International reserve-holding in the developing world: self insurance in a crisis-prone era?

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Abstract

Developing countries’ reserves have increased dramatically in recent years—growing by over 60% since the Asian financial crisis. This paper explores the self-insurance motivation behind this. As a first step, it revisits the literature on international reserve demand. This paper then examines the reserve-holding trends in a sample of 65 developing countries. It seeks to answer the following: Have reserves increased across the board or have these been concentrated in a few countries? If so, does it represent a break in previous policy? At what cost? This paper concludes by briefly examining some policy implications and avenues for future research.

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1. Introduction

The collapse of the Bretton Woods system of fixed currencies in 1973 (which precipitated the float of the major currencies), coupled with increasing capital mobility and what was expected to be growing broad based developing country access to the international capital markets led many to believe that the demand for international reserves would decline significantly. There is evidence, however, that

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the reverse has actually occurred (Fig. 1). In the developing world, international reserve levels climbed from US$50 billion in 1973 to about US$1.26 trillion in 2001. Their intensified reserve-holding behavior in recent years is quite prominent. The Report of the High-Level Panel on Financing for Development to the United Nations in 2001—also known as the Zedillo Report—noted a 60% increase in developing country reserves since the Asian financial crisis (UN, 2001). Scaled against short-term debt, output, and imports, international reserves in these countries (as an aggregate) have increased markedly (Table 1).

In addition, following the string of recent financial crises in the emerging markets—including Mexico (1994–1995), Asia (1997–1998), Russia (1999), Brazil (1999), Turkey (2001), and Argentina (2001–present)—researchers have found that the lack of international reserves contributes significantly to financial crisis vulnerability. Some policymakers have since argued that many developing countries have resorted to ‘self-insurance’ (Buira, 2002; Griffith-Jones, 2003) or ‘self-protection’ (Feldstein, 1999a) by way of increased reserves. This is an issue of particular

Table 1
Developing country reserves (International reserves from 1973 to 2001—In Billion US Dollars)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Grossb</td>
<td>20</td>
<td>179</td>
<td>350</td>
<td>1171</td>
<td>1260</td>
</tr>
<tr>
<td>Scaled by</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short term debt</td>
<td>2.13</td>
<td>1.23</td>
<td>1.43</td>
<td>3.08</td>
<td>3.42</td>
</tr>
<tr>
<td>Gross national incomec</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>18</td>
<td>20</td>
</tr>
<tr>
<td>Importsd</td>
<td>2.9</td>
<td>3.5</td>
<td>4.4</td>
<td>6.4</td>
<td>7.0</td>
</tr>
</tbody>
</table>

*aDeveloping countries also grouped by region.
*bIn US$ billion.
*cIn percent.
*dIn months of import cover.

*Source: Authors’ calculations. Data from International Financial Statistics (IMF, 2002a) and Global Development Finance (World Bank, 2002).
importance because such an ‘insurance policy’ comes at high cost. Rodrik (2000) estimates that for Peru and the Republic of Korea, the cost of holding excess reserves (defined as reserves over the 3-month import cover rule) was approximately 0.7% of these countries’ GDP in 2000.

Given these findings, it is important to ascertain whether and to what extent international reserve holdings in the developing world have increased across the board. That is, have all these countries increased their reserves? Moreover, if so, why and at what cost? The challenge would be to refine the explanations behind reserve accumulation in the present context of high capital mobility, gyrating exchange rates and frequent financial crises.

The paper is outlined as follows: Section 2 briefly examines the theories of international reserve-holding. In Section 3, the paper tackles several questions that have surfaced in very recent discussions on international reserves. Finally, in Section 4, the paper draws on some of the policy implications, particularly in the international arena.

2. Why do countries hold reserves?

2.1. Macro and micro foundations of reserve-holding

Monetarist and Keynesian roots: Some of the earlier work on international reserves approached the topic from a macroeconomics perspective. Johnson (1965) reasoned that reserve accumulation (decumulation) occurs when there is excess demand for (supply of) domestic currency. Zero reserves, then would force costly expenditure switching or reduction strategies to restore balance of payments. Johnson’s approach has been followed by other researchers1 and has since been referred to as either ‘global monetarism’ or ‘international quantity theory’ (Black, 1985).

