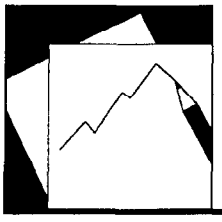
WP/01/143



IMF Working Paper

Reserve Adequacy in Emerging Market Economies

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INTERNATIONAL MONETARY FUND

WP/01/143

IMF Working Paper

Office of Executive Directors

Reserve Adequacy in Emerging Market Economies

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September 2001

Abstract

This paper analyzes reserve adequacy in emerging market countries. It argues that the old rule of thumb of maintaining reserves equivalent to three months of imports has become obsolete and that, instead, a new benchmark is needed which takes into account the increased importance of capital flows. The paper suggests such a benchmark, consisting of the sum of short-term debt on a residual maturity basis (the external drain) and an allowance for possible capital flight (the internal drain), taking into account differences in country risk and exchange rate regime.

JEL Classification Numbers: F31, F41

Keywords: Reserves, vulnerability, capital flight

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I. Introduction

The nature of international financial crises has changed markedly in recent decades. These changes are mirrored by a wealth of currency crises models, ranging from Krugman's (1979) 'first-generation model' to more recent models of multiple equilibria and those emphasizing balance sheet effects. The latter half of the 1990's, in particular, has highlighted the importance of international financial markets. Starting with the Mexican crisis in 1995 - termed the first crisis of the 21st century by the then IMF Managing Director Camdessus – and later Asia, Russia and Brazil, drastic reversals of capital flows wreaked havoc in emerging markets. Clearly, the capital account of the balance of payments has become a major vehicle for if not a source of vulnerability in its own right.

In analyzing the impact of the enormously increased importance of international financial markets at the country level, the traditional distinction between only two categories – the industrial and developing countries – has become outdated. Among the countries traditionally classified as developing, there are very large differences with respect to their ability to attract private foreign capital. Hence it is desirable to make a distinction between low-income developing countries and emerging market countries. The low-income developing countries generally have no access to financial markets. They are eligible for credits from the IMF's Poverty Reduction and Growth Facility (formerly ESAF) at highly subsidized rates of interest. Since these countries are not major debtors to the private sector, they do not figure in international financial crises as such (though they may be affected by the fallout) and will not be part of the analysis of this paper.

We focus our analysis on the emerging market countries, which have generally made important progress in their economic development and are striving to graduate to the status of industrial countries. This increasingly important group, encompassing a large part of Latin America, several Asian countries, a number of Eastern European countries, as well as South Africa, are large importers of private capital. They are also the most important borrowers from the IMF, and have figured prominently in recent international financial crises.

Much of the global architecture debate concerning emerging market financial crises has centered around the following issues: the extent of moral hazard created by large-scale official involvement, the bail-out of banks and other market participants by the IMF, the need to 'bail-in' the private sector, the need for increased transparency, the adoption of standards and codes in order to guide best practices in emerging market countries, the improvement of statistics, and the appropriate exchange rate regime for emerging market countries. [2] An

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[2] See the IMF website for a comprehensive overview of the various reforms being undertaken (http://www.imf.org/external/). For two interesting non-IMF contributions to the debate see the report of the Independent Task Force of the Council of Foreign Relations (1999) and De Gregorio et. al. (1999).

underplayed aspect in the debate is the role reserve policies of the emerging market countries can play in crisis prevention, to which special attention will be accorded in this paper.

Devoting (fresh) attention to the size of countries' international reserves is important for four reasons. First, we currently have no commonly accepted framework for assessing reserve adequacy for emerging market countries. The heyday of the reserve adequacy literature dates back to the 1960's and 1970's, when the focus was mainly on import-based (variability) measures. Scant attention was given to the importance of (short-term) capital flows and, for instance, capital flight. There is thus a clear need to update our approach in light of the changed global circumstances. This would assist monetary authorities in assessing what level of reserves is 'optimal' for smoothing adjustment and creating a buffer stock against crises. Second, reserves in various ratios with other economic variables have turned out to be a useful crisis predictor, as borne out by the flurry of literature on crisis prediction and early warning systems that started to emerge in the mid 1990's. Third, reserve targets are an important factor in calculating financing gaps under IMF programs and, as such, determine the size of Fund arrangements. [3] The degree of judgment used in determining those reserve targets has become problematic, especially as regards emerging market countries. For developing countries a rule of thumb of three months of imports is often used as a target level, but for emerging market countries the argumentation varies.[4] Fourth, and related to the aforementioned point, reserve levels play a role in determining the degree of 'private sector involvement'. That is, if reserve levels are projected to fall due to large net capital outflows and the financing gap reaches such dimensions that the IMF cannot or will not – for instance out of moral hazard considerations - close it with its own resources, it will not wait until a country's reserves have been completely depleted. Rather a pre-determined 'floor' for net international reserves, a standard feature in Fund arrangements, can serve as a trigger for debt rescheduling. [5] Where that floor is set is of no small concern to private sector creditors.

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[3] Total gross (residual) financing need under an IMF arrangement during the program period is defined as the sum of the current account deficit, amortization payments on medium- and long-term debt (including Fund repurchases), targeted reduction of arrears, and targeted accumulation of gross reserves. The financing need is of course not determined autonomously but depends, most importantly, on the strength of the adjustment effort (economic policy) and the external macro-economic environment.

[4] There is, to our knowledge, no clear theoretical or empirical basis for the rule of thumb. As recently as 1997 internal papers confirmed that a reserves/imports ratio of three to five months was a "reference point" for assessing members' strength in selecting those countries that would contribute to the Fund's Financial Transactions Plan (aside from looking at a range of other indicators).

[5] Absent such rescheduling of spontaneous capital inflows, reserves would fall below the 'floor' and the country would be in violation of the performance criteria set under the program. The program would be off track and IMF financing would, in principle, be stopped.

The paper is organized as follows. Section II provides a brief overview of the literature on reserve adequacy. Earlier major contributions to the literature are highlighted, followed by a description of newly proposed "rules of thumb" for reserve adequacy in the aftermath of the Asian crisis. In section III we present our own proposed reserve adequacy benchmark, and provide data on how these relate to the actual reserve positions of emerging markets. The costs of holding reserves are also treated in this section. This is followed by conclusions in section IV.

II. A Brief Review of the Literature on Reserve Adequacy

Three developments stand out in the reserve adequacy literature of the last fifty years. First, the focus on money based measures of adequacy – which were prevalent prior to World War II - has largely disappeared, with the exception of that used in the context of currency board arrangements. Second, reserve adequacy of individual countries, in the post-World War II period, has come to be almost entirely defined in terms of trade and trade variability. Third, research has highlighted the importance of different levels of development (and market access) between countries, and different types of exchange rate regimes, in explaining different levels of demand for reserves. Studies singling out the role of capital account vulnerability in explaining reserve demand have been largely absent.

II.1 The shift to trade related measures of adequacy

The importance of reserves for mitigating external vulnerability gained increasing attention after World War II, under the influence of the Great Depression and the writings of Keynes. This was reflected in the Keynes plan for an international clearing union where the bancor quotas – the proposed main source of liquidity – would be related to the value of trade. The importance of external vulnerability was also recognized in the quota formulas in the IMF Articles (which won out over Keynes' bancor proposals), where export variability was one of the five variables used to calculate each member's ability to contribute, voting rights, and entitlement to IMF resources. Triffin (1947) went further and argued that the demand for reserves should normally be expected to grow in line with trade – i.e. in a linear fashion - so that the reserves/imports ratio could be taken as a measure of reserve adequacy[6].

The IMF was first asked in 1953, by the United Nations, to conduct a study on the adequacy of reserves.[7] The IMF staff argued that adequacy was not a simple matter of an arithmetical relationship. Rather, it was related to the efficiency of the international credit

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[6] See Williamson (1973), who provides an extensive survey of the post-war literature on international liquidity. See also De Beaufort Wijnholds (1977).

[7] See IMF (1953).

system, the realism of the existing pattern of exchange rates, the appropriateness of monetary and fiscal policies, policy objectives and the stage of development of countries.[8] Much of that holds true today. A somewhat less qualified approach was followed five years later (IMF, 1958) with the staff stating that "Foreign trade is the largest item in the balance of payments. It is therefore *natural* that in the first place reserves should be compared with a country's trade figures." The 1958 study substantiated this with the observation that an analysis of the data showed that countries in general appeared to achieve annual reserve/import ratios of between 30 and 50 percent. This was qualified by saying that such a ratio could, at best, only give a preliminary indication of adequacy. Triffin (1960) criticized this minimum benchmark, as 30 percent (i.e. 4 months of import cover) would be too low given the economic circumstances of countries around or below those levels. In his view, a 35 percent reserves/import ratio was a minimum.

Heller (1966) was the first to analyze the needed level of reserves in terms of a rational optimizing decision. The optimal reserve level was defined at that point where marginal utility equals marginal cost. He highlighted the precautionary motive for holding reserves, with the benefit of holding reserves stemming from the ability to smooth consumption and production in case of a balance of payment deficit. Importantly, however, he also included an analysis of the opportunity cost for holding the reserve buffer. It was assumed that the rate of return on reserves had to be compared with the social return on capital. This was proxied by a rough average of long-term government bond yields of a range of countries (estimated at around 5 percent). In Heller's model, the demand for reserves was thus determined by the cost of adjusting to the external imbalance, the opportunity cost of holding reserves, and the probability that a need for reserves of a given magnitude would arise. [9] Heller argued that his approach led to a more reliable and consistent index of reserve adequacy then some simple reserve/import ratio.

Subsequent studies, like Heller, went beyond the earlier casual empiricism of finding simple reserve/import ratios, and generally focused on four main variables affecting the demand for reserves: external payments variability, the marginal propensity to import, a scale variable such as output or imports, and opportunity cost.

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[8] In 1953, Fund staff defined adequacy in terms of different degrees of exchange restrictions that a country would be required to introduce. It was also noted that the prevalent opinion of the international business community itself is a factor in determining the 'real' adequacy of reserves. In other words, the reserves of country are not adequate until the public thinks that they are adequate. This seems to have very much driven the size of the financial packages to some of the emerging market countries in recent years.

[9] Estimated as the mean absolute first difference of historical trend-adjusted annual reserves, and presumed independent of reserves. Later work by, among others, Frenkel and Jovanovic (1981) linked the probability of reserve depletion explicitly to the level of reserves.

The variability measure was generally uncontested, it being assumed that the demand for reserves was positively associated with the fluctuations in the balance of payments. Different measures have been used to measure variability –with variability being defined either in terms of reserves or export receipts -but in essence there have been no major disagreements.[10] Empirically, the variability variable also held up.

More debated on theoretical grounds was the rationale to use the marginal propensity to import (usually proxied by the *average* imports as a share of GDP) in the reserve demand function. On theoretical grounds it was unclear whether the propensity to import should have a positive or negative effect. In a Keynesian model, reserves are built up by a contraction in imports; thus a negative relationship would be expected (e.g. Heller, 1966). To the extent, however, that a high import/GDP ratio reflected openness, and thus more vulnerability, a positive relationship could be expected (Cooper (1968), Iyoha (1976)). Frenkel (1978) developed a model which allowed for expenditure switching rather than expenditure reduction which, also empirically, yielded significant results . More openness was associated with a higher demand for reserves.

The main question surrounding the scale variable was whether economies of scale were present. The key point here is that reserves do not finance flows but payments imbalances. Whether or not reserves thus grow with world trade hinges entirely on whether imbalances in payments can be expected to grow in proportion to international transactions. Implicitly, this is the assumption behind using a reserve/import ratio for reserve adequacy. Polak (1970) noted that the evidence was mixed, but that the ratio of the rates of growth of payments fluctuations to trade is unlikely to be below unity ('or say, 0.8'). Other studies, e.g. Oliviera (1971) and Officer (1976) argue that the elasticity of reserves with respect to imports is significantly below unity.

Probably the most difficult challenge has been finding an adequate measure of opportunity cost that can withstand empirical scrutiny. Alternative measures proposed have included per capita income (presumably capital is scarcer in developing countries and therefore the opportunity cost higher), net foreign indebtedness (another measure of capital scarcity), the government bond yield, and the spread between the government bond yield and short term interest rates (to reflect the fact that reserves also generate investment income). Despite these efforts, the various proxies that had been tried for opportunity cost had, as Williamson put it in 1973, met with a uniform lack of success. One explanation for the lack

[10] Several methods have been used to estimate this variable such as the mean absolute first difference of the trend-adjusted par values of reserves; the standard deviation of these values, the variance or standard deviation of the residuals obtained from estimating a first-order autoregressive process for the change in reserves.

of explanatory value of opportunity cost variables could be that central banks are extremely risk-averse regarding reserve shortfalls (Grimes, 1993).[11]

In addition to the four main variables discussed above, mention should be made of two main other findings in the reserve adequacy literature that are pertinent to what follows. First, reserve demand was found to be influenced by the type of exchange regime. After the breakdown of the Bretton Woods system, attention focused on assessing the demand for reserves of the move to more flexible exchange rate regimes. Heller and Khan (1978) found that for industrial countries there had indeed been a downward shift in reserves – even if the shift had not been very significant-, but for non-oil developing countries the demand for reserves seemed to have increased. The latter seemed to reflect the fact that these countries retained pegged regimes even after the collapse of Bretton Woods. To the extent that countries were floating, the float was anything but free and overall uncertainty and payments variability had increased. Frenkel (1983) later found further evidence that the move to floating had reduced the demand for reserves, although the effect for developed/industrial countries had been more pronounced than for developing countries.

Second, studies generally found that the behavior of developing countries differed significantly from that of industrial countries, with external variability being a more important factor of reserve demand for the former. Lizondo and Mathieson (1987) found that the debt crisis of the early 1980's had produced a similar structural break in the demand for reserves as the collapse of the Bretton Woods system. The sensitivity to payment imbalances and openness had increased for developing countries, but it had declined for industrial countries. They hypothesized that this reflected the relative degree of market access for the two groups. Related to this, but more generally, several studies (Heller and Khan (1978), Eichengreen and Frankel (1996)) postulated that there can be no presumption that the advent of capital mobility either raises or lowers the demand for reserves. On the one hand, capital mobility allows countries to finance at least a portion of external deficits by borrowing abroad. On the other hand, it assumes that capital mobility is not a source of vulnerability in its own right. A high degree of capital mobility could, for instance, increase exchange rate variability.

While there exists a rich literature on reserve adequacy, most of it dates from before the 1980's. Interest in the subject waned as much of the industrial world moved to floating exchange rates and the level of reserves became largely demand determined for countries with easy access to the vastly expanded international financial markets. Moreover, the emergence of a multiple reserve currency system removed the Triffin dilemma.[12]

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[11] The IMF in 1953 had noted that "in a world in which uncertainty is a major factor (...), reserves must be considerably larger than would be indicated by any reasonable evaluation of the probabilities of actual use".

[12] See Eichengreen and Frankel (1996). They note that if dollar, yen or deutsche mark liabilities ever become so great in relation to gold or other international reserves held by the issuing country (or the

(continued)

Not only is much of the literature on reserves dated, it is also clear that many of the often ingenious theoretical contributions in the field of assessing reserve adequacy suffer from a lack of operational value. That is, they have not provided much guidance on what level of reserves would be adequate for an individual country. This has made them of limited use for actual assessments of reserve adequacy. Hence, the IMF has continued to rely quite heavily on the imperfect, yet readily available, ratio of reserves to imports, although more recently this has been complemented with so-called vulnerability indicators in the country reports that are presented to the IMF Executive Board (IMF, 2000). Appendix I shows the development of the reserves/import ratio over the last 25 years for emerging market countries. The crude rule of thumb that reserves have to equal at least three months of imports has lost much of its relevance as openness and external vulnerability are no longer merely defined in terms of trade shocks. Its significance is nowadays mainly limited to countries at an early stage of development that have no significant access to international financial markets.

