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Reserve Adequacy in Asia Revisited: New Benchmarks Based on the Size and Composition of Capital Flows

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Abstract

There has been considerable debate about the rationale behind the reserve hoarding by Asia, with wide ranging explanations having been offered for this behavior. In view of the ferocity and suddenness of the Asian crisis of 1997-98, the precautionary motive no doubt looms large in the decision to build up reserves to unprecedently high levels. This paper deals more narrowly with the issues of sensible values for such coverage ratios and also the likely sufficiency of focusing only on additive coverage ratios. The paper also investigates concepts of reserve adequacy in countries that may be subject to overly optimistic bubbles of capital flows which subsequently burst. The focus is on the size and composition of international capital flows.

Key words: *capital flows, currency crises, external debt, imports, liquidity, reserves*

JEL Classification: *F31, F33, F41*

1. Introduction and Overview

Among the key imbalances and tensions that plague the global macroeconomy are the burgeoning US current account deficit and the rapid stockpiling of international reserves by Asia. The Asian reserves (which stood at well over US$ 2,000 billion as of early 2004) have in turn been partly financing the US current account gap (hovering at close to 6 percent of GDP). While Japan and China together account for about half of Asia's reserve holdings, South Korea, Taiwan, Hong Kong, India and Singapore each also hold over US$ 100 billion of reserves (Figure 1).

There has been considerable debate about the rationale behind the reserve hoarding by Asia, with wide ranging explanations having been offered for this behavior[1]. Some have argued that the reserve growth in Asia is a by-product of a desire by regional central banks to smooth exchange rate movements. While concerns about "excessive" volatility of trade and foreign direct investment (FDI) are well founded (see Calvo and Reinhart, 2002, Rajan, 2002 and references cited within), smoothing behavior by central banks should, over time, have no net impact on reserves. The fact that reserves are being continuously built up suggests that foreign exchange intervention is largely asymmetric,

[1] Of course, part of the rise in reserves in recent years is directly attributable to the depreciation of the US dollar, leading to valuation gains of that part of reserves denominated in euros, yen, etc. We do not explore the important issue of appropriate currency composition of reserves here (see Eichengreen and Mathieson, 2000).

i.e. sale of domestic currency during periods of upward pressure, but limited intervention on the downside[2]. A far more plausible argument behind Asia's reserve accumulation is that it stems from a deep-rooted mercantilist desire by regional central banks to maintain undervalued exchange rates[3]. Despite the generalized weakness of the US dollar, Figure 2 reveals that the real effective exchange rates (REERs) of a number of Asian countries have remained stable or slightly depreciated since 2000[4].

In contrast to these exchange rate motives, others argue that reserves are being accumulated by Asia as a buffer against future financial crises or shocks (for instance,

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[2] A more sophisticated line of reasoning is that high reserves help to reduce exchange rate volatility via a signaling effect (i.e. signal of creditworthiness). There is some evidence of the validity of this thesis (Hviding et al, 2004). We return to this theme in the concluding section.

[3] Mercantilism may also have an important political dimension. As the former Chairman of the President Bush's National Economic Council, Lawrence Lindsay, recently noted about China:

> The objective of mercantilism is fundamentally not economic in nature as we understand that term. It is political. It is designed to enhance the power of the state…The Chinese state not only has the same vested interest in mercantilism as Louis XIV, it also has the same interest as exporters generally as elements of the state, particularly the army, own some of the leading exporting firms…So, the maintenance of a fixed exchange rate also symbolizes an inherent political fact about China: economic policies are made in the interests of the state and the elements that make it up, not in the interests of the economy or the population more generally. We should view this as a fundamental weakness -- or immaturity -- in Chinese political and economic development (Lindsay, 2003, pp.9-11).

[4] This further suggests that other regions like Europe and Latin America have undergone significant real appreciations.

see Aizenman and Marion, 2004). While it is generally appreciated that stockpiling reserves cannot act as a substitute for appropriate domestic policy reforms, this insurance or precautionary motive is consistent with modern second generation (escape clause-based) currency crises models *a la* Obstfeld (1994, 1996). These models emphasize the possibility of multiple equilibria in a world of substantial capital mobility where a country's underlying payments position is neither "quite strong" nor "hopelessly weak", i.e. where it is in a vulnerable zone. In such circumstances, a country's reserve level not only influences its ability to finance speculative runs on its currency, but can also has a bearing on their probability of occurring[5]. Such large levels of "own liquidity" may be particularly necessary in the absence of the development of strong quasi lender of last resort capabilities by the IMF and limited progress in monetary cooperation at the regional level[6].

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[5] Sachs, Tornell, and Velasco (1996) assume and purport to find empirical support for the proposition that high reserves ratios can fully offset weak fundamentals. However, Willett et al (2004b) question the robustness of the Sachs-Tornell-Velasco conclusion that high reserves can offset weak fundamentals and point out that it is at odds with the standard crisis models. With fundamentals in the vulnerable zone, high reserves could have a powerful effect in protecting against crises. But with weak fundamentals, first generation crisis models imply that reserve levels should only influence the timing of crises, not whether they occur. This also suggests that reserve needs should be related to the state of fundamentals in a non-linear manner.

[6] While the ASEAN plus Three (China, Japan and Korea) economies have established the Chiang-Mai initiative (CMI), it remains a series of bilateral and uncoordinated swap arrangements. While there has been some discussion about regionalizing the CMI (Montiel,

Broadly, we can think of the precautionary demand for reserves as arising from three types of considerations: (a) the ability to finance underlying payments imbalances; (b) the ability to provide liquidity in the face of runs on the currency; and (c) the preventive function of reducing the probability of runs on the currency. All of these considerations will in turn be influenced by external and internal shocks, the degree of exchange rate flexibility, the ability and willingness of governments to make domestic policy adjustments, and the magnitudes of currency pressure that can be quickly brought to bear. Of course, while there is always the possibility of domestic currency holders running for the exits ("internal drain"), a country's exposure to currency runs is also heavily influenced by the extent of foreign capital in the country, especially liquid capital such as portfolio investments and short term bank loans ("external drain").

What does this imply for central bankers keen on operational guidelines in reserve management? There is already a broad understanding that in a world of substantial capital mobility traditional measures of reserve adequacy in terms of month's worth of imports is of limited value. The capital account nature of crises has led some of the more sophisticated governments and central banks to develop rules of

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2004), no significant steps have been taken in that direction. There is also some discussion about – but no action regarding -- the possibility of pooling part of the region's international reserves as a means of safeguarding against financial crisis (Bird and Rajan, 2002, Rajan, 2003, 2004 and Rajan and Siregar, 2004).

thumb for reserve adequacy based on different types of international liabilities[7].

