



Centre for International
Economic Studies

Discussion Paper
No. 0210

**Too Much of a Good Thing?: The
Adequacy of International Reserves in the
Aftermath of Crises**

Graham Bird and Ramkishen Rajan

April 2002

**Adelaide University
Adelaide 5005 Australia**

CENTRE FOR INTERNATIONAL ECONOMIC STUDIES

The Centre was established in 1989 by the Economics Department of the Adelaide University to strengthen teaching and research in the field of international economics and closely related disciplines. Its specific objectives are:

- to promote individual and group research by scholars within and outside the Adelaide University
- to strengthen undergraduate and post-graduate education in this field
- to provide shorter training programs in Australia and elsewhere
- to conduct seminars, workshops and conferences for academics and for the wider community
- to publish and promote research results
- to provide specialised consulting services
- to improve public understanding of international economic issues, especially among policy makers and shapers

Both theoretical and empirical, policy-oriented studies are emphasised, with a particular focus on developments within, or of relevance to, the Asia-Pacific region. The Centre's Director is Professor Kym Anderson (kym.anderson@adelaide.edu.au) and Deputy Director is Dr Randy Stringer (randy.stringer@adelaide.edu.au)

Further details and a list of publications are available from:

Executive Assistant
CIES
School of Economics
Adelaide University
SA 5005 AUSTRALIA
Telephone: (+61 8) 8303 5672
Facsimile: (+61 8) 8223 1460
Email: cies@adelaide.edu.au

Most publications can be downloaded from our Home page:
<http://www.adelaide.edu.au/cies/>

ISSN 1444-4534 series, electronic publication

CIES DISCUSSION PAPER 0210

**Too Much of a Good Thing?: The Adequacy of
International Reserves in the Aftermath of Crises**

Graham Bird and Ramkishen Rajan

Surrey Centre for International Economic Studies, University of Surrey, Guildford, UK
g.bird@surrey.ac.uk

and

School of Economics, University of Adelaide, Australia and Institute of Southeast Asian
Studies, Singapore
ramkishen.rajan@adelaide.edu.au

April 2002

1. INTRODUCTION

In the 1960s the dominant international financial issue related to the adequacy of international reserves¹. Plans to reform the Bretton Woods system focused on creating additional liquidity and culminated in the introduction of Special Drawing Rights (SDRs) in 1970². The concern then was that inadequate global liquidity would eventually drive the world economy into recession and would prevent countries from effectively protecting the values of their currencies, as the Bretton Woods system required them to do. In this regard, reserve inadequacy could affect individual countries differently. Some countries opted to hold more reserves than others and it seemed only natural to ask at what point reserves became inadequate; or indeed excessive.

A literature rapidly built up around the issue of reserve adequacy and the related demand for international reserves. Indeed, this literature had become sufficiently large and important to warrant a survey article in the *Economic Journal* (Williamson, 1973). However, there was a certain irony in the timing of this survey; just as it appeared, the issue upon which it focused seemed to fade in significance. The adoption of generalised flexible exchange rates in 1973 implied that balance of payments disequilibria would lead to changes in the relative values of currencies rather than changes in the level of reserves. Moreover, the growth of international capital markets suggested that many countries could augment their reserves by international borrowing.

¹ This is reflected in a survey of plans for reforming the international monetary system produced at the time which deals almost entirely with schemes designed to increase international liquidity (Machlup, 1964)

² Bird (1998) provides a brief analysis of the economics as well as the politics which lay behind the decision to introduce SDRs. The IMF envisaged that the SDR would become the principal reserve asset in the international monetary system, but as things turned out, it has played nothing more than a marginal role.

Other developments also seemed to sideline concerns about the composition of international reserves that had been another feature of the 1960s (Dooley, Lizondo and Mathieson 1989)³. The Triffin dilemma (Triffin, 1970) had highlighted an internal inconsistency associated with using the US dollar as the world's principal international reserve asset since, in effect, it was being required to be simultaneously a "weak" and a "strong" currency. Weak in the sense that the US needed to create externally held dollar liabilities in order to add to international liquidity, and strong in the sense that there was a need to maintain confidence in it. The move towards a multiple currency system alongside the reduced need for the growth of international reserves as a consequence of the move to flexible exchange rates and the growth of private international capital markets helped circumvent the Triffin dilemma.

Yet even as the question of reserve adequacy disappeared from the agenda for international monetary reform, it remained a prominent issue for many developing countries. Many of these countries lacked easy access to international capital markets from which they could supplement their reserves. Furthermore they were reluctant to abandon currency pegging. This meant that they were vulnerable to the "third currency phenomenon" where the value of their currencies changed in step with the value of the currency to which they pegged. Inappropriate changes in the value of their currency relative to third currencies, driven by changes in the value of the anchor currency, could then exacerbate their balance of payments problems. Some analysts therefore suggested that the move to generalised flexible exchange rates among *developed countries* served to increase the need for reserves in *developing countries*. Indeed, developing countries themselves pushed for changes in the way in which

³ The composition of reserves was found to be dependent on the type of exchange rate regime, the composition of foreign debt, as well as the dominant trade partners.

SDRs were distributed that would favour them⁴. However, different exchange rates practices across developing countries as well as differences in access to private capital meant that it was illegitimate to treat them as a single group. Studies generally confirmed that reserve adequacy could be expected to vary amongst developing countries depending on their economic circumstances (Bird, 1978, Flanders, 1971, Heller and Khan, 1978, Iyoha, 1976, Kafka, 1968, Kenen and Yudin, 1965, Niehans, 1970, and Officer, 1976).

The issue of reserve adequacy surfaced again as an issue of more general interest during the 1990s and early 2000 as a series of currency crises hit emerging economies such as Mexico, Thailand, Korea, Indonesia, Malaysia, Russia, Brazil and Argentina. Rapid reserve depletion became a defining feature of currency crises, and reserve levels *ex ante* showed up as a significant variable in studies examining the predictability of crises (Bussiere and Mulder, 1999, ul Haque, Kumar and Mathieson, 1996 and Disyatat, 2001). Events in the 1990s and beyond also illustrated the deficiencies of earlier approaches to judging the adequacy of reserves. These earlier approaches had frequently been based on a benchmark ratio of reserves-to-imports (R/M) which was derived from a trade-related approach to the balance of payments and reserve needs. Crises in the 1990s were more to do with the *capital account*; measures of reserve adequacy based on the *current account* were therefore largely inappropriate. Certainly the R/M ratio had not provided any clear indication of the

⁴ Williamson (1976) offers an attempt to quantify the effect of generalised floating on the reserve needs of developing countries. The issue is also discussed at some length in Bird (1978) who also provides an assessment of the proposal for an SDR-aid link. Heller and Khan (1978) also find that the demand for reserves in developing countries seemed to increase following the collapse of the Bretton Woods system. Lizondo and Mathieson (1987) report a similar structural break following the debt crisis in the early 1980s, with the demand for reserves in developing countries becoming more sensitive to payments imbalances and openness, suggesting that this reflected reduced capital market access.

probability of crisis. Dissatisfaction with this measure has motivated the pursuit of a superior but operationally expedient alternative.