II.2 New reserve adequacy measures – post Asia crisis

One of the lessons that has been drawn from the Asian financial crisis is that countries' vulnerability to the withdrawal of capital could have been reduced by better management of their asset and liability position. In other words, better reserves and debt management. These developments have stimulated a renewed interest in the question of reserve adequacy, especially for emerging market countries.

It is increasingly recognized that it is necessary to take into account the vastly increased importance of capital flows for emerging market economies, and to relate the size of reserves to a country's short term external debt (Greenspan, 1999). This ratio appears to be the most relevant single indicator of reserves for countries that borrow in international financial markets. Building on Sachs, Tornell and Velasco (1996) and using variables from the Early Warning System model developed by the IMF staff, Bussière and Mulder (1999) conclude that higher liquidity can significantly decrease countries' vulnerability to external shocks in the face of weak domestic fundamentals. Their research suggests full coverage of total short-term external debt as a practical rule for reserve adequacy for individual countries. There is a proviso, however, that the real exchange rate should not be seriously overvalued and that the current account deficit is modest. Deviations would call for higher reserve levels.

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exports, GDP, or net international investment position) as to bring their value into question, central banks could simply switch to the currencies of new rising countries in which they have confidence. Moreover, capital mobility now increasingly allows central banks (of creditworthy countries) to obtain reserves from private markets, not just other central banks, while increased exchange rate flexibility, as an instrument of adjustment, supplements balance of payments financing. As such the so-called Triffin dilemma no longer exists.

Feldstein (1999), who observes that judging reserve adequacy in terms of imports ".... ignores the fact that currency crises are about capital flows, not trade financing ...", also supports the notion that large reserves reduce countries' vulnerability to financial crises and increase confidence in their currencies. He adds, however, that when currencies are overvalued, protection through reserves requires much larger reserves than have been traditionally held by emerging market countries. Fischer (1999) points out that countries holding very large reserves have coped better with the financial crises of recent years than others. He also expects that a lesson that countries will draw from these crises is that they should hold much larger reserves than before, and cites the case of Korea where a rapid build up of reserves can be observed.

Two concrete proposals for minimum benchmarks for reserve adequacy have been put forward, which could serve as new rules of thumb.

First, 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.[13] This implies, at a minimum, that foreign exchange reserves should exceed scheduled external amortization for one year.

The second proposal, put forward by Alan Greenspan, Chairman of the Federal Reserve Board of the United States, is to complement the "Guidotti-rule" with two enhancements. 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.[14] The second enhancement is to have a "liquidity-at-risk" standard. Under this standard, a country's external liquidity 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 one that provides a high probability that external liquidity will be sufficient to avoid new borrowing for one year (say 95 percent). This methodology is similar to the value-at-risk methodology used by commercial banks.

This shift in emphasis toward analysis of the need for reserves of emerging market countries in terms of the potential for capital outflows is apposite. In our view, however, the Guidotti/Greenspan suggestions could usefully be improved upon. First, their proposals seem

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[13] This suggestion was made by Guidotti at a seminar of the Group of 33 in Bonn in the spring of 1999. However, the notion of strengthening liquidity management, specifically developing a best-practice standard for maintaining reserves plus credit lines in some proportion to short-term external debt, was already discussed earlier by policymakers. To our knowledge, the first formal discussion on the topic was on December 7, 1997 (three days after the approval by the IMF Executive Board of the Stand-By Arrangement for Korea), at a meeting of Central Bank Governors at the Bank for International Settlements.

[14] See Greenspan (1999).

to focus entirely on an 'external drain' on a country's reserves, disregarding the fact that there is also usually an 'internal drain' (i.e. capital flight by residents). This is a factor that needs to be added. Secondly, the Greenspan proposal for a "liquidity-at-risk" approach could be simplified to make it operational. In the following analysis, leading to an estimate of what constitutes adequate reserves for 21 emerging market countries, we build upon the suggestions by Guidotti and Greenspan.

III. Adequate Reserves for Emerging Market Countries: A New Minimum Benchmark

The question whether emerging market countries should hold larger international reserves than hitherto is a complex one which requires making assumptions with regard to exchange rate policies, controls on capital flows and the magnitude of potential official financing packages. Dealing with these matters in a purely analytical approach would require a comprehensive model and an analysis of many variables. Looking at everything, however, is tantamount to looking at nothing. Rather than attempting to take that route we choose a less elaborate but fully quantifiable approach based on key reserve need indicators. These indicators are refined in order to capture better the specific circumstances of countries, such as their exchange rate regime and the degree of risk of capital flight. The exercise results in estimates of a range of adequate reserves for twenty-one emerging market countries. Finally, considerations of the costs of holding reserves are taken into account.

Several matters have to be clarified before we can proceed with the approach envisaged. First of all, we acknowledge that there is no single optimal exchange rate regime for emerging market countries, let alone for all countries. There is, however, strong evidence that pegged exchange rates have become much more risky in a world with mobile capital. Indeed, several emerging market countries have in recent years abandoned their pegs and adopted floating rates. While such a regime change reduces the need for holding reserves as such, care should be taken not to infer that floaters require few reserves. Apart from the need to maintain a certain level of reserves for strategic reasons (the age old 'war chest'), countries tend to manage the float of their exchange rate. There has hardly been a country in modern times that over an extended period has adhered to a fully free, or 'clean' float [15]. This even includes the United States which has intervened in the foreign exchange market from time to time despite the fact that it has no exchange rate objective. At the other end of the spectrum are a number of countries who adhere to a currency board regime. Hong Kong SAR is the prime example of an economy where various economic and political factors provide strong arguments for such an approach. We therefore distinguish three groups of countries when

[15] See De Beaufort Wijnholds (1974) for an early statement on this matter. The past twenty five years have only served to strengthen this point. Recently, Mussa, et.al. (2000) have explained that a freely floating exchange rate can be especially problematic for developing countries given the lack of depth of their foreign exchange markets.

assessing the adequacy of their reserves: those with independently floating exchange rates, those with managed floats or fixed rates, including pegs, bands and crawls, and those with a currency board. Note that this exchange rate categorization is *de jure*, i.e. it is the official classification reported to the IMF. This may not reflect the reality of exchange rate fluctuations. A number of Asian countries, for instance, were classified as floaters prior to the Asian crisis even though de facto they were pegged to the US dollar. Masson (2000) contains some references to studies which have grappled with the de jure versus de facto classification of exchange rates. In the official classification managed floats are subject to active intervention by monetary authorities whereas independently floating regimes are not. Appendix 2 provides an overview of the exchange rate classification for our sample economies in the 1990's.

While many emerging market economies have liberalized parts of their external financial relations in recent years, most retain a mixed system of restrictions and freedom as regards capital movements, as clearly described in Williamson and Mahar (1998) and IMF (1999b). Although the degree of control over capital transactions is relevant for assessing the need for reserves of a country, we assume that the differences among most emerging market countries on this score are not all that big[16]. Where such differences may be significant we point this out in qualitative terms (there are obvious difficulties of quantification as regards the overall degree of control over capital flows). It should also be emphasized that with the development of modern technology and new financial instruments, countries find it increasingly hard in the absence of a huge and dirigistic foreign exchange control apparatus to avoid capital flight during a crisis. In extreme cases of capital controls – where the exchange of currency is for instance prohibited – capital flight would likely still occur, but this would not necessarily show up in the reserves figures. We disregard such extreme cases in what follows. We also disregard the possibility of debt defaults or moratoria which would be another way of protecting reserves. We assume that neither capital controls, nor debt defaults, constitute a working assumption of central banks in deciding on reserve adequacy levels. We discuss below to what extent capital flight could have an effect on reserves, taking into account that some forms of capital flight (e.g. non-repatriation of capital, or underinvoicing of exports) need not affect the official reserves (other than that reserves would have been higher without the capital flight).

Another potentially major factor influencing reserve adequacy is the availability of official financial support. If a country can rely on ready access to credit from the International Monetary Fund and friendly central banks, it can feel justified in keeping relatively modest reserves. The same is true if countries can rely on contingent credit lines from the private sector. In practice, however, countries have been very reluctant to come to

[16] The IMF (1999b) has developed a capital control index illustrating the degree of restrictiveness for both developed and developing countries. While capital restrictions are still prevalent in many countries, they are decreasing. Moreover, as a group, emerging markets are relatively homogenous (reflecting the correlation between the level of development and the degree of control).

the IMF, partly because some perceive it as signaling a crisis; there is a political cost in asking for financial help and economic advice from an outside organization; and the conditionality associated with Fund programs, though necessary, is often politically painful. In other words, we do not believe in significant debtor moral hazard, nor do we believe that countries conduct reserve management policy taking into account possible IMF reserve supplements, which in any case have to be repaid.[17]

As for private contingent reserve supplements, the market for this seems rather thin. Only a few countries have negotiated such lines and there are questions as to their additionality (i.e. they may be at the cost of other credit to an economy because of offsetting transactions, dynamic hedging or country exposure limits of creditors).[18] Moreover, contingent credit lines with commercial banks were not renewed after Mexico's use of them in the fall of 1998. Banks seemed to awaken to the fact that the lines would be drawn, and bank exposure increased, precisely when they are seeking to reduce them. We assume that while emerging market countries could reduce somewhat their need for holding reserves through arrangements with the private sector, they will be reluctant to place a strong reliance on them even if they can obtain them. This appears to be different for an advanced capital-importing country like Canada, where relatively low reserves are supplemented by special arrangements and ready access to financial markets.[19]

III.1 A simple benchmark for reserve adequacy

In order to ascertain whether the reserve holdings of emerging market countries are broadly adequate in light of the considerable potential for capital outflows, we present a relatively simple benchmark for reserve adequacy for twenty-one countries. These countries are the largest emerging market countries that enjoy more or less uninterrupted access to international financial markets[20].

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[17] At the margin, the IMF – as a mutual insurance fund consisting of the pooled reserves of its membership – of course generates some moral hazard, akin to any other form of insurance.

[18] See IMF (1999a).

[19] Canada has private contingent credit lines with both domestic banks ($ 1 bln) and foreign banks ($ 6 bln). See the website of the Canadian Ministry of Finance, or the IMF's website (on the Special Data Dissemination Standard).

[20] Two of the countries included are nowadays categorized by the IMF as advanced economies (Korea, Hong Kong SAR). However, in view of their large appetite for foreign capital and their vulnerability to crises, we consider them to be still emerging market economies - though no longer developing economies, in which group all the other countries included in our exercise are categorized by the IMF.

For many of the emerging market countries gross international reserves have grown considerably in the 1990's, as can be ascertained from the charts in Appendix 12. There is, however, a distinct dip for most emerging market countries in 1997, reflecting the financial crisis in Asia and its subsequent spread to other countries. Reserves declined strongly in Brazil and Russia in 1998 when both countries came under speculative attack and had to abandon their fixed rate regime. Korea's reserves have shown a spectacular increase as it recovered from the 1997/98 crisis, reflecting the lesson mentioned by Fischer as well as the country's aversion to ever going through the experience of a sharp financial crisis again. China's rapid earlier reserve accumulation slowed down in recent years, but is still at a very high level in absolute terms as compared to other countries[21], while Hong Kong SAR's reserves have on balance declined slightly since 1997.

As a first step toward assessing reserve adequacy we look at three indicators (table 1). While we put no great store in the reserves to imports ratio, the first indicator, we do note the low coverage for Mexico, Russia and South Africa. It should be borne in mind that Mexico's important border trade with the United States probably contributes to a high import content of exports. Russia and South Africa are major gold producers and do not hold large amounts of foreign exchange reserves. Because of valuation problems as well as the diminishing role of monetary gold, we have excluded gold from our calculations of reserves. Emerging market countries tend to hold modest amounts of gold in their reserves[22].

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[21] China's reserves ($ 158 bln) at the end of 1999 were the second largest in the world after Japan ($ 287 bln). It is striking to see that very high reserves were also held by Hong Kong SAR ($ 96 bln) and Taiwan Province of China ($90 bln). Singapore has also accumulated very high reserves ($77 bln), especially viewed against the size of its economy.

[22] The largest holder of official gold among these countries end 1999 was Russia (13.3 million ounces, or roughly $ 3.6 billion at current market price), followed by China (12.7 million ounces) and India (11.5 million ounces). South Africa held only 3.9 million ounces of gold in its official reserves.

Table 1: Reserve Adequacy Indicators: Emerging Market Countries

(All data is for end-1999)

Independent Float	Reserves/Imports (weeks of imports)	Reserves/M2 (percentage)	Reserves/short-term external debt (percentage)
Brazil	35	21	83
Chile	50	43	200
Colombia	40	38	134
India	38	14	327
Indonesia	57	29	126
Korea	32	26	162
Mexico	11	25	119
Peru	56	51	131
Philippines	22	28	145
Poland	28	41	316
Russian Federation	11	23	70
South Africa	12	8	43
Thailand	43	25	206
(average)	*33*	*29*	*159*
Managed Float or Fixed Regime			
China	49	11	655
Czech Republic	23	37	225
Hungary	20	52	154
Malaysia	24	37	336
Turkey	30	35	93
Venezuela	43	68	235
(average)	*32*	*40*	*283*
Currency Boards			
Argentina	53	29	62
Hong Kong SAR	28	27	103
(average)	*41*	*28*	*82*

Source: All data is from the IMF's *International Financial Statistics* (line 1.l.d. for non-gold reserves, line 71..d for imports c.i.f., and the sum of line 34 and line 35 for broad money, or M2) 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 a fixed regime.

Turning to the second indicator, several studies related to the research on Early Warning Systems (EWS) that started to come to fruition after the Mexico crisis of 1995,

indicate that the ratio of reserves to broad money supply is a predictor of financial crises.[23] Thus with higher levels of R/M2 the probability of a crisis is reduced. Calvo (1996), for instance, argues that the ratio of reserves to the broad money supply is the appropriate standard for reserve adequacy for countries with a pegged exchange rate. Other studies that found R/M2 (either defined as a 'level' or 'the change in') to be a significant variable in predicting crises were: Esquivel and Larrain (1998), Kaminsky, Lizondo and Reinhart (1998), Frankel and Rose (1996), Sachs, Tornell and Velasco (1996).[24] Care should be taken in interpreting the EWS results. The models tend to produce many false crisis prediction signals, use very different techniques, and perform significantly better in-sample than out-sample (i.e. predicting a crisis that still has to happen). Nevertheless, M2 seems a natural measure for assessing the potential demand for foreign assets from domestic sources. It is also noteworthy to add that the EWS regressions show reserves themselves to be a reliable predictor of crises.

The data do indicate slightly higher ratios of reserves to M2 for countries with pegged exchange rates on average, consistent with the premise that their central banks attach more concern to possible internal demand for their reserves (see also appendix III for a more elaborate table with Reserves/M2 ratios). The low figures for China (and also India) probably reflect the dearth of alternative financial investment instruments in these countries and therefore a relatively large money supply. The two currency board cases do not show any unusual feature. For them full coverage of the monetary base is of course the immediate target. However, given the inflexibility of a currency board regime and the risk of loss of confidence when reserves are seen as dangerously low, a considerable surplus over base money coverage seems to be necessary (see also Rojas-Suárez and Weisbrod, 1995).

The third indicator, which we consider to be the most important one for emerging market economies, relates reserves to short term external debt (STED), defined as debt with a remaining maturity of less than one year. Again, several EWS studies that have specified R/STED have found low levels of this variable to lead to an increased probability of crisis (Bussiére and Mulder (1999), Rodrik and Velasco (1999), Berg, Borensztein, Milesi-Ferretti and Patillo (1999)). Examination of this indicator across countries in general shows the expected result, i.e. a (much) higher ratio of reserves to short term external debt for countries with managed floats or fixed regimes than for countries operating a more freely floating rate regime. The unweighted average for the independent floaters was 159 percent at the end of 1999, while it was almost double (283) for the managed floats and fixed regimes. Very comfortable reserve positions are indicated for China, India, Malaysia, Poland, the Czech Republic and Venezuela and Thailand. Among the floaters quite low levels of

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[23] For an overview of the EWS literature, see Kaminsky, Lizondo and Reinhart (1997), and Berg, Borensztein, Milesi-Ferretti and Pattillo (1999).