In this paper we deal more narrowly with the issues of sensible values for such coverage ratios, and also the likely sufficiency of focusing only on additive coverage ratios (as opposed to considering interactions among the different categories and interrelationships with other variables incorporated in the demand for reserves literature)[8]. We also investigate concepts of reserve adequacy in countries that may be subject to overly optimistic bubbles of capital flows which subsequently burst. While extremely difficult to capture in formal optimizing crises models, many observers have suggested that such behavior has characterized a number of recent currency crises, including Asia in 1997-98 (for example, see Willett et al, 2004b).

The remainder of this paper is organized as follows. Section 2 offers a brief overview of the inadequacies of current coverage ratios in light of the capital account

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[7] The Bank of Korea (BOK) and the Reserve Bank of India (RBI) are examples. For details on reserve management in India, Korea and other selected countries, see IMF (2001).

[8] Traditional models of the demand for reserves assume that the probabilities and magnitudes of reserve drains were independent of countries' reserve holdings. While the rapid accumulation of international reserves by Asia has led to a resurgence of interest in empirical studies of the demand for international reserves after a gap of two decades (for instance, see Aizenman, 2003, 2004, Edison, 2003 and Flood and Marion, 2001), the best these studies can do is to identify whether a country is out of step with average behavior. It could still be following the better policy.

crises that have afflicted Asia and other emerging economies since the mid 1990s. While crises due to bank panics are well known, portfolio investment is another form of highly mobile capital that needs to be taken into account. To emphasize this point, we outline a simple model of capital account crisis based on booms and busts in portfolio flows. Section 3 discusses new benchmarks for judging reserve adequacy based on the behavior of different types of capital flows during currency crises. We also present analysis of the ratios of reversals for different types of capital flows during the Asian crisis to investigate whether their is a case for holding different levels of "reserve backing" against different types of capital flows. Alternative measures of the "size" of recent crises and their implications for levels of reserve adequacy for a number of Asian countries today are also considered. Section 4 offers a summary and a few concluding remarks.

2. Capital Account Crises and Limitations of Existing Reserve Adequacy Measures

For the post war period, the reserves-to-imports ratio became the standard way of quantifying reserve adequacy. In other words, imports were thought to be the most appropriate scale variable. The broad rule-of-thumb for reserve adequacy was that

reserves should be sufficient to pay for about three to four months of imports[9]. Figure 3 reveals that all countries in Asia have well exceeded this conventional rule-of-thumb, particularly in the cases of the India, China, Korea and Indonesia. In any case, the reserves-to-imports criterion was appropriate when international capital flows were highly limited. However, as the emerging economies have liberalized short term capital movements during 1990s, most of the countries have become far more exposed to the risk of sudden stops or outright capital reversals. As the IMF (2001) has noted:

> As international capital flows increased relative to the size of national economies, so too did the disruption threatened by their reversal. The need to maintain investor confidence can serve as a useful discipline, magnifying the rewards for good policies and the penalties for bad ones. But in recent years flows have become much more volatile than changes in the economic prospects of individual countries could explain or reasonably justify. Economies have thus become increasingly vulnerable to crises of confidence, akin to runs on banks. Investors on occasion overreact to economic developments, responding late and excessively (p.2).

But what are the specific connections between the various forms of mobile capital flows and crises?

2.1 Bank Flows, Crises and Reserves-to-Short Term Debt Ratio

Conceptually, the crisis-inducing nature of bank loans is straight forward, being

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[9] In its *World Economic Outlook* the IMF has regularly presented data about reserve levels in this way.

based on an open economy version of the bank panic model *a la* Diamond-Dybvig (1983)[10]. Following some negative shock, depositors, concerned about the safety of their savings, attempt to withdraw *en masse* (which occurs given the "first-come-first-served" rule of deposit withdrawals), while creditors become unwilling to rollover short-term loans. This sudden termination of bank finance forces the abandonment of potentially solvent investment projects, leading to a sudden and sharp economic collapse[11].

Empirically, the extent of short term indebtedness has been found to be a key indicator of (il)liquidity and a robust predictor of financial crises (for instance, see Bussière and Mulder, 1999, 2003, Dadush et al, 2000, Rodrik and Velasco, 1999 and World Bank, 1999). In recognition of this, Pablo Guidotti, former Deputy Minister of Finance of Argentina and Alan Greenspan, Chairman of Fed proposed that countries hold reserves at least equivalent to short term debt cover (i.e. all debt that actually falls due over the year) (Bird and Rajan, 2003, Greenspan, 1999 and De Beaufort Wijnholds

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[10] For recent formalizations, see Chang and Velasco (1998, 1999) and Goldfajn and Valdes (1997).

[11] A reasonable question some times asked is, if short term debt is potentially hazardous and must be "insured against" (by holding reserves), why not restrict this form of capital flows in the first instance? In a somewhat contrarian view, Jeanne (2000) argues that short-term debt contracts may play a socially advantageous function in reducing agency problems.

and Kapteyn, 2001). This implies, at a minimum, that usable international reserves should exceed scheduled external amortization for one year. Table 1 makes apparent that even if one considers a benchmark of reserve adequacy based on the sum of the three months import and short term external debt, most of the Asian economies held excess reserves (except Philippine and Hong Kong[12]).

Bussière and Mulder (1999, 2003) find empirical support for the Greenspan-Guidotti rule and offer a simple rule-of-thumb based on the results of empirical tests: the reserve target should be set at the level of short term debt, and should be augmented by 5 percent for each one per cent of current account deficit and by 1 percent for each per cent of overvalued exchange rate. While this is a notable modification, even the modified debt based measure of reserve adequacy has some significant limitations.

First, while the reserves-to-short term external debt gives an indication of the vulnerability to an "external drain", it fails to take into account internal drain associated with capital flight by residents. The latter may be best captured by measures of broad money supply (M2). Specifically, the reserves-to-M2 ratio captures the extent to which liabilities of the banking system are backed by international reserves; a low and declining ratio is among the leading indicators of a currency crisis (for instance, see

[12] Ideally we need to incorporate longer-term debt that comes due within the year. Unfortunately we do not have data on this.

Berg and Pattillo, 1998 and Kaminsky and Reinhart, 1999). Figure 4 offers an indication of how the Asian countries perform based on reserves-to-M2 ratio. The ratio has either remained high and stable or has risen for a number of the countries[13].

Two, the reserves-to-short term external debt ratio does not account for other liabilities that may be highly mobile and easily reversible. For instance, while reversals of bank loans dominated the capital account dynamics during the Asian crisis (see for instance, Rajan and Siregar, 2002 and Willett et al, 2004a), reversals in portfolio flows were important in Mexico and other countries. To help fix ideas, we outline a simplified version of a capital crisis model driven by portfolio investment based on Calvo-Mendoza (2000).

2.2 Crises and Portfolio Investment Flows

Assume the existence of homogenous atomistic investors. Assume J countries in which investors allocate a fixed pool of funds which we normalize to one unit. Assume returns in each are distributed i.i.d. with mean of ρ and variance of σ_0^2.