Fischer (2001) nicely summarises the importance of reserves in the era of capital mobility as follows.

Reserves matter because they are a key determinant of a country's ability to avoid economic and financial crisis. This is true of all countries, but especially of emerging markets open to volatile international capital flows...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) (also see De Beaufort Wijnholds and Kapteyn, 2001).

This paper has a number of purposes. First, it revisits the older theory of reserve adequacy and optimality to see whether this can still be used and perhaps strengthened in ways that would inform the current debate. Second, it explores the connection between reserve adequacy and currency crisis in the light of recent experience and empirical research. Third, it critically investigates alternative rule-of-thumb measures of reserve adequacy. Fourth, and drawing on the foregoing analysis, it examines the extent to which crisis countries should seek to replenish and build up their international reserves in the post crisis period. Additional owned reserves represent a guaranteed and unconditional source of liquidity; is this what is needed?

2. JUDGING RESERVE ADEQUACY: THEORETICAL AND OPERATIONAL APPROACHES

a The Historical Context

International reserves are, in essence, an inventory held against the uncertain future course of the balance of payments. Where balance of payments instability

emanates from the current account, there may appear to be some logic in judging the adequacy of reserves against the size of trade flows as proxied by the value of imports. For this reason, as well as for reasons of operational simplicity, the reserves-to-imports (R/M) ratio became the standard way of quantifying reserve adequacy. In other words, imports were thought to be the most appropriate scale variable. In its *World Economic Outlook* the IMF has regularly presented data about reserve levels in this way. Indirectly the R/M ratio measures the number of months of imports that can be financed by reserves. A rule-of-thumb emerged that reserves were inadequate if they covered less than about three to four month's worth of imports (Fischer, 2001). However, theoretical justification for this approach was never strong; the central problem was one of defining the optimum value of the R/M ratio. Moreover, unless the incidence of deficits grows in a linear relationship with the value of imports, it cannot be assumed that any specific value of the ratio will remain appropriate over time as trade grows. Although attempts have been made to bring greater theoretical sophistication to the R/M approach, by, for example, allowing for trend movements and stock adjustments (Frenkel and Jovanovic, 1981), it has remained at best little more than an exercise in approximation.

A theoretically stronger optimising approach fared little better because of its operational shortcomings. This approach was derived from theoretically adjacent analysis of the demand for reserves which viewed demand as being a positive function of the benefits conferred by reserves, in the form of consumption smoothing, and a negative function of the opportunity cost of holding them⁵. The demand therefore reflected the choice made by the relevant monetary authorities concerning

⁵ De Beaufort Wijnholds (1977) provided a contemporary and comprehensive survey of the demand for reserves and related methods of evaluating the adequacy of reserves. A briefer review of the principal issues may be found in Bird (1985).

the combination of balance of payments *financing* and *adjustment* in the event of a balance of payments deficit, and, in relation to this, their preferences as between the *level* and *stability* of national income⁶. The demand for reserves was expected to rise alongside the probability of balance of payments deficits and the perceived costs of adjustment. Similarly, in as much as reserves represent a precautionary balance or insurance, it might be assumed that the income elasticity of demand for reserves would exceed one, unless, of course, there are economies of scale⁷. The standard reference with regard to optimal international reserves for this period was Heller (1966) who examined not only the underlying theory but also provided an attempt at empirical estimation. He found that in the early 1960s developing countries as a group held sub-optimal reserves; but this was not the case for all of them⁸.

At the same time, in what became known as the “Mrs Machlup’s Wardrobe Theory”, Machlup (1966) suggested that the acquisitive characteristics of monetary authorities in terms of adding to their reserves resembled those of his wife in terms of clothes. According to this idea no level of reserves was ever enough. Bird (1978) summarises Machlup’s argument as follows.

Perhaps the most devastating attack on the use of any ratios in the analysis of the demand for reserves has been undertaken by Machlup

⁶ A clear exposition of optimal reserves, which approached the subject in this way was provided by Clark (1970). Bird (1978) revisits the approach and applies it in the context of developing countries.

⁷ Theory is somewhat unclear on this issue. To some extent reserves are a precautionary balance and may be regarded as a luxury good, which therefore only better off countries might be expected to be able to afford. At the same time analogies with the transactions demand for money along Baumolian lines (Baumol, 1952) might imply that the “square-root rule” could apply. This argument is developed in Heller (1968).

⁸ The range is illustrated by the following examples which report the ratio of actual to optimal reserves. Argentina, 0.29, Brazil, 0.56, Chile, 0.55, Colombia, 0.40, Jamaica, 2.28, Mexico, 0.98, Peru, 1.65, Venezuela, 0.64, India, 0.48, Indonesia, 0.19, Korea, 0.92, Malaysia, 3.95, Pakistan, 0.70, Philippines, 0.56, Thailand, 2.26.

(1966). He argues that at both a theoretical and empirical level there is little or no evidence to support the existence of a straightforward relationship between reserves and any other suggested explanatory variable... (H)e concludes, basically, that year upon year monetary authorities wish to see their reserves grow in size. The demand for reserves in any period is then simply a function of the level of reserves in the previous period. The level of reserves demanded in period $t+1$ is merely equal to the level of reserves in period t , plus a growth factor (p.100).

The general difficulty, however, was more in finding suitable proxies for the theoretical determinants of optimal reserves. To what extent could the *ex ante* probability of future balance of payments deficits be captured by their *ex post* incidence, or is balance of payments instability purely random? To what extent could the costs of adjustment be estimated by using the average propensity to import? And how could the social return on resources be captured in order to help calculate the opportunity cost of holding reserves?

b Limitations of the Historical Approach to Judging Reserve Adequacy

There were further problems with the optimising approach since in theory optimal reserves depended on the nature of the exchange rate regime and access to international capital. In principle, it seemed reasonable to assume that exchange rate flexibility and international borrowing were substitutes for holding reserves; but to what extent? Moreover, as noted, even in principle it was unclear whether flexible exchange rates would necessarily reduce the demand for reserves since currency misalignment had been shown to be feasible under a flexible rate regime, and access to international capital markets depends on creditworthiness which may itself change in positive association with the level of reserves (ul Haque, Kumar and Mathiesen, 1996).

While researchers made valiant efforts to deal with these theoretical and operational difficulties, their results bore testimony to the significance of the assumptions made; results were sensitive to alterations in the assumptions. The operational simplicity of the R/M ratio triumphed over the theoretical sophistication of the optimising approach. However, recent global developments have glaringly revealed the shortcomings of the R/M ratio. It is time to rethink the issue of reserve adequacy.

Two questions immediately arise. First, is it possible to resurrect and operationalise the optimising approach? The short answer is “not easily”. The theoretical determinants of optimal reserves cannot be estimated with sufficient precision and accuracy to allow calculations of reserve optimality to be regarded with confidence. Thus any estimates of optimum reserves need to be accompanied by a sensitivity analysis which almost certainly makes fairly meaningless the attempt to be precise. These difficulties were again illustrated during debates towards the end of 1990s about whether there was a global need for an additional allocation of SDRs. The theory simply did not allow a definitive judgement to be made about the adequacy of international reserves (Mussa, 1996).