[24] It should be noted that other studies, such as Bussiére and Mulder (1999), did not find R/M2 to be significant (or having the correct sign).

reserves/STED can be seen for Russia, Brazil, Colombia and Indonesia, all of which had to abandon their peg in 1998/1999, and turned to the IMF. South Africa also has a very low ratio. For a number of years it pursued a policy of intervening in the forward exchange market for large amounts, enabling it to support its currency despite a lack of foreign exchange reserves. In this way it built up a large net open forward position, the bulk of which has since been paid down. Among the countries with a managed float or fixed exchange rate, only Turkey has a R/STED below 100 per cent. After long negotiations it reached agreement with the IMF in the latter part of 1999 for a standby credit of $4 billion, specifically intended to strengthen its gross reserves. Turkey's economic problems have since intensified significantly, however, and it had to abandon its crawling peg but this falls outside the time period analyzed in this paper. Among this group the ratio for Hungary is also substantially below the average. Finally, the figures for the two currency board cases prima facie look on the low side. As regards Hong Kong SAR, the fact that the short term external liabilities of the banking system partly reflect the purely interbank relationships of a financial center appears to explain its rather modest level of R/STED. For Argentina it should be noted that a significant part of its banking system is owned by foreign headquartered institutions which artificially inflates its debt figures, possibly quite substantially so. Argentina also has private contingent credit lines which could be taken into account.[25]

It is also useful to examine how the R/STED indicator of reserve adequacy has developed over the past years (see table 2, and also appendix IV which reproduces the table as a set of charts). What stands out is that for most countries with a low level of R/STED, a financial crisis ensued and that the affected countries turned to the IMF for financial support.

[25] Similarly, a range of other adjustments could be made to the reserves and debt figures in assessing the liquidity of the national balance sheet. For instance, for oil-exporting countries, such as Mexico and Venezuela, one can be relatively certain about a minimum level of foreign exchange income although such 'near-reserves' are still not as liquid as the foreign exchange reserves held by the central bank. Moreover, other current account flows could offset oil revenues. For these reasons the Fund does not add these near-reserves to official reserves. Nevertheless, it is worth noting that a country's assets are broader than just its foreign exchange reserves. On the liability side, one could decide that trade-related credits need to be deducted from STED as these have proven relatively stable in some recent crises (although not in the Korean crisis). Conversely, however, it would also seem appropriate to add derivatives exposure and domestically issued debt held by non-residents, as these are not covered by the BIS/IMF/OECD/World Bank debt statistics.

Table 2: Reserves as a Percentage of Short-Term External Debt (Residual Maturity)

	1991		1992		1993		1994		1995		1996		1997		1998		1999	
Independent Float																		
	Brazil	35	Brazil	85	Brazil	94									Brazil	92	Brazil	83
	Peru	118	Peru	128	Peru	190	Peru	283	Peru	184	Peru	161	Peru	156	Peru	128	Peru	131
	Philippines	84	Philippines	102	Philippines	147	Philippines	146	Philippines	106	Philippines	109	Philippines	53	Philippines	94	Philippines	145
	South Africa		South Africa	13	South Africa	16	South Africa	20	South Africa	27	South Africa	9	South Africa	32	South Africa	32	South Africa	43
	Venezuela	191	Venezuela	168														
																	Colombia	134
			India	103	India	175	India	233	India	194	India	232	India	265	India	312	India	327
															Indonesia	91	Indonesia	126
													Korea	31	Korea	131	Korea	162
							Mexico	15	Mexico	52	Mexico	58	Mexico	85	Mexico	99	Mexico	119
															Thailand	117	Thailand	206
																	Poland	316
					Russian Federation	60	Russian Fed.	21									Russian Fed.	70
																	Chile	200
Number of countries	5		6		6		6		5		5		6		9		13	
Average		107		100		114		120		113		114		104		122		159
Managed Float or Fixed																		
	Chile	198	Chile	172	Chile	171	Chile	184	Chile	172	Chile	179	Chile	153	Chile	176		
	Colombia	226	Colombia	201	Colombia	197	Colombia	140	Colombia	124	Colombia	137	Colombia	123	Colombia	110		
					Czech Republic	343	Czech Rep.	329	Czech Rep	327	Czech Rep.	242	Czech Rep.	168	Czech Rep.	161	Czech Rep.	225
	India	75																
	Indonesia	52	Indonesia	54	Indonesia	53	Indonesia	51	Indonesia	46	Indonesia	48	Indonesia	43				
	Korea	54	Korea	60	Korea	63	Korea	58	Korea	54	Korea	45						
	Mexico	69	Mexico	77	Mexico	78												
	Thailand	128	Thailand	123	Thailand	108	Thailand	90	Thailand	76	Thailand	76	Thailand	62				
	China	316	China	122	China	116	China	227	China	262	China	333	China	358	China	449	China	655
	Hungary	136	Hungary	180	Hungary	252	Hungary	189	Hungary	239	Hungary	165	Hungary	142	Hungary	121	Hungary	154
	Malaysia	314	Malaysia	379	Malaysia	304	Malaysia	338	Malaysia	246	Malaysia	206	Malaysia	124	Malaysia	266	Malaysia	336
	Poland	88	Poland	92	Poland	89	Poland	246	Poland	505	Poland	451	Poland	463	Poland	420		
	Turkey	62	Turkey	70	Turkey	49	Turkey	70	Turkey	103	Turkey	114	Turkey	88	Turkey	87	Turkey	93
					Venezuela	171	Venezuela	162	Venezuela	144	Venezuela	298	Venezuela	251	Venezuela	230	Venezuela	235
							Brazil	122	Brazil	128	Brazil	106	Brazil	89				
									Russian Fed.	65	Russian Fed.	42	Russian Fed.	39	Russian Fed.	44		
Number of countries	13		12		13		13		14		14		13		10		6	
Average		143		139		153		170		178		174		162		206		283
Currency Board																		
	Argentina	56	Argentina	66	Argentina	77	Argentina	64	Argentina	55	Argentina	59	Argentina	63	Argentina	63	Argentina	62
	Hong Kong	21	Hong Kong	24	Hong Kong	24	Hong Kong	23	Hong Kong	26	Hong Kong	34	Hong Kong	51	Hong Kong	84	Hong Kong	103
Number of countries	2		2		2		2		2		2		2		2		2	
Average		38		45		51		44		41		47		57		74		82

Source: exchange rate regimes classified according to the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER)- various

Note: We have categorized anything other than an 'independent float' or a currency board as a managed float or a fixed regime (including exchange rate regimes "adjusted to indicators", pegs, conventional pegs, crawling pegs, crawling bands, and regimes with "limited flexibility to single currency or cooperative arrangement"). Note also that Hong Kong SAR's currency board until 1998 was called a managed float, and Argentina's currency board a 'peg', but that since 1998 both are classified as a currency board. Also, in 1991 and 1992 the number of economies does not add up to 21 as the Russian Federation joined the Fund in 1992 and data does not start until 1993. There is no data for South Africa in 1991, and for the Russian Federation and the Czech Republic in 1991 and 1992.

Perhaps the most striking examples of how low levels of reserve adequacy, as indicated by low R/STED ratios, goes hand in hand with an external financial crisis are provided by the main actors in the Asian financial crises: Indonesia, Korea and Thailand, but also the Philippines and to a lesser extent Malaysia. In Indonesia an already unfavorable ratio declined further to a level of only 43 percent in 1997, whereas in Korea the decline was even sharper, falling to a level of only 31 per cent by the end of 1997. In Thailand, where the Asian crisis originated in the summer of 1997, a relatively comfortable level of R/STED was almost halved between 1993 and 1997. Had these developments been clearly highlighted before the Asian crisis, the IMF and other relevant parties would have been better forewarned about the impending problems, especially in Korea where they were least expected. What about Malaysia, which managed to avoid having to turn to the IMF? It clearly had a much better starting position than the three Asian countries most affected by the crisis. While Malaysia's short term external debt more than doubled between 1994 and 1997, as was the case in the three crisis countries, its relatively high level of reserves before the onset of the Asian crisis appears to have protected it from more serious damage. [26] In the meantime, all Asian countries shown in table 2 have experienced a sharp improvement in their R/STED ratios, led by Korea where a quadrupling took place in only one year. On average, the five most affected Asian countries saw their R/STED ratio rise by 132 percentage points since 1997.

Russia is another example where a strong decline in the R/STED indicator foreshadowed a serious collapse. With a relatively weak starting level of around 65 percent in 1995, the Russian coverage of short term external debt fell to a level of 40 percent in 1997. Given its continuing difficulties with capital flight, R/STED for Russia has remained dangerously low. In sharp contrast to this is the experience of China, which had absorbed into its reserves a significant share of the huge capital inflows it enjoyed during the early and middle 1990s. It succeeded in maintaining a stable exchange rate during the Asian financial crisis despite many calls for a devaluation of the yuan.

The evidence provided here strongly suggests that countries holding large international reserves, especially relative to their short term debt obligations in foreign currency, are much less prone to suffer from financial crises than those with relatively low reserves. The R/STED stands out as the most appropriate indicator of reserve adequacy for emerging market countries. For countries with floating exchange rates, a level of reserves that fully covers its foreign debt obligations with a maturity of up to a year, would seem to be a prudent minimum to aim for. [27] Although the one-year rule is perhaps somewhat arbitrary –

[26] To what extent its use of capital controls played a role is more difficult to assess.

[27] It is sometimes suggested to add the amount of the current account deficit to STED. This would, however, only seem necessary to the extent that the deficit exceeds net foreign direct investment. In quite a number of emerging market countries, such investment covers a large part or all of the current account deficit.

aside from the empirical support it receives in EWS regressions – it is conceptually similar to the stress-tests used by financial institutions to analyze exposure to large market movements. In view of the rather weak standing of a number of these countries in international financial markets, as reflected for instance by an unfavorable investment grade, they would seem well advised to aim for a more comfortable level of reserves than 100 percent of STED. For them there is a distinct risk that they could be cut off from the capital markets for more than a year. Moreover, they have to take into account the risk of capital flight by residents. Even if they are prepared to have the exchange rate take some of the strain, emerging market countries are generally not prepared to allow a free fall of their currency even for short periods. For countries that operate a currency peg of one kind or another, more stringent requirements are clearly in order. Defending the peg in the face of a financial crisis will require a larger buffer of foreign exchange than for countries practicing a free float.

This brings us to what we would consider a useful benchmark for the adequacy of reserves for the main emerging market countries. Starting from the minimum of full coverage of short term external debt, we add a rough estimate of the potential for capital outflow stemming from residents (Table 3). Residents will require domestic liquidity to enable them to purchase the foreign currency that allows capital flight. It is therefore logical to assume that a certain fraction of the broad domestic money supply provides an indication of the potential for capital flight. Obviously the risk that residents will wish to convert domestic into foreign liquidity in times of lack of confidence will be greater for countries with a currency peg than for floaters. However, since emerging market countries tend to practice (some degree of) managed floating, the central bank will also have to hold foreign exchange against the risk of some drain on the reserves in countries with a flexible exchange rate. How much of a country's broad money supply could be mobilized against reserves to finance capital flight is very difficult to ascertain (See appendix V). De Gregoria et.al. (1999) argue that "if residents are inclined to flee in response to developing financial difficulties, the whole of the money supply (M1 or even wider aggregates) has to be covered by foreign reserves to prevent the collapse of the exchange rate regime and the financial system". However, in our view this is too extreme. It is hard to see how in a relatively short span of time the entire money supply could be mobilized against reserves. Moreover, with rising marginal costs of reserves, optimal reserve levels would presumably not need to cover the entire money supply.

We have assumed that for countries with a managed float or fixed regime the fraction of domestic money to be covered by reserves could be between 10 and 20 percent of M2 (we use M2 since there are standardized IMF data for this magnitude). In some cases these fractions may be too low, but we wish to avoid presenting figures that would clearly go beyond a minimum level of adequacy for most of the countries examined. For countries with independently floating exchange rates we assume that no more than between 5 and 10 percent of M2 would be mobilized against reserves in a relatively short time span. For countries operating a currency board we assume the same, in view of the confidence that one could normally expect to stem from the operation of a solid currency board. Appendix V provides a rationale for these chosen fractions. For instance the standard deviation of the

Reserves/M2 ratio over the last ten years falls within the 5-10 percent range for 10 out of 13 countries with independently floating exchange rates in 1999 (while two out of the three remaining countries with a higher standard deviation –Columbia and Poland – had a fixed regime or managed float all through the1990's until 1999). For countries with a fixed exchange rate, a third of the countries have a standard deviation of the Reserves/M2 ratio that falls within the 10-20 percent range. The average standard deviation for this group of countries is slightly higher than for the independent floaters and would be equal to the lower end of the 10-20 percent M2 fraction. The upper end is equal to twice the average standard deviation. We do not want to exaggerate the degree of precision of the M2 fraction that is chosen. Nevertheless, conceptually it makes sense to take a somewhat smaller fraction for more freely floating exchange rates than for more fixed rates.

The third element of the benchmark – complementing the external drain of non-rolled over short term external debt and the internal drain of capital flight – is to recognize that not all emerging market countries are equally susceptible to the risk of capital flight. Countries with good economic, financial and political fundamentals obviously run a smaller risk of residents 'voting with their money', than countries where the potential for instability is large. In order to incorporate this element, we adjust the fraction of M2 (between 10 and 20 percent for managed floats and fixed regimes and between 5 and 10 percent for floaters) for an index of country risk (column 3 in Table 3). For this we use *The Economist*'s country risk index (1999), which takes into account 77 different indicators ranging from monetary and fiscal policy to political stability.[28] The index is expressed in a scale of 0-100, with Russia seen as the riskiest country among the countries included in our table in 1999, and Chile as the least risky. One could of course also use another country risk index or rating system. The point is to augment/adjust any general reserve benchmark to country-specific circumstances. The adjustment factor thus obtained (i.e. the fraction of broad money multiplied by the country risk index) is added to the amount of STED from column 1, which produces our estimates in the range of adequate reserves for emerging market countries (column d). These are then compared to the actual level of reserves (column e).

[28] The index also incorporates a short-term debt measure and the level of reserves/M2, leading to some endogeneity. Given the multitude of other variables, however, this effect should be negligible.

