime continuum, none of them have opted to jump to either of its extreme poles. In that sense, they have helped to fill the “hollow middle” of exchange rate regimes.

How well have these modifications in their exchange rate regimes served the Asian crisis countries? The most plausible interpretation of the objectives of exchange rate policy in these countries is that they were designed to achieve three objectives: to stabilize high-frequency exchange rate movements<sup>20</sup>, to slow the pace of real appreciation after the overshooting associated with the crisis, and to accumulate a “war chest” of liquid foreign exchange reserves. We have argued that all of these were reasonable objectives of policy in the post-crisis context.

Moreover, these post-crisis regimes have been successful both from the narrow perspective that they have apparently been judged sustainable by the markets (i.e., they have not been subjected to extreme episodes of “exchange market pressure”) and from the broader perspective that, especially in countries that have avoided political instability, they have been associated with very successful macroeconomic performance, both in terms of real activity as well as of the economies’ external accounts. Growth has picked up rapidly, inflation has remained low, and current accounts have adjusted rapidly.

Is there a link between the exchange rate practices adopted and these measures of performance? On this we have offered little evidence. We can speculate that the removal of the “one-way bet” in the foreign exchange market, together with the crisis-induced real exchange rate overshooting, may have made a difference in preventing the emergence of exchange market pressures, and that the depreciated real exchange rate together with the accumulation of large stocks of reserves, may have respectively supported aggregate demand and enhanced confidence.

But there is also a darker side to exchange rate policies in these countries. In particular, smoothing-cum-reserve accumulation may have been a *substitute* for other measures that need to be undertaken in these economies. To the extent that these measures have been absent and/or remain incomplete, the chosen policy is best interpreted as a second-best transition strategy, and the authorities may actually have had little discretion over its adoption. *Given* the incompleteness of such measures, however, the chosen exchange rate policy is an appropriate one. Nonetheless, from this perspective, the chosen exchange rate

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<sup>19</sup> Note that in figure A.1 in the appendix Indonesia uses a different scale.

<sup>20</sup> We argued in section IV that smoothing could not be the *only* objective as all the countries accumulated a significant amount of reserves in the post-crisis. However, it is plausible that smoothing was the ultimate objective and the accumulation resulted from an initial low level of reserves.

policy represents a symptom of something that is wrong or unfinished, rather than a component of an optimal policy package. Once these other components of reform have been completed in the crisis countries, continuation of the chosen exchange rate policy would be sub-optimal, since such a policy would be a wasteful of scarce national resources.

Finally, what lessons can be drawn for other countries? One tentative lesson is that the size of the “middle” that is actually “hollow” is probably small. What enhanced financial integration has undoubtedly done is made it far more difficult for financially integrated countries to sustain “soft” pegs, simply because capital markets will not allow domestic policy mistakes to go unpunished. Whether there is literally no scope for such regimes depends on whether the domestic authorities can avoid vulnerability through their policy choices. That is the lesson of pre-crisis Asia, where policy mistakes were not avoided. It may also be the lesson of post-crisis Malaysia, however, where the adoption of an exchange rate peg, together with policies viewed by markets in an unfavorable light, were perceived to require –and prompted– the imposition of barriers to capital movements.

The lesson of other post-crisis Asian countries seems to be that there remain other choices away from the extremes of the exchange rate spectrum, and that active management of the exchange rate not only remains feasible under current international conditions, but may actually be desirable depending on country circumstances. Specifically, under post-crisis conditions, if the fragility of domestic balance sheets rules out “hard” pegs as an option (because of the strains imposed by periods of high interest rates that are needed to defend the peg), a “dirty” float designed to resist real appreciation and accumulate reserves has much to recommend it over the polar extreme of “clean” floating.

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### Appendix 1. Asian Crisis Countries in Calvo and Reinhart (2000a)

Calvo and Reinhart (2000a) look at the volatility of monthly (log) exchange rate changes, using end-of-month data. Specifically, they focus at the percentage of changes that lie within a narrow band, and compare this to what is observed among the “pure” floaters (U.S., Germany, Japan). The greater the percentage of changes falling within a narrow band, the more likely that countries have been intervening to smooth the exchange rate. Their results for our countries are reported in Table A1.