The second question is whether there is a better “rule of thumb” than can be used to replace or augment the reserves-to-imports ratio. The literature discussing the R/M ratio had, even in the 1960s, contemplated relating reserves to the domestic money supply or liquid liabilities held by foreigners or a country’s net external balance (see, for example, Johnson, 1958, Scitovsky, 1958, Lamfalussy, 1968, IMF, 1970). Although these ratios suffer from many of the same drawbacks as the R/M ratio, they at least reorientate attention away from the current account as the source of balance of payments instability.

As noted, crises of the 1990s and beyond that have afflicted many middle-income developing countries have predominantly been crises of the capital account. Reserve adequacy benchmarks accordingly need to be modified to allow for capital outflows as well as for imports to be a potential drain on reserves (Bird and Rajan, 2002, Fischer, 2001 and Rajan, 2002b). The weight attached to the current account or the capital account as potential sources of balance of payments instability may, of course, be expected to vary across developing and emerging economies. For some poorer economies which have not attracted private capital and have a highly concentrated export base the R/M ratio may remain the more useful indicator of reserve adequacy. For other richer and more diversified economies which have experienced inflows of private capital, a measure of reserve adequacy that acknowledges their vulnerability to sudden capital outflows (or reduced capital inflows) rather than sudden export shortfalls may be more useful.

The next section attempts to move from the general to the specific by offering some alternative measures of reserve adequacy. There are two conceptual weaknesses associated with reserve adequacy that need to be noted and underlined at this stage. First, and as implied earlier, the adequacy of reserves can only be legitimately viewed in the context of a package of policies. Reserve decumulation is but one way of responding to a current account balance of payments deficit. There are alternative options in terms of both external *financing* and economic *adjustment*. Thus, a specific level of reserves may be inadequate in the context of a situation where there are no alternative sources of financing and a reluctance or inability to correct a current account deficit, but at the same time adequate when alternative sources of financing exist or adjustment can be quickly attained. It follows that it is of limited value to examine the adequacy of reserves in “partial” terms and in isolation. In this sense, any

ratio approach to judging reserve adequacy will give a misleading impression of simplicity (we take this issue up again in section 4).

Second, and in the context of currency crises, there is an element of truth in the idea that any level of reserves that international capital markets, and nationals who are in a position to engage in capital flight, perceive as being inadequate will turn out to be inadequate. Once investors lose confidence in a currency and the government is unable to restore it, reserves will tend to rapidly dissipate. The rate of depletion is then likely to increase as the level of reserves declines, since falling reserve levels will further erode confidence. Panic sets in and this infects other investors who would otherwise not have thought to withdraw their capital. There is an element of self-fulfillment here as the perception that reserves are inadequate leads to behaviour that then makes them inadequate. Where reserves are no longer adequate to cover short-term external liabilities, the loss of confidence may become total.

The problem, of course, is that while it is easy to say that the adequacy of reserves depends on investor confidence, it is difficult to say with precision what determines this. Again, it will almost certainly be influenced by the package of economic policies that a government is pursuing and the commitment with which they are being pursued, as well as by economic performance, but it is also likely to be affected by the perceived degree of political stability and indeed by the level of reserves itself (Bird and Rajan, 2001, 2002). In these circumstances rule-of-thumb indicators of reserve adequacy, for all their shortcomings, may be the best that can be achieved. They may remain helpful provided they are interpreted as merely indicative rather than definitive. Mistakes in judgement may still be made where *ex ante* assumptions are not matched by *ex post* reality. Thus it was that prior to crises both the Mexican and the Thai authorities built up their international reserves to levels that

exceeded conventional indicators of adequacy (see section 4). The fact that, as events turned out, these levels were insufficient to prevent the currency crises that occurred in part reflects the deficiencies of these conventional measures but also reflects the problems in anticipating and forecasting investor behaviour.

3. INDICATORS OF RESERVE ADEQUACY: WHAT DO THEY SHOW?

The analysis in the previous section shows that definitive measures of reserve adequacy may be beyond our reach because of the theoretical complexities involved. The information needed to construct these measures is simply unavailable. At the same time, global experience has suggested that reserve levels may be a significant factor in helping to explain and predict currency crises (Fischer, 2001). It is therefore unwise to regard reserve levels as altogether irrelevant. Conventional indicators of reserve adequacy based on instability in the current account of the balance of payments may remain useful for some countries where trade-related shocks remain the principal source of payments vulnerability. However, for other countries that have a large stock of short-term external debt, the ratio of reserves to imports is unlikely to capture their ability to finance payments shocks. This suggests that the reserves-to-imports ratio needs to be supplemented by other rules-of-thumb. But what form would these alternatives take?

a Importance of Short-term External Debt

In the aftermath of the East Asian crisis, the extent of short-term indebtedness has been found to be a key indicator of illiquidity and a robust predictor of financial crises (Bussière and Mulder, 1999, Dadush, Dasgupta and Ratha, 2000, Rodrik and Velasco, 1999 and World Bank, 2000). According to Dadush et al., and on the basis

of data for 33 developing economies, the elasticity of short-term debt with respect to GDP growth is 0.9 when there is a positive shock and -1.8 when there is a negative shock. The extreme reversibility of short-term debt in the event of negative shock exposes borrowers to liquidity runs and systemic crises⁹. In view of the importance of short-term external debt, proposals have been made to resurrect the idea of expressing a country's reserves in relation to its short-term external debt (STED).

The reserves-to-short-term external debt (R/STED) ratio may provide a useful indicator of the threshold at which investors lose confidence. It may therefore connect with the theory of currency crises. Pablo Guidotti, former Deputy Minister of Finance of Argentina, is credited with being the first to propose that countries should manage their external assets and liabilities in such a way as to be capable of living without foreign borrowing for up to one year (De Beaufort Wijnholds and Kapteyn, 2001). This implies, at a minimum, that *usable* foreign exchange reserves should exceed scheduled external amortisation for one year. However, this “external balance sheet rule” measure implies that there is a discreet distinction between reserve adequacy and reserve inadequacy. It may therefore be insufficiently subtle. Other criticisms have been made of the R/STED ratio, suggesting that, while it gives an indication of the vulnerability to an “external drain”, it fails to capture the threat of an “internal drain” associated with capital flight by residents (De Beaufort Wijnholds and Kapteyn, 2001). The latter may be best captured by measures of broad money supply (M2)¹⁰.

Perhaps of more significance, is that the R/STED ratio fails to reflect the

⁹ In a somewhat contrarian view, Jeanne (2000) argues that it is not clear that short-term debt contracts ought to be discouraged as they may play a socially advantageous function in reducing agency problems. The World Bank (1999) surveys recent literature on short-term debt and financial crises.