[13] De Beaufort Wijinholds and Kapteyn (2001) proposed a new criterion of reserve adequacy for the emerging market economy which incorporates both short term external debt and a measure of the scope for capital flight (part of M2) modified by a "probability factor" captured by a country risk index.

Focusing on a single agent, assume the investor hears a "rumor" that country k's new stochastic return is r, where $(r - \rho) = \varepsilon \neq 0$. Let returns in country k = σ_1. Let $\varnothing$ be the share of the portfolio invested in all countries other than country k. Denote the portfolio by X. Thus, the portfolio's mean and variance are respectively:

$$E(X) = \rho + (1 - \varnothing)\varepsilon, \quad (1)$$

$$Var(X) = [(\varnothing\sigma_0)^2/(J - 1) + (1 - \varnothing)\sigma_1^2]. \quad (2)$$

Assume that the representative agent is a price taker. Under the assumption of normal distribution of returns, let the agent maximize the following quadratic objective function (U) w.r.t. $\varnothing$:

$$Max\ EU(X) = [(1 - \varnothing)\varepsilon + \rho] - \nu/2[(\varnothing\sigma_0)^2/(J - 1) + (1 - \varnothing)^2\sigma_1^2], \quad \nu > 0. \quad (3)$$

Solving for the proportion of funds devoted to country k obtains:

$$(1 - \varnothing) = [\Upsilon + \varepsilon/\nu]/[\Upsilon + \sigma_1^2], \quad (4)$$

where: $\Upsilon = \sigma_0^2/(J - 1)$.

In the absence of news on returns in country k (i.e. country k is identical to all other countries *ex-ante*), from eq. (4), the share of portfolio allocated to the country is 1/J, as would be expected a priori. Accordingly, in the absence of news, the portfolio allocated to country k tends to become negligible as J gets arbitrarily large (i.e. abundant alternatives for portfolio diversification). On the other hand, from eq. (4), with the impact of news, the change in portfolio composition to country k becomes extremely sensitive to the expected mean return differential (ε) and variance in country k as $J \rightarrow \infty$. Specifically,

$$\partial(1 - \varnothing)/\partial\varepsilon = [\nu/[\Upsilon + \sigma_1^2]^{-1}, \tag{5}$$

and, $$\partial(1 - \varnothing)/\partial\varepsilon \rightarrow 1/(\nu\sigma_1^2) \quad \text{as} \quad J \rightarrow \infty. \tag{5'}$$

$$\partial(1 - \varnothing)/\partial\sigma^2_1 = -[\Upsilon + \varepsilon/\nu]/[\Upsilon + \sigma_1^2]^2, \tag{6}$$

and, $$\partial(1 - \varnothing)/\partial\sigma^2_1 \rightarrow -\varepsilon/(\nu\sigma_1^4) \quad \text{as} \quad J \rightarrow \infty. \tag{6'}$$

Those who take a benign view of speculation argue that it would be in the agent's best interests to gather the necessary information upon which to make their investment decisions. To the extent that their actions are based on best available

information, speculation cannot be considered arbitrary. The incentive for investors to gather information may be explored within this portfolio diversification model.

Let there be an unspecified fixed cost involved in learning about country k. Assume that the learning costs allow the agent to obtain information about returns in the country with certainty (i.e. $\sigma_1^2 = 0$). From eq. (4):

$$(1 - \varnothing) = [1 + \varepsilon/(\nu\Upsilon)]. \qquad (4^l)$$

Assuming no short sales, the following relationship between the range of values of ε and $(1 - \varnothing)$ may be derived:

If $\underline{\varepsilon}$	Then $\underline{(1 - \varnothing)}$
$[0, \infty)$	1
$[-\nu\Upsilon, 0)$	(0, 1)
$(-\infty, -\nu\Upsilon)$	0

From the above conditions we see that for $\varepsilon \geq 0$, as long as the fixed information costs are not prohibitively large, there is gain to be had from information

gathering ex-post. Conversely, for $\varepsilon \leq -\nu\Upsilon$, there is no ex-post gain to be reaped from information gathering. What about the intermediate case of $\varepsilon = [-\nu\Upsilon, 0)$? As $J \rightarrow \infty$, there is no ex-post gain to be had, as the i.i.d. distribution of returns ensures that a highly diversified portfolio will provide a return of ρ which exceeds r (as $\varepsilon = r - \rho$). On the other hand, for small J, ex-post utility could still increase with information gathering. Putting all this together and assuming continuity, we have that the marginal gain of information gathering about any single country falls as portfolios get increasingly diversified internationally.

As noted, the second generation crises models require the existence of a range or zone of weakness (i.e. "gray area") in which a currency is potentially vulnerable to a speculative attack. In contrast, the Calvo-Mendoza model does not necessarily require the existence of any actual macroeconomic weaknesses. Rather, just a rumor of such vulnerabilities may suffice to generate large-scale reallocation of funds away from one destination to another, making small open economies susceptible to large swings in capital flows and costly boom-bust cycles.

3. Capital Account Crises and New Benchmarks of Reserve Adequacy

3.1 Issues in Measuring Capital Account Crises

Both the Diamond-Dybvig and the Calvo-Mendoza models make apparent that vulnerability to capital account crises should not be judged by standard measures of the variance of different types of capital flows. Such measures confound the variability of rates of inflow with the size of capital flows reversals which is much more important from the perspective of financial crises. Some studies have used rather sophisticated econometric methodologies to study the variability of different types of capital flows (for instance, see Chuhan et al, 1996, Claessens et al, 1995, Gabriele et al, 2000 and Sarno and Taylor, 1997). However, since the data sample was dominated by periods of capital inflows, the results had little predictive power with respect to the magnitude of different types of capital outflows during the Asian crises. For instance, the greater variability of portfolio investment during the inflow period was not matched by more severe capital flow reversals during the crisis period. Rather, the outflows from the banking sector in Asia in 1997-98 were far greater, both in absolute terms and as a percentage of previous inflows (see Willett et al, 2004a).

It is also for the preceding reason that simple coverage ratios (be they trade based, debt based or money based) are inadequate as they fail to reflect the dynamics of currency crises. It light of this, it has become common-place to suggest that, in addition to coverage ratios, reserve management in an uncertain environment needs to adopt the

liquidity-at-risk (LAR) methodology, i.e. calculating the probabilities of different size losses of reserves over a wide range of possible outcomes for pertinent financial variables (De Beaufort Wijnholds and Kapteyn, 2001 and Greenspan, 1999).