**Table A1. Monthly Fluctuations In Exchange Rate Changes**

Country	Period	+/- 1 percent band	+/- 2.5 percent band
<b>U.S./DM</b>	<b>February 1973-April 1999</b>	<b>26.8</b>	<b>58.7</b>
<b>U.S./Japan</b>		<b>33.8</b>	<b>61.2</b>
Indonesia	November 1978-June 1997	96.4	99.1
	July 1997-April 1999	9.5	14.3
Korea	March 1980-October 1997	80.1	97.6
	November 1997-April 1999	5.9	17.7
Malaysia	January 1986-February 1990	71.4	98.1
	March 1990-November 1992	84.4	96.9
	December 1992-September 1998	59.4	81.2
Philippines	January 1988-April 1999	60.7	74.9
Thailand	January 1970-June 1997	95	95
	July 1997-April 1999	14.3	38.1

The conclusion suggested by these results is that Indonesia, Korea, and Thailand intervened heavily to support a peg before the crisis, but have done so much less after the crisis. Malaysia and the Philippines have intervened relatively heavily throughout. By comparison with the “pure floaters” these countries were clearly “fixers” before the crisis, and Indonesia, Korea, and Thailand became “floaters” afterward.

Using Calvo and Reinhart’s methodology, for floaters a high percentage of reserve changes should be contained within narrow bands. Using the same countries as benchmarks as in Table A1, their results for our countries are given in Table A.2 below.

In every case reserve variations are greater than for the “pure” floaters, both before and after the crisis (fewer reserve movements are contained within narrow bands). The implication is that these countries have been intervening to defend an exchange rate target, both before and after the crisis. Thus, while they have allowed more scope for exchange rate movements, they have *not* adopted “pure” floats.

What is surprising is that for Indonesia and Thailand, reserves seem to be more variable after the crisis than before, suggesting more intervention. For other countries, it is not possible to make direct comparisons. How to reconcile this with the previous result for these two countries? The sample period includes the crisis period, and shocks were larger during this period.

**Table A2. Monthly Fluctuations In Reserve Changes**

Country	Period	+/- 1 percent band	+/- 2.5 percent band
<b>U.S.</b>	<b>February 1973-April 1999</b>	<b>26.8</b>	<b>62.2</b>
<b>Japan</b>		<b>44.8</b>	<b>74.3</b>
Indonesia	November 1978-June 1997	22.8	41.5
	July 1997-April 1999	10	29.9
Korea	March 1980-October 1997		
	November 1997-April 1999	0	5.6
Malaysia	January 1986-February 1990	20	35.9
	March 1990-November 1992	9.1	39.4
	December 1992-September 1998	34.3	55.7
Philippines	January 1988-April 1999	9.7	26.1
Thailand	January 1970-June 1997	21.3	50.2
	July 1997-April 1999	9.1	40.9

Finally, Calvo and Reinhart argue that if shocks are credibility-driven and Central banks intervene to defend the rate, then interest rate volatility will be higher than otherwise. Interest rate volatility thus arises from two sources: credibility shocks and intervention to support the rate. Assuming no other sources of interest rate changes, comparisons across countries and across time can thus reveal something about the *joint* impact of credibility shocks and intervention to support the rate. The greater the proportion on interest rate movements contained within a narrow band, therefore, the smaller the incidence of credibility shocks-cum parity defenses. For our countries their results are:

**Table A3. Monthly Interest Rate Volatility**

Country	Period	basis points			
		< 25	< 50	> 400	> 500
<b>U.S.</b>	<b>February 1973-April 1999</b>	<b>59.7</b>	<b>80.7</b>	<b>0.3</b>	<b>0.3</b>
<b>Japan</b>		<b>67.9</b>	<b>86.4</b>	<b>0</b>	<b>0</b>
Indonesia	November 1978-June 1997	30.6	46.8	5.2	4
	July 1997-April 1999	0	0	75	70.1
Korea	March 1980-October 1997	31.1	51.9	0	0
	November 1997-April 1999	13.3	19.9	13.3	6.7
Malaysia	January 1986-February 1990	52.1	68	3.9	2.1
	March 1990-November 1992	72.7	96.9	0	0
	December 1992-September 1998	66.7	83.3	2.9	1.4
Philippines	January 1988-April 1999	22.1	38.9	1.5	0.7
Thailand	January 1970-June 1997	24.1	41.2	2.4	0.8
	July 1997-April 1999	4.6	9.1	22.7	22.7

Note that, except for Malaysia during 1990-98, interest rates have been much more volatile (in the sense that *fewer* interest rate changes were contained within a narrow band) for our countries than for the reference ones. Our countries have also been more likely to experience extreme interest rate changes. The conclusion is that our countries have been more vulnerable to credibility shocks, and may have more often countered these with tight monetary policies to defend the rate.