¹⁰ A low and declining reserves-to-M2 ratio, which captures the extent to which liabilities of the banking system are backed by international reserves, is among the leading indicators of a

dynamics of currency crises. In addition to monitoring the level of reserves in relation to proxies for either current account or capital account vulnerability, an attempt should also be made to monitor the change in reserves as well as its rate of change. How rapidly are reserves falling and how quickly will threshold ratios be reached? A country with stable reserves close to the “threshold” or “minimum” ratios may have fewer problems than a second country which, although having higher contemporary ratios, appears more likely to dip below the threshold ratios if current trends continue. The need for policy change could therefore be signalled by a country falling below a predefined set of ratio values or by a rate of reserve depletion suggesting that these values will rapidly be approached. But how rapidly? Since rapid reserve loss signals the need for a change in policy, the indicator needs to be designed in a way that allows sufficient time for the policy changes to be implemented and to take effect.

Again precision appears beyond current scientific capabilities and some degree of subjective judgement is therefore unavoidable. There are also different rates of response to policies designed to strengthen the current as compared with the capital account. Thus, currency devaluation may take some months before its impact is felt on export earnings, since export supply elasticity may be little different from zero in the near term. On the other hand, and in combination with supportive macroeconomic and structural policies, it may have a much more rapid or even quasi-immediate impact on the capital account by restoring confidence and by changing expectations¹¹. Given that currency crises tend to be associated with the capital account, it may be reasonable to allow for a modest cushion over and above short-term external debt.

currency crisis (Kaminsky and Reinhart, 1999). See the notes in Table 2.

¹¹ Another difficulty in this context is that in some circumstances devaluation may have an adverse effect on confidence and may therefore weaken the capital account even further (Bird and Rajan, 2001 and Rajan and Shen, 2001).

The cushion might be required to vary with the maturity structure of the debt. For illustrative purposes assume that a country holds \$X billion of short-term debt that falls due evenly throughout the next 290 working days. Assume further that the implementation of an effective policy change takes 10 days, then an additional cushion of approximately 3 percent of short-term debt may be warranted¹². However, the principal purpose of monitoring the dynamics of reserve depletion is not to estimate the exact adequacy of reserves but rather to signal the need for policy change in advance of reaching a minimum threshold that may herald the arrival of a full blown crisis as captured by conventional currency crisis models.

It is also in this spirit that Alan Greenspan, Chairman of the Federal Reserve Board of the United States, offered two enhancements to the “Guidotti-rule” (Greenspan, 1999). The first of these would be to have an additional rule that the average maturity of a country’s external liabilities should exceed a certain threshold, such as three years. The second enhancement is to have a “liquidity-at-risk” standard. Under this standard, a country’s external liability position would be calculated over a wide range of possible outcomes, taking into account the full set of external assets and liabilities. An appropriate level of reserves would then be the one that provides a high probability that external liquidity will be sufficient to avoid new borrowing for one year (say 95 per cent). This methodology is broadly similar to the value-at-risk methodology used by commercial banks’ (De Beaufort Wijnholds and Kapteyn, 2001).

¹² Thus, while countries would monitor changes in reserves and the rate at which reserves are changing in an on-going way, they would hold a cushion of reserves above the minimum level implied by the Guidotti-rule to allow for a policy response to reserve depletion before the minimum level was reached.

b What Do the Data Tell Us?

Table 1 presents data on two alternative measures of reserve adequacy for emerging economies at the end of the 1990s. The table distinguishes between those countries identified by the IMF as having independent floating or a managed float/pegged exchange rate¹³. A number of observations may be made about the data. First, and on average, R/M ratios are not discernibly different between those countries with independent floating and managed floating or exchange rate pegging. Second, there are wide differences within each category. Amongst the independent floaters (“floating with a life jacket”) there is a range from 11 weeks of imports in the case of Mexico to 46 weeks in the case of Peru. Data relating to reserves-to-imports ratios would not have accurately predicted future difficulties in Brazil, Turkey and Argentina in the post 1999 period. Data on the reserves-to-short-term external debt ratio also reveal wide dispersion. However, in general, countries with managed exchange rates hold a higher ratio of reserves to short term external debt. Third, there is no close correlation between the alternative measures of adequacy. While Mexico failed the three months of imports threshold of reserve adequacy, it passed the short-term external debt (STED) threshold by having sufficient reserves to cover short-term debt. Meanwhile Brazil, South Africa, Turkey and Argentina failed the STED threshold, but passed - albeit only just in the case of South Africa - the R/M threshold. Only Russia failed in terms of both criteria.

Table 2 presents two further calculations of reserve adequacy for emerging economies. One is based on a measure advocated by De Beaufort Wijnholds and Kapteyn (2001) 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

¹³ This distinction is notoriously imprecise (see De Beaufort Wijnholds and Kapteyn, 2001).

country risk index. Their measure is more fully explained in the notes to the table. The second measure is based on incorporating an additional cushion over and above short-term external debt to provide a time period for policy change before the R/STED threshold is reached as discussed in the previous subsection. There is broad agreement across the two indicators concerning reserve adequacy except in the cases of Colombia, Indonesia and Mexico where the De Beaufort Wijnholds and Kapteyn (2001) measure implies reserve inadequacy and the augmented short-term external debt measure does not. However, in none of these cases are the differences quantitatively large. Both approaches suggest that Brazil, Russia, South Africa, Turkey and Argentina were holding inadequate reserves in 1999.

The Table reveals something else as well. It suggests that while, from amongst the Asian economies, Hong Kong, Indonesia, and the Philippines were holding broadly “adequate” reserves by end 1999, Korea, Thailand and Malaysia had actual reserves significantly in excess of adequate levels. Substantial “excess” reserve holdings also existed in Chile, India, Poland, China, Czech Republic and Venezuela and to a lesser extent in Hungary. This raises a further important question. To what extent should countries avoid holding reserves above adequate levels? What is the opportunity cost of holding reserves? As discussed earlier these costs are difficult to calculate with any degree of precision. Put simply, holding reserves means that they are not spent. The opportunity cost of stockpiling reserves is therefore the difference between the return on reserves and the return on the resources upon which reserves could have been spent. The former Deputy Governor of the Reserve Bank of Australia, Stephen Grenville (1999) has observed of the Guidotti-Greenspan rule, “why..(is)..this short-term debt..useful in the first place, if the proceeds of the short-

term borrowing have to be stacked away in reserves (at a lower rate of return than the cost of borrowing)” (p.6)?¹⁴

In what follows we make an attempt to estimate the potential opportunity cost of reserve accumulation so that this may be juxtaposed against the benefits¹⁵. Following Rodrik (2000), we make two key assumptions. First, all reserves beyond the age-old rule of thumb of three months’ worth of imports are considered to be “excess”. We treat these “excess” levels of reserves as the opportunity cost of maintaining an open capital account. Second, the spread between the yield on foreign reserves (the US Treasury bill rate) is used as a proxy of the marginal cost of domestic funds and is taken to be 6 percentage points¹⁶. Under these assumptions, and as reported in Table 3, we find the annual cost of this “insurance policy premium” against financial market unpredictability to be of the order of 0.3 to 1 percent of GDP for the five crisis-affected economies in East Asia in 1999. As a share of GDP, these costs are the highest for Thailand and Malaysia and least for the Philippines.

c Tiers of Liquidity

Since our computations imply that there may be a significant cost associated with holding reserves, another question directly follows on. Is there any way in which

¹⁴ Similarly the Economist (September 23-29, 2000) has noted of this external balance sheet rule:

It is rather as though a household with lots of cash sitting idle in a low-interest bank account was at the same time paying a much higher interest rate on its debt. It would make more sense to repay some of that debt (p.90).