While consideration of a standard that is stochastic is a clear improvement, two caveats should be flagged. First, different types of shocks can give rise to different patterns among returns so that -- as the investment-brokers routinely warn -- past performance is not a guarantee of future returns[14]. Second, LAR type statistical exercises typically use data over much too short time periods to yield much confidence that they capture most of the range of possible developments. Thus the designers of LAR methodologies recommend that they be complemented by stress testing, that is, by imagining various types of shocks and simulating these effects. This is similar to military planner efforts to calculate what it would takes to be able to engage effectively in a specific set of actions.

While there may be value in the LAR and stress testing approaches to reserve management, we argue below that developments during recent crises can offer useful information for these purposes. We illustrate how these experiences can be used for stress testing or scenario analysis to help countries determine what levels of reserves

[14] This was made apparent in the financial world with the Long Term Capital Management (LTCM) saga (see Edward, 1999 for details).

would be sufficient to protect themselves from crisis of the order of magnitude of recent ones.

3.2 New Benchmarks of Reserve Coverage: Capital Outflows

In measuring the size of capital account crises and their implications for the size of prudent precautionary reserves, two simple benchmarks come to mind.

The first measure is the size of actual outflows during the crisis. This would be appropriate where the rest of the balance of payments had been in approximate balance so that previous capital flows had their counterpart primarily in changes in reserves.

The second measure is the change in the size of net flows from their previous levels. (Because of year-to-year fluctuations, the average of several previous years should probably be used as the benchmark). This would be appropriate where, prior to the crisis, the other components of the balance of payments account, especially the current account, had adjusted fully to the net capital flows, yielding approximate overall payments balance. In a situation where previous capital inflows were large, a sizeable fall in inflows could cause a problem. For example if net inflows fall from 5 to 1 percent of GDP while the current account deficit remains at 5 percent of GDP, there would be a financing or adjustment problem of 4 percent of GDP. Thus, a capital

account crisis does not necessarily require a sudden stop or outright reversal; there may be cases -- as above -- where a slowdown in capital inflows could have relatively more deleterious effects.

Of course, the two simple measures just described represent the two extremes of zero and full adjustment to previous capital flows. Often the actual situation will be one of partial adjustment. As a rough gauge of the degree of adjustment we could compare the average change in reserves to the average net capital flows over the preceding few years. We also need to remember that while the most dramatic of recent crises have usually been preceded by large net capital inflows, it need not always be the case. Crises have often been preceded by substantial periods of capital flight and reserve losses.

3.3 Application of New Benchmarks to Asia[15]

We note that there is no one good way to accurately measure changes in capital flows. Data for many types of capital flows are not highly reliable, and it is believed that a nontrivial portion of changes in capital flows show up in the errors and omissions category.

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[15] This section is highly preliminary and a work in progress.

Tables 2 and 3 report data on various combination of capital outflows for the five countries most directly and adversely impacted by the 1997-1998 crisis, viz. Indonesia, Korea, Malaysia, the Philippines and Thailand[16].

In order to be prudent when considering the likely size of reserves needed to finance shifts in capital flows during a future crises, we wish to develop plausible upper bound estimates of the sizes of outflows during the recent crises. To aid in this exercise we report several different combinations of capital flows and their ratios to M2 (Table 4). The capital flows-to-M2 ratio is used as a yardstick to allow comparisons across countries in the severity of crises and to scale up the expected magnitudes of future crises. We concede that there is no unambiguously best scale variable for this purpose. So while M2 is frequently used, we will also check the sensitivity of our results to the use of GDP instead (Table 5).

Based on the various combinations, the maximum sizes of outflows as a proportion to M2 are presented in Table 6. These range from a low of 5 percent for Malaysia to a high of about 20 percent for Thailand and Korea.

For reasons noted previously, such figures may understate the degree of

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[16] From Tables 2 to 8, FDI denotes foreign direct investment; “other loans” refer to short-term bank loan; and FAC denotes the balance of financial account. All data come from IMF-IFS cd-rom.

dislocation generated by capital account crises if and when countries have adjusted to substantial capital inflows. In Tables 7 and 8 we present data for the differences between flows during the crisis periods and their previous averages [over five years]. In a similar vein to Table 6, Table 9 gives the maximum measures of capital outflows for each country as a proportion of M2. In Table 10 we scale up the sizes of the maximum estimates of capital outflows and reversals to 2003 values and compare these with actual levels of reserve holdings. (The scale factor used was M2 which gave higher numbers than for GDP for all countries).

These calculations suggest that Indonesia, Malaysia, and the Philippines have already built up more than adequate reserve levels. For Korea and Thailand reserves appear more than adequate to handle a repeat of the actual capital outflows that occurred during the 1997-98 crises scaled up to 2003 values, but in terms of capital flow reversals, their reserve holdings at the end of 2003 were not necessarily excessive. There should be little need for contained large accumulations, however.

4. Concluding Remarks

Asia has been rapidly accumulating international reserves since the crisis of 1997-98. In view of the ferocity and suddenness of the Asian crisis of 1997-98, the

precautionary or insurance motive no doubt looms large in the decisions of the various Asian economies to build up reserves to unprecedently high levels[17]. The need to hold reserves as a financial safeguard has been nicely outlined by Fischer (2001):

> Reserves matter because they are a key determinant of a country's ability to avoid economic and financial crisis…The availability of capital flows to offset current account shocks should, on the face of it, reduce the amount of reserves a country needs. But access to private capital is often uncertain, and inflows are subject to rapid reversals, as we have seen all too often in recent years. We have also seen in the recent crises that countries that had big reserves by and large did better in withstanding contagion than those with smaller reserves.. (pp.1-3).

Many previous studies have concluded that Asia is holding reserves far in excess of what is justifiable based on conventionally used yardsticks of reserve coverage or reserve demand. However, the typical response by policy makers to suggestions that they are holding "excessively high" reserves has been that these studies have failed to sufficiently incorporate the possibility of sudden and sharp changes in the capital account (slowdowns, stops or outright reversals).

Taking this criticism on seriously, we have proposed new benchmarks of reserve cover that attempt to capture the changing profile of capital flows by taking into account the extent of changes in the flows of short term external debt, portfolio

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[17] Admittedly motives behind reserve accumulation may vary within a country over time and between Asian countries. For instance, see Dean and Rajan (2004) for a discussion of the motivations behind reserve build-up in Mainland China specifically.

investment and other mobile capital. Application of these benchmarks to selected Asian countries leads us to conclude that Indonesia, Malaysia and the Philippines held excessive reserves in 2003. Results are slightly less definitive in the cases of Korea and Thailand[18]. Nonetheless, for *all* the countries considered, further reserve accumulation beyond the 2003 levels appears unjustified based on the precautionary motive.

Given the high costs of reserve holdings (Bird and Rajan, 2003 and Rajan and Siregar, 2004), Asia should clearly be concerned about their reserves holdings above "adequate" levels, or at least the costs of continuing to amass even more reserves. It does not appear, however, that cost considerations will be a compelling factor in influencing a change in the behavior of Asian central banks, particularly as it would effectively imply that the regional currencies are allowed to float relatively more freely[19]. Herein lies a paradox.