Table 3: Estimated Adequate and Actual Reserves (end-1999, billions of US dollars)

	STED	Fraction of M2*	Country Risk Index	Adequate Reserves a+(bxc)	Actual Reserves
Independent Float					
	a	b	c	d	e
Brazil	41.9	8.4-16.8	0.66	47.4-53.0	34.8
Chile	7.2	1.7-3.3	0.31	7.7-8.2	14.4
Colombia	5.7	1.0-2.1	0.53	6.3-6.8	7.6
India	10.0	11.7-23.4	0.42	14.9-19.8	32.7
Indonesia	21.0	4.5-9.0	0.71	24.2-27.4	26.4
Korea	45.8	14.5-28.9	0.36	51.0-56.2	74.0
Mexico	26.7	6.3-12.6	0.51	29.9-33.1	31.8
Peru	6.7	0.9-1.7	0.52	7.1-7.5	8.7
Philippines	9.1	2.4-4.7	0.40	10.0-11.0	13.2
Poland	7.8	3.2-6.4	0.35	8.9-10.0	24.5
Russian Federation	12.1	1.8-3.6	0.78	13.5-15.0	8.5
South Africa	14.6	3.8-7.6	0.52	16.6-18.6	6.4
Thailand	16.5	6.7-13.4	0.40	19.2-21.9	34.1
Managed Float or Fixed Regime					
China	24.1	146.2-292.4	0.43	86.9-149.8	157.7
Czech Republic	5.7	3.5-6.9	0.36	6.9-8.2	12.8
Hungary	7.1	2.1-4.2	0.43	8.0-8.9	11.0
Malaysia	9.1	8.3-16.7	0.36	12.1-15.1	30.6
Turkey	25.0	6.7-13.4	0.62	29.1-33.3	23.3
Venezuela	5.2	1.8-3.6	0.54	6.2-7.2	12.3
Currency Boards					
Argentina	42.6	4.5-8.9	0.55	45.0-47.5	26.3
Hong Kong SAR	93.9	17.7-35.5	0.33	99.7-105.5	96.2

* For countries with independent floats or currency boards: 5 to 10 percent of M2; for countries with managed floats or fixed regimes: 10 to 20 percent of M2.
Sources: Same as for Table 1, plus the Economist Intelligence Unit for the country risk index.

We are aware that the estimates of reserve need provided here may be subject to challenges on several grounds. Indeed, such estimates should be seen as indicating a rough order of magnitude. Nevertheless, an exercise such as this appears useful since mere qualitative expressions such as 'reserves are too small', or 'more than adequate', are too vague for policy purposes. No doubt further useful refinements could be made to the calculations, but this would require quite specific country knowledge. National authorities would be best placed to undertake such an exercise. We do feel that the approach followed here could be a useful starting position for countries to examine the adequacy of their reserve positions. In case they have arranged contingent credit lines with the private sector, and are

confident that these can be fully relied upon in an emergency, these should be taken into account. We are aware of only quite limited credit lines of this nature for emerging market countries at present. In fact Mexico no longer relies on this instrument after using it in the fall of 1998. Mexico did announce a package of new contingent funding in 1999, which undoubtedly provides it with considerable comfort on top of its reserves, which at the end of 1999 was only just inside the minimum adequacy range.

Our benchmark range for adequate reserves deviates substantially from actual reserve levels in a number of cases. Among the countries with managed floats or fixed regimes only in Turkey did reserves fall short of calculated adequate reserves. As mentioned, it turned to the IMF in 1999 to borrow reserves. As regards independently floating economies, the largest shortfalls are found in the case of Russia, South Africa and Brazil. The picture is modified somewhat when monetary gold is included.

Our benchmark estimates, which do not err on the side of caution partly in view of the costs of holding reserves (discussed in the next subsection), also show a few cases where reserves appear to be quite to very comfortable. This is the case for Malaysia and Poland, where actual reserves were more than double the estimated midpoint of the adequacy range as well as for Chile, India, Korea, Thailand and Venezuela. In view of China's still elaborate capital controls, the adjustment factor (10 to 20 percent of M2) may be on the high side. Even so actual reserves exceeded the upper band of the adequacy range. On the other hand, the M2 range of 5 to 10 percent could well be on the low side for Russia where capital flight has been a continuous headache since the breakdown of the Soviet Union. Russia's M2 converted into dollars is quite small following the sharp devaluation of the ruble in August 1998. There may well be scope for more capital outflows via the liquidation of other assets or other more obscure channels, as recent history seems to suggest.

Reserve levels for Indonesia and Mexico fall just within the adequacy range. Argentina, operating a currency board since 1991, while covering base money with its reserves, falls short of the Guidotti rule, i.e. full coverage of its short term external debt. However, Argentina established a contingent credit line of $ 6.1 bln with commercial banks in late 1996 which has been rolled over but not used so far. It makes sense to take into account this line when evaluating Argentina's reserve position (and, as noted, its debt figures may be artificially inflated). Finally, Hong Kong SAR where a currency board has been place since 1983, holds reserves somewhat smaller than our estimate of an adequate level. However, the short-term external debt average requirement seems to be too severe in cases where a large part of it constitutes interbank positions in a financial center.

In 2000 the reserve situation of the countries analyzed was little changed, with a few exceptions (not shown in table). Korea continued with its rapid build-up of reserves, increasing them from $ 74 to $ 96 bln, while both China and Hong Kong SAR increased their reserves by an also substantial $ 10 bln, to $ 168 bln and $ 107 bln respectively. More spectacular, however, is the tripling of reserves in Russia to roughly $ 24 bln. Russia seems to have benefited substantially from the higher world oil prices, although Venezuela's

reserves -another oil exporter- are virtually unchanged. Turkey and Argentina, which at the time of writing were experiencing market turbulence, also managed to roughly maintain reserve levels at their end-1999 levels, with only a minor decline. Noteworthy, however, is the increase in short-term debt in both Turkey and Argentina in 2000, rising by roughly $ 7 bln and $ 5 bln respectively.

III.2 The costs of holding reserves

Most emerging market economies borrow on international financial markets on a regular basis, bringing in foreign exchange to the country either through loans taken up by the government or the private sector, including interbank financing. Borrowing costs differ widely, however, depending on the creditworthiness of the debtor as well as the type and maturity of the loan. Reserves are of course invested by the central banks managing them. Although yields will vary according to the type of investment, the range of outcomes will tend to be much narrower across countries than in the case of borrowing, since central banks tend to stick to assets with a high degree of liquidity. This is necessary in order to ensure that intervention demands can be met at short notice and without suffering major losses due to, for instance, an intervening decline in bond rates. This implies that the net costs of obtaining reserves for emerging market countries is mainly due to the difference in borrowing costs.

The external debt profile of emerging market countries shows considerable differences. While some countries, have been able to place large amounts of international bonds, others have relied more on loans from foreign banks. The large Latin American countries have been users of both instruments. Some countries have matched increases in their reserves with short-term external borrowing. This is the cheapest way of obtaining foreign exchange, and in the absence of a high country risk premium, the net cost of holding reserves could be quite modest. However, as emphasized earlier, in times of crisis rollover problems can occur. Hence, a broader spectrum of external borrowing will make countries less vulnerable with respect to rollovers. Nevertheless, a degree of short-term external borrowing can be an acceptable means of strengthening reserves, if indeed the proceeds are held as reserves by the central bank.[29] Take, for instance a country with reserves of $5 billion and an external short-term debt of $10 billion. The coverage is only 50 percent. If the country decides to borrow an additional $5 billion of short-term funds, and invests all of it as liquid reserves, it will increase its cover ratio to 67 percent. Assuming a margin of 100 basis points in net borrowing costs, the total annual cost to the country of holding reserves of $10 billion will be only $100 million. If, however, the country decides that it does not want to be vulnerable to a sudden cessation of further short-term borrowing, and it succeeds in borrowing the required $5 billion in bond markets, its cost will be considerably higher.

[29] Kletzer and Mody (2000) take a more negative view, stating that "..short-term public borrowing to accumulate foreign reserves is at best costless and useless."

Typically an emerging market country with an average credit rating has to pay around 300 to 400 basis points above the interbank rate. Thus the insurance against a sudden withdrawal of capital would add some $200 to 300 million a year to the budgetary outlays of the country in our example. Whether such an insurance premium is excessive is difficult to judge. It very much depends on the probability of a financial crisis and the macro-economic cost (and from the point of view of the sitting government, the political cost) of having to take abrupt adjustment measures. Typically countries use a blend of borrowing instruments, reflecting trade-offs of this nature. Obviously for countries with low creditworthiness, the cost of borrowing in bond markets can be very high, if they can obtain such funds at all. Examples are Russia and Turkey before the summer of 1998, that had to pay spreads of between 400-700 basis points (yield spread measured as the difference between the bond yield at issue and the prevailing yield for industrial country government bonds in the same currency and of comparable maturity). Countries like Korea can, however, presently obtain bond financing at around 200 basis points above the interest rate on US Treasury bonds. Syndicated bank loans, once the dominant form of international financing, tend to be less expensive, but harder to obtain for emerging market countries since the Asian crisis. Bonds with shorter maturities or notes can also be an attractive and relatively inexpensive vehicle for these countries. The main point here is that it is not accurate to generalize, as some authors do, that borrowing to strengthen reserves is quite costly for emerging market countries, assuming that such borrowing is all done in long-term bond markets. Feldstein (1999), for instance, calculates that if Mexico borrows an additional $30 billion in order to double its reserves, the cost would be $1.8 billion or half of one percent of its GDP per year. Assuming borrowing in accordance with Mexico's external debt profile, where bank loans (a portion of which has a short maturity) outstrip bond borrowing, the cost would be considerably lower.[30]

One way to mitigate the cost of borrowing to build up reserves is to invest the proceeds in higher-yielding assets. In fact, over the last decade or so, central banks have increased the range of assets in which they invest their reserves in order to obtain a higher return. There are limits to this development, however, as reserves by their nature have to be sufficiently liquid to serve their purpose. Reserves should not be confused with government investment accounts. [31] There may also be legal limitations with respect to the types of asset in which a central bank can invest its reserves. Feldstein (1999), however, suggests that emerging market countries should invest part of their reserves in equity. This is unsound

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[30] For reserve accumulation resulting from attempts to sterilize capital inflows, the cost for Latin American countries for the post-1985 period have been estimated at between ¼ and ½ percent of GDP (see Khan and Reinhart, 1994). A similar result was obtained by Kletzer and Spiegel (1998) for Pacific Basin countries.

[31] In several countries where governments have accumulated very large holdings of foreign exchange, these are usually not held as part of the official reserves, but are placed in special government funds which invest in higher yielding non-liquid assets. Well-known examples are the Kuwait Investment Authority, and Norway's State Petroleum Fund.

advice. While yields will tend to go up, so will volatility. Reserves need to be liquid in a broad sense, i.e., not only must it be possible to liquidate reserve assets readily (and this would be true for blue chip stocks), but the holder must also be able to rely on its value. The second requirement is not met with respect to stocks (or long-term bonds). Indeed, according to the IMF's definition of reserve assets, these should be liquid and marketable. 'Marketable' assets refer to those that can be bought, sold and liquidated with minimum cost and time and for which there are willing sellers and buyers (IMF, 1999). To our knowledge central banks have refrained from investing in equity; they are not investment agencies and should not take the degree of risk that goes with investment in the stock market.

Returning to the question whether holding larger reserves under conditions of increased capital mobility is optimal for emerging market countries, we consider the following. The 'insurance premium' to be paid for better protection against the shocks of financial crises equals the net borrowing costs, as measured by the average gross borrowing cost and the yield obtained on reserve assets. The policymakers of emerging market countries have to make conscious judgments on the trade off involved. It is our impression that the minimum estimates of adequate reserves presented in the previous section will generally prove to be acceptable in terms of the costs involved to the twenty-one countries included in our sample. In other words, the countries for which inadequate reserves are indicated should—preferably gradually—borrow prudently to strengthen their reserves, either from the markets or temporarily from the IMF. The cost of 'regular' borrowing from the Fund is considerably lower than turning to the market, [32] but IMF financing is of course meant to be temporary and subject to policy conditionality.

A final consideration that we have is that whereas holding inadequate reserves can leave a country dangerously exposed to shocks, an excessive build up of reserves is also to be avoided. Holding very large amounts of reserves, even if financed at relatively attractive terms, can be a considerable drain of a country's budget. Moreover, and probably more importantly, a very high degree of reserve ease can affect countries' willingness to adjust to changing circumstances (see Rojas-Suárez and Weisbrod, 1995, and Polak, 1970). Huge reserves can effectively remove the external constraint as regards countries' policy choices, which may lead to laxity in macroeconomic policies, or the prolonged defense of overvalued exchange rates. Such policy mistakes can turn out to be quite costly in the long run. The question arises whether some countries, in the aftermath of the negative experience of the Asian crisis, now seek to build up reserves beyond what could be considered ample.

[32] The charges under the Fund's regular stand-by credits are presently a little over 5 percent. For countries using the Supplemental Reserve Facility, between 300 and 500 basis points are added.

IV. Conclusions

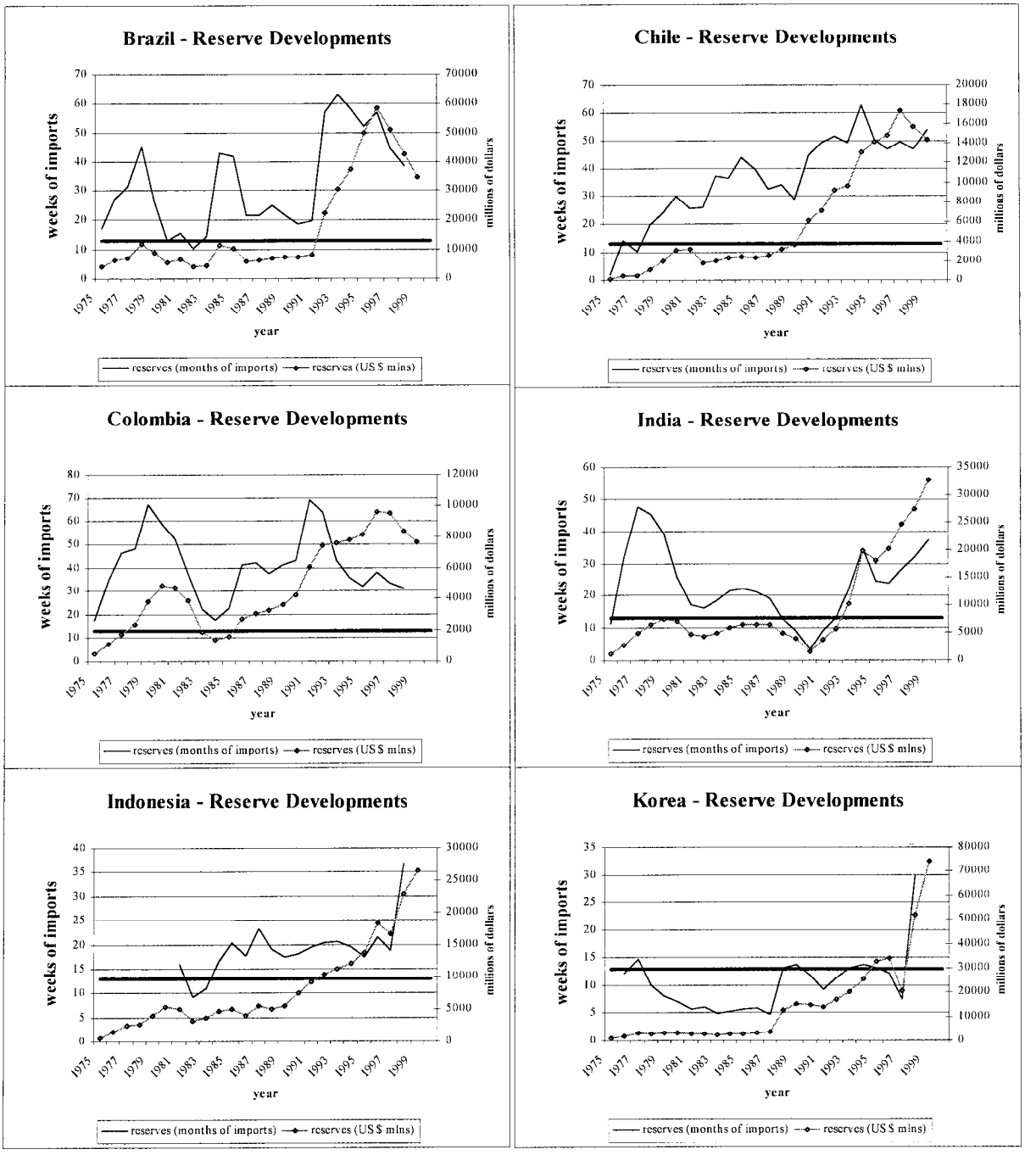
The severe international financial crises witnessed since the mid 1990s have generated a debate on the so-called global financial architecture, focusing on both crisis prevention and crisis resolution. As concerns crisis prevention, many proposals have been put forward and quite a few are being developed or implemented under the aegis of the IMF. These include greater transparency and improved data collection, codes of conduct for fiscal and monetary policy, strengthened surveillance of member countries' performance and policies and the creation of a new facility, the CCL, which has not been used so far. What has been underplayed in the prevention debate is the role of holding adequate reserves in crisis-prone countries. It is striking to observe that emerging market countries that held relatively large reserves withstood the recent financial crises considerably better than those with only modest reserves. This lesson seems to have been learned in that many emerging market countries have been strengthening their reserves in the aftermath of the Asian and the Russian financial crises.