However, Triffin (1947) argued that the demand for international reserves would increase with the growth in world trade. Hence, reserve adequacy would be determined by its external transactions, which at that time revolved mostly around the current account. Machlup (1966) and Heller (1968) argued that the variability of trade—and not necessarily its level—is a much better measure of reserve demand. In subsequent research, variance and levels of trade have since both been used as explanatory variables for reserve-holding.2

Micro-foundations: Olivera (1969) expanded Baumol’s (1952) inventory theoretic approach to the transactions demand for money, reasoning that a country’s demand for international reserves is no different from an individual’s transactions demand for cash. He further argued that Baumol’s square root result also applies to countries—that the elasticity of a country’s demand for international reserves vis-à-vis its level of trade is 0.5, implying economies of scale in reserve holding. Follow-up research has tested the economies of scale argument with mixed results.3

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2 See for example, Frenkel and Jovanovic, 1981 and more recently Flood and Marion, 2002.
2.2. The inventory control problem

Even as the macro and micro foundations of the demand for international reserves were established, there was growing consensus in the literature that international reserves are best seen as buffer stocks—accumulated in times of abundance and decumulated in times of scarcity. Based on the seminal work of Triffin (1947); Heller (1966) formalized the concept of reserve demand as an inventory control problem. In his view, international reserves would be held to reduce adjustment costs under a no-reserve scenario. However, such benefits would need to be balanced against the opportunity cost of holding these reserves—for instance, an alternative investment with a higher rate of return.

Heller also developed the linkage between a country’s propensity to import (MPI) and its demand for international reserves. He argued that a higher MPI would lower the marginal cost of adjustment. Hence, he predicted a negative relationship between a country’s MPI and its demand for international reserves. However, Frenkel (1974; Frenkel, 1978), argued that the propensity to import reflects the openness—hence vulnerability—of a country to external shocks. If reserves were held as a precautionary measure, this would imply a positive relationship between import propensity and reserve-holding.

Building on Heller’s work, Frenkel and Jovanovic (1981) modeled how optimal reserve holdings would increase as the volatility of reserves increased. Their empirical study of reserve holding in 22 (mostly industrial) countries during the period from 1971 to 1997 revealed that reserve volatility was a robust predictor of reserve holding behavior. Flood and Marion (2002) extended Frenkel and Jovanovic’s work by modifying the volatility measure and by incorporating the fundamental determinants of garden variety financial crises of the Krugman–Flood–Garber–type. Their empirical analysis provides evidence that increased volatility significantly increases reserve holdings, but that the family of buffer stock models (including theirs) can only explain approximately 10–15% of countries’ reserve holding behavior. Clearly, other motivations for holding reserves are still largely unexplained.

2.3. Reserves as self-insurance

The theory of international reserve demand is essentially a precautionary theory, with the objective of striking a balance between the costs of holding the asset and the benefits it provides (Black, 1985). Hence, viewing reserves as a form of insurance against a ‘bad state of nature’ is not a new concept. In fact, maintaining a buffer stock is ipso facto a form of self-insurance. Viewing reserve demand more broadly from a self-insurance angle would therefore be a natural extension to the previous literature, and there already have been efforts to this effect. The challenge for policymakers is to find out how exactly such an approach can be operationalized.

Self-insurance in theory: Van Wijnbergen (1990) examined cash/debt buy-backs in the context of missing terms of trade contingent instruments in international

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4 The logic was that with higher volatility, reserves would hit the lower bound more frequently. This would then make higher reserve holdings necessary in order to intervene.
capital markets coupled with differences in risk aversion between commercial creditors and developing country borrowers. He argued that the price of debt in secondary markets do not adequately reflect the insurance value of reserves to debtors. In the ‘bad state’ (i.e. a debt default) the debt buy-back is of little use since no debt can be serviced. In addition, the depleted reserves due to the buy-back means diminished options for consumption smoothing. Hence, Wijnbergen’s model demonstrates how reserves ensure that policymakers have some additional options during the bad state.

More recently, Distayat (2001) developed a reserve demand model compatible with the second-generation (i.e. self-fulfilling) variety of financial crises. He demonstrated that at the optimum, the sum of the costs of maintaining a peg and that of any external finance would need to be equal to the benefits of the peg itself. One could infer from Distayat’s model that countries with relatively higher risk aversion would prefer to pay a premium to stay away from the region of instability in order to limit the potential for crisis. That premium could very well the cost of holding higher reserve levels, which, in any case, represents a more conservative approach to international financial management.

**Self-insurance in practice:** While these models can be used to demonstrate an optimum level for a buffer stock conceptually, in practice, it would be difficult to imagine reserve levels being maintained on the razor’s edge of the optimum. Central bankers are thought to possess higher tolerance for reserves to go above their desired optimal level rather than for these to go below (Machlup, 1966; Frenkel, 1978). Hence, on an applied level, rules of thumb have been designed, including the maintaining reserves worth at least three months of imports. Such import-cover rules served not only as a standardized easy-to-follow guide for policymakers, it also served as an unambiguous and easy-to-verify signal to the market (e.g. to deter a speculative attack on an exchange rate peg). Before the 1980s, such rules were likely to work reasonably well, and the IMF regularly required updated data on the length of import coverage from its member countries. However, such is clearly not the case today, especially in light of increased capital mobility and prevalence of financial crises.

Under an environment of high capital mobility with frequent and costly financial crises, the import cover notion of reserve adequacy is clearly no longer sufficient. This is particularly true for those developing countries that have opened current and capital accounts substantially: the emerging market economies. Mistry (1998)

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5 This has also been referred to as ‘Mrs. Machlup’s wardrobe effect,’ referring to the commonly observed preference for a larger wardrobe.