The adoption of a more flexible exchange rate regime implies that balance of payments disequilibria would lead to changes in the relative values of currencies rather than alterations in the level of reserves (i.e. adjustment rather than financing). This seems to suggest the need to hold lower levels of reserves. However, with greater

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[18] We will examine previous years as well at a later stage.

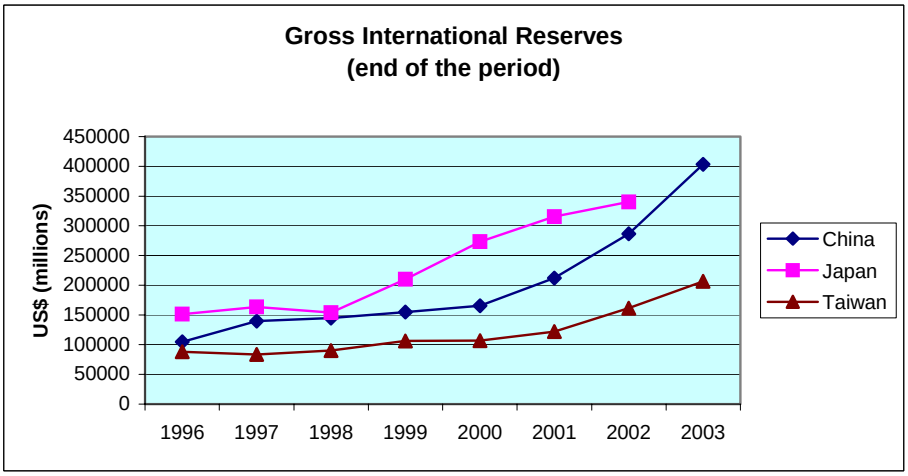
[19] Clearly, neither will the issues of sharing of global macroeconomic adjustments.

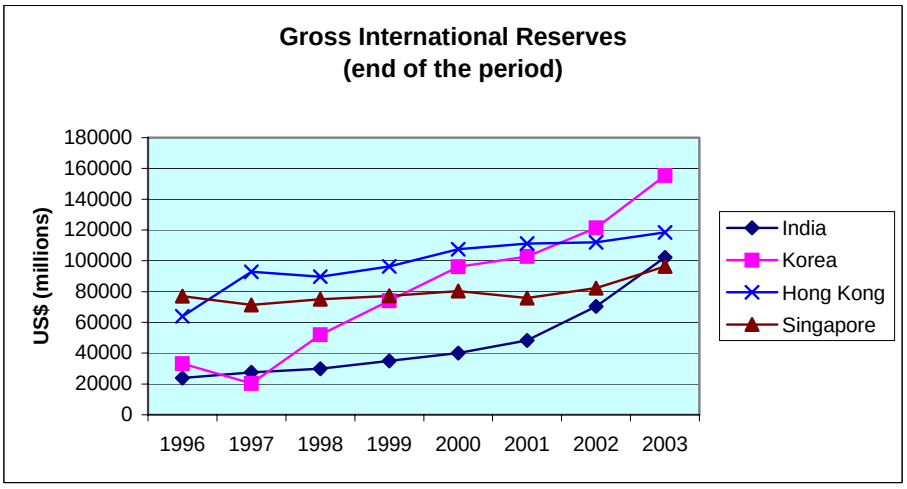
exchange rate flexibility and an open capital account, it becomes particularly important to convince financial markets that the economy is "healthy" and can meet its external obligations, failing which the exchange rate will become highly variable and possibly weaken[20]. Creditworthiness in turn appears to be positively associated with the level of reserves (Ul Haque et al, 1996)[21]. Hence it is unclear whether flexible exchange rates will necessarily reduce the demand for reserves in Asia anytime in the near future.

[20] This line of reasoning is not unlike the Tornell and Velasco (2000) argument that flexible rates ought to instill greater fiscal restraint/discipline, as the costs of macroeconomic policy transgressions have to be paid upfront. In other words, the key distinction between fixed and floating rates is in the intertemporal distribution of costs and benefits.

[21] If reserves are in fact viewed as a sign of the country's creditworthiness, another positive externality from reserve stockpiling would be a decline in its external borrowing costs.

Figure 1


Gross International Reserves
(end of the period)
US$ (millions)
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
1996
1997
1998
1999
2000
2001
2002
2003
China
Japan
Taiwan


Gross International Reserves
(end of the period)
US$ (millions)
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
1996
1997
1998
1999
2000
2001
2002
2003
India
Korea
Hong Kong
Singapore