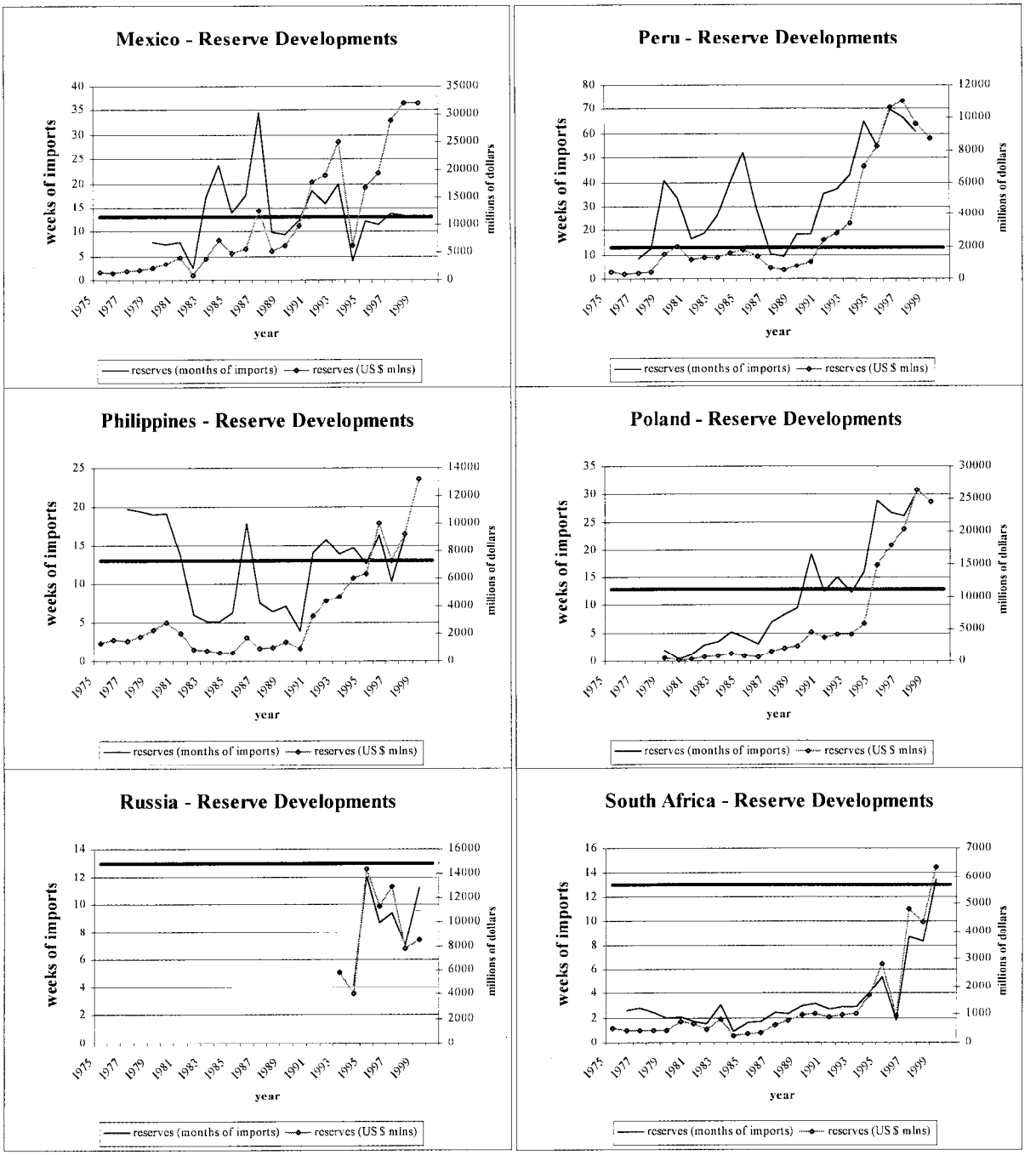
It is one thing to state that higher reserves offer better protection against contagion and crises, but quite another to indicate with some precision what levels can be considered adequate but not excessive. The traditional adequacy measure, expressed in terms of months of imports, has lost most of its relevance, particularly for emerging market countries that generally rely on private capital inflows to balance their external accounts. We propose an alternative, relatively simple and operational benchmark for reserve adequacy, building on the approach which relates the level of reserves to the size of short-term external debt (STED). While we consider it necessary for countries to hold reserves that fully cover STED, we believe that such a level would still provide insufficient protection in a confidence crisis. In addition to the external drain on foreign exchange reserves that results from the non-rollover of STED, there tends to be an internal drain on account of capital flight by residents. This second element can be captured by assuming that a fraction of broad money can flow out in a relatively short period. We distinguish in this regard between countries with floating exchange rates and those with fixed regimes, including crawling pegs and bands. The fraction of broad money that could readily flow out is assumed to be considerably higher for countries with a fixed rate regime than for floaters whose exchange rate movements will absorb part of the effect of the outflow.

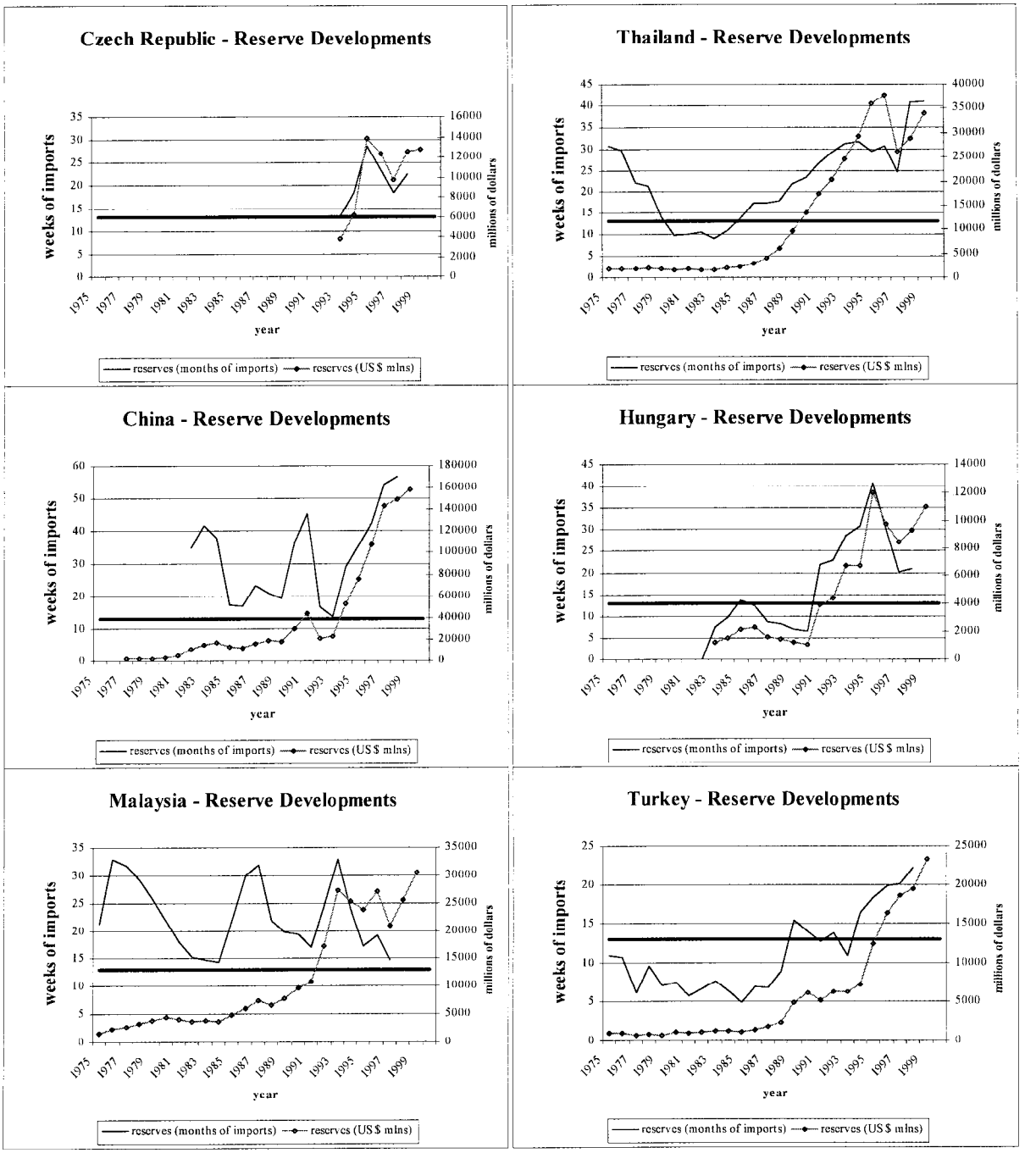
In a further refinement, especially to allow for better cross country comparisons, we adjust the fraction of broad money susceptible to quasi-immediate outflow with a country risk factor. Clearly the risk of capital flight by residents is closely related to the riskiness with which the country is perceived. Hence, for countries – such as Russia – with high financial and political risk the capital flight component of the reserve adequacy benchmark is commensurately higher than for a low risk country such as Chile. In order to avoid the suggestion of precision, we express the minimum benchmark for reserves in terms of a range. Calculations are presented for twenty-one of the larger emerging market countries.

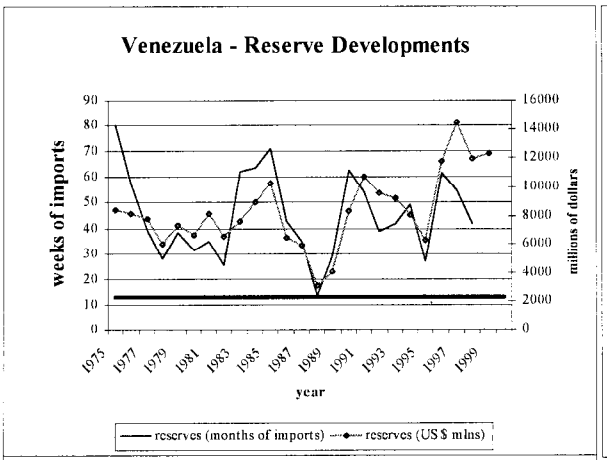
While there is a strong case for accumulating adequate reserves in emerging market countries, one should not overlook the costs involved. For countries having access to international financial markets the costs consist of the difference between the interest paid on external borrowing and the yield obtained on the investment of the proceeds. We argue that it is not necessary to accumulate reserves only through borrowing on bond markets that generally carries the highest cost, but that syndicated bank loans and in some cases also limited amounts of short-term borrowing can also be part of countries' borrowing strategies. For those emerging market countries where reserves fall short of the estimated minimum benchmark range, we believe that the cost of reaching an adequate level is reasonable. It can be viewed as an insurance premium to provide a degree of protection against financial crises. It is also emphasized, however, that in some cases countries may have a tendency to accumulate excessive reserves. Not only will this entail a considerable cost, but it could also lead to a laxity in macroeconomic policies in the future as the external constraint is effectively removed.

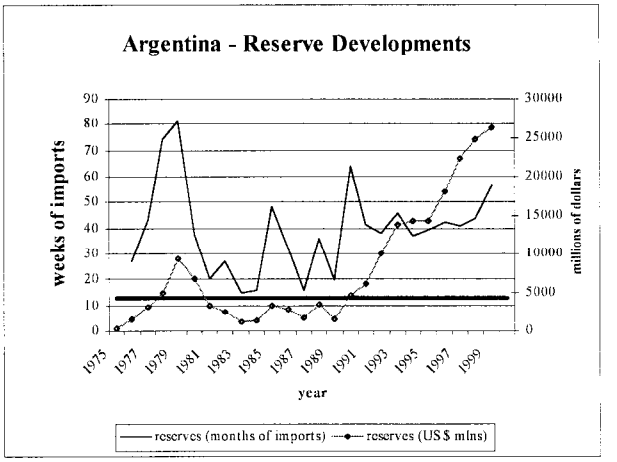
Reserve Developments in Emerging Market Economies

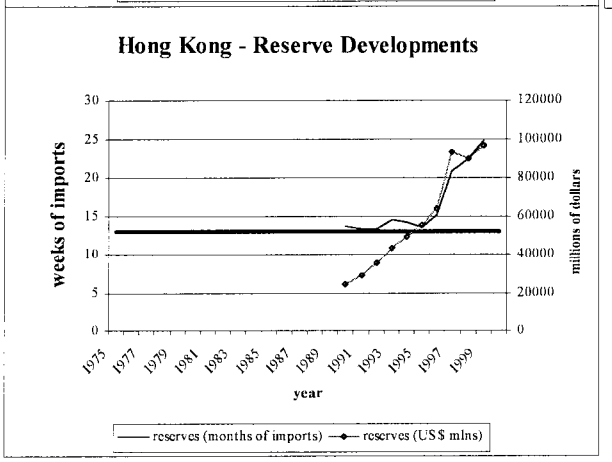



Mexico - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US $ mlns)
Peru - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US $ mlns)
Philippines - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US $ mlns)
Poland - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US $ mlns)
Russia - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US $ mlns)
South Africa - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US $ mlns)


Czech Republic - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US$ mlns)
Thailand - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US$ mlns)
China - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US$ mlns)
Hungary - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US$ mlns)
Malaysia - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US$ mlns)
Turkey - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US$ mlns)


Venezuela - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US$ mlns)


Argentina - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US$ mlns)


Hong Kong - Reserve Developments
weeks of imports
millions of dollars
year
reserves (months of imports)
reserves (US$ mlns)

Appendix 2: Classification of Exchange Rate Regimes

	1991	1992	1993	1994	1995	1996	1997	1998	1999
Independent Float									
	Brazil	Brazil	Brazil					Brazil	Brazil
	Peru	Peru	Peru	Peru	Peru	Peru	Peru	Peru	Peru
	Philippines	Philippines	Philippines	Philippines	Philippines	Philippines	Philippines	Philippines	Philippines
	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa	South Africa
	Venezuela	Venezuela							
									Colombia
		India	India	India	India	India	India	India	India
								Indonesia	Indonesia
							Korea	Korea	Korea
				Mexico	Mexico	Mexico	Mexico	Mexico	Mexico
								Thailand	Thailand
									Poland
		Russian Federation	Russian Federation	Russian Federation					Russian Federation
									Chile
Number of countries	5	7	6	6	5	5	6	9	13
Managed Float or Fixed Regime									
	Chile	Chile	Chile	Chile	Chile	Chile	Chile	Chile	
	Colombia	Colombia	Colombia	Colombia	Colombia	Colombia	Colombia	Colombia	
	Czech Republic	Czech Republic	Czech Republic	Czech Republic	Czech Republic	Czech Republic	Czech Republic	Czech Republic	Czech Republic
	India								
	Indonesia	Indonesia	Indonesia	Indonesia	Indonesia	Indonesia	Indonesia		
	Korea	Korea	Korea	Korea	Korea	Korea			
	Mexico	Mexico	Mexico						
	Thailand	Thailand	Thailand	Thailand	Thailand	Thailand	Thailand		
	China	China	China	China	China	China	China	China	China
	Hungary	Hungary	Hungary	Hungary	Hungary	Hungary	Hungary	Hungary	Hungary
	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia	Malaysia
	Poland	Poland	Poland	Poland	Poland	Poland	Poland	Poland	
	Turkey	Turkey	Turkey	Turkey	Turkey	Turkey	Turkey	Turkey	Turkey
			Venezuela	Venezuela	Venezuela	Venezuela	Venezuela	Venezuela	Venezuela
				Brazil	Brazil	Brazil	Brazil		
					Russian Federation	Russian Federation	Russian Federation	Russian Federation	
Number of countries	13	12	13	13	14	14	13	10	6
Currency Board									
	Argentina	Argentina	Argentina	Argentina	Argentina	Argentina	Argentina	Argentina	Argentina
	Hong Kong SAR	Hong Kong SAR	Hong Kong SAR	Hong Kong SAR	Hong Kong SAR	Hong Kong SAR	Hong Kong SAR	Hong Kong SAR	Hong Kong SAR
Number of countries	2	2	2	2	2	2	2	2	2

Source: exchange rate regimes classified according to the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* (AREAER) - various issues.