6 In 1985, six out of every 10 IMF member countries maintained capital account restrictions. By 1995, this ratio had dropped to less than three out of every 10 (World Bank, 1997, pages 10–18).

7 The IMF (1998, p.79) notes that from 1975 to 1997, there have been a total of 158 currency crises, 54 banking crises and 32 twin (i.e. currency and banking) crises. Of these, 116 currency, 42 banking, and 26 twin crises occurred in the emerging markets. Furthermore, the International Monetary Fund reports that: (i) recessions coupled with financial crises are anywhere from 5 to 12 percentage points more severe compared to recessions without crises (IMF, 2002b, p.113); and (ii) for financial crises in the emerging markets, the cumulative loss of output on average is 8% for currency crises, 14% for banking crises, and up to 19% for twin (i.e. banking and currency) crises (IMF, 1998, p.79).
predicted that the reporting of reserves in terms of import coverage would eventually become quite meaningless for countries with sufficient creditworthiness and access to international capital markets. Yet, such openness to international capital is a double-edged sword—a painful lesson for emerging market economies such as Mexico, Thailand, Republic of South Korea, Indonesia, the Russian Federation and Argentina. In many of these recent crisis economies—notably those in Asia in 1997—the excess of foreign currency liabilities over international reserves contributed to financial fragility and made these economies susceptible to capital reversal. Very recent balance of payments crises originated mainly from imbalances in the capital account, due to the combination of external (e.g. non-roll-over of debt, capital reversal) and internal drain (e.g. capital flight).

The existing body of empirical evidence suggests that a country’s international reserve—scaled against such variables as output, money supply, debt or imports—appears to be a robust explanatory variable across various crisis samples, types and episodes. How then is the notion of reserve adequacy to be treated in the present context of volatile financial markets? In order to help answer this question, the next section investigates present reserve-holding trends in an attempt to determine whether and to what extent reserve-holding behavior has indeed changed in the developing world.

3. Reserves in the developing world: who has been self-insuring and at what cost?

There are several reasons to expect many developing countries to maintain reserves. First, most of these countries have resorted to various types of managed exchange rates or outright pegs. The IMF’s Annual Report on Exchange Arrangements and Exchange Restrictions (IMF, 2002c) indicates that well over half of its 180 member countries maintain exchange rate regimes that are classified as pegs, limited flexibility or managed floats. Second, not many developing countries have adequate access to external capital in lieu of reserves. Developing country spreads during periods of volatility have reached up to 924 basis points (World Bank, 2002: p. 38). Third, even with more flexible exchange rates, monetary authorities still intervene in order to prevent large swings in a floating exchange rate. Finally, the variability in foreign aid flows—estimated by the IMF at about five times that of tax revenues on average—is a further motivation for holding additional reserves in efforts to stabilize public expenditure levels. Typically, recipients of foreign aid incorporate donors’ commitments in planning their budget. Yet, the reality is that

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9 In addition, Reinhart and Rogoff (2002) re-assess the IMF’s standard classification of 153 countries’ exchange rate regimes, and find that the difference between the official de jure classifications are often vastly different from the de facto regime. According to their ‘natural’ classification algorithm based on, among other variables, data on market-determined dual or parallel rates, of countries classified by the IMF as managed floating, about half turned out to be de facto pegs, crawls or narrow bands to some anchor currency.
these commitments are often too optimistic, and shortfalls and variability in aid disbursements are not uncommon.

Hence, it is not surprising that the Zedillo report noted a 60% increase in developing country reserves since the Asian financial crisis (UN, 2001). If the Asian crisis somehow influenced risk-aversion levels, then increased reserve holding would fall neatly under a self-insurance logic. The issue would then be an empirical one: To determine whether and to what extent recent financial crises have prompted increased reserve accumulation in each of the developing countries. What this paper will seek to investigate next is if very recent trends in these countries’ reserve accumulation are somehow linked to the Asian financial crisis, and what appears to be a more tumultuous international financial environment. More specifically, it will seek to answer the following questions:

1. In general, to what extent have developing countries been increasing their reserve holdings? If so, by how much?
2. What have been the trends in reserve accumulation for individual developing countries in recent years? Is there evidence of a structural break?
3. What has been the cost of this strategy to these countries? Which countries have paid this cost and which have not?

This section will proceed as follows. First, summary statistics of various reserve adequacy indicators will be presented for a sample of 65 developing countries—including the Republic of Korea and Singapore. Indicators of a possible relationship between reserve holding and factors such as measures of country risk, GDP growth, and GDP growth volatility will be examined. Second, structural break (i.e. Chow) tests will be applied in order to determine whether or not there has been a different trend in these countries’ reserve accumulation after the Asian financial crisis. Third, preliminary estimates of the cost of holding ‘excess’ reserves will be presented. Finally, the shares of total reserve holdings in the developing world will be analyzed to reveal which countries had most likely been following a policy of self-insurance, viz. reserve accumulation.