¹⁵ This draws on Bird, Rajan and Siregar (2002). While the discussion thus far has focused on the Baumol transactions theory (see fn 7), there is an older strand of the literature *a la* Tobin-Markowitz which focuses on optimising the returns on the reserve holdings subject to the risk associated with the assets of the central bank (“portfolio theory of the demand for international reserves”).

¹⁶ Ideally we would like to have obtained data on an individual country’s market bond rates and estimated more exact spreads. Rodrik (2000) argues that for a lot of emerging and developing countries this 6 percent spread is likely to be a conservative estimate of the true opportunity cost of holding reserves.

the liquidity yield from holding reserves may be generated without the need for individual countries to continue to accumulate them? One way might be for regional economies to develop a network of swap arrangements that would provide member countries with extra liquidity in the event of a crisis. This is in fact the direction in which East Asia appears to be moving (Bird and Rajan, 2002 and Rajan, 2002b).

The implications of the analysis in this section are at least two fold. First, it may certainly be sensible for countries with inadequate reserves to build them up to “adequate levels”. This will tend to reduce their vulnerability to speculative attack by creating more confidence in the minds of investors, and may provide a brief time period within which policy may be altered before a crisis becomes full-blown. But second, beyond adequate levels, it may be preferable to develop alternative ways of providing short-term liquidity which do not require further reserve accumulation. Countries would then have two lines of defence. Owned reserves are always likely to offer the highest degree of liquidity and have zero conditionality, but these features alone do not mean that it is always desirable to add to the stock of them. Indeed, both from a systemic and individual country perspective, it may be desirable to have “tiers of liquidity”. The top tier would be owned reserves. The second tier would be regional liquidity arrangements and the third tier would be conventional IMF lending (Bird and Rajan, 2002). With such a structure, the degree of liquidity could be inversely related to the degree of conditionality.

The revealed preference of some countries to accumulate reserves beyond levels that would be deemed adequate by the rules of thumb ratios discussed in this section clearly does not necessarily imply irrational behaviour. Rather, it may simply mean that governments have assessed the benefits and costs of acquiring and holding reserves in a different way. Assuming that they are behaving rationally, continued

reserve accumulation implies that, at the margin, the benefits of extra reserves are perceived as exceeding the costs. It seems likely that there is a political premium on avoiding future crises and retaining the option of a slower speed of adjustment should the balance of payments weaken. However, the danger may be that reserve accumulation is seen as a substitute for appropriate policy reform, not least in terms of exchange rate policy¹⁷. And this could ultimately enhance the risk of further economic difficulties. Again policy with respect to international reserves needs to be seen as but one part of a coherent overall economic strategy. Thus Fischer (2001) has recently noted of the IMF's surveillance policies:

(W)e are focusing more on those policy areas that can leave a country vulnerable to crises. The management of reserves is one. Others include macroeconomic policies, exchange rate regimes, financial sector soundness, and debt management (p.2).

4. CONCLUDING REMARKS

Reserve inadequacy was perceived as a major deficiency of the international monetary system in the 1960s and reform proposals focussed on increasing the global quantity of international reserves. In retrospect, the apparent inadequacy of reserves was as much a reflection of an inadequate adjustment mechanism. Exchange rates were pegged under the Bretton Woods system and demand management policies failed to eliminate balance of payments disequilibria. Although its theoretical foundations were always weak, the adequacy of individual countries' reserves was frequently judged by consulting the reserves-to-imports ratio. While this measure may still remain indicative for countries that are vulnerable to current account shocks, its shortcomings have been underlined since the early 1990s when balance of payments

¹⁷ Indeed, another reason for the accumulation of reserves is the "fear of floating" that seems to characterise developing countries (Calvo and Reinhart, 2000, Hausmann, et al., 2000 and Rajan, 2002a).

crises have had more to do with volatile international capital flows than unstable export earnings. Reserves-to-imports ratios often failed to identify crisis countries *ex ante*, while crises themselves have been characterised by rapid reserve depletion.

Dissatisfaction with the old measures of reserve adequacy has stimulated the pursuit of superior ones. Unfortunately it remains impossible to convert sound theory into operational indicators since many of the theoretical determinants of reserve adequacy are difficult (impossible) to measure. Whilst rules-of-thumb may therefore be unavoidable, proposals have been made to augment the reserves-to-imports ratio with other ratios that reflect a country's vulnerability to reduced capital inflows or capital outflows.

The evidence presented in this paper supports the claim that these capital account related measures would have been helpful in identifying reserves that were inadequate in the event of a loss of market confidence; although it is also suggested that dynamic measures of changes in reserve levels would be helpful in signalling the need for changes in economic policy. Before the event, therefore, countries may need to hold reserves slightly in excess of their short-term external debt in order to provide a window of opportunity for policy change in advance of reserves imploding in the context of a full-blown crisis.

With memories of crisis still reasonably fresh, it is perhaps unsurprising that crisis countries have exhibited a desire to build up reserves as an insurance against future crises. Data drawn from the IMF's *World Economic Outlook* show that developing countries as a group increased their R/M ratio from 38.5 in 1993 to 52.1 in 1999 (Table 4). However, taken too far this may represent inappropriate diagnosis and prescription. Where fundamental policy change is needed, even high levels of reserves may prove inadequate. Beyond some minimum or threshold reserve ratio

designed to avoid a sudden loss of confidence, the costs of further reserve acquisition may well exceed the benefits. Building up reserves by short-term borrowing will involve a cost in terms of the interest rate differential between the return on reserves and the rate of interest on borrowing. While improving the reserves-to-imports ratio, reserve accumulation financed by borrowing will fail to strengthen the reserves-to-short-term external debt ratio since both the numerator and denominator increase and it is also open to the Grenville-critique noted above. Accumulating reserves by running current account surpluses will avoid this problem but carries an opportunity cost both in terms of sacrificed imports as well as holding relatively low-yielding foreign assets. There may be better ways of increasing the availability of short-term liquidity via pooling arrangements, especially where speculative attacks on currencies follow a sequential rather than a concurrent path, as they appear to do.