## Appendix 2. Asian Crisis Countries in McKinnon (2000b)

As indicated in the text, McKinnon (2000b) has drawn the conclusion that, with the exception of Indonesia, the Asian crisis countries have essentially reverted to a dollar standard in the post-crisis period. McKinnon bases his interpretation of exchange rate policy in these countries on regressions of the form:

$$\begin{aligned} (\Delta\% \text{ loc. currency}/\text{SWF}) = & \beta_1 + \beta_2(\Delta\% \text{ US}\$/\text{SWF}) + \beta_3 (\Delta\% \text{ JP}\yen/\text{SWF}) \quad (\text{A.1}) \\ & + \beta_4 (\Delta\% \text{ DM}/\text{SWF}) + \varepsilon \end{aligned}$$

where SWF denotes the Swiss franc, JP¥ the Japanese yen, and DM the German mark. He emphasizes the coefficient and standard error of the dollar/swf rate, finding it to be close to unity with a small standard error both before and after the crisis for Korea, the Philippines, and Thailand, and concludes that this suggests that these currencies have effectively been re-pegged against the US dollar.

It is true that this coefficient would be close to unity, its standard error would be small, and the equation would have very large explanatory power if the currency in question were tied to the dollar through a fixed-rate arrangement. Thus, if one knows that a currency is fixed to a basket, but does not know the composition of the basket, this equation can be used to estimate the composition of the basket from observed exchange rate movements, as in Frankel and Wei (199\_).

But it is *not* true that if the coefficient is close to unity and its standard error small, this implies the existence of a fixed-rate basket arrangement. The same result could emerge under a floating exchange rate regime. The correlation between the bilateral exchange rate of the domestic currency and that of the U.S. dollar against a third currency depends on the extent to which the domestic currency and the U.S. dollar experience similar shocks. The prevalence over the sample period of symmetric shocks affecting the domestic economy and the United States, or the presence of strong channels of transmission for economic shocks (contagion) from the US to the domestic economy would tend to magnify the size of this correlation. Thus, the magnitude of the coefficient of the bilateral exchange rate of the US dollar against a third currency in the regression above and the precision with which its is estimated would tend to depend on the strength of economic links between the economy in question and the United States.

The explanatory power of the regression under flexible exchange rates, on the other hand, would depend on the incidence of asymmetric shocks (shocks that only affect the domestic economy, but are not transmitted back to the United States). The stronger such shocks, the smaller the explanatory power of the regression. Thus, McKinnon's results are consistent either with a tight peg against the US dollar (his preferred interpretation) or with a much looser currency link to the dollar combined with tight economic links to the dollar area and a relative absence of independent shocks during the sample period. Based on the evidence in the text, we prefer the latter interpretation.

To support our view, we have conducted similar exercises for Switzerland and Chile. In the former case, the Swiss franc has long been considered one of the “pure floaters”, while in the latter case there was an explicit change in the foreign exchange regime in the direction of a much greater floating. Running regressions similar to (A.1) we derived the following results:

**Table A.4 Switzerland**

**1.- Pre-crisis period**

Dependent Variable: SF  
 Method: Least Squares  
 Date: 02/26/01 Time: 11:35  
 Sample: 1995:07 1997:06  
 Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001410	0.002812	-0.501312	0.6214
DM	1.190645	0.121715	9.782260	0.0000
YEN	-0.005156	0.083750	-0.061559	0.9515
R-squared	0.860328	Mean dependent var		0.010416
Adjusted R-squared	0.847025	S.D. dependent var		0.032141
S.E. of regression	0.012571	Akaike info criterion		-5.798396
Sum squared resid	0.003319	Schwarz criterion		-5.651139
Log likelihood	72.58075	F-statistic		64.67588
Durbin-Watson stat	1.280502	Prob(F-statistic)		0.000000

Note: the results remain qualitatively identical after correcting for first order autocorrelation.