Note: We have categorized anything other than an 'independent float' or a currency board as a managed float or a fixed regime (including exchange rate regimes "adjusted to indicators", pegs, conventional pegs, crawling pegs, crawling bands, and regimes with "limited flexibility to single currency or cooperative arrangement"). Note also that Hong Kong SAR's currency board until 1998 was called a managed float, and Argentina's currency board a 'peg', but that since 1998 both are classified as a currency board. Also, in 1991 the number of economies does not add up to 21 as the Russian Federation was not yet a Fund member and, hence, its exchange rate regime had not yet been classified. The classification for the Czech Republic in 1991 is that of Czechoslovakia.

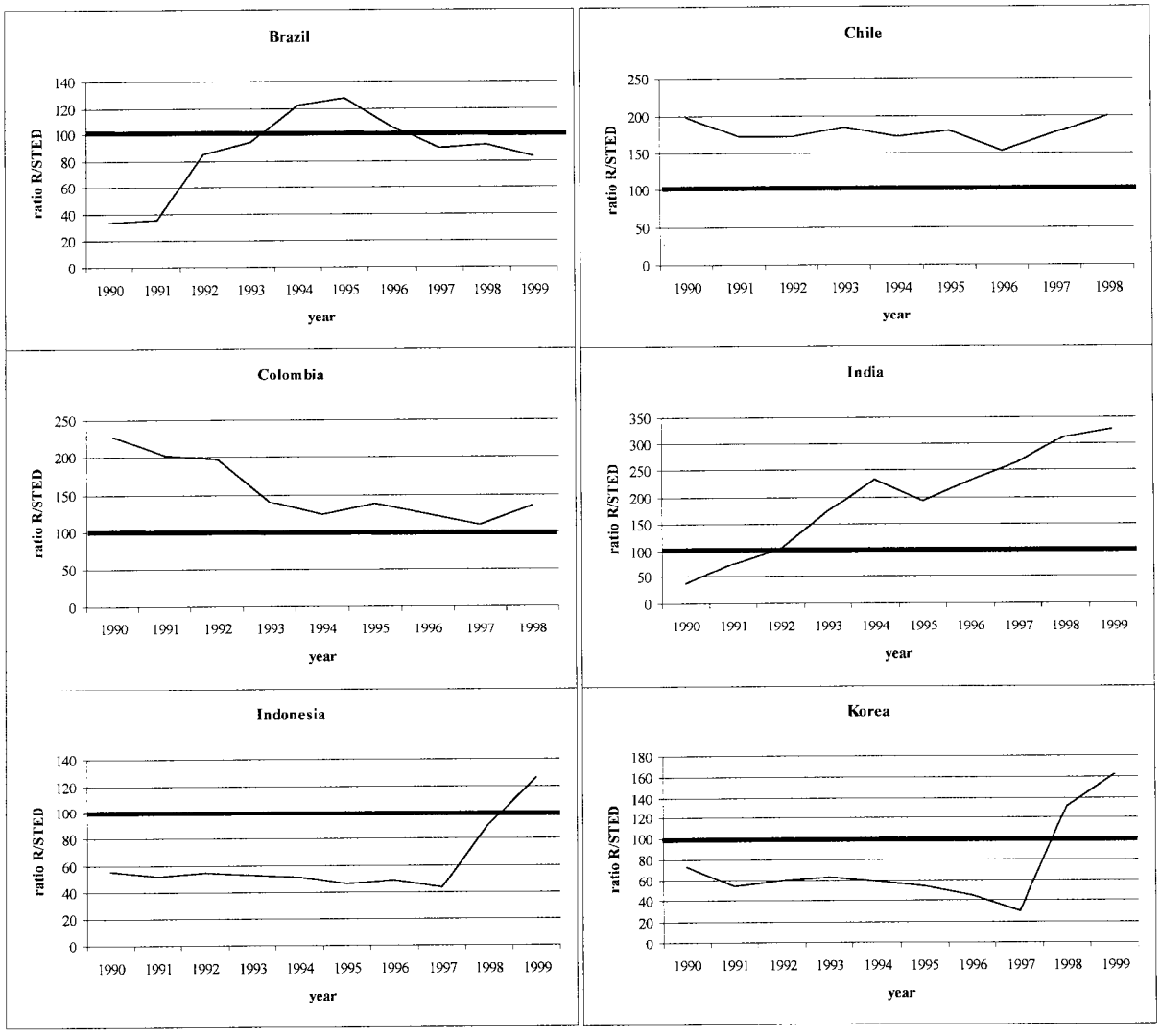
Appendix 3: Reserves to Broad Money

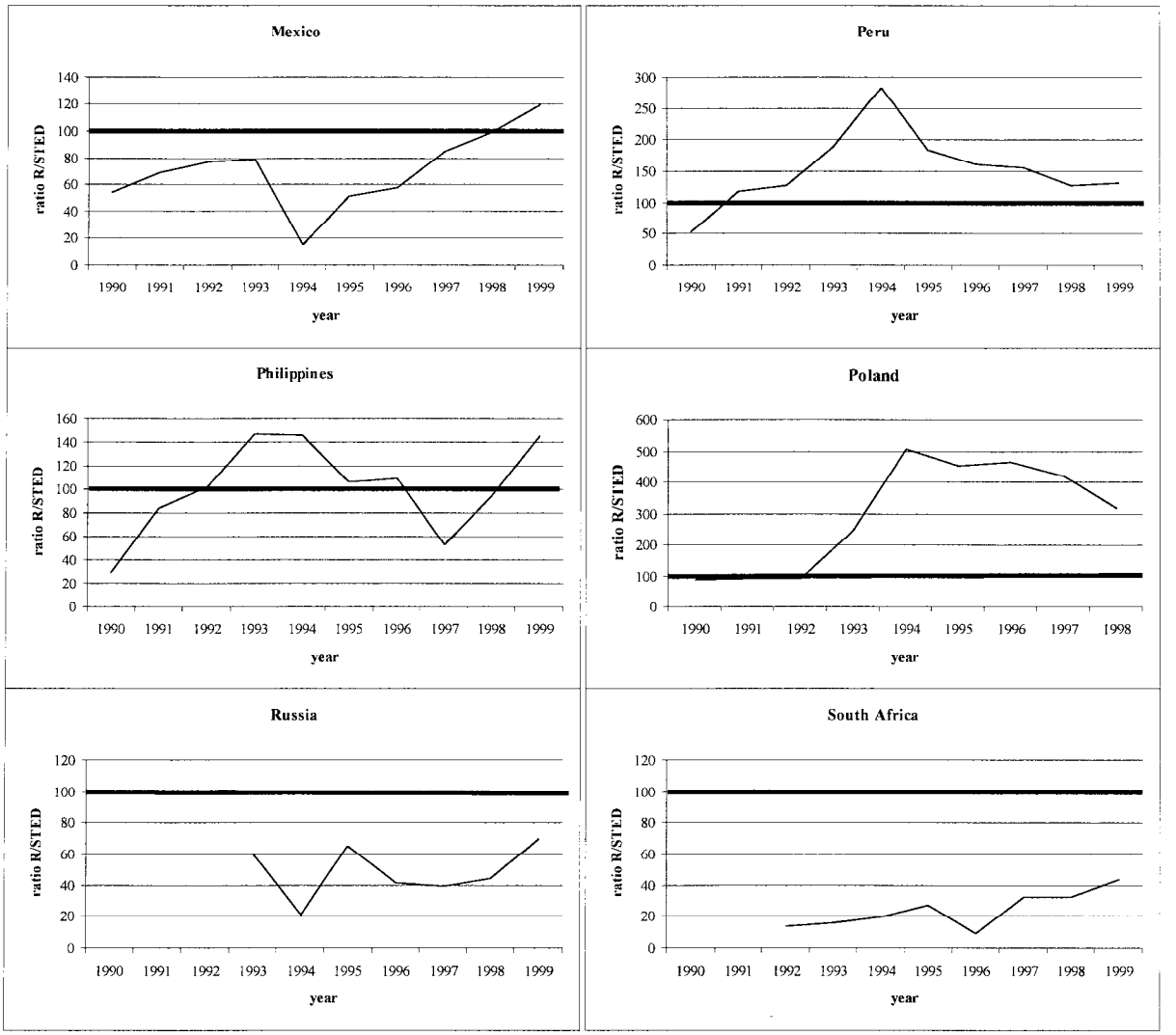
	1991		1992		1993		1994		1995		1996		1997		1998		1999	
Independent Float																		
	Brazil	0.15	Brazil	0.28	Brazil	0.33									Brazil	0.18	Brazil	0.21
	Peru	0.54	Peru	0.57	Peru	0.52	Peru	0.79	Peru	0.76	Peru	0.80	Peru	0.67	Peru	0.58	Peru	0.51
	Philippines	0.20	Philippines	0.22	Philippines	0.21	Philippines	0.18	Philippines	0.17	Philippines	0.22	Philippines	0.19	Philippines	0.22	Philippines	0.28
	South Africa	0.01	South Africa	0.02	South Africa	0.02	South Africa	0.03	South Africa	0.04	South Africa	0.01	South Africa	0.06	South Africa	0.06	South Africa	0.08
	Venezuela	0.65	Venezuela	0.64														
																	Colombia	0.38
			India	0.04	India	0.08	India	0.13	India	0.12	India	0.12	India	0.13	India	0.13	India	0.14
															Indonesia	0.32	Indonesia	0.29
													Korea	0.17	Korea	0.24	Korea	0.26
							Mexico	0.08	Mexico	0.24	Mexico	0.23	Mexico	0.26	Mexico	0.29	Mexico	0.25
															Thailand	0.22	Thailand	0.25
																	Poland	0.41
					Russian Fed.	0.18	Russian Fed.	0.11									Russian Fed.	0.23
																	Chile	0.43
Number of countries	5		6		6		6		5		5		6		9		13	
Average		0.31		0.29		0.22		0.22		0.27		0.28		0.25		0.25		0.29
Managed Float or Fixed																		
	Chile	0.56	Chile	0.60	Chile	0.58	Chile	0.66	Chile	0.57	Chile	0.52	Chile	0.54	Chile	0.48		
	Colombia	0.98	Colombia	0.91	Colombia	0.77	Colombia	0.50	Colombia	0.51	Colombia	0.49	Colombia	0.45	Colombia	0.38		
					Czech	0.16	Czech	0.21	Czech	0.34	Czech	0.29	Czech	0.29	Czech	0.31	Czech	0.37
	India	0.03																
	Indonesia	0.19	Indonesia	0.18	Indonesia	0.17	Indonesia	0.16	Indonesia	0.14	Indonesia	0.16	Indonesia	0.22				
	Korea	0.12	Korea	0.14	Korea	0.15	Korea	0.15	Korea	0.16	Korea	0.16						
	Mexico	0.23	Mexico	0.20	Mexico	0.23												
	Thailand	0.24	Thailand	0.25	Thailand	0.25	Thailand	0.26	Thailand	0.27	Thailand	0.26	Thailand	0.28				
	China	0.13	China	0.05	China	0.04	China	0.10	China	0.10	China	0.12	China	0.13	China	0.12	China	0.11
	Hungary	0.25	Hungary	0.25	Hungary	0.38	Hungary	0.38	Hungary	0.71	Hungary	0.56	Hungary	0.49	Hungary	0.44	Hungary	0.52
	Malaysia	0.33	Malaysia	0.41	Malaysia	0.53	Malaysia	0.42	Malaysia	0.32	Malaysia	0.29	Malaysia	0.29	Malaysia	0.36	Malaysia	0.37
	Poland	0.15	Poland	0.16	Poland	0.16	Poland	0.18	Poland	0.35	Poland	0.38	Poland	0.41	Poland	0.43		
	Turkey	0.21	Turkey	0.23	Turkey	0.24	Turkey	0.28	Turkey	0.35	Turkey	0.39	Turkey	0.41	Turkey	0.34	Turkey	0.35
					Venezuela		Venezuela	0.54	Venezuela	0.53	Venezuela	1.08	Venezuela	0.86	Venezuela	0.70	Venezuela	0.68
							Brazil	0.22	Brazil	0.25	Brazil	0.28	Brazil	0.22				
									Russian Fed.	0.24	Russian Fed.	0.18	Russian Fed.	0.17	Russian Fed.	0.26		
Number of countries	12		11		13		13		14		14		13		10		6	
Average		0.28		0.31		0.30		0.31		0.35		0.37		0.37		0.38		0.40
Currency Board																		
	Argentina	0.31	Argentina	0.32	Argentina	0.30	Argentina	0.27	Argentina	0.27	Argentina	0.29	Argentina	0.29	Argentina	0.29	Argentina	0.29
	Hong Kong	0.18	Hong Kong	0.21	Hong Kong	0.22	Hong Kong	0.23	Hong Kong	0.23	Hong Kong	0.24	Hong Kong	0.32	Hong Kong	0.27	Hong Kong	0.27
Number of countries	2		2		2		2		2		2		2		2		2	
Average		0.25		0.26		0.26		0.25		0.25		0.26		0.30		0.28		0.28