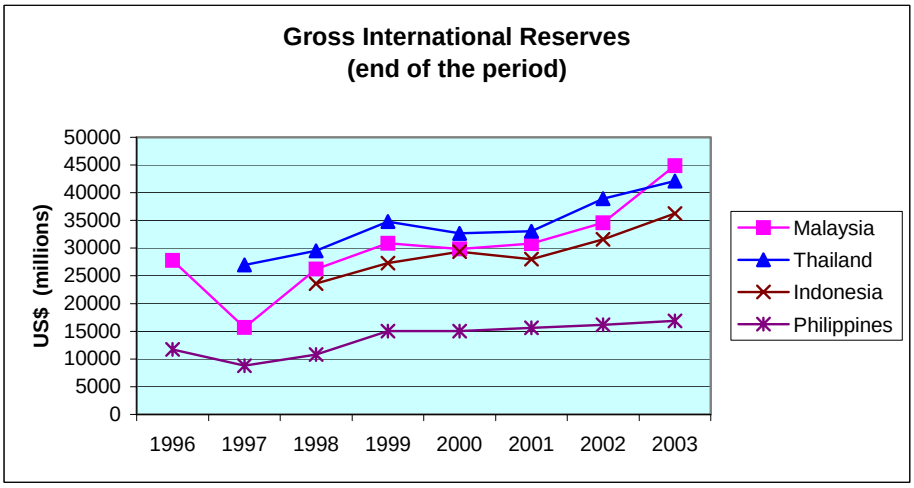
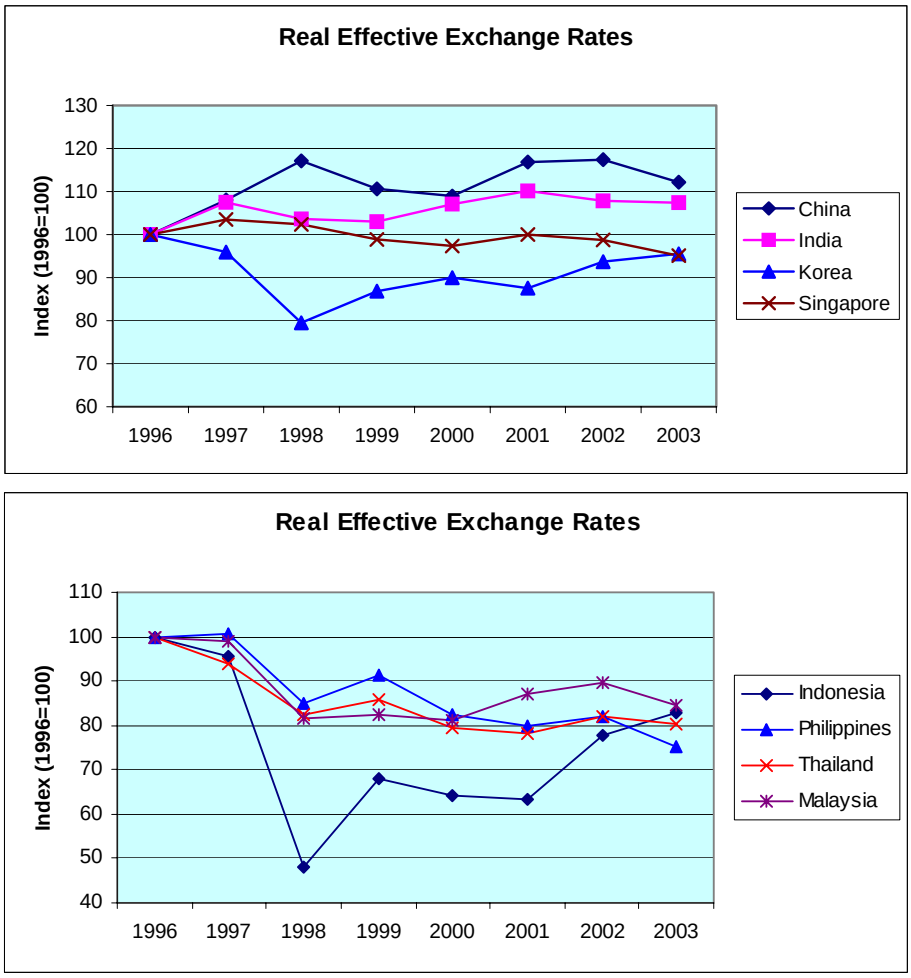
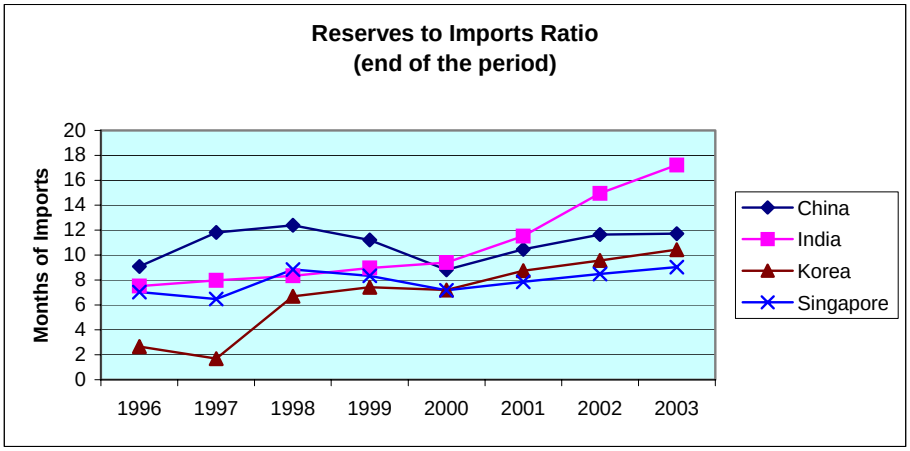

Gross International Reserves
(end of the period)
US$ (millions)
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
1996
1997
1998
1999
2000
2001
2002
2003
Malaysia
Thailand
Indonesia
Philippines

Figure 2



Note: Decline implies real depreciation

Figure 3


Reserves to Imports Ratio
(end of the period)
Months of Imports
20
18
16
14
12
10
8
6
4
2
0
1996
1997
1998
1999
2000
2001
2002
2003
China
India
Korea
Singapore

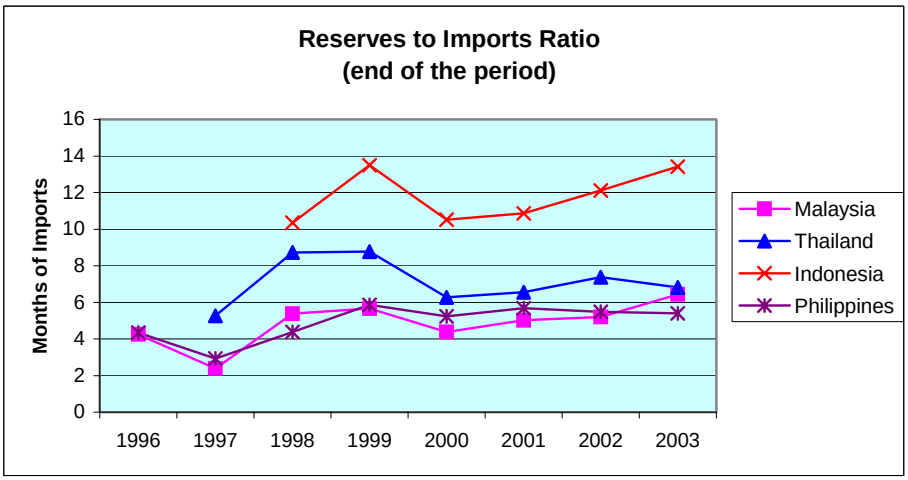
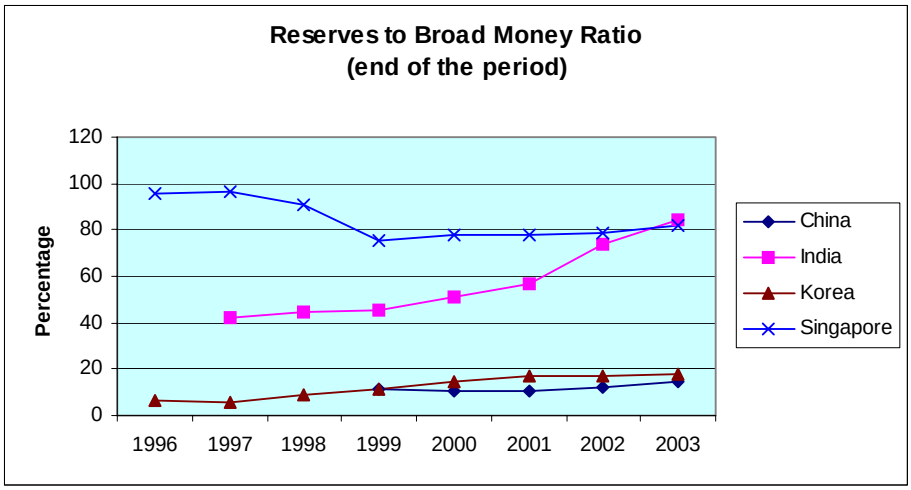