**2. Post-crisis period**

Dependent Variable: SF  
 Method: Least Squares  
 Date: 02/26/01 Time: 11:33  
 Sample: 1999:02 2001:01  
 Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001910	0.001579	-1.209224	0.2400
EURO	0.959883	0.054514	17.60795	0.0000
YEN	-0.037723	0.057977	-0.650653	0.5223
R-squared	0.936590	Mean dependent var		0.006599
Adjusted R-squared	0.930551	S.D. dependent var		0.027951
S.E. of regression	0.007366	Akaike info criterion		-6.867411
Sum squared resid	0.001139	Schwarz criterion		-6.720154
Log likelihood	85.40893	F-statistic		155.0901
Durbin-Watson stat	2.309603	Prob(F-statistic)		0.000000

Note that the coefficient on the DM/Euro was close to unity and significant in both periods, and that the regression appears to possess a high degree of explanatory power. This regression would appear to have the (counterfactual) implication that the Swiss franc was tied to the DM/Euro in both periods. Similarly, turning to the results of a

specification for Chile identical to the one used by McKinnon for the Asian countries, we obtain the following results:

**Table A.5 Chile**

**1.- Pre-crisis period**

Dependent Variable: PESO  
 Method: Least Squares  
 Date: 02/26/01 Time: 10:59  
 Sample: 1995:07 1997:06  
 Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.003294	0.002795	1.178842	0.2523
DOLLAR	0.976946	0.116533	8.383407	0.0000
DM	-0.313771	0.289633	-1.083337	0.2915
YEN	0.294248	0.083813	3.510784	0.0022
R-squared	0.894775	Mean dependent var		-0.004814
Adjusted R-squared	0.878991	S.D. dependent var		0.035867
S.E. of regression	0.012477	Akaike info criterion		-5.778866
Sum squared resid	0.003113	Schwarz criterion		-5.582523
Log likelihood	73.34639	F-statistic		56.68954
Durbin-Watson stat	2.002477	Prob(F-statistic)		0.000000

**2. Post-crisis period**

Dependent Variable: PESO  
 Method: Least Squares  
 Date: 02/26/01 Time: 10:55  
 Sample(adjusted): 1999:02 2001:01  
 Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009520	0.007891	1.206464	0.2417
DOLLAR	1.091868	0.384462	2.839987	0.0101
EURO	-0.757272	1.051387	-0.720259	0.4797
YEN	0.047385	0.284342	0.166647	0.8693
R-squared	0.480469	Mean dependent var		0.001194
Adjusted R-squared	0.402540	S.D. dependent var		0.046370
S.E. of regression	0.035842	Akaike info criterion		-3.668385
Sum squared resid	0.025693	Schwarz criterion		-3.472043
Log likelihood	48.02062	F-statistic		6.165432
Durbin-Watson stat	2.410064	Prob(F-statistic)		0.003847

Chile has explicitly moved –in the absence of a crisis– toward a greater degree of exchange rate flexibility in the second of the two sample periods reported above. Yet the regression reveals an *increase* in the coefficient on the US dollar during the second period. We conclude from these results that regressions of this type provide an unreliable indicator of exchange rate policies.

### **Appendix 3. Interest Rate Volatility and the Commitment to Exchange Rate Stability**

In Section III, the volatility of the domestic interest rate is considered as an indicator of a country's commitment to exchange rate stability. The interpretation of this indicator is much less straightforward than that of exchange rate and reserves volatility. A serious problem with drawing inferences about the exchange rate regime from observations on the volatility of interest rates across countries and over time is that, because such volatility could arise as the result of a variety of shocks, an increased commitment to exchange rate stability could be associated with either increased or reduced volatility of domestic interest rates.

To see how the possibility of alternative origins of shocks complicates inferences about exchange rate regimes drawn from interest rate volatility, suppose we retain the basic monetary exchange rate model used by Calvo and Reinhart, and consider three alternative sources of shocks, namely, (i) money supply shocks; (ii) money demand shocks; and (iii) credibility shocks (in the form of anticipated future currency depreciation).