3.1. Summary statistics

The preliminary analysis of the individual reserve-holding trends of the sample countries mainly focused on comparison of the mean levels and volatilities of first and the second periods. Most of the sample countries exhibited an increase in the mean from the first period, 1985 (1st quarter) to 1996 (1st quarter), to the second, 1998 (1st quarter) to 2001 (2nd quarter). However, the results were mixed for the analysis of standard deviation.

3.1.1. Average reserve levels

Fifty-eight out of 65 countries studied exhibited increased mean reserve levels in the second period (Table 2). In 34 of these 58 countries, the level of reserves at

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10 Data source and explanations are found in the Annex. Data are available from the author upon request.
Table 2
Changes in the mean level of reserves

<table>
<thead>
<tr>
<th>Region</th>
<th>Increased by</th>
<th>Decreased</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than 100%</td>
<td>At least 100%</td>
</tr>
<tr>
<td>Africa</td>
<td>Ethiopia, Mauritius, Seychelles, Swaziland</td>
<td>Botswana, Kenya, Lesotho, Malawi, Morocco, Sierra, Leone</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nigeria, Burundi, Tanzania, Tanzania, Djibouti, Ghana, Swaziland, Zimbabwe</td>
</tr>
<tr>
<td>Asia</td>
<td>Myanmar, Pakistan, Samoa, Solomon Islands, Sri Lanka, Vanuatu</td>
<td>Indonesia, Malaysia, Nepal, Singapore, Thailand</td>
</tr>
<tr>
<td>North Africa</td>
<td>Cyprus, Malta</td>
<td>Romania</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>Russian Federation</td>
<td></td>
</tr>
<tr>
<td>Middle East</td>
<td>Bahrain, Kuwait, Oman, Qatar, Saudi Arabia</td>
<td>Egypt, Jordan, Lebanon</td>
</tr>
<tr>
<td>Latin America</td>
<td>Antigua/Bar, the Bahamas, Belize, Colombia, Ecuador, Venezuela</td>
<td>Barbados, Bolivia, Brazil, Chile, Mexico, Uruguay</td>
</tr>
</tbody>
</table>

Total (65) 24 20 14 7

least doubled; and in 14 out of the 34 countries, reserves at least quadrupled. Of the 57 countries that have data, as many as 43 countries exhibited an increase in the mean of reserves scaled by imports in the second period. Furthermore, in the second period, 17 out of the above 57 countries had enough reserves to cover at least two quarters of imports. In 34 out of 63 countries with data, the mean of reserves scaled by M2 increased in the second period. In the case of reserves scaled over Foreign liabilities, more than half of the countries studied exhibited an increase. In some countries, reserves covered over five quarters worth of foreign liabilities.

3.1.2. Standard deviation of reserves

The standard deviation of reserve levels has increased in many of the countries that have experienced financial crises of late: Republic of Korea, Indonesia, the Philippines, Brazil and the Russian Federation. The latter, in particular, exhibited an increase in standard deviation in all four series: reserves, reserves by imports, reserves by M2, and reserves by foreign liabilities. The same pattern was apparent for reserves scaled over imports (Table 3). As for reserves scaled over M2, only six countries exhibited increased volatility: Algeria, Malawi, South Africa, Indonesia, Russia, and Ecuador. As for reserves over foreign liabilities, as many as 27 out 54
Table 3
Changes in the standard deviation of reserves scaled by imports

<table>
<thead>
<tr>
<th>Region</th>
<th>Decreased by</th>
<th>At least 50%</th>
<th>At least 75%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Less than 50%</td>
<td>At least 50%</td>
<td>At least 75%</td>
</tr>
<tr>
<td>Africa</td>
<td>Burundi, Lesotho</td>
<td>Botswana, Ethiopia, Kenya, Mauritius, Morocco, Seychelles, Uganda</td>
<td>Ghana</td>
</tr>
<tr>
<td>Asia</td>
<td>Malaysia, Maldives, Papua New Guinea, Philippines, Samoa, Sri Lanka, Thailand, Tonga, Vanuatu</td>
<td>India, Nepal, Pakistan</td>
<td>Myanmar</td>
</tr>
<tr>
<td>North Africa</td>
<td>Cyprus</td>
<td>Malta</td>
<td></td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>Romania</td>
<td>Poland</td>
<td>Russian Federation</td>
</tr>
<tr>
<td>Middle East</td>
<td>Turkey, Jordan, Kuwait</td>
<td>Bahrain, Lebanon</td>
<td>Egypt</td>
</tr>
<tr>
<td>Latin America</td>
<td>Argentina, Bahamas, Belize, Brazil, Chile</td>
<td>Bolivia, Colombia, Peru, Venezuela</td>
<td>Mexico</td>
</tr>
<tr>
<td>Total (57)</td>
<td>21</td>
<td>18</td>
<td>4</td>
</tr>
</tbody>
</table>

countries showed the increase. Ten out of 12 Latin American countries studied, exhibited a higher volatility in the second period. Furthermore, in countries like Barbados, Colombia, Mexico, and Uruguay the numbers increased by more than 50 times. The means in those countries have increased by almost as much.