In relation to this, while it may be sensible in the midst of a crisis for the IMF to recommend that countries should replenish depleted reserves, it may be unwise to take this too far and advocate the sustained accumulation of reserves. For the practicability of agreeing IMF-backed programmes, better rule-of-thumb measures of reserve adequacy are certainly needed than the conventional reserves-to-imports ratio. However, sustained reserve accumulation via running current account surpluses merely makes certain now the uncertain future consumption sacrifices that reserves are intended to avoid. There is little point in having a lending institution such as the IMF if countries attempt to accumulate reserves to a level at which they would almost never need the liquidity that the IMF can provide. While recent crises have appropriately drawn attention to the issue of reserve adequacy and the problems of measuring it, they should not be interpreted as implying that emerging economies

need to pursue policies that result in a sustained increase in their owned reserves;
other preferable liquidity enhancing policies are available.

REFERENCES

- Baumol, W. (1952). "The Transactions Demand for Cash: An Inventory Theoretic Approach", Quarterly Journal of Economics, 66, pp.545-56.
- Bird, G. (1978). The International Monetary System and the Less Developed Countries, London: Macmillan, Chapter 5.
- Bird, G. (1985). World Finance and Adjustment, London: Macmillan, Chapter 5.
- Bird, G. (1998). "The Political Economy of the SDR: the Rise and Fall of an International Reserve Asset", Global Governance, 4, pp 355-79.
- Bird, G. and R. Rajan (2001). "Recovery or Recession? Post-Devaluation Output Performance: The Thai Experience", Discussion Paper No.00/43, Centre for International Economic Studies, University of Adelaide.
- Bird, G. and R. Rajan (2002). "The Evolving Asian Financial Architecture", Princeton Essays in International Economics No.226, International Economics Section, Princeton University.
- Bird, G., R. Rajan and R. Siregar (2002). "Revisiting the Economics of International Reserve Holdings: With Reference to Asia" (in progress).
- Bussiere, M. and C. Mulder (1999). "External Vulnerability in Emerging Market Economies: How High Liquidity Can Offset Weak Fundamentals and the Effects of Contagion", Working Paper No.99/88, IMF.
- Calvo, G. and C. Reinhart (2000). "Fear of Floating", Working Paper No.7993, NBER.
- Clark, P. (1970). "Optimum International Reserves and the Speed of Adjustment", Journal of Political Economy, 78, pp.356-76.
- Dadush, U., D. Dasgupta and D. Ratha (2000). "The Role of Short-term Debt in Recent Crises", Finance and Development, 37, pp.54-7.
- De Beaufort Wijnholds, J.A.H (1977). The Need for International Reserves and Credit Facilities, Leiden, Martinus Nijhoff Social Sciences Division.
- De Beaufort Wijnholds, J.A.H. and A. Kapteyn (2001). "Reserve Adequacy in Emerging Market Economies", Working Paper No.01/43, IMF.
- Disyatat, P. (2001). "Currency Crises and Foreign Reserves - A Simple Model", Working Paper No.01/18, IMF.
- Dooley, M., S. Lizondo and D. Mathieson (1989). "The Currency Composition of Foreign Exchange Reserves", IMF Staff Papers, 36, pp.385-34.

Fischer, S. (2001). "Opening Remarks", IMF/World Bank International Reserves: Policy Issues Forum (Washington, DC, April 28).

Flanders, M. (1971). "The Demand for International Reserves", Studies in International Finance 27, International Economics Section, Princeton University.

Frenkel, J. and B. Jovanovic (1981). "Optimal International Reserves: A Stochastic Framework", Economic Journal, 9, pp.507-14.

Greenspan, A. (1999). "Currency Reserves and Debt", remarks at the World Bank Conference on Trends in Reserve Management (Washington, DC, April 29).

Grenville, S. (1999). "Financial Crises and Globalisation", BIS Review 83/1999, Bank for International Settlements.

Hausmann, R., U. Panizza and E. Stein (2000). "Why do Countries Float the Way they Float?", Working Paper No. 418, Washington, DC: Inter-American Development Bank.

Heller, R. (1966). "Optimal International Reserves", Economic Journal, 76, pp 296-311.

Heller, R. (1968). "The Transactions Demand for International Means of Payment", Journal of Political Economy, 76,1,pp141-145.

Heller, R. and M. Khan (1978). "The Demand for International Reserves Under Fixed and Floating Exchange Rates", IMF Staff Papers, 25, pp.623-49.

Iyoha, M. (1976). "Demand for International Reserves in Less Developed Countries: A Distributed Lag Specification", Review of Economics and Statistics, August, pp.351-55

International Monetary Fund (IMF) (1970). International Reserves: Needs and Availability, Washington DC, IMF.

Jeanne, O. (2000). "Foreign Currency Debt and the Global Financial Architecture", European Economic Review, 44, pp.719-27.

Johnson, H. (1958). International Trade and Economic Growth, London, Allen and Unwin.

Kafka, A. (1968). "International Liquidity: Its Present Relevance to Less Developed Countries", American Economic Review, Papers and Proceedings, May, pp.596-603.

Kaminsky, G. and C. Reinhart (1999). "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems", American Economic Review, 89, pp.473-500.

Kenen, P. and E. Yudin (1965). "The Demand for International Reserves", Review of Economics and Statistics, August, pp.242-250.

- Lamfalussy, A. (1969). The Role of Monetary Gold over the Next Ten Years, Washington DC, IMF.
- Lizondo, J. and D. Mathieson (1978). "The Stability of the Demand for International Reserves", Journal of International Money and Finance, 6, pp 251-82.
- Machlup, F. (1964). "Plans for the Reforming of the International Monetary System", Special Papers in International Economics No3, International Economics Section, Princeton University.
- Machlup, F (1966). "The Need for Monetary Reserves", Banca Nazionale del Lavoro Quarterly Review, September, pp.58-75.
- Mussa, M (1996). "The Rationale for SDR Allocation Under the Present Articles of Agreement of the International Monetary Fund", in M. Mussa, J. Boughton and P. Isard (eds.), The Future of the SDR in the Light of Changes in the International Monetary System, Washington DC: IMF.
- Niehans, J. (1970). "The Need for Reserves of a Single Country", in IMF (1970) *op. cit.*.
- Officer, L. (1976). "The Demand for International Liquidity", Journal of Money, Banking and Credit, August, pp.75-86.
- Rodrik, D. (2000). "Exchange Rate Regimes and Institutional Arrangements in the Shadow of Capital Flows", mimeo (September).
- Rajan, R. (2002a). "Exchange Rate Policy Options for Post-Crisis Southeast Asia: Is There a Case for Currency Baskets?", The World Economy, 25, pp.137-63.
- Rajan, R. (2002b). "Safeguarding Against Capital Account Crises: Unilateral, Regional and Multilateral Options for East Asia", in G. de Brouwer (ed.), Financial Arrangements in East Asia, London: Routledge, forthcoming.
- Rajan, R. and C.H. Shen (2001). "Are Crisis-Induced Devaluations Contractionary?", Discussion Paper No.0135, Centre for International Economic Studies, University of Adelaide.
- Rodrik, D. and A. Velasco (1999). "Short Term Capital Flows", Working Paper No.7364, NBER.
- Scitovsky, J (1958). Economic Theory and Western European Integration, London, Allen and Unwin.
- Triffin, R. (1970). Gold and the Dollar Crisis, New Haven: Yale University Press.
- ul Haque, N. Kumar, M. Nelson and D. Mathieson (1996). "The Economic Content of Indicators of Developing Country Creditworthiness", IMF Staff Papers, 43, pp.688-723.