Assume that these shocks are uncorrelated with each other, and are independent of the foreign exchange regime. Note that under completely fixed exchange rates, only the third of these sources of shocks would affect the volatility of the domestic interest rate in a small open economy, since money supply or demand shocks would give rise to capital flows, rather than variations in domestic interest rates. The implication is that switching to a clean float could *increase* the volatility of the domestic interest rate, by making it susceptible to all three types of shocks. It would do so if money demand and supply shocks are important relative to credibility shocks. But it could also *decrease* the volatility of the domestic interest rate. This would happen if credibility shocks were dominant, because under floating rates part of the pressure created in financial markets by an expected depreciation would be absorbed by the exchange rate, thereby muting the interest rate adjustment required to clear the money market.

Now, rather than the extremes of rigidly fixed rates or clean floats, consider a more general case, in which the authorities maintain a more or less 'dirty' float, and suppose that we want to identify their degree of commitment to stabilizing the exchange rate. It is easy to see that it must remain true in this case as well that whether a greater degree of commitment to exchange rate stability is reflected in lesser or greater interest rate volatility depends on whether shocks are dominated by domestic money supply and demand volatility or by credibility effects. The larger the role of credibility effects, the stronger is the connection between a commitment to exchange rate stability and enhanced domestic interest rate volatility.

The upshot is that inferring changes in the degree of commitment to exchange rate stability from changes in the volatility of domestic interest rates requires establishing the relative role of credibility shocks *vis-à-vis* domestic money supply and demand shocks during the sample period. How can we do this?

One way to do it is to exploit the differences in correlation among financial variables that arise when alternative sources of shocks prove to be dominant. Assuming flexible rates and no intervention, for example, under money *supply* shocks (changes in domestic monetary policy), we should observe a positive correlation between domestic interest rates and the exchange rate (measured as the foreign-currency price of the domestic currency), since tight money would raise the domestic interest rate and increase the value of the currency, while loose money would have the opposite effect.<sup>21</sup> Since foreign exchange reserves would be unchanged, the correlation of both variables with reserves would be trivially zero. The correlation between domestic interest rates and the exchange rate should also be positive under money *demand* shocks. When shocks arise from lack of credibility, however (modeled as an anticipated future depreciation), interest rates and exchange rates should be *negatively* correlated, since the anticipation of a future depreciation would result in a less than proportionate current depreciation that would have the effect of increasing domestic interest rates.

Under a “dirty float,” in which governments intervene directly in foreign exchange markets to stabilize the value of the currency, we can also draw inferences about the sources of shocks on the basis of correlations between domestic interest rates and reserve movements. Assuming flexible rates and *partial* intervention, for example, both money supply and money demand shocks should give rise to *positive* correlations between domestic interest rates and reserves, while under credibility shocks, this correlation should again be negative.

Having previously established in Section III that foreign exchange market intervention characterized both the pre- and post-crisis periods in our five countries, we can use changes in interest rate volatility to help identify changes in the degree of commitment to exchange rate stability if we can determine whether this volatility was primarily driven by domestic money supply and demand shocks or by credibility shocks during the sample period. A negative correlation between interest rate and reserve movements would support the interpretation that credibility shocks were dominant. Indeed, for four out of our five countries, we indeed observe such a negative correlation during the post-crisis period.<sup>22</sup> We conclude that an increased commitment to exchange rate stability would be indicated by an *increase* in domestic interest rate volatility.

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<sup>21</sup> This is, of course, the basis for an interest-rate defense of the currency.

<sup>22</sup> These correlations were  $-0.10$  for Korea,  $-0.36$  for Malaysia,  $-0.33$  for the Philippines, and  $-0.42$  for Thailand during the post-crisis period. The exception to the rule was Indonesia, with a correlation of  $0.12$ . However, this evidence for the preponderance of credibility shocks is in fact rather weak. Only the coefficients for Malaysia and Thailand are statistically significant at standard confidence levels. For the Philippines the marginal significance level is 14 percent (7 percent for a one-tailed test).

**Figure A.1: Exchange Market Pressure (basis: June 1997)**