The People’s Republic of China was an interesting case. It accumulated the largest amount of international reserves since the Asian financial crisis. The average level of reserves in the second period was six times that of the first period. The situation is not very different when its reserves are scaled over imports—the mean of the second period is more than twice that of the first, but the standard deviation is about the same. This could be evidence of successful self-insurance strategy using reserves—an increase in levels accompanied by lower volatility.

3.1.3. Correlations of reserves with country risk

Country risk as an explanatory variable for reserve holding behavior can be seen in previous studies (see for instance, Wijnholds et al., 2001). Indeed, measures such as the International Country Risk Guide are generally treated by market agents as
bell-weather indicators of a country’s economic health. Not surprisingly, the level of reserves is itself a component of this country risk measure, for the key reason that reserves mitigate (if not prevent) the adjustment costs linked to crisis episodes. Yet while the literature refers to the use of country risk variables to explain longer-term reserve holding trends, examining the correlation between changes in this measure of country risk and changes in reserves reveals an interesting short-term dynamic (Fig. 2).

Shortly before the crisis broke out (i.e. recognized by many as having occurred with the devaluation of the Thai baht in July 1997), the correlation of changes in (scaled) reserves with the changes in the country risk measure was negative. During the quarter that the crisis broke out, the correlation jumped to take a positive value, and then dropped again to a negative value a quarter thereafter. One could infer from this that the reserve levels fluctuated significantly during this period, vis-à-vis the scaling factors (i.e. imports, foreign liabilities and M2). These correlations suggest that there was a significant ‘surprise,’ since reserve levels did not correlate as much with the country risk measure before the crisis. Correlations in the post-crisis period, particularly towards the last quarter, suggest a higher correlation between country risk and reserves, suggesting a departure from past policy stance.

3.2. Structural break tests

In order to evaluate whether and to what extent developing countries have been following a policy of self-insurance, vis-à-vis reserve-accumulation, structural break tests for the pre- and post-Asian financial crisis periods were applied to the three series: reserves over M2, reserves over foreign liabilities, and reserves over imports. The first quarter of 1998 has been selected as the breakpoint, based on IMF intervention and crisis adjustment beginning at slightly before that period. The regression results do not indicate a common and overarching reserve-holding pattern (Table 4). Of the 65 countries studied, only 22 countries exhibited any significant and positive structural break in the intercept, and only 15 countries showed any significant and positive break in the slope. Analysis of each of the variables reveals that only Egypt, Sri Lanka and Turkey exhibited a positive structural break in all three series. As for the slope, only Belize, the Russian Federation and Tanzania were found to have a structural break in all three series. These six countries span the spectrum of exchange rate arrangements classified by the IMF—from pegged (Egypt and Belize), to managed floating (Russian Federation and Sri Lanka), and finally to independently floating (Tanzania and Turkey). The results presented in Table 4 lend further support to the argument that there is still a

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11 For more on the International Country Risk Guide published by The PRS Group, see www.prsroup.com/icrg/icrg.html
12 For a comprehensive chronology of the Asian crisis, refer to Nouriel Roubini’s ‘Global Macroecon- onomic and Financial Policy Site’ at http://pages.stern.nyu.edu/~nroubini/asia/. The choice of the year 1998 is consistent with work by Dell’ Ariccia et al. (2002). They used the non-bailout of Russia in that year as a reference point for a revaluation of the perceived risk in emerging market debt.
Fig. 2. Correlation of change in country risk with change in reserves.
Table 4
Structural break test results: countries with a statistically significant positive break