Williamson, J. (1973). "Surveys in Applied Economics: International Liquidity", Economic Journal, 83, pp.685-746

Williamson, J. (1976). "Generalised Floating and the Reserve Needs of Developing Countries", in D. Leipziger (ed.), The International Monetary System and the Developing Nations, ??.

World Bank (1999). Global Development Finance 1999, New York: Oxford University Press.

World Bank (2000). Global Economic Prospects and the Developing Countries, New York: Oxford University Press.

CIES DISCUSSION PAPER SERIES

The CIES Discussion Paper series provides a means of circulating promptly papers of interest to the research and policy communities and written by staff and visitors associated with the Centre for International Economic Studies (CIES) at the Adelaide University. Its purpose is to stimulate discussion of issues of contemporary policy relevance among non-economists as well as economists. To that end the papers are non-technical in nature and more widely accessible than papers published in specialist academic journals and books. (Prior to April 1999 this was called the CIES Policy Discussion Paper series. Since then the former CIES Seminar Paper series has been merged with this series.)

Copies of CIES Policy Discussion Papers may be downloaded from our Web site at <http://www.adelaide.edu.au/cies/> or are available by contacting the Executive Assistant, CIES, School of Economics, Adelaide University, SA 5005 AUSTRALIA. Tel: (+61 8) 8303 5672, Fax: (+61 8) 8223 1460, Email: cies@adelaide.edu.au. Single copies are free on request; the cost to institutions is US\$5.00 overseas or A\$5.50 (incl. GST) in Australia each including postage and handling.

For a full list of CIES publications, visit our Web site at <http://www.adelaide.edu.au/cies/> or write, email or fax to the above address for our *List of Publications by CIES Researchers, 1989 to 1999* plus updates.

- 0210 Bird, Graham and Ramkishen Rajan, "Too Much of a Good Thing? The Adequacy of International Reserves in the Aftermath of Crises", April 2002.
- 0209 Anderson, Kym, "Measuring Effects of Trade Policy Distortions: How far have we come?" April, 2002.
- 0208 Rajan, Ramkishen and Rahul Sen "The Japan-Singapore "New Age" Economic Partnership Agreement: Background" March, 2002.
- 0207 Anderson, Kym, "Peculiarities of Retaliation in WTO Disputes Settlement" March, 2002
- 0206 Jackson, Lee Ann, "Is Regulatory Harmonization Efficient? The Case of Agricultural Biotechnology Labelling." March 2002
- 0205 Siregar, Reza and Ramkishen S. Rajan, "Impact of Exchange Rate Volatility on Indonesia's Trade Performance in the 1990s", March 2002.
- 0204 Xueyan Zhao, Kym Anderson and Glyn Wittwer, "Who Gains from Australian Generic Wine R & D and Promotion?", February 2002.
- 0203 Bird, Graham and Ramkishen Rajan, "The Evolving Asian Financial Architecture", January 2002.
- 0202 Rajan, Ramkishen and Rahul Sen, "Singapore's New Commercial Trade Strategy: the Pros and Cons of Bilateralism", January 2002.
- 0201 Rajan, Ramkishen, "Safeguarding Against Capital Account Crises: Unilateral, Regional and Multilateral Options for East Asia", January 2002. (Revised version forthcoming in G. de Brouwer (ed.), *Financial Arrangements in East Asia*, London: Routledge, 2002.)
- 0150 Rajan, Ramkishen, "Economic Globalization and Asia: Trade, Finance and Taxation", December 2001. (Published in *ASEAN Economic Bulletin*, 18(1): 1-11, 2001.)
- 0149 Rajan, Ramkishen and Iman Sugema, "The Devaluation of the Thai Baht and a Simple Second Generation Currency Crisis Model", December 2001. (Revised version forthcoming in *Economia Internazionale*, 2002.)

- 0148 Rajan, Ramkishen, "International Financial Flows and Regional Financial Safeguards in East Asia", December 2001.
- 0147 Rajan, Ramkishen S. and Rahul Sen, "Trade Reforms in India Ten Years on: How has it Fared Compared to its East Asian Neighbours?", December 2001.
- 0146 Evenett, Simon J., "Do all Networks Facilitate International Commerce. The case of US law firms and the mergers and acquisitions wave of the late 1990s", December 2001.
- 0145 Anderson, Kym and Shunli Yao, "How Can South Asia and Sub-Saharan Africa Gain from the Next WTO Round?", November 2001.
- 0144 Bernauer, Thomas and Erika Meins, "Scientific Revolution Meets Policy and the Market: Explaining Cross-National Differences in Agricultural Biotechnology Regulation", November 2001.
- 0143 Anderson, Kym, David Norman and Glyn Wittwer, "Globalization and the World's Wine Markets: Overview", November 2001
- 0142 Busse, Matthias, "Do Labour Standards Affect Comparative Advantage? Evidence for Labour-Intensive Goods", November 2001.
- 0141 Stringer, Randy and Glyn Wittwer, "Grapes, Wine and Water: Modelling Water Policy Reforms in Australia", November 2001.
- 0140 Damania, Richard, Randy Stringer, K. Ullas Karanth, and Brad Stith, "The Economics of Protecting Tiger Populations: Linking Household Behaviour to Poaching and Prey Depletion", November 2001.
- 0139 Damania, Richard and Erwin H. Bulte, "The Economics of Captive Breeding and Endangered Species Conservation", October 2001.
- 0138 James, Jennifer S and Julian M Alston, "Taxes and Quality: A Market-Level Analysis", October 2001.
- 0137 Rajan, Ramkishen, "Choosing an appropriate exchange rate regime for small and open economies" October 2001. (Paper prepared for *Malaysian Economic Outlook* 2001, organized by the Malaysian Institute for Economic Research, Kuala Lumpur, Malaysia).
- 0136 Anderson, Kym, Betina Dimaranan, Joseph Francois, Tom Hertel, Bernard Hoekman, and Will Martin, "The Burden of Rich and Poor Country Protectionism on Developing Countries", September 2001. (Since published in *Journal of African Economies* 10(3): 227-257, 2001).
- 0135 Rajan, Ramkishen and Chung-Hua Shen, "Are Crisis-Devaluations Contractionary?", September 2001.
- 0134 Shapiro, Perry and Petchey, Jeffrey "Internationally Mobile Factors of Production and Economic Policy in an Integrated Regional Union of States", August 2001.
- 0133 Rajan, Ramkishen and Graham Bird, "Still the Weakest Link: the Domestic Financial System and Post-Crisis Recovery in East Asia", July 2001. (Since published in *Development Policy Review* 19 (3): 355-66, 2001
- 0132 Rajan, Ramkishen and Bird, Graham, "Banks, Maturity Mismatches and Liquidity Crises: a Simple Model", July 2001. (Forthcoming in *Economia Internazionale*, 2002.)
- 0131 Montreevat, Sakulrat and Rajan, Ramkishen, "Banking Crisis, Restructuring and Liberalization in Emerging Economies: an Analytic Case Study of Thailand", June 2001.