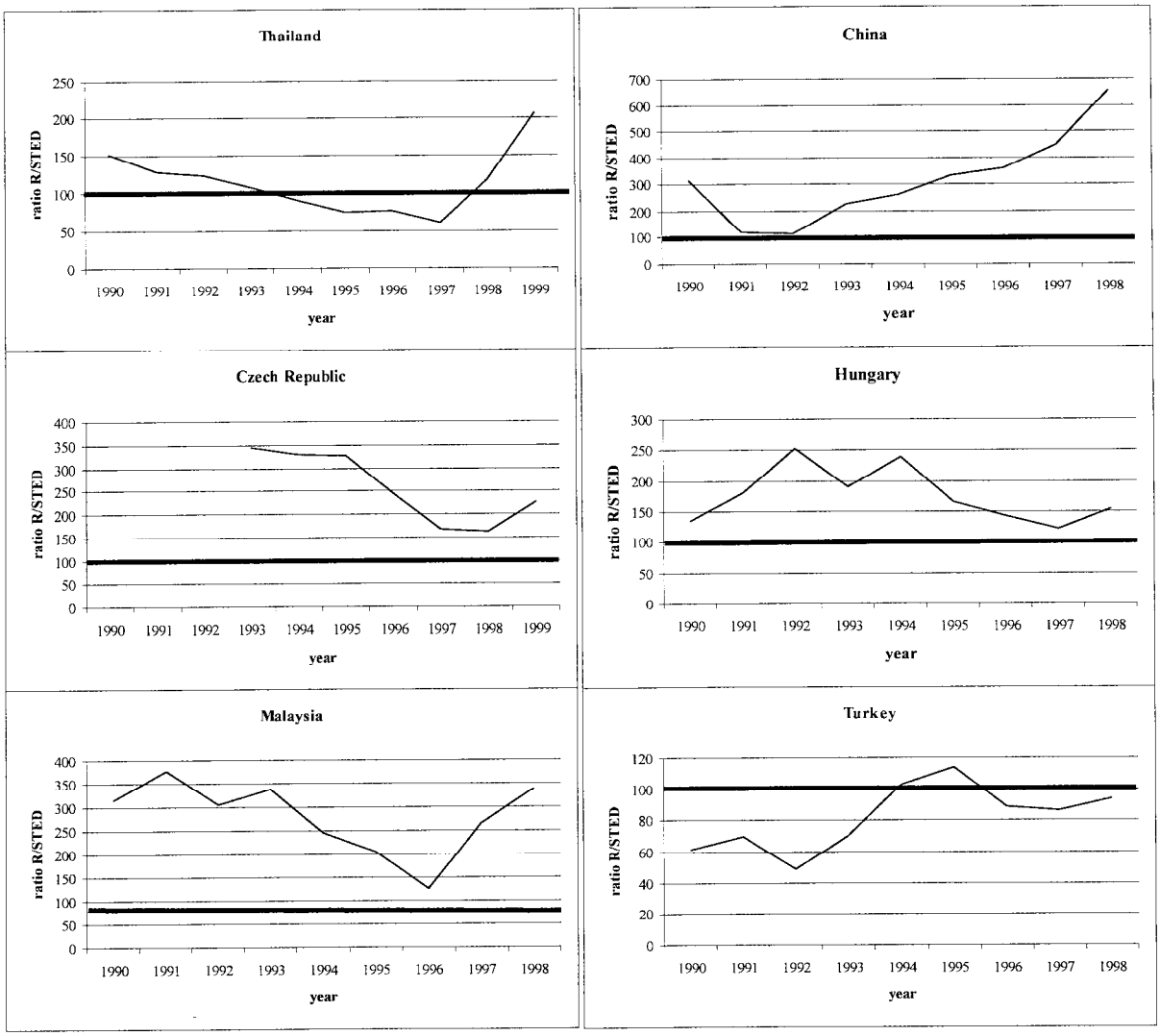
Source: exchange rate regimes classified according to the IMF's *Annual Report on Exchange Arrangements*

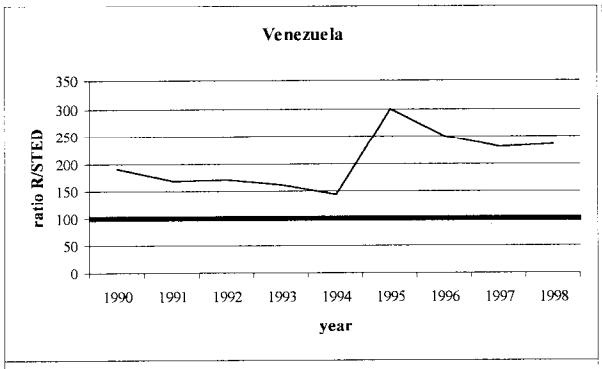
Note: We have categorized anything other than an 'independent float' or a currency board as a managed float or a fixed regime (including exchange rate regimes "adjusted to indicators", pegs, conventional pegs, crawling pegs, crawling bands, and regimes with "limited flexibility to single currency or cooperative arrangement"). Note also that Hong Kong SAR's currency board until 1998 was called a managed float, and Argentina's currency board a 'peg', but that since 1998 both are classified as a currency board. Also, in 1991 and 1992 the number of economies does not add up to 21 as the Russian Federation joined the Fund in 1992 and data does not start until 1993. Data for the Czech Republic also does not start until 1993.

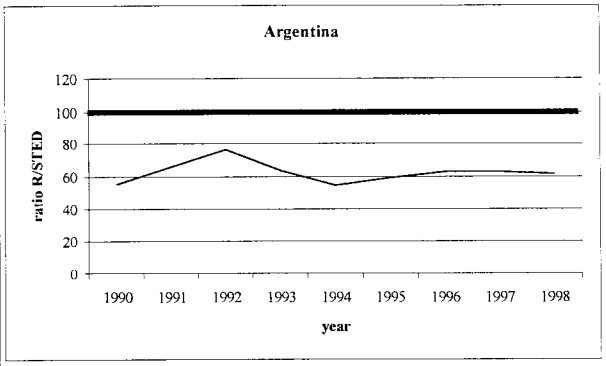
Reserves as a Percentage of Short-Term External Debt

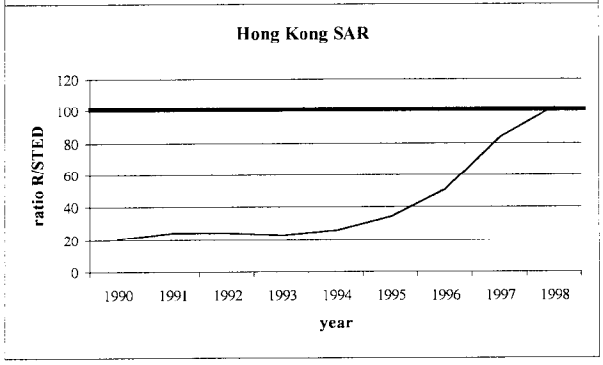



Mexico
ratio R/STED
year
Peru
ratio R/STED
year
Philippines
ratio R/STED
year
Poland
ratio R/STED
year
Russia
ratio R/STED
year
South Africa
ratio R/STED
year


Thailand
ratio R/STED
250
200
150
100
50
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
year
China
ratio R/STED
700
600
500
400
300
200
100
0
1990 1991 1992 1993 1994 1995 1996 1997 1998
year
Czech Republic
ratio R/STED
400
350
300
250
200
150
100
50
0
1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
year
Hungary
ratio R/STED
300
250
200
150
100
50
0
1990 1991 1992 1993 1994 1995 1996 1997 1998
year
Malaysia
ratio R/STED
400
350
300
250
200
150
100
50
0
1990 1991 1992 1993 1994 1995 1996 1997 1998
year
Turkey
ratio R/STED
120
100
80
60
40
20
0
1990 1991 1992 1993 1994 1995 1996 1997 1998
year


Venezuela
ratio R/STED
350
300
250
200
150
100
50
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
year


Argentina
ratio R/STED
120
100
80
60
40
20
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
year


Hong Kong SAR
ratio R/STED
120
100
80
60
40
20
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
year

Capital Flight - What Proportion to take of Broad Money?

Deciding which fraction of M2 to take as a buffer against domestic capital flight is fraught with difficulties. There are several reasons for this:

First, not all forms of capital flight constitute an internal drain, in the sense that domestic currency is exchanged for foreign currency. That is, not all forms of capital flight affect M2 or official reserves. There are essentially three forms of capital flight: (i) the 'internal drain', where domestic currency assets are exchanged for foreign currency assets[33]; (ii) the transfer of foreign currency assets, which were foreign currency assets to begin with, abroad; (iii) and the non-repatriation of profits earned abroad[34]. The latter two forms of capital flight do not involve an exchange of domestic currency and thus do not affect M2. Moreover, because the flight capital is already denominated in foreign currency, official reserves are also unaffected (other than that an increase in reserves is foregone due to the fact that the flight capital stays abroad and is not transferred back to the home country).

Second, capital flight is not restricted to M2. All longer-term assets that are not part of M2 would not be captured by taking a fraction of M2. Since such assets are less liquid, however, especially in non-industrial countries, the probability that they will be utilized for capital flight is smaller than for broad money.

Third, there are significant problems in measuring capital flight. From a conceptual standpoint it is hard to distinguish 'normal' capital outflows from those that are 'abnormal' and thus constitute flight capital (see for instance Deppler and Williamson, 1987, who define it as all outflows that are motivated by an attempt to avoid 'large' losses; see also Eggerstedt, Brideau Hall and Van Wijnbergen, 1995). Dooley (1986), for instance, noted that capital flight need not even be embodied in a flow of capital but may occur when there is a shift in residents' motives for holding their stock of foreign assets. The difficulty of distinguishing capital flight from normal flows is reflected in the array of estimation techniques for capital flight. These range from a very narrow measure of net short-term outflows and 'errors and omissions' in the balance of payments (Cuddington, 1986) to a much broader measure of outflows of private financial assets including direct and portfolio investments (World Bank, 1985).[35]

---

[33] This would include overinvoicing of imports in that you 'pay' for the artificially higher reported imports (affecting both M2 and reserves). Conceptually it is useful to also categorize foreign currency deposits as part of the internal drain, as they are part of domestic broad money and their withdrawal would affect reserves.

[34] This would include underinvoicing of exports. The non-reported export revenues would presumably be denominated in foreign currency and thus not need to be exchanged (i.e. they would not constitute flight out of M2 into reserves).

[35] Dooley (1986) has proposed a 'derived' measure for measuring capital flight which avoids these conceptual, and inherently normative, problems. It measures capital flight as that part of a country's

(continued)

Leaving aside these difficulties it is nevertheless possible to establish a lower bound for a fraction of M2, which may be considered a minimum buffer against capital flight. For the lower bound, we elect to simply use the 'errors and omissions' item in the balance of payments (following IMF, 1998b and Abalkin and Whalley 1999). Note that this is an even narrower measure than that routinely used for 'hot money' in the capital flight literature, in order to correct for the first two caveats raised in this box, namely that not all capital flight affects M2 (although 'errors and omissions' may of course also reflect true data shortcomings which are not necessarily indicative of capital flight). The table below shows the errors and omissions for our 21 emerging market countries.[36]

Errors and Ommissions in Balance of Payments (in $ blns)

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Min	Max
Brazil	0.9	-1.4	-0.8	-0.4	1.4	-2.0	-3.2	-2.9	0.2	-3.2	1.4
Chile	0.4	0.4	0.0	-0.6	0.1	-0.7	-0.4	-1.2	0.2	-1.2	0.4
Colombia	0.2	0.2	-0.1	0.3	0.1	0.1	-0.9	-0.4	-0.2	-0.9	0.3
India	0.6	1.5	-1.0	1.5	1.0	-1.9	-1.3	1.4	0.3	-1.9	1.5
Indonesia	0.1	-1.3	-2.9	-0.3	-2.3	1.3	-2.6	1.8	2.1	-2.9	2.1
Republic of Korea	0.8	1.1	-0.7	-1.8	-1.2	1.1	-5.0	-6.2	-3.5	-6.2	1.1
Mexico	-2.3	-0.9	-3.1	-3.3	-4.2	0.1	2.2	0.4	-0.8	-4.2	2.2
Peru	1.0	0.5	0.6	0.2	0.5	0.9	-0.3	0.7	0.3	-0.3	1.0
Philippines	-0.1	-0.5	0.1	0.2	-2.1	-3.0	-5.2	-0.7	-3.3	-5.2	0.2
Poland	-0.7	-0.2	0.2	-0.1	-0.6	0.3	1.3	-0.5	2.1	-0.7	2.1
Russian Federation				0.4	-8.0	-4.9	-4.9	-9.1	-6.9	-9.1	0.4
South Africa	0.2	-1.2	-2.4	-0.5	-0.9	-2.4	-1.1	-1.7	1.2	-2.4	1.2
Thailand	0.4	-0.1	-0.2	0.1	-1.2	-2.6	-3.2	-2.8	0.0	-3.2	0.4
China	-6.8	-8.2	-10.1	-9.1	-17.8	-15.5	-22.1	-18.9	-14.7	-22.1	-6.8
Czech Republic			0.1	-0.2	0.6	-0.7	0.4	0.4	0.2	-0.7	0.6
Hungary	-0.1	0.0	0.7	0.2	0.8	1.0	0.0	0.0	-0.3	-0.3	1.0
Malaysia	-0.2	0.1	3.6	0.2	-0.8	-2.5	-0.1	3.0	-1.3	-2.5	3.6
Turkey	0.9	-1.2	-2.2	1.8	2.4	-1.8	-2.6	-2.0	1.9	-2.6	2.4
Venezuela	-1.5	-0.3	-0.5	-0.3	-0.5	-0.9	-1.5	-1.4	-1.0	-1.5	-0.3
Argentina	-0.3	0.0	-1.0	-0.8	-1.9	-1.6	-0.9	-0.3	-1.2	-1.9	0.0
Hong Kong SAR								0.2	-0.7	-0.7	0.2

Source: IMF *International Financial Statistics*

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stock of foreign assets which does not yield a recorded inflow of investment of income credits, under the presumption that only the retention of investment income abroad is indicative of flight concerns. Deppler and Williamson (1987) have suggested that Dooley's derived measure could also be used to establish a lower bound for capital flight as it likely excludes many 'normal' flows. They note, however, that it is sensitive to the accuracy of balance of payments statistics on investment income credits, the choice of the interest rate used to capitalize the investment income credits, and the assumption that all assets yield a market rate of return. For this reason, we do not use the measure. See Claessens and Naudé (1993) for a discussion of the main estimation methods of capital flight.

[36] It should be noted that there are large differences between regions in the proportion of wealth held abroad. Collier, Hoeffler and Patillo (1999) note that East Asia holds only 6 percent of its wealth abroad, compared to 40 percent for Africa.

What the table shows is that in crisis years (e.g. Mexico 1995, Asia 1997/98) the increase in errors and omissions was substantial and in the same direction as officially reported capital (out)flows, suggestive of unrecorded capital flows. In Korea, for instance, the errors/omissions jumped by roughly $ 5-6 bln in 1997/98. China and Russia are somewhat unique in that they show consistently large and negative errors/omissions, in accordance with several studies of sustained capital flight in these countries (see Sicular 1998, Loukine 1998, and Abalkin and Whalley 1999).

The following table expresses errors/omissions as a fraction of M2. It shows that in Asian countries most affected by the recent financial crisis, for instance, the fraction of this narrow capital flight proxy, ranged from less than 1 percent for Malaysia (perhaps due to capital controls) to almost 14 percent of M2 for the Philippines. Although our 5-20 percent fraction of M2 as a capital flight reserve buffer is an arbitrary one, it seems to be in the range of errors and omission outliers (i.e. the crisis/capital flight years) for most countries, taking into account that errors and omissions probably constitute an absolute minimum estimate of capital flight.