Reserves to Imports Ratio
(end of the period)
Months of Imports
16
14
12
10
8
6
4
2
0
1996
1997
1998
1999
2000
2001
2002
2003
Malaysia
Thailand
Indonesia
Philippines

Figure 4


Reserves to Broad Money Ratio
(end of the period)
Percentage
120
100
80
60
40
20
0
1996
1997
1998
1999
2000
2001
2002
2003
China
India
Korea
Singapore

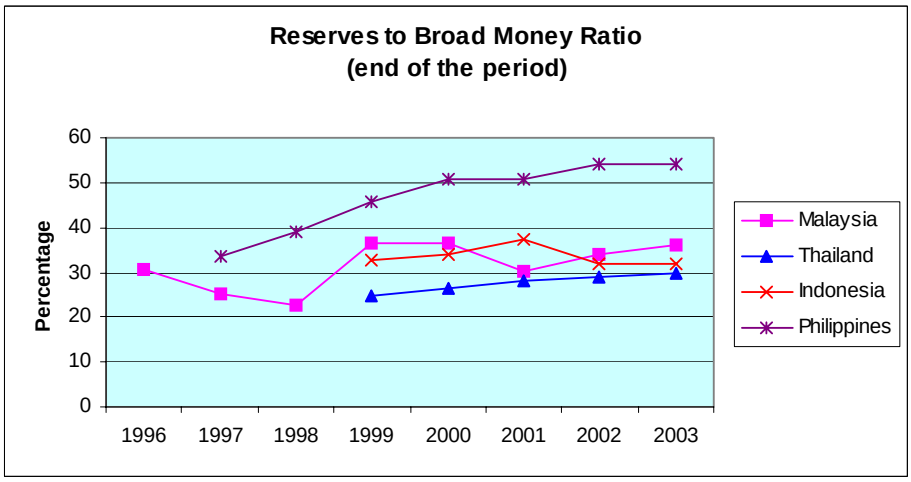

Reserves to Broad Money Ratio
(end of the period)
Percentage
60
50
40
30
20
10
0
1996
1997
1998
1999
2000
2001
2002
2003
Malaysia
Thailand
Indonesia
Philippines

Figure 5

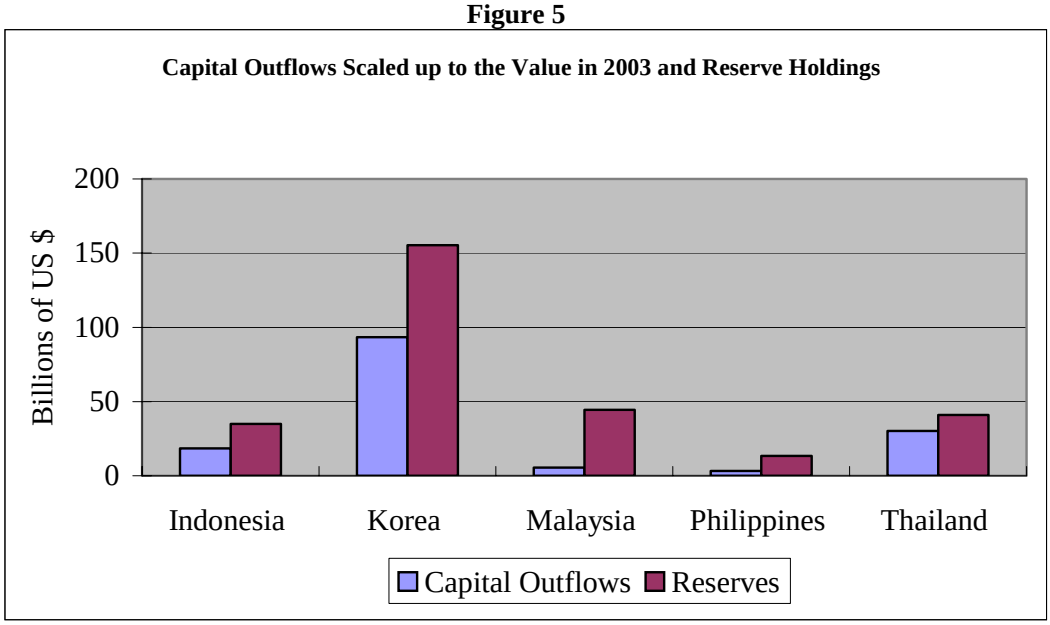


Figure 6

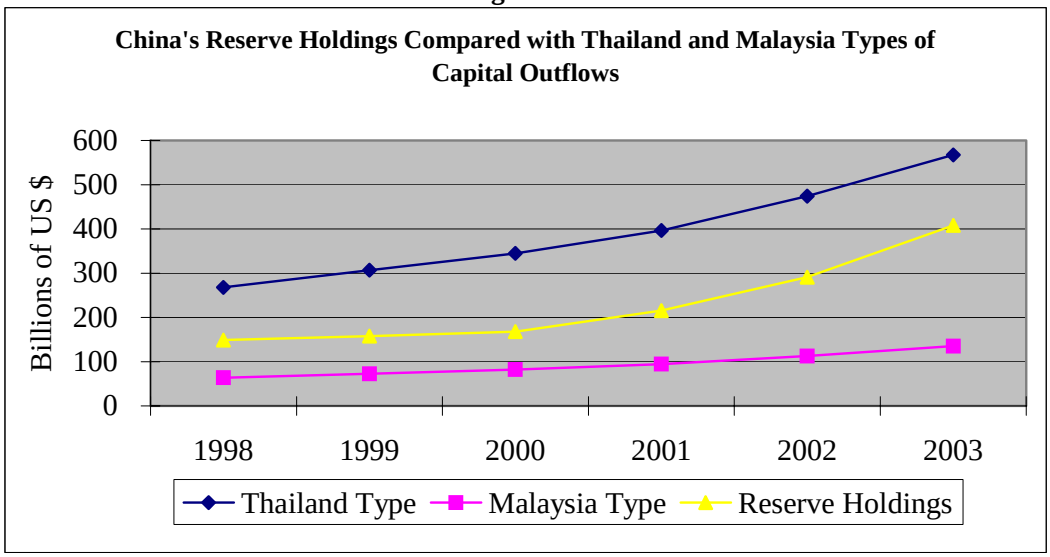


Table 1
Reserve Adequacy in Asia, 2003
(US$ millions)