Table 1: Reserve Adequacy Indicators: Emerging Market Countries
(All data is for end-1999)

<u>Independent Float</u>	<u>Reserves/Imports</u> (Weeks of imports)	<u>Reserves/Short-term External Debt</u> (percentage)
Brazil	35	83
Chile	50	200
Colombia	40	134
India	38	327
Indonesia	57	126
Korea	32	162
Mexico	11	119
Peru	56	131
Philippines	22	145
Poland	28	316
Russian Federation	11	70
South Africa	12	43
Thailand	43	206
(average)	33	159
<u>Managed Float or Fixed Regime</u>		
China	49	655
Czech Republic	23	225
Hungary	20	154
Malaysia	24	336
Turkey	30	93
Venezuela	43	235
(average)	32	283
<u>Currency Boards</u>		
Argentina	53	62
Hong Kong SAR	28	103
(average)	41	82

Source: De Beaufort Wijnholds and Kapteyn (2001). All data is from the IMF's International Financial Statistics (line 1.1.d. for non-gold reserves, line 71.d for imports c.i.f. and the sum of line 34 and 35 for broad money,) except for the short-term external debt data (residual maturity) which is from the Joint BIS/IMF/OEDC/World Bank Statistics on External Debt (line G, H and I). The debt data, which is collected from creditor sources, may deviate from the data reported in individual IMF staff reports, which is usually obtained from the national authorities. The exchange rate classification is based on the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (2000). We have classified anything other than an independent float or a currency board as a managed float or fixed regime.

Table 2: Estimated Adequate and Actual Reserves
(end 1999, billions of US dollars)

<u>Independent Float</u>	<u>BHK measure^a</u>	<u>Augmented STED Measure^b</u>	<u>Actual reserves</u>
Brazil	47.4-53.0	43.2	34.8
Chile	7.7-8.2	7.4	14.4
Colombia	6.3-6.8	5.9	7.6
India	14.9-19.8	10.3	32.7
Indonesia	24.2-27.4	21.6	26.4
Korea	51.0-56.2	47.1	74.0
Mexico	29.9-33.1	27.5	31.8
Peru	7.1-7.5	6.8	8.7
Philippines	10.0-11.0	9.4	13.2
Poland	8.9-10.0	8.0	24.5
Russian Federation	13.5-15.0	12.5	8.5
South Africa	16.6-18.6	15.3	6.4
Thailand	19.2-21.9	17.1	34.1
<u>Managed Float or Fixed</u>			
China	86.9-149.8	24.8	157.7
Czech Republic	6.9-8.2	5.9	12.8
Hungary	8.0-8.9	7.3	11.0
Malaysia	12.1-15.1	9.4	30.6
Turkey	29.1-33.3	25.9	23.3
Venezuela	6.2-7.2	5.4	12.3
<u>Currency Boards</u>			
Argentina	45.0-47.5	43.7	26.3
Hong Kong SAR	99.7-105.5	96.1	96.2

Notes: a) This measure is provided by De Beaufort Wijnholds and Kapteyn (2001) where they amalgamate the R/STED ratio with a reserves-to-broad money ratio adjusted to reflect the fraction presented as a range of M2 which may realistically be expected to be mobilised against reserves in a short time span. They also make an allowance for the fact that “not all emerging market economies are equally susceptible to the risk of capital flight”. To make the adjustment they use *The Economist’s* country risk index which takes into account 77 different indicators ranging from monetary and fiscal policy to political stability. The fraction of broad money multiplied by the country risk index is then added to the amount of STED.

b) This measure simply augments STED in the way described in the text of the paper by adding a “policy change” cushion of 3 per cent of short-term external debt.

Source: Modified from Table 3 in De Beaufort Wijnholds and Kapteyn (2001). All data is from International Financial Statistics for reserves and from BIS/IMF/OEDC/World Bank Statistics for external debt. The exchange rate classification is based on the IMF’s Annual Report on Exchange Arrangements and Exchange Restrictions (2000). Reserves have been calculated to exclude gold.

Table 3
Social Cost of Excess Reserves, 1999

Country	Foreign Reserves (million of US dollars) ^a	Reserves in months of imports	“Excess Reserves” (percent of GDP) ^b	Annual Cost of Excess Reserves (percent of GDP) ^c
Indonesia	26445	7.6	11	0.66
Malaysia	30588.2	4.8	15	0.90
Philippines	13299.7	4.3	5	0.30
Thailand	34062.8	7.3	16	0.96
South Korea	73987.3	5.9	9	0.54

Notes: a) Total reserves minus gold at the end of 1999

b) “Excess” refers to the level beyond the 3-month benchmark

c) Assuming a 6 percent spread between the yield on foreign reserves and the marginal cost of borrowing

Source: Computed from International Financial Statistics, IMF

Table 4

Developing Countries: Ratio of Reserves to Imports of Goods and Services^{1,2}

	1993	1994	1995	1996	1997	1998	1999	2000
Developing countries	38.5	41.5	41.3	45.5	46.3	49.9	52.1	48.8
Regional Groups								
Africa	19.1	22.7	20.5	23.7	30.7	29.2	29.0	36.5
Sub-Saharan	17.1	19.6	19.4	20.7	25.8	25.1	25.7	30.2
Developing Asia	37.9	44.1	40.8	45.4	47.1	59.5	60.9	51.8
Other developing Asia	45.2	40.9	34.4	35.4	28.3	42.5	47.3	39.9
Middle East, Malta, and Turkey	34.4	42.7	43.8	46.1	45.8	46.3	51.4	52.2
Western Hemisphere	53.6	44.9	50.9	55.7	51.7	46.9	48.0	45.6
Analytical groups								
By source of export earnings								
Fuel	28.8	34.1	31.9	39.6	42.4	39.8	40.9	49.5
Nonfuel	41.1	43.0	43.2	46.7	47.0	51.9	54.3	48.6
of which, primary products	63.9	71.1	62.7	62.3	61.9	60.1	64.7	60.7
By external financing source								
Net debtor countries	40.7	43.2	42.7	46.9	47.8	51.8	53.7	49.7
of which, official financing	53.1	53.6	45.6	46.5	51.7	47.2	45.2	52.8
Net debtor countries by debt-servicing experience								
Countries with arrears and/or rescheduling during 1994-98	44.0	48.5	45.4	49.6	44.4	46.3	47.6	53.7
Other groups								
Heavily indebted poor countries	47.5	50.0	45.4	43.3	41.6	39.5	41.2	39.7
Middle East and north Africa	35.2	42.4	42.6	46.7	48.9	47.8	49.8	54.4

Source: *IMF World Economic Outlook* (April 2001)

¹Official holdings of gold are valued at SDR 35 an ounce. This convention results in a marked underestimate of reserves for countries that have substantial gold holdings.

²Reserves at year-end in percent of imports of goods and services for the year indicated.