<table>
<thead>
<tr>
<th>Country</th>
<th>M2</th>
<th>Foreign liabilities</th>
<th>Imports</th>
<th>Monetary arrangementa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egypt</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Pegged with horizontal band</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Managed float with no pre-announced path</td>
</tr>
<tr>
<td>Turkey</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Independently floating; monetary aggregate target</td>
</tr>
<tr>
<td>Brazil</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Independent float; inflation target</td>
</tr>
<tr>
<td>Burundi</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Managed float with no pre-announced path</td>
</tr>
<tr>
<td>Israel</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Crawling band</td>
</tr>
<tr>
<td>Lesotho</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Conventional fixed peg against a single currency</td>
</tr>
<tr>
<td>Poland</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Independent float; inflation target</td>
</tr>
<tr>
<td>Singapore</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Managed float with no pre-announced path</td>
</tr>
<tr>
<td>Botswana</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Independent float; inflation target</td>
</tr>
<tr>
<td>China</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Conventional fixed peg against a single currency</td>
</tr>
<tr>
<td>Colombia</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Independent float; inflation target</td>
</tr>
<tr>
<td>Ecuador</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Another currency as legal tender</td>
</tr>
<tr>
<td>Ghana</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Managed float with no pre-announced path; monetary aggregate target</td>
</tr>
<tr>
<td>Lebanon</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Conventional fixed peg against a single currency</td>
</tr>
<tr>
<td>Peru</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Independent float; monetary aggregate target</td>
</tr>
<tr>
<td>Philippines</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Independent float; monetary aggregate target</td>
</tr>
<tr>
<td>Samoa</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Conventional fixed peg against composite</td>
</tr>
<tr>
<td>Thailand</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Managed float with no pre-announced path; inflation target</td>
</tr>
<tr>
<td>Uruguay</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Crawling band</td>
</tr>
<tr>
<td>Venezuela</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Crawling band</td>
</tr>
<tr>
<td>Belize</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Conventional fixed peg against a single currency</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Managed float with no pre-announced path</td>
</tr>
<tr>
<td>Tanzania</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Independent float</td>
</tr>
<tr>
<td>Barbados</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Conventional fixed peg against a single currency</td>
</tr>
<tr>
<td>Cyprus</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Pegged rate with horizontal band</td>
</tr>
<tr>
<td>Ecuador</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Another currency as legal tender</td>
</tr>
<tr>
<td>Kuwait</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Conventional fixed peg against a composite</td>
</tr>
<tr>
<td>Malawi</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Independent float; monetary aggregate target</td>
</tr>
<tr>
<td>Oman</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Conventional fixed peg against a single currency</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>●</td>
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<td>●</td>
<td>Independent float</td>
</tr>
<tr>
<td>Uruguay</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Crawling band</td>
</tr>
<tr>
<td>Algeria</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Managed float with no pre-announced path</td>
</tr>
<tr>
<td>India</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Managed float with no pre-announced path</td>
</tr>
<tr>
<td>Indonesia</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>Managed float with no pre-announced path; monetary aggregate target</td>
</tr>
</tbody>
</table>

a As of 31 December 2001, reported in IMF (2002c).
healthy demand for reserves despite the switch to more flexible exchange rate regimes.

These results are consistent with a self-insurance explanation, but this still does not prove that only self-insurance motivates these results. Yet, if policymakers are indeed more risk-averse after the Asian financial crisis and increased reserves are seen as a form of self-insurance, one thing is clear from the results: Empirically, only a few countries have been able to follow a more aggressive reserve holding strategy, indicated by a positive structural break in reserve levels (i.e. intercept) and speed of accumulation over time (i.e. slope).

3.3. Cost estimates of ‘excess’ reserves

As noted earlier, the cost of holding ‘excess’ reserves—often described as reserves over 3 months worth of imports—has been used before to make the argument that the net-benefits of an open capital account need to be constantly evaluated. Using the sample of 65 developing countries studied here and based on an interest rate spread of 6% (i.e. between the cost of reserves and the risk-free return on reserve holdings), the average quarterly opportunity cost was about US$60 million for the 1985–1996 period—increasing to approximately US$450 million for the 1998–2001 period. Of course, these numbers need to be taken in proper context. A cost of US$60 million may be large for a country like Uganda, but infinitesimal in countries like Malaysia or Brazil. Not only the sizes of their economy differ, but also their relative openness to capital flows. What is interesting to note, however, is the fact that this average cost has increased dramatically between the two periods, due to two factors. First, much higher levels of over-all reserves have been held. Second, recent instability in the international capital markets has contributed to higher risk-adjusted spreads.

Fig. 3 presents the average costs for some selected countries. If increased reserves is a necessary form of self-insurance against financial crises, then the ‘premium’—or the opportunity cost of this policy—has increased dramatically since the Asian financial crisis. With the preponderance of financial crises in the emerging market economies, the very strategy of pursuing an open capital account itself may need to be seriously re-considered.

3.4. Who are the self-insurers?

Thus far, the evidence suggests that particular countries have accumulated reserves (i.e. levels and scaled) more aggressively, as indicated by higher means and steeper trends. Furthermore, the costs of this strategy are substantial; US$450 million per

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13 Rodrik (2000) approximates the spread between the yield on foreign reserves and the marginal cost of borrowing at 6%. However, the Zedillo report (UN, 2001) quotes a spread of 8%. Rodrik’s spread is used as a conservative estimate.

14 The average developing country spread in 2000 was approximately 700 basis points. In 2001, the spread peaked at 900 basis points in the third quarter (World Bank, 2002).

15 See Wyplosz, 2001 for a discussion.
Quarter on average in the 4-year period after the Asian crisis (i.e. 1998–2001) for the developing countries studied. This is an eight-fold increase from the pre-crisis years (i.e. 1985–1996). These observations are consistent with previous analyses of reserve-holding patterns in the developing world (see, for instance, Buira, 2003; Griffith-Jones and Kimmis, 2002; UN, 2001). As argued earlier, these reserve-holding patterns are consistent with a self-insurance motivation.
In this context, it is important to note that only a handful of countries have been able to follow such a strategy. Fifteen countries accounted for approximately two-thirds of the increase in foreign reserve holding since the Asian crisis (Table 5; note that Taiwan is excluded). These 15 countries accounted for 42% of total developing country reserves in the first quarter of 1996, jumping to 52% by the first quarter of 2001. Five countries—China, the Republic of Korea, Mexico, and India—comprised 40% of the increase in reserves in the 4 years following the Asian crisis. In the first quarter of 1996, these four countries comprised approximately 20% of developing country reserves, increasing to 30% 5 years later.

4. Policy implications

4.1. Reserve holding rules and signaling

Before the advent of more capital account openness in the developing world, holding reserves equivalent to at least 3 months of imports was the widely practiced and prescribed minimum external cover rule. This rule guided reserve management when the balance of payments was primarily dominated by the current account. Today, monetary authorities try to account for new risks in the financial environment.
by again resorting to rules of thumb—but this time for a much broader notion of external cover. For instance, the Greenspan–Guidotti rule suggests the maintenance of reserves equivalent to 12 months of a country’s total foreign obligation, which includes but is not limited to imports.\footnote{See Greenspan (1999) and BIS (2000).} Yet, reserve-holding in some countries appear to follow an even more pronounced precautionary path. For example, in the period from 1998 (Q1) to 2001 (Q1), for each quarter the Republic of Korea maintained reserves that, on average, covered two quarters (6 months) of imports or eight quarters (2 years) worth of foreign liabilities.

Generalized rules serve at least two purposes. First, these rules could serve as a means to operationalize the self-insurance motivation for holding reserves Second, and perhaps more important, these rules of thumb also serve as easy-to-verify indicators for market agents, by conveying simplified information to the market. Clearly, surpassing these rules could also be used as part of a broader signal of robust macroeconomic fundamentals to the market. As long as an economy could be distinguished from other, presumably less well-managed economies, the market could reward that economy with larger and more stable capital inflows. In the case of the Republic of Korea, the preceding empirical trends reveal that it is one of only a few countries that does send, and could send, this signal—a precondition for effectively signaling quality (Bernheim and Redding, 1996).

There is at least one clear policy implication from the foregoing analysis: the practice of signaling could lead to a further polarization of access to the international capital markets. That is, only those that could afford to send very positive signals would gain access to the capital markets under the most favorable conditions. As noted earlier, this study finds that only approximately 15 countries account for roughly two-thirds of the increase in foreign reserves in the developing world since the Asian financial crisis. Hence, most other developing countries would need to wrestle with the ‘Catch-22’ of international finance: Access to international capital, under more reasonable terms, would likely remain out of reach for the majority of developing countries that need capital the most.

4.2. Special drawing rights

The general proposal to increase the role of special drawing rights (SDRs) in the international monetary system by increasing their allocations and/or making these allocations more frequent is not new and has been the subject of debate and discussion since before the spate of multiple crises in the 1990s. (For a discussion, see Mussa et al., 1996; Bird, 1998; Clark and Polak, 2002). The important point to include in this debate is that if countries are indeed self-insuring, then an additional argument could be made for further SDR allocations. Such allocations could improve both the quantity as well as the quality of reserves in the developing world. That is, further allocations would limit the need to hold excessive reserves and lower the deadweight losses from such a strategy.

However, the prospects for a one-off SDR allocation—let alone further regular allocations—are presently dim. Since any allocation would primarily create benefits
for those countries that presently do not have as much access to the international capital markets, there is stronger support for it among developing countries. In fact, for many industrial countries, SDR allocations would be irrelevant, considering that they have adequate access to international capital at much the same cost. Perhaps more importantly, the leading reserve currency (i.e. the US dollar) grants benefits to its source economy, not the least of which in the form of seigniorage gains from the rest of the world, which holds that currency for precautionary, and transactions purposes. It would therefore be a rational response for this country, the United States (US) to block the development of a competing reserve currency like the SDR. True to form, its de facto veto in the IMF presently blocks any new allocation from taking place. Accounting for approximately 17% of the vote at the IMF, the US has blocked the 85% majority requirement for an SDR allocation.¹⁷

4.3. International economic insurance and macro markets

Besides implementing more stringent reserve management rules and exploring further SDR allocations at the IMF, a third policy option could be to develop international contracts for mitigating financial and economic risk. The impetus behind such contracts would primarily lie in undertaking risk sharing at the national level to augment private economic risk sharing by individuals. Inter-governmental action would be required to undertake contracts that would likely extend well beyond the lives of individuals and involve massive transfers of resources on the scale that only governments are best equipped to handle. Such arrangements could take several forms.

Shiller (2003) describes the possibility of structuring parallel loan agreements between any two countries (or one country and a group of countries) of sufficiently different economic prospects. Essentially, the contracts would specify a formula based on which the country that grew faster than expected would compensate the country (or countries) that grew slower than expected. That is, a country would owe debt to its counter parties as some fraction of the unexpected increase in its gross domestic product (GDP). If it underperforms, relative to ex ante forecasts and the economic performance of its counterparties, then other countries would owe debt to it instead. Such an arrangement would not necessarily alter the totality of risks in the world, but individual country risks could certainly be reduced significantly.

In addition, Caballero (2003) argues that national underinsurance greatly amplifies the recessions that accompany financial crises in the developing world. As with Shiller, he notes that the absence of risk mitigating markets leaves many developing countries with no option but to self-insure or bear with deep precautionary recessions as part of the cost of living in an environment of volatile capital flows. He argues for the development of contingent markets—markets that would allow for the contracting of risks beyond the control of national policymakers—perhaps in a manner reminiscent of the development of emerging market bond markets after the

¹⁷ For more on the political economy of SDR allocations, see Bird (1998) and Buira (2003).
of the 1980s. Preliminary calculations by Caballero and Panageas (2003) suggest that a fairly priced contingent bond contract in a well-developed market for this instrument would cost significantly less than the savings gained from the reduction in sovereign risk, or the added costs of borrowing from self-insurance. It is also important to note that this approach has the added benefit of private sector involvement, as much of the risk contracting would be done with private sector counterparties, rather than through the official sector.

Hence, one of the key policy implications from these proposals by Shiller and Caballero is that international cooperation is required to construct these ‘macro markets’ where the larger risks related to recessions and national output loss could be mitigated through risk sharing among nations. Since these markets are unlikely to emerge on their own due to their collective action nature, international financial institutions such as the IMF could likely play a key role in facilitating their creation.\textsuperscript{18}

The proposals certainly sound appealing for developing countries, which are more likely to face adverse economic conditions based on historical trends. However, what of industrial countries? Would these countries find it in their interest to undertake such contracts?

Shiller and Athanasoulis (2001) conclude that industrial countries could in fact be willing to pay a developing country to participate in this contract, if there were a free market for such swaps (i.e. back-to-back loan agreements). Furthermore, their simulations on India and the United States (which would be one of several industrial country counterparties) as potential contracting parties, these authors found that the ex ante economic value of participating in the contract would be over 10% of GDP for India and 0.2% of GDP for the US. The contract would undoubtedly be welfare enhancing for both parties. Hence, countries would not enter into risk management contracts and markets out of altruism. On the contrary, the primary justification could lie purely within the realm of self-interest. This novel policy approach certainly requires further analysis and consideration.

5. Conclusion

The objective of this paper was to investigate a possible self-insurance motivation behind increased reserve-holding in the developing world after the Asian financial crisis. A brief analysis of the literature showed that a self-insurance framework would be a reasonable extension of previous theoretical models to explain reserve holding. An empirical verification of this hypothesis provided evidence that several countries could indeed be self-insuring: Algeria, PR of China, India, Indonesia, Israel, Kuwait, Philippines, Poland, the Russian Federation, Singapore and Venezuela. Further empirical, as well as anecdotal, evidence could confirm if indeed these countries are indeed self-insuring. If such is the case, the key implication is that only a few countries are able to follow this strategy and that significant levels of

\textsuperscript{18} The IFIs could help facilitate the replacement of existing debt with contingent bonds, an action, which few countries are likely to undertake on their own.
deadweight losses would nonetheless be incurred by all countries that choose to pursue such a strategy.

A brief overview of the three possible areas of policy responses reveals that reserve holding rules of thumb and allocations of SDRs are both somewhat problematic solutions. Reserve holding rules do not preclude the practice of signaling ‘quality,’ which could lead to the further polarization between those that do and those that do not have access to the international capital markets. However, industrial countries, most especially the United States, do not have strong incentives to support further SDR allocations in general, let alone one that primarily targets and benefits the developing world. From an incentives-based vantagepoint, this leaves the development of macro markets for international economic insurance as a very promising option to consider further. Among the three options, this approach is the most likely to find widespread support from both industrial and developing countries, as the benefits from risk sharing, in fact, increases with more diverse participants. Future research on this option should therefore be highly encouraged.

Acknowledgments

This views expressed in this paper are my own and do not necessarily reflect the policies of the institution I am affiliated with. My special thanks to Paola Margarita Deles.

Appendix A: Annex

A.1. Data

The data used for this study were retrieved from the IMF’s International Financial Statistics CD-ROM (Version June 2002). The time period selected was based on data availability and extends from the 1st quarter of 1985 to the 2nd quarter of 2002. The description of the variables is provided below:

- International Reserves—Series ‘001.1…DZF’ (millions SDR), total reserves.
- M2—The sum of M1 and quasi-money. The calculations were performed in national currency units and later the data were converted into millions SDR using the period average exchange rate.
- Imports—Series ‘71.DZF’, quoted in millions US dollars and were converted into millions SDR using the period average exchange rate.
- Foreign Liabilities—Series ‘16C…ZF’, quoted in millions national currency and converted into millions SDR.

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