	Foreign Reserves (A)	Monthly Import (3 months) (B)	Short Term Debt (C)	(B)+(C)	A-(B+C)
Korea	**155,284**	**44,696**	**56,249**	**100,945**	**54,339**
Japan	**663,289**	**103,249**	**-**	**103,249**	**560,040**
China	**408,151**	**103,266**	**40,187**	**143,453**	**264,698**
Malaysia	**44,515**	**20,487**	**11,897**	**32,384**	**12,131**
Philippines	**13,457**	**9,628**	**11,111**	**20,739**	**-7,282**
Indonesia	**34,962**	**10,421**	**15,706**	**26,127**	**8,835**
Thailand	**41,077**	**19,821**	**11,553**	**31,374**	**9,703**
Singapore	**95,746**	**32,699**	**60,707**	**93,406**	**2,340**
Hong Kong	**118,360**	**57,974**	**72,091**	**130,065**	**-11,705**

Source : BIS/IMF/OECD/World Bank Statistics for External Debt

Table 2
Capital Outflows in Crisis Year and the Following Year
(US$ billions)

Country	FAC	Errors	FDI	Portfolio	Other Loans	Changes of Reserves
Indonesia	**-1.4**	**-0.8**	**4.1**	**-4.5**	**-13.9**	**4.46**
Korea	**-1.4**	**-11.3**	**-0.9**	**13.2**	**-31.3**	**17.94**
Malaysia	**-0.4**	**2.9**	**7.3**	**0**	**2.4**	**-1.45**
Philippines	**8.1**	**-6**	**3.2**	**-0.3**	**2.9**	**-0.80**
Thailand	**-13.7**	**-6**	**10.5**	**4.9**	**-6.3**	**-8.91**

Table 3
Capital Outflows in Crisis Year and the Following Year
(US$ billions)

Country	FAC+Errors	FAC+Errors-FDI	Errors+ Other Loans	Errors+ Other Loans+ Portfolio
Indonesia	**-2.2**	**-6.4**	**-14.7**	**-19.2**
Korea	**-12.7**	**-11.7**	**-42.6**	**-29.4**
Malaysia	**2.5**	**-4.8**	**5.3**	**5.3**
Philippines	**2.1**	**-1.1**	**-3.1**	**-3.4**
Thailand	**-19.7**	**-30.2**	**-12.3**	**-7.4**

Table 4
Ratios of Capital Outflows over M2 in Crisis Year and the Following Year
(percentage)

Countries	FAC+Errors	FAC+Errors-FDI	Errors+Other Loans	Errors+Portfolio +Other Loans
Indonesia	**-1.89**	**-5.41**	**-12.46**	**-16.29**
Korea	**-6.00**	**-5.56**	**-20.12**	**-13.89**
Malaysia	**2.75**	**-5.13**	**5.67**	**5.71**
Philippines	**4.59**	**-2.32**	**-6.73**	**-7.46**
Thailand	**-13.53**	**-20.75**	**-8.49**	**-5.13**

Table 5
Ratios of Capital Outflows over GDP in Crisis Year and the Following Year
(percentage)

Countries	FAC+Errors	FAC+Errors-FDI	Errors+Other Loans	Errors+Portfolio +Other Loans
Indonesia	**-1.00**	**-2.85**	**-6.56**	**-8.58**
Korea	**-2.56**	**-2.37**	**-8.57**	**-5.92**
Malaysia	**2.54**	**-4.73**	**5.24**	**5.27**
Philippines	**2.58**	**-1.31**	**-3.79**	**-4.20**
Thailand	**-10.93**	**-16.77**	**-6.86**	**-4.15**

Table 5
Ratios of Capital Outflows over M2 in Crisis Year and the Following Year
(percentage)

Countries	FAC+Errors	FAC+Errors-FDI	Errors+Other Loans	Errors+Portfolio +Other Loans
Indonesia	**-1.89**	**-5.41**	**-12.46**	**-16.29**
Korea	**-6.00**	**-5.56**	**-20.12**	**-13.89**
Malaysia	**2.75**	**-5.13**	**5.67**	**5.71**
Philippines	**4.59**	**-2.32**	**-6.73**	**-7.46**
Thailand	**-13.53**	**-20.75**	**-8.49**	**-5.13**

Table 6
Maximum Sizes of Capital Account Crises as Percentage of M2
(percentage)

Countries	Ratios	Scaling Factor	Types of Capital Outflows
Indonesia	**-0.17**	**M2**	**Errors+Other Loans+Portfolio**
Korea	**-0.20**	**M2**	**Errors+Other Loans**
Malaysia	**-0.05**	**M2**	**FAC+Errors-FDI**
Philippines	**-0.08**	**M2**	**Errors+Other Loans+Portfolio**
Thailand	**-0.21**	**M2**	**FAC+Errors-FDI**

Table 7
Capital Reversals in Crisis Year and the Following Year
(US$ billions)

Country	FAC	Errors	FDI	Portfolio	Other Loans	Changes of Reserves
Indonesia	**-8.74**	**0.29**	**1.29**	**-7.45**	**-15.11**	**4.46**
Korea	**-13.86**	**-10.91**	**0.46**	**3.34**	**-38.45**	**17.94**
Malaysia	**-7.94**	**2.78**	**2.54**	**0.87**	**0.74**	**-1.45**
Philippines	**2.63**	**-4.92**	**2.25**	**-1.69**	**1.36**	**-0.80**
Thailand	**-28.39**	**-5.18**	**9.10**	**1.59**	**-11.74**	**-8.91**

Table 8
Capital Reversals in Crisis Year and the Following Year
(US$ billions)

Country	FAC+Errors	FAC+Errors-FDI	Errors+Other Loans	Errors+Other Loans+Portfolio
Indonesia	**-8.46**	**-9.75**	**-14.82**	**-22.27**
Korea	**-24.78**	**-25.23**	**-49.36**	**-46.02**
Malaysia	**-5.16**	**-7.70**	**3.52**	**4.39**
Philippines	**-2.29**	**-4.54**	**-3.56**	**-5.25**
Thailand	**-33.57**	**-42.67**	**-16.92**	**-15.33**

Table 9
Maximum Sizes of Capital Flow Reversals

Countries	Capital Outflows	Reversals	Actual Reserve Holdings
Indonesia	**-18.4**	**-20.5**	**35.0**
Korea	**-93.5**	**-156.3**	**155.3**
Malaysia	**-5.4**	**-8.9**	**44.5**
Philippines	**-3.3**	**-4.7**	**13.5**
Thailand	**-30.2**	**-42.1**	**41.1**

Table 10
Maximum Sizes of Capital Outflow and Reversals
(Scaled to 2003 Values in US$ billions)

Countries	Ratios*	Scaling Factor	Types of Capital Outflows
Indonesia	**-0.189**	M2	**Errors+Other Loans+Portfolio**
Korea	**-0.234**	M2	**Errors+Other Loans**
Malaysia	**-0.083**	M2	**FAC+Errors-FDI**
Philippines	**-0.113**	M2	**Errors+Other Loans+Portfolio**
Thailand	**-0.293**	M2	**FAC+Errors-FDI**

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