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The Cost of Holding Excess Reserves: Evidence from India

Introduction

With the collapse of the Bretton Woods system, the pressure on industrial countries to accumulate reserves eased as they moved to flexible exchange rate regimes and overcame the problem of original sin. Emerging markets, however, have been struggling to define adequate reserve levels, and have been typically motivated by the principle of "non-satiability" while dealing with international reserves. Over the last decade, developing countries, particularly those in East and South Asia, have accumulated massive stockpiles of international reserves with economies like China, South Korea, Russia, and India holding reserves in excess of US$2.85 trillion by middle of 2008.[1] The massive scale of reserve accumulation has raised questions about the cost of holding large volume of reserves since most of it is held as low-yield government bonds. Such costs are extremely important for a country like India as scarce resources are being diverted to reserve accumulation, which has increased over five-fold since 2001–02.

In India, holdings of international reserves has increased substantially from less than US$5 billion in July 1991 to more than US$316 billion by middle of August 2008, before falling in recent months owing to the ongoing financial turmoil. As described subsequently in this paper, the bulk of the reserve accumulation in India can be identified taking place over three main episodes that lasted from July 1993 to October 1994, November 2001 to May 2004, and November 2006 to February 2008. Moreover, strong capital

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1. These reserves do not include gold.

inflows were the principal source of reserve accumulation during most of these episodes, except for the early period in the second episode, when India witnessed a current account surplus. The current levels of reserve holdings are well in excess of the traditional debt- and trade-based reserve adequacy indicators.

However, international reserves are held for a number of reasons apart from just financing current account deficit and covering short-term debt obligations. These include defusing a speculative run on currencies and preventing excessive volatility in the exchange rate, among others. Reserve accumulation can also be a byproduct of maintaining an undervalued exchange rate to promote export-led growth. In this paper, we employ empirical methods to generate an international norm of reserve holding, incorporating the various objectives of holding reserves. We then compare the actual reserve holdings with the international norm for emerging markets and the difference is deemed as excess reserves. Next, we calculate the cost of holding these excess reserves in India by looking at three alternate uses of the resources employed in building up the stockpile of reserves.

The rest of the paper is structured as follows. The second section undertakes a brief review of the existing literature. The next section introduces the empirical model to identify the principle determinants of reserve holding. Using the results of the empirical model, we create an international norm of reserve holding and calculate the extent of excess reserves. The fourth section discusses the reserve management in India, identifying the principle episodes of reserve accumulation. The following section outlines the cost of holding excess reserves in India focusing on alternative uses of resources. Finally, the sixth section lists out the main conclusions of the study.

Selected Review of the Existing Literature

In one of the earliest papers on reserve holdings, Heller (1966) argued that countries should add reserves till the marginal utility of holding additional reserves equals the marginal cost. The precautionary motive for holding reserves stems from the ability to smoothen consumption and production during a balance of payments deficit. A measure of opportunity cost was employed by assuming that the return on reserves had to be compared with the rate of capital. Subsequent studies focused on the extent of external payments variability, the propensity to import, a scale variable like population, and an opportunity cost as influencing the demand for reserves. The impact of import propensity was a subject of considerable debate. High trade

openness reflected greater vulnerability and implied a positive relationship with reserves. However, high reserves level could be achieved by generating a current account surplus through reduction in imports, implying an inverse relationship. While Cooper (1968), Iyoha (1976), and Frenkel (1978) found evidence for the positive relationship, Heller (1966) argued for a negative relationship.

Several studies in the late 1960s looked at the demand for reserves during the Bretton Woods period. Kenen and Yudin (1965) argue that the demand for reserves in industrialized countries depends on the extent and duration of balance of payments disturbances, per capita income, central bank's liquid liabilities, and overall money supply. Other papers like Thorn (1967) and Courchene and Youssef (1967) conclude that the level of imports, money supply, and long-term interest rate play an important role in determining the level of reserve holdings in developed economies.

Most studies in the 1970s and 1980s focused on the impact of import propensity, import volume, and balance of payments variability. The impact of the scale variable has been particularly ambiguous in the literature. While studies like Frenkel (1974a), Frenkel (1974b), Frenkel and Jovanovic (1981), and Bahamani-Oskoee (1987), found scale economies in reserve holdings, others including Heller and Kahn (1978), Frenkel (1983), Edwards (1983), Lizondo and Mathieson (1987), and Islam et al. (1994) do not.

While early studies considered that reserves were largely held to mitigate the current account disturbances, the collapse of the Bretton Woods system in 1973 altered the factors influencing the demand for reserves. Haberler (1977) speculated that a move toward more flexible exchange rate regimes would reduce the demand for reserves as exchange rates would fluctuate in response to changes in trade. However in reality, governments showed high concern about exchange rate variability, and an open capital account was seen as a source of instability. Thus despite an announced move toward more flexible exchange rates, the reserve to GDP ratio did not decline in most countries. Calvo and Reinhart (2000) argue that some countries, which identified themselves as floaters, look akin to peggers in terms of the probability that the monthly percentage change in their exchange rate will fall within a narrow band. Hausman et al. (2001) find that countries with limited ability to borrow abroad in domestic currency would seek reduced exchange rate volatility to limit the damage from currency mismatches of their liabilities.

Consequently, a key question in the post-1973 period was the stability of reserve demand across exchange rate regimes. Frenkel (1980; 1983) tested for change in the demand for reserves across exchange rate regimes and

found a leftward shift in reserve demand in the post-1973 period, concluding that floating-rate regimes require fewer reserves. Edwards (1983) finds that balance of payments variability is a significant determinant of reserves for fixed-rate developing countries, but not for countries preferring devaluations. Employing a dummy to distinguish between fixed-rate and devaluing countries, Edwards conclude that the devaluing countries hold fewer reserves than fixed-rate countries.