Errors and Ommissions as a Percentage of M2

	1991	1992	1993	1994	1995	1996	1997	1998	1999	Min	Max
Brazil	1.5	-1.7	-0.9	-0.3	0.7	-1.0	-1.4	-1.3	0.1	-1.7	1.5
Chile	3.1	2.4	-0.1	-2.8	0.5	-2.3	-1.4	-3.6	0.5	-3.6	3.1
Colombia	2.9	2.3	-1.3	2.0	0.7	0.5	-4.0	-2.0	-0.7	-4.0	2.9
India	0.5	1.2	-0.8	1.0	0.6	-1.1	-0.7	0.7	0.1	-1.1	1.2
Indonesia	0.2	-2.2	-4.3	-0.3	-2.4	1.1	-3.5	2.6	2.4	-4.3	2.6
Republic of Korea	0.7	0.9	-0.5	-1.1	-0.6	0.5	-4.2	-2.9	-1.2	-4.2	0.9
Mexico	-2.9	-0.9	-2.9	-4.4	-6.1	0.1	2.0	0.3	-0.6	-6.1	2.0
Peru	22.4	9.7	8.6	2.2	4.6	6.9	-1.8	4.0	2.0	-1.8	22.4
Philippines	-0.8	-2.7	0.4	0.5	-5.6	-6.4	-13.9	-1.8	-7.0	-13.9	0.5
Poland	-3.1	-0.7	0.8	-0.3	-1.3	0.7	2.6	-0.8	3.3	-3.1	3.3
Russian Federation			0.0	1.1	-13.4	-7.6	-6.3	-29.8	-19.0	-29.8	1.1
South Africa	0.3	-1.9	-4.2	-0.7	-1.1	-3.5	-1.4	-2.4	1.5	-4.2	1.5
Thailand	0.6	-0.2	-0.2	0.1	-0.9	-1.8	-3.5	-2.2	0.0	-3.5	0.6
China	-2.0	-1.9	-1.6	-1.6	-2.4	-1.7	-2.0	-1.5	-1.0	-2.4	-1.0
Czech Republic			0.4	-0.7	1.5	-1.7	1.1	0.9	0.5	-1.7	1.5
Hungary	-0.5	0.0	4.1	1.2	4.7	5.6	0.2	0.2	-1.3	-1.3	5.6
Malaysia	-0.5	0.2	7.1	0.3	-1.0	-2.7	-0.2	4.3	-1.5	-2.7	7.1
Turkey	3.8	-4.4	-8.5	6.8	6.6	-4.2	-5.7	-3.5	2.8	-8.5	6.8
Venezuela	-9.2	-2.0	-3.8	-1.9	-4.2	-8.2	-8.8	-8.4	-5.5	-9.2	-1.9
Argentina	-1.8	0.0	-2.3	-1.5	-3.7	-2.6	-1.2	-0.4	-1.3	-3.7	0.0
Hong Kong SAR								0.1	-0.2	-0.2	0.1

Source: IMF *International Financial Statistics*

Finally, and alternatively, one could simply look at the degree of variation in the behavior of the Reserves/Broad Money ratio (see the table below). It can be seen that the 5-10 percent fraction of M2 for countries with independently floating exchange rates is roughly equal to the *average* standard deviation for this group of countries, with Colombia, Peru and Poland being the outliers. That is, the *average* standard deviation (7) is equal to the midpoint in the range; 10 out of 13 floating rate countries have a standard deviation that falls within

that range. South Africa and Poland show particularly high coefficients of variation. Interestingly, the *average* standard deviation for countries with a pegged exchange rate regime (10) is only marginally higher, and lies at the lower end of the 10-20 percent fraction for countries with managed floats or fixed exchange rates. The upper bound of that range is equal to twice the *average* standard deviation. Only Hungary and Venezuela have a standard deviation that falls within the range. However, the table is based on exchange rate classification in 1999. In this regard, it should be kept in mind that two of the outliers in the independently floating category (Colombia and Poland) were classified as managed floating or fixed exchange rates all through the 1990's until 1999. Noteworthy is also the relatively low standard deviation and coefficient of variation of both currency boards.

Reserves as a Percentage of Broad Money - Summary Statistics (1991-1999)

Independent Float	Average 1991-1999	Standard Deviation	Coefficient of Variation
Brazil	23	6	24
Chile	55	7	12
Colombia	60	23	38
India	10	4	39
Indonesia	20	6	31
Republic of Korea	17	5	26
Mexico	22	6	26
Peru	64	12	19
Philippines	21	3	15
Poland	29	13	43
Russian Federation	19	5	27
South Africa	4	3	71
Thailand	25	2	7
Average	29	7	29
Managed Float or Fixed Regime			
China	10	3	34
Czech Republic	28	7	26
Hungary	44	15	34
Malaysia	37	8	21
Turkey	31	7	24
Venezuela	70	17	24
Average	37	10	27
Currency Board			
Argentina	29	2	6
Hong Kong SAR	24	4	17
Average	27	3	11

Source: calculations with data from IMF *International Financial Statistics* (same as in table 1); exchange rate classification based on 1999.

REFERENCES

Abalkin, A. and J. Whalley (1999), "The Problem of Capital Flight from Russia", *World Economy*, May 1999, pp.421-44.

Aizenman, Joshua, and Nancy Marion, (1999), "Reserve Uncertainty and the Supply of International Credit", *NBER Working Paper* 7202, National Bureau of Economic Research, July 1999.

Berg, Andrew, Eduardo Borensztein, Gian Maria Milesi-Ferretti, and Catherine Patillo, (1999), "Anticipating Balance of Payments Crises; The Role of Early Warning Systems", *Occasional Paper* 186, International Monetary Fund, 1999.

--------and Catherine Patillo, (1999), "Are Currency Crises Predictable? A Test", *IMF Staff Papers*, Vol. 46, No. 2, International Monetary Fund, June 1999.

Boyce, James, (1992), "The Revolving Door? External Debt and Capital Flight: A Philippine Case Study", *World Development* 20:335-49, March 1992.

Bussière, Matthieu, and Christian Mulder, (1999), "External Vulnerability in Emerging Market Economies: How High Liquidity Can Offset Weak Fundamentals and the Effects of Contagion", *IMF Working Paper* WP/99/88, International Monetary Fund, July 1999.

Calvo, Guillermo, (1996), "Capital Flows and Macroeconomic Management: Tequila Lessons", International Journal of Finance & Economics, July 1996.

Claessens, Stijn, and David Naudé, (1993), "Recent Estimates of Capital Flight", *World Bank Policy Research Working Paper Series*, No. 1186 (Washington: World Bank).

----------(1997) "Estimates of Capital Flight and Its Behavior", *Revista de Análisis Económico*, Vol. 12, No. 1, pp.3-34, June 1997.

Collier, Paul, Anke Hoeffler, and Catherine Patillo, (1999) "Flight Capital as a Portfolio Choice", *IMF Working Paper* No. WP/99/171, International Monetary Fund, December 1999.

Cooper, R.N. (1968), "The Relevance of International Liquidity to Developed Countries", *American Economic Review* (May).

Cuddington, John T., (1986), "Capital Flight: Estimates, Issues and Explanations," *Princeton Studies in International Finance*, No. 58 (Princeton: Princeton University).

De Beaufort Wijnholds, J.A.H., (1974), "The Need for Reserves Under Full and Limited Flexibility of Exchange Rates", *De Economist*, Vol. 122, No.3, 1974.

----------(1977), *The Need for International Reserves and Credit Facilities*, Martinus Nijhoff, Leiden, 1977.

De Gregorio, Jose, Barry Eichengreen, Takatoshi Ito and Charles Wyplosz, (1999), *An Independent and Accountable IMF*, Geneva Reports on the World Economy nr. 1, International Center for Monetary and Banking Studies/Center for Economic Policy Research, 1999.

Deppler, Michael, and Martin Williamson, (1987) "Capital Flight: Concepts, Measurement and Issues", Research Department of the IMF, *Staff Studies for the World Economic Outlook* (Washington DC: IME, 1987).

Dooley, Michael P. (1986), "Country Specific Risk Premiums, Capital Flight and Net Investment Income Payments in Selected Developing Countries", International Monetary Fund, mimeo.

Economist Intelligence Unit (1999), *Country Risk; Global Prospects for 2000*, Research Report EIU, London, 1999.

Eggerstedt, Harald, Rebecca Brideau Hall and Sweder Van Wijnbergen, (1995), "Measuring Capital Flight: A Case Study of Mexico", *World Development*, Vol. 23, No. 2, pp.211-232 .

Eichengreen, Barry, and Jeffrey A. Frankel (1996), "The SDR, Reserve Currencies, and the Future of the International Monetary System", in *The Future of the SDR, in Light of Changes in the International Financial System*, Editors Michael Mussa, James Boughton and Peter Isard, Proceedings of a Seminar held in Washington DC, March 18-19, 1996, International Monetary Fund, 1996.

Esquivel, Gerardo, and Felipe Larráin (1998), "Explaining Currency Crises", Development Discussion Paper No. 666, Cambridge, Massachusetts, Harvard Institute for International Development.

Feldstein, Martin (1999), "A Self-Help Guide for Emerging Markets", *Foreign Affairs*, Volume 78, No.2, March/April 1999, pp. 93-109.

Fischer, Stanley, (1999), "On the Need for an International Lender of Last Resort", *Journal of Economic Perspectives*, Vol.13, No.4, Fall 1999, pp. 85-104.

Frankel, Jeffrey A., and Sergio L. Schmukler, (1996), "Country Fund Discounts and the Mexican Crisis in December 1994: Did Local Residents Turn Pessimistic Before International Investors?", Board of Governors of the Federal Reserve System, *International Finance Discussion Papers* Number 563, September 1996.

Frenkel, Jacob, (1978), "International Reserves: Pegged Exchange Rates and Managed Float", in K. Brunner and A.H. Meltzer (eds), *Public Policies in Open Economies*, Carnegie-Rochester Series on Public Policy, Vol. 9 (Amsterdam), pp.111-40.

----------and B. Jovanovich (1981), "Optimal International Reserves: A Stochastic Framework", *Economic Journal*, Vol. 91, pp. 507-14.

---------- (1983), "International Liquidity and Monetary Control", in *International Money and Credit: the Policy Roles*, Ed. George von Furstenberg, pp. 65-129, International Monetary Fund, Washington DC, 1983.

Greenspan, Alan, (1999), *Currency Reserves and Debt*, remarks before the World Bank Conference on Recent Trends in Reserves Management, Washington DC, April 29, 1999.

Grimes, A., (1993), "International Reserves under Floating Exchange Rates: Two Paradoxes Explained", *The Economic Record*, Vol. 69, No. 207 (December), pp. 411-15.

Heller, H. Robert (1966), "Optimal International Reserves", *Economic Journal*, Vol. 76 (June), pp. 296-311.

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

International Monetary Fund, (1953), "The Adequacy of Monetary Reserves", *International Monetary Staff Papers*, Vol. III No.2, October 1953.

---------, (1958), *International Reserves and Liquidity*, A Study by the Staff of the International Monetary Fund, Washington DC, International Monetary Fund.

---------, (1998a), "Early Warning Signals of Vulnerability to Currency Crisis", pp. 94-97 in *World Economic Outlook; A Survey by the Staff of the International Monetary Fund*, International Monetary Fund, Washington DC.

---------, (1998b), "Unrecorded Capital Flight from Asia", pp.17, Box 2.3 in *International Capital Markets: Developments, Prospects and Key Policy Issues*, September 1998..

---------, (1999a) *International Capital Markets: Developments, Prospects and Key Policy Issues*, IMF, Washington DC, September 1999.

--------, (1999b) *Exchange Rate Arrangements and Currency Convertibility; Developments and Issues*, Prepared by a Staff Team led by Barry Johnston, IMF, Washington DC, 1999.

--------, (1999c), Balance of Payments Statistics, Newsletter, Year-End 1999.

--------, *International Financial Statistics,* IMF, (various issues).

--------, *Annual Report on Exchange Arrangements and Exchange Restrictions*, IMF, (various issues).

--------, (2000), "Debt- and Reserve-Related Indicators of External Vulnerability", Prepared by the Policy Development and Review Department in consultation with other departments, March 2000, http://www.imf.org/external/np/pdr/debtres/index.htm.

Independent Task Force Sponsored by the Council on Foreign Relations (1996), *Safeguarding Prosperity in a Global Financial System; The Future International Financial Architecture*, A Council on Foreign Relations-Sponsored Report Published by the Institute for International Economics, 1999 .

Islam, Anisul, Moosa Khan and Muhammad Islam (1994), "An Empirical Test of the Demand for International Reserves", in Dilip K. Ghosh and Edgar Ortic, eds., *The Changing Environment of International Financial Markets* (St. Martins Press: New York), 1994.

Iyoha, M.A. (1976), "Demand for International Reserves in Less Developed Countries: A Distributed Lag Specification", *The Review of Economics and Statistics*, Vol. 60 (August), pp.351-55.

Kaminsky, Graciela, and Carmen Reinhart, (1996), "The Twin Crises: The Causes of Banking and Balance of Payments Problems", Board of Governors of the Federal Reserve System, *International Finance Discussion Papers* Number 544, March 1996.

--------Saul Lizondo, and Carmen Reinhart, (1997), "Leading Indicators of Currency Crises", *Policy Research Working Paper 1852*, World Bank, November 1997.

Khan, Mohsin S. and Carmen Reinhart (1994), "Macroeconomic management in maturing economies: The response to capital inflows", *International Monetary Fund Issues Paper*, March 1994, Washington DC.

Kletzer, Kenneth and Mark M. Spiegel (1998), "Speculative Capital Inflows and Exchange Rate Targeting", in R. Glich ed., *Managing Capital Flows and Exchange Rates*, Cambridge University Press, New York, pp. 409-435.

--------and Ashoka Mody (2000), "Will Self-Protection Policies Safeguard Emerging Markets from Crises?", unpublished.

Krugman, Paul, 1979, "A Model of Balance-of-Payments Crises," *Journal of Money, Credit and Banking*, Vol. 11 (August), pp. 311-25.

Lizondo, J.S. and D.J. Mathieson (1987), "The Stability of the Demand for International Reserves", *Journal of International Money and Finance*, Vol. 6 (September), pp. 251-282.

Loukine, Konstantin (1998), "Estimation of Capital Flight from Russia: Balance of Payments Approach", *World Economy*, July 1998, pp. 613-28.

Masson, Paul, (2000), "Exchange Rate Regime Transitions", *IMF Working Paper* 134, International Monetary Fund, July 2000.

Mishkin, Frederic, (1998), "International Capital Movements, Financial Volatility and Financial Instability", *NBER Working Paper* 6390, National Bureau of Economic Research, January 1998.

Mussa, Michael, Paul Masson, Alexander Swoboda, Esteban Jadresic, Paolo Mauro and Andy Berg (2000), "Exchange Rate Regimes in an Increasingly Integrated World Economy", *IMF Occasional Paper No. 193*, 2000, International Monetary Fund, Washington DC.

Officer, Lawrence H., (1976), "The Demand for International Liquidity", *Journal of Money, Credit and Banking*, August 1976.

Oliviera, Julio H.G. (1971), "The Square-Root Law of Precautionary Reserves", *Journal of Political Economy*, Vol. 79 (September/October 1971), pp. 1095-1104.

Polak, J.J., (1970), "Money: National and International", *International Reserves: Needs and Availability*, Papers and Proceedings of a Seminar at the International Monetary Fund, June 1-3, 1970, IMF.

Rodrik, Dani, and Andrés Velasco, "Short-Term Capital Flows", *NBER Working Paper* 7364, National Bureau of Economic Research, September 1999.

Rojas-Suárez, Liliana, (1991) , "Risk and Capital Flight in Developing Countries", Chapter IV in "Determinants and Systemic Consequences of International Capital Flows", A Study by the Research Department of the International Monetary Fund, *Occasional Paper 77*, International Monetary Fund, March 1991.

--------and Steven Weisbrod, (1995), "Financial Fragilities in Latin America; the 1980's and 1990's", *Occasional Paper* 132, International Monetary Fund, October 1995.

Sachs, Jeffrey, Aaron Tornell, and Andrés Velasco, (1996), "Financial Crises in Emerging Markets: The Lessons from 1995," *Brookings Papers on Economic Activity: 1*, Brookings Institution, pp. 147-215.

Sicular, Terry (1998), "Capital Flight and Foreign Investment: Two Tales From China and Russia", *World Economy*, July 1998, pp.589-602.

Tornell, Aaron, (1999), "Common Fundamentals in the Tequila and Asian Crises", *NBER Working Paper* 7139, National Bureau of Economic Research, May 1999.

Triffin, Robert (1947), "National Central Banking and the International Economy", *Review of Economic Studies*, February 1947.

--------(1960), *Gold and the Dollar Crisis*, Yale University Press, New Haven.

Whittlesey C.R., (1964), "Liquidity, International Liquidity, and the Dollar Problem", *Weltwirtschaftliches Archiv*, 1964.

Williamson John, (1973), "International Liquidity: A Survey, "Economic Journal, Vol.83 (September), pp.685-746.

----------and Molly Mahar (1998), "A Survey of Financial Liberalization", *Essays in International Finance*, No. 211, Princeton, November 1998.

World Bank (1985), *World Development Report*, Washington DC, World Bank.