A spate of crises in emerging markets during 1980s and 1990s compelled researchers to revisit the issue of reserve adequacy. This period also witnessed gradual opening up of the capital account in the developed countries followed by emerging markets. Increased capital flows have a dual impact on demand for reserves. While studies like Heller and Khan (1978) and Eichengreen and Frenkel (1996) argue that capital mobility allows countries to finance part of the external deficit by borrowing abroad, greater capital mobility can be a source of external vulnerability as it raises exchange rate volatility.

These crises resulted in a spurt of literature looking at the importance of holding reserves to meet short-term obligations. Reserves provide self-insurance against sudden stops and adverse fiscal shocks. Ben-Bassat and Gottlieb (1992a) argue that international reserves reduce the probability and the intensity of an output drop due to a sudden stop. Greenspan (1999) pointed out the ratio of short-term external debt to reserves is the single most relevant indicator of reserves for countries borrowing in international markets. Bussiere and Mulder (1999), using a methodology developed by Sachs et al. (1996), concluded that higher liquidity can significantly decrease countries' vulnerability to external shocks in the face of weak domestic fundamentals. They argue for complete coverage of total short-term external debt as a rule for reserve adequacy for emerging markets.

The pattern of reserve holding has changed considerably in Asian economies in the aftermath of the Asian crisis with economies exhibiting increased demand for reserves for self-insurance. Focusing on Korea, Aizenman et al. (2004) find a structural break in the pattern of reserve holding post-Asian crisis with financial openness and external indebtedness becoming significant predictors of reserve holdings. Aizenman and Marion (2004) find that the size of international transactions, their volatility, exchange rate arrangements, and political stability are the key determinants of international reserve holdings in East Asia. Countries characterized by sovereign risk, costly tax collection, and large inelastic fiscal liabilities exhibit greater precautionary demand for reserves.

Feldstein (1999) points out that emerging markets must protect themselves from crises like the one that occurred in 1997, and the key to self-protection is liquidity in the form of large foreign exchange reserves. Reserves also lower the real exchange rate volatility, induced by terms of trade shocks. Aghion et al. (2006) show that in countries characterized by limited financial development, exchange rate volatility negatively impacts the growth rate. Thus, any mechanism reducing exchange rate volatility will enhance the growth performance. Edison (2003) also shows that along with real GDP per capita, population level, and ratio of imports to GDP, exchange rate volatility influences the demand for reserves.

Obstfeld et al. (2008) argue that one of the reasons for countries to hold reserves above the traditional trade- and debt-based adequacy measures is to ensure domestic financial stability and prevent a run on the domestic banking system. With financial globalization, residents can withdraw domestic assets to exchange for foreign ones if there are concerns about the future economic health of the country. Such a run on the financial system can lead to a currency crisis unless the central bank has enough foreign reserves to exchange for domestic assets. Burke and Lane (2001) conclude that apart from trade openness and external indebtedness, financial depth is a principal determinant of international reserves. This could also explain why some emerging markets like India and China are holding reserves well above the traditional reserve adequacy measures. The central banks of these countries might expect further financial integration and monetization in the near future.

Dooley et al. (2003) argue that the growing stockpiles of international reserves in some emerging markets like China could be attributed to a deliberate strategy of facilitating growth by maintaining an undervalued real exchange rate to promote exports.

Thus it is evident that countries are accumulating reserves to meet a wide range of objectives. The ongoing financial turmoil has also highlighted the various uses of international reserves. A number of countries like Russia, South Korea, and Mexico have used their reserves to counter capital's "flight to safety" and defend their currency. Consequently, a number of these countries have witnessed a decline in reserve holdings in recent months.

Despite the above varied objectives of accumulating international reserves, the existing literature looking at the cost of holding reserves implicitly assumes that holding international reserves does not generate any benefits or the reserves are held only to meet a single objective like current account financing. Consequently, it either takes into account the entire stockpile of reserves or reserves in excess of a single adequacy measure (import cover).

Such a perspective fitted well in a world where financial markets were not integrated and trade openness reflected countries' vulnerability to external shocks, that is, the Bretton Woods period. However, with increased financial integration in recent years, the emerging markets have increased their exposure to volatile short-term inflows of capital that are subject to frequent sudden stops and reversals.

Early papers looking at the cost of holding reserves like Iyoha (1976) and Frenkel and Jovanovic (1981) treat the opportunity cost as the inverse of the discount rate and find that the demand for reserves varies inversely with the opportunity cost. However, Shinkai (1979) points out that since most the reserves are held in dollar-denominated assets, it makes more sense to use the difference between returns on such assets and a country-specific interest rate, which measures the net gain (inverse cost) of holding reserves instead of investing the equivalent sum within the country.

Another measure usually employed to capture the cost of holding reserves is the return on investment in physical capital. Neely (2000), Ben-Bassat and Gottlieb (1992a), and Baker and Walentin (2001) assume that if assets were not held as reserves they would be available to fund domestic investment in physical capital. Thus an increase in reserves represents an enormous cost to the developing nations as they forego domestic investment in either physical or human capital. Baker and Walentin (2001) point out that these costs exceed 1 percent of GDP and possibly 2 percent of GDP for many developing economies.

In a recent paper Rodrik (2006) terms excess reserves as reserves held over and above what is required to meet three months of imports. Using this rule Rodrik (2006) finds that by investing resources in accumulation of reserves instead of reducing private sector's short-term borrowing, the developing nations are losing about 1 percent of their GDP.

Determinants of Reserves

In this section, we use empirical methods across 167 countries over the period of 1980–2005 to identify the principal determinants of cross-country variation in the level of international reserves. The dependent variable is the ratio of reserves minus gold to GDP. The reserves include special drawing rights, reserves of the International Monetary Fund (IMF) members held by the IMF, and holdings of foreign exchange under the control of monetary authorities. Data on reserve holdings and GDP are taken from the World Development Indicators (WDI). Both reserve holdings and GDP are measured in current US dollars.

As discussed already, a wide range of variables have been found in the literature to influence the reserve holding behavior of an economy. In the subsequent analysis, we draw on that literature to identify the principal determinants of reserve holding. The first variable is a measure of real income per capita, which acts as a measure of the overall development of the economy and captures a wide range of factors affecting reserve holdings. Owing to the large variation in this variable across the countries, we use the log of real per capita GDP instead of level.

There is a close association between domestic financial development and exposure to external crises. To the extent that the liabilities of the domestic sector are partly denominated in foreign currency, financial deepening should be matched by an increase in international reserves. We measure financial depth with the ratio of money and quasi money (M2) to GDP. Data on M2 and per capita GDP are also taken from the WDI.

The volume of reserves is also crucially affected by the exchange rate regime. A country with a currency peg is likely to hold more reserves either to defend against attacks on the exchange rate or as a consequence of resisting an appreciation of the domestic currency. On the other hand, in a flexible exchange rate regime, the exchange rate can freely float to reflect market reality and hence such a country is likely to hold fewer reserves. To control for exchange rate regime, we use the exchange rate index formulated by Levy-Yeyati and Sturzenegger (2005), which is a *de facto* classification based on data on exchange rates. The index ranges from 1 to 5 with a lower number implying a more flexible exchange rate regime.

The extent of capital account liberalization is another variable influencing the precautionary motive for reserve accumulation. As a country opens up to greater capital flows, it needs to ensure adequate safeguards to protect itself against sudden stops. Thus greater capital account openness tends to be associated with higher reserves. We measure capital account openness using Chinn–Ito index developed in Chinn and Ito (2006). The index ranges from 1.79 to 2.54 with a higher value indicating greater financial openness.

Aizenman and Marion (2004) point out that political uncertainty will also influence a country's strategy regarding holding of reserves. Suppose alternatively the government in a country has a "tough" administration that ensures responsible fiscal behavior and a "soft" administration that behaves opportunistically in appropriating and allocating resources with high discount rates to special interest groups. A "soft" administration would want to increase the consumption of special interest groups and reduce international reserve holdings, and accumulate international debt to achieve that. On the other hand, a "tough" administration would be reluctant to hold

lot of reserves if there is a high probability that it will lose power in the near future and the future administration will be "soft" and grab the rewards for the special interest rate groups. Thus, political instability can reduce the level of reserve holdings below the level supported by efficiency considerations. We use the political stability index developed by *International Country Risk Guide*. The index is made up of variables like government stability, socio-economic conditions, conflicts, law and order, and so on. The index ranges from 0 to 100 with a higher number indicating a more politically stable regime.

As pointed out in Dooley et al. (2003) reserve accumulation can also be treated as a byproduct of maintaining an undervalued exchange rate with a desire to promote exports and provide employment in the traditional sectors. Consequently, countries with an undervalued exchange rate will accumulate reserves to facilitate export growth by resisting currency appreciation. To account for this possibility we control for exchange rate overvaluation. The measure of exchange rate overvaluation is taken from Johnson et al. (2007), and a positive number implies an overvalued exchange rate.

Finally, we also include a series of dummy variables that indicate the behavior of the Asian and the Latin American economies after the crises of 1994 and 1997. These dummies intend to capture the change in the reserve-holding behavior of these economies after they were hit by these crises.

The empirical model is given by following equation:

$$\begin{aligned} Y_{it} = \alpha_0 + \beta_1 X_{1it} + \beta_2 X_{2it} + \beta_3 X_{3it} + \beta_4 X_{4it} + \beta_5 X_{5it} \\ + \beta_6 X_{6it} + \beta_7 X_{7it} + \beta_8 X_{8it} + \upsilon_i + \varepsilon_{it} \end{aligned} \tag{1}$$

where i refers to the country and t represents the time period. Here Y is the dependent variable, measured as ratio of reserves (minus gold) to GDP. Among the explanatory variables, X_1 is log of per capita GDP, X_2 is a measure of trade openness, X_3 is a measure of exchange rate regime, X_4 measures capital account openness, X_5 measures financial depth, X_6 is a measure of political stability, X_7 is the ratio of short-term debt to GDP, and X_8 measures the extent of currency overestimation.

In our sample of countries, a Woolridge test for autocorrelation suggests the presence of first-order serial correlation. Thus the error term in Equation 1 can be written as

$$\varepsilon_{it} = \rho_i \varepsilon_{it-1} + \mu_{it} \tag{2}$$

In the literature, there are several ways to estimate the model in the presence of serial correlation. One can use a feasible generalized least squares

(FGLS) with AR(1) correlation. However, this procedure has been criticized for underestimating the standard errors. The panel-corrected standard error estimates, which uses Prais–Winstein regression, address this problem. It assumes that the disturbances are heteroskedastic and contemporaneously correlated across panels. The panel-corrected standard error estimates allow for first order correlation, AR(1), with a common coefficient of the AR(1) process across all the panels ($\rho_i = \rho, \forall i$), as well as a specific coefficient of the AR(1) process for each panel ($\rho_i \neq \rho, i \neq j$).

Table 1 displays the results of the Prais–Winstein regression with panel specific autocorrelation coefficients. We focus on all the countries in our sample as well as just the emerging market economies. Across the entire sample, log of per capita GDP has a positive and significant impact on reserve holdings. Richer countries tend to have higher reserve holdings. Trade openness, measured as the ratio of imports to GDP, also exerts a strong positive and significant impact on reserve holdings, thereby highlighting the precautionary motive in which countries having a higher share of imports want to hold enough resources to be able to finance their imports.

Across all specifications for the full sample, the exchange rate regime has a significant positive impact on reserves. According to the exchange rate regime measure used, a higher number indicates a less flexible regime. Thus countries with relatively fixed exchange rate regimes tend to accumulate greater reserves. Like trade openness, capital account openness also positively affects international reserve holdings. That is, countries that have opened up their capital account tend to hold greater reserves to protect themselves against episodes of sudden stops. We find that greater financial depth tends to have a positive association with reserve holdings. In many countries, the liabilities of the financial sector are denominated in foreign currencies and this is reflected in higher reserves. Political stability also has the expected positive impact on reserve holdings, but the impact is not significant across all specifications. Finally, external indebtedness has no significant correlation with reserve holdings. Among the categorical variables, only the measure for Asian economies after the Asian crisis has a strong positive and significant effect on reserves suggesting that after the crisis, the Asian economies made a deliberate attempt to bolster their reserve holdings to prevent another such attack.

When we focus only on emerging markets, we find that political stability along with exchange rate regime are no longer significant predictors of the volume of reserves. However, both trade and capital account openness along with per capita GDP, short-term indebtedness, and financial depth continue to be the major determinants of reserve accumulation. We also find strong

TABLE 1. Principal Determinants of Reserve Accumulation, 1980–2005

	Full sample of countries						*Emerging markets*					
	I	*II*	*III*	*IV*	*V*	*VI*	*VII*	*VIII*	*IX*	*X*	*XI*	*XII*
Per capita GDP (Log)	0.917*** [3.82]	0.682*** [2.83]	0.335 [0.97]	1.480*** [3.34]	1.303*** [2.93]	2.973*** [6.36]	0.694 [1.21]	0.09 [0.13]	0.485 [0.69]	3.637*** [3.81]	4.170*** [3.95]	4.179*** [4.44]
Import share	0.119*** [12.69]	0.148*** [15.01]	0.187*** [11.21]	0.153*** [8.05]	0.148*** [6.82]	0.171*** [7.10]	0.256*** [8.44]	0.263*** [8.44]	0.175*** [4.35]	0.139*** [3.09]	0.124*** [3.04]	0.120*** [3.32]
Exchange rate regimes		0.151*** [2.62]	0.283*** [3.51]	0.269*** [3.05]	0.224** [2.57]			0.119 [0.94]	0.161 [1.08]	0.198 [1.16]	0.206 [1.21]	
Capital account openness		0.513*** [3.96]	0.557*** [3.23]	0.535** [2.53]	0.527** [2.48]	0.596*** [2.80]		0.534** [2.11]	0.420* [1.66]	0.477* [1.76]	0.499* [1.91]	0.466* [1.82]
Share of M2 in GDP			0.084*** [5.58]	0.110*** [5.34]	0.116*** [6.30]	0.001 [0.01]			0.104*** [3.99]	0.115*** [4.09]	0.121*** [4.72]	0.129*** [6.09]
Political stability			0.024 [1.41]	0.054** [2.50]	0.046** [2.21]	0.042** [2.05]			0.017 [0.55]	0.012 [0.32]	0.011 [0.30]	–0.003 [0.09]
Ratio of short-term debt to GDP				0.004 [1.01]	0.006 [1.43]	0.005 [1.29]				0.026 [1.60]	0.02 [1.06]	0.02 [1.12]
Exchange rate overvaluation					0.003 [0.52]	0.009 [1.64]					–0.032** [2.16]	–0.030** [2.23]
Observations	3,633	2,836	1,737	1,375	1,298	1,418	573	465	394	344	336	375
Number of countries	167	158	112	89	89	90	25	24	23	21	21	22

Source: Author's calculations.

Note: Robust z statistics in parentheses.

*** indicates significant at 1 percent, ** indicates significant at 5 percent, and * indicates significant at 10 percent.

evidence for the mercantilist motive with currency undervaluation being associated with increased reserve accumulation.

Several papers like Gosselin and Parent (2005) and Edison (2003) have pointed out a structural break in the volume of reserves in 1997 due to the emergence of financial crisis in several countries in Asia. Consequently, in table 2 we focus on post-1998 period. Following Aizenman and Lee (2006), we also include two-period lagged export growth (based on a three-year moving average) to capture the mercantilist motive. Reserve hoardings due to mercantilist concerns should be associated with higher export growth rate and an undervalued currency. However, we find that the effect is not significant.[2]

Next, we use the above empirical model to predict the demand for international reserves for various emerging countries. In particular, we use the

TABLE 2. Principal Determinants of Reserve Accumulation, 1998–2005

	I	II
Per capita GDP (log)	3.972***	4.000***
	[4.40]	[4.39]
Import share	0.077***	0.081***
	[2.78]	[2.84]
Capital account openness	0.683**	0.648**
	[2.22]	[2.09]
Share of M2 in GDP	0.175***	0.173***
	[8.69]	[8.39]
Political stability	–0.037	–0.03
	[0.94]	[0.77]
Ratio of short-term debt to GDP	0.035***	0.037***
	[2.68]	[2.63]
Exchange rate overvaluation	–0.032**	–0.030**
	[2.29]	[2.09]
Export growth		0.006
		[0.28]
Observations	132	132
Number of countries	20	20

Source: Author's calculations.

Notes: Robust z statistics in parentheses.

*** indicates significant at 1 percent, ** indicates significant at 5 percent, and *indicates significant at 10 percent.

2. The robustness of the results reported in tables 1 and 2 was checked using alternative explanatory variables. For financial depth, variables such as share of credit allocated to the private sector and ratio of liquid liabilities to GDP were used. Trade openness was measured using total trade as a percentage of GDP, while capital account openness was measured by looking at the volume of capital flows to GDP. Political stability was proxied by government stability, law and order, and corruption. The results were broadly similar to the ones reported.

regression in column II of table 2 to calculate the volume of reserves predicted by our model.

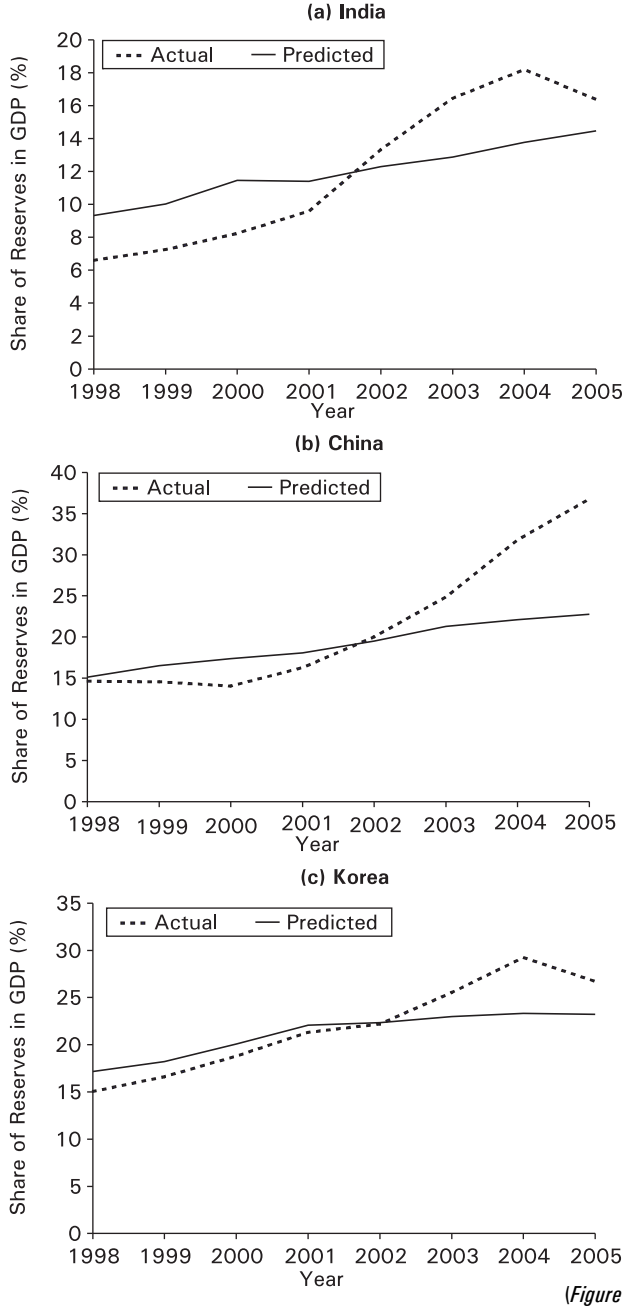
In figure 1, we look at the reserve accumulation performance of some selected emerging markets in Asia and Latin America. There are five countries whose actual reserve accumulations (as a percentage of GDP) were significantly higher than what our model predicted. These include India, China, Korea, Russia, and Malaysia. By 2005, the excess reserve accumulation in these countries stood at US$16 billion, US$312 billion, US$24 billion, US$72 billion, and US$12 billion respectively. On the other hand, by 2005, Indonesia, Philippines, and Argentina had accumulated reserves close to the amount predicted by our model. Finally, only in Brazil the actual reserve accumulation was less than the international norm predicted by our model.

Reserve Accumulation in India

Prior to the time of financial globalization, countries used to hold reserves mainly to manage foreign exchange demand and supply arising from current account transactions. India was no exception to this rule, and for a number of years after Independence, India largely followed an inward-looking and interventionist strategy that was characterized by licensing requirements, financial repression, state ownership in most industries, and protection from imports. During the early 1980s, the current account deficit was kept within check and in most years it was below 1.5 percent of GDP. However, as India reoriented its development strategy toward greater exports and introduced a host of measures to promote exports and liberalize exports for importers, the situation underwent a change. Steps taken to deregulate the economy along with increased competitiveness due to a real depreciation of the rupee boosted exports rapidly. However, there was also a sharp spurt in imports as domestic petroleum production slowed down. Widening of the current account deficit was exacerbated by rising expenditure and increased defence spending.

The quantum of the current account deficit in the late 1980s became higher than funds available through aid financing on concessional terms and consequently, the current account deficit started being financed by non-resident remittances and borrowings at commercial terms. Thus within a short span, there was a significant increase in the reliance on high-cost short-term financing. Medium- and long-term debts more than quadrupled during this period and stood at US$13 billion in 1990–91 compared to only

FIGURE 1. Reserve Accumulation (as a Percentage of GDP) in Selected Emerging Markets



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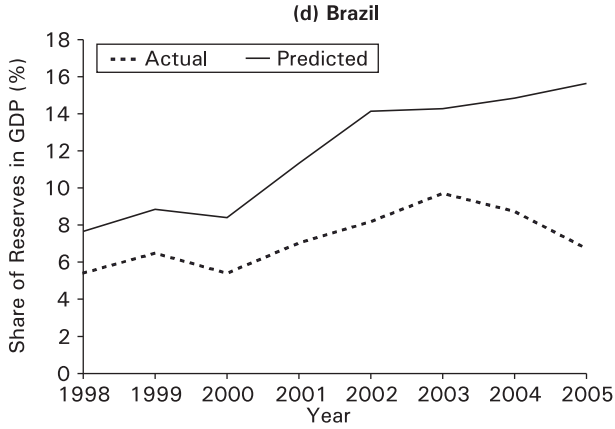

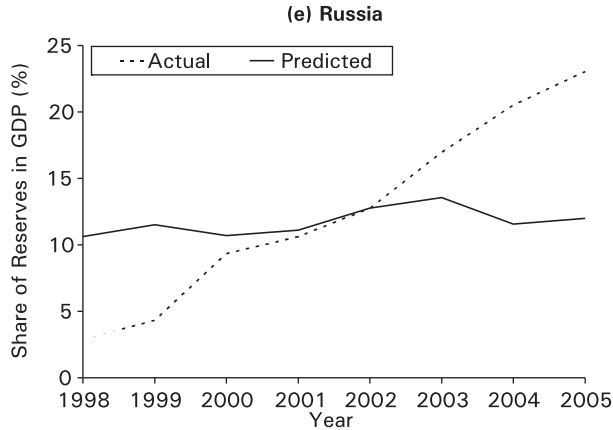

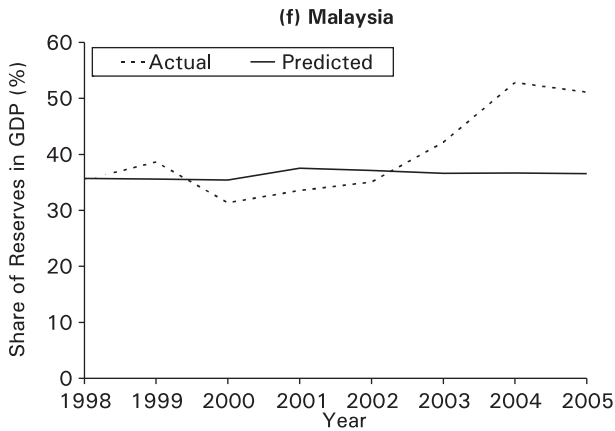

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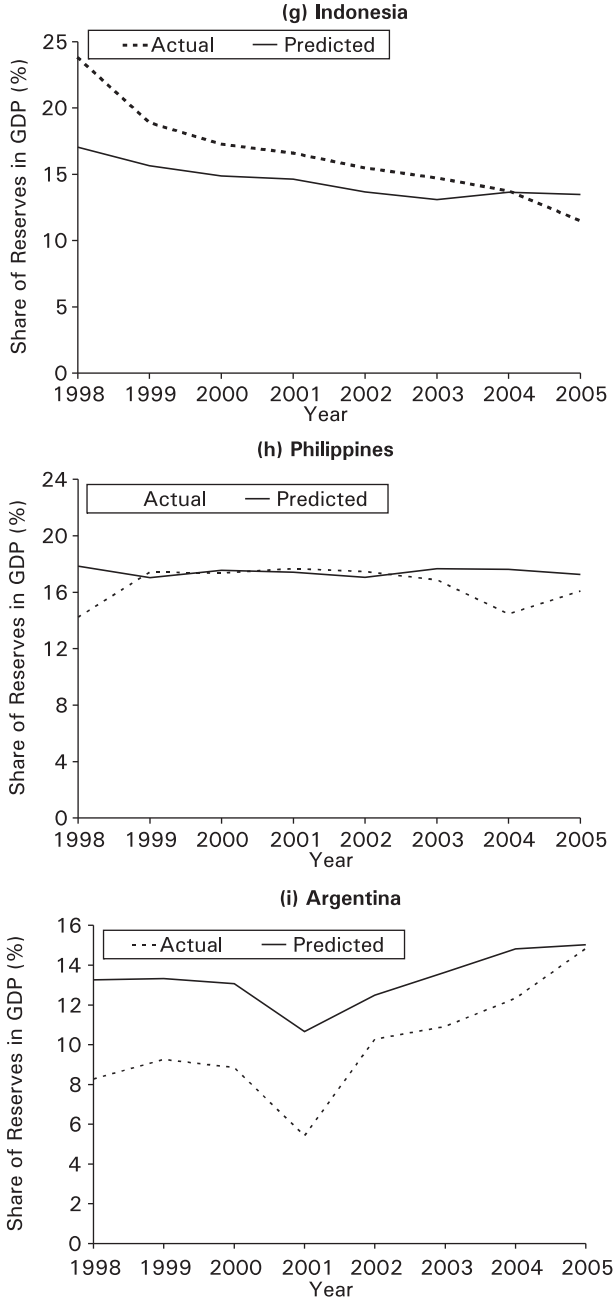


Source: World Development Indicators 2008.

US$3 billion in 1984–85. Short-term external debt increased by US$6 billion during this period and the ratio of debt service payments to current receipts widened to nearly 30 percent. Thus India became increasingly vulnerable to external shocks and shifts in creditor confidence.

Cerra and Saxena (2002) point to two external shocks that contributed to the large current account deficit in 1990–91. The first one came from the then ongoing Middle East crisis, which resulted in a sharp increase in oil prices. Petroleum imports increased by more than US$2 billion in 1990–91 compared to the previous year. This rise was due to a sharp spike in global prices of crude oil as well as a sharp increase in the volume of imports as domestic crude oil production became impaired by supply difficulties.

The current account deficit also widened due to slow growth in India's major export markets. While the Middle East crisis adversely affected these markets, the erstwhile Soviet Union was also impacted by the crisis. Global growth halved from 4.5 percent in 1988 to 2.25 percent in 1991. The US, which was a major destination for Indian exports, witnessed an even sharper decline with growth declining from a healthy 3.9 percent in 1988 to less than 1 percent in 1990, and negative 1 percent in 1991. As a result, there was a sharp deceleration in the growth of Indian exports, with export volumes growing by only 4 percent in 1990–91.

Along with a growing current account deficit, India's balance of payments also started encountering difficulties on capital account. Investor confidence, which had already begun to erode, declined significantly as international credit rating agencies downgraded India below investment grade to speculative level. Commercial bank finances became difficult to obtain while capital outflow started taking place as creditors refused to roll over the short-term debts. The Middle East crisis also had a negative impact on the remittance earnings of the workers, and strong inflows of non-resident deposits soon turned into net outflows.

The economic downturn was aggravated by growing political uncertainty during this period. The election in 1989 did not give the mandate to any single party, and a number of political parties formed a coalition government headed by V. P. Singh. However, soon the coalition became unstable as it became involved in a number of caste- and religion-based conflicts. The government fell in November 1990 as it lost a confidence motion in the Parliament. The V. P. Singh government was succeeded by another coalition government headed by Chandra Shekhar, which lasted only four months before it lost the majority of the house and fresh elections were called. The political uncertainty came to a head when Rajiv Gandhi, a former prime minister and the leader of the Indian National Congress, was assassinated

in May 1991 while campaigning for elections. Even after fresh elections, no political party was able to get an absolute majority, and a minority government under P. V. Narasimha Rao came into power.

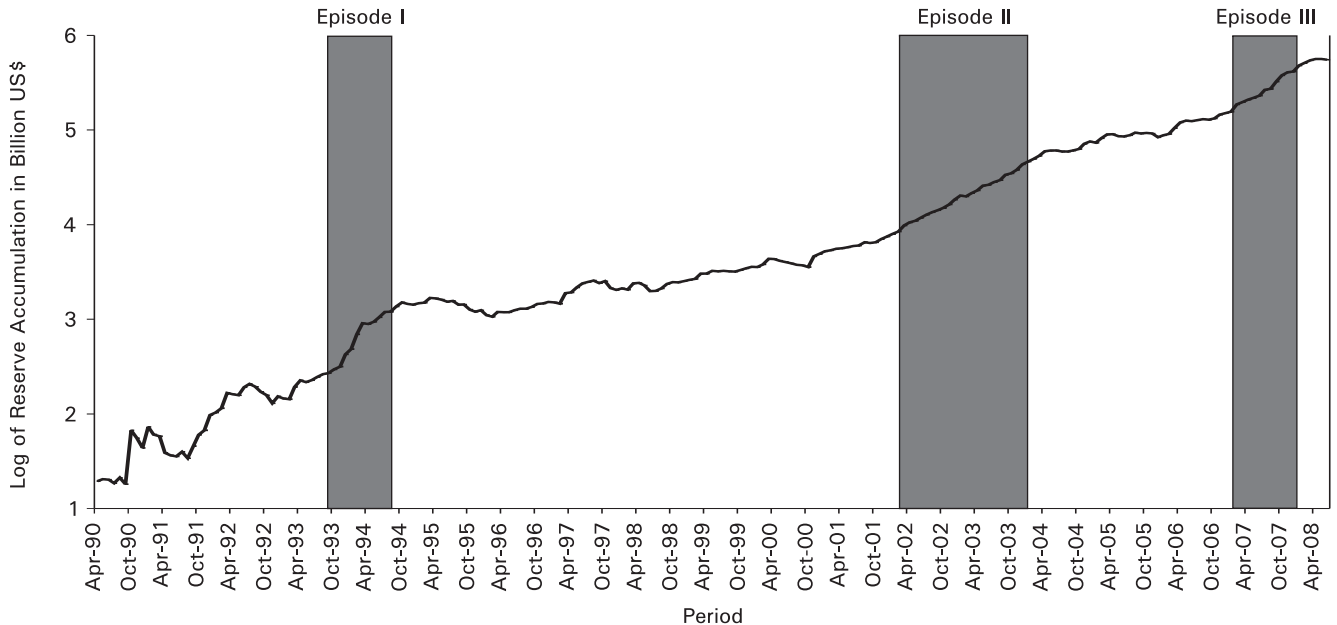
In a move to contain the economic crisis and restore economic health, the new government undertook a wide range of reforms. Some of the major reforms in the external sector involved devaluation of the exchange rate and a move toward market-determined rate, reduction of tariffs, elimination of quantitative restrictions to facilitate imports, and a greater emphasis on import liberalization. It was also decided to encourage direct and portfolio investment, reduce short-term borrowings, and to put annual caps and minimum maturity requirements on commercial borrowing. Finally, a strong emphasis was placed on the build up of foreign exchange reserves to provide insurance against future external shocks.

The last objective has been admirably achieved as India's reserve holdings increased from US$5.8 billion in 1991 to over US$315 billion in May 2008. Indian policymakers have followed a conscious policy of accumulating reserves to prevent excess pressure on the rupee to appreciate in response to current account surpluses or a surge in capital flow. As can be seen in the figure 2, three main episodes of reserve accumulation can be identified over the last 18 years.

The first episode of reserve accumulation began in July 1993 and went on till October 1994 (figure 3). Patnaik (2005) points out that owing to the various reforms undertaken in the external, fiscal, financial, and monetary sectors of the economy in the aftermath of the 1991 crisis, there was a steady decline in the current account deficit and it remained below 2 percent through most of the 1990s. Foreign Institutional Investor inflows more than trebled from US$307 million in July–September 1993 to US$935 million in October–December 1993. It doubled again to US$2.3 billion during January–March 1994. Net capital inflow of over US$9 billion during 1993–94 and 1994–95 was three times that of previous years.

Studies, including Acharya (2002), have argued that sustained capital flow should be met by partial sterilization, productive absorption of these flows through greater liberalization of the current account, and a policy of allowing the capital flows to increase the capital in the economy, reduce real interest rate, and stimulate investment. However, a policy of accumulating reserves by buying up the capital flowing into the country to prevent the rupee from appreciating was pursued. Throughout the interval of April 1993 to July 1995, the exchange rate remained steady at Rs. 31.4 per dollar. India's reserve holdings more than doubled from less than US$12 billion in July 1993 to US$24 billion in October 1994.

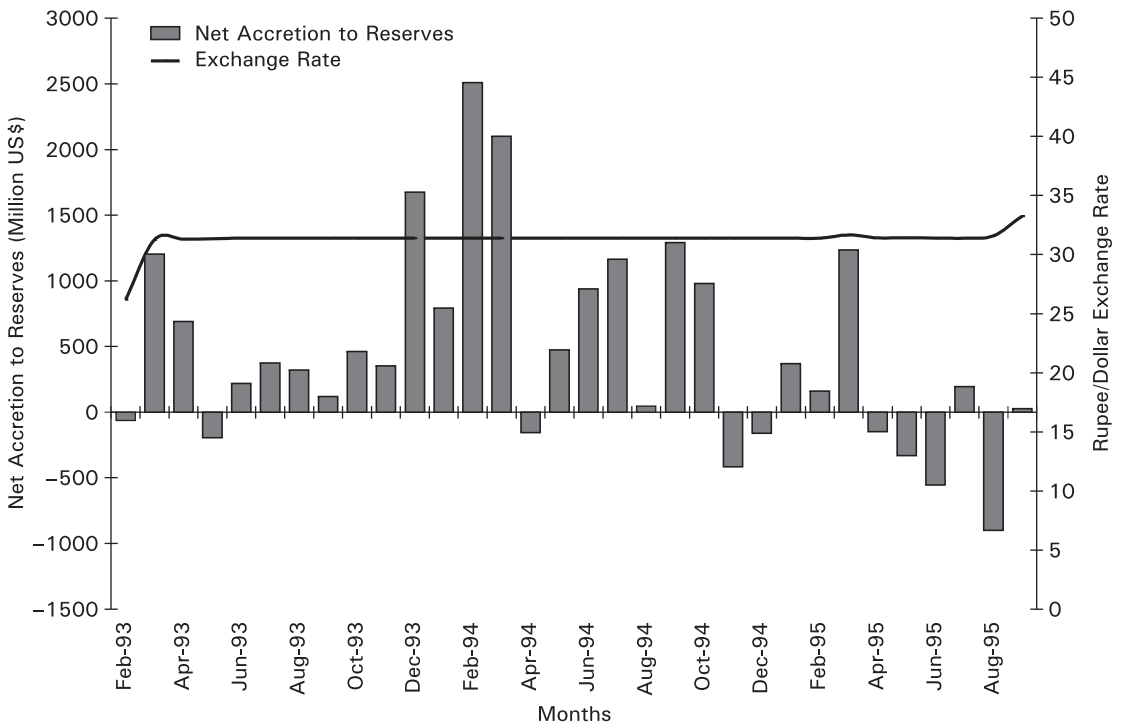
FIGURE 2. Episodes of Reserve Accumulation



Source: Author's calculations based on RBI's database on Indian economy.

Note: We identify an episode of reserve accumulation as a contiguous period of more than eight months when the 3-month average monthly growth rate in reserves is in excess of 2 percent. According to this definition, Episode I lasted from July 1993 to October 1994, Episode II ran from November 2001 to May 2004, and Episode III began in November 2006 and lasted till February 2007.

FIGURE 3. Reserve Accumulation and Policy Response in Episode I



Source: RBI's database on Indian economy.

The Reserve Bank of India (RBI) chose not to sterilize these interventions, as a result of which there was a sharp increase in money supply.[3] The money supply growth rate surged to 20 percent in late 1994 and contributed to a rapid rise in inflation. In an attempt to control the monetary expansion, the cash reserve ratio (CRR) was raised a number of times in 1994–95. While the ordinary CRR was raised from 14 percent to 15 percent, CRR applicable to Foreign Currency Non-Resident (FCNR) accounts was raised from 0 percent to 15 percent, while that for non-resident accounts was hiked from 0 percent to 7.5 percent.

The second episode of reserve accumulation started in November 2001 when reserve holdings jumped by US$1.6 billion compared to the previous month. The episode continued till May 2004, by when international reserve holdings had increased by US$73 billion compared to the start of the episode. Beginning from a deficit of US$4.7 billion (1999–2000), the current account registered a surplus of US$3.4 billion in 2001–02, which progressively increased to US$14.1 billion in 2003–04. The turnaround in the current account was achieved through a reduction in the merchandize trade deficit as well as a significant improvement in the invisibles surplus, primarily due to a jump in the exports of software services. This change of over US$19 billion in the current account deficit over a period of four years added significantly to the reserves. Net capital flows during the early part of the episode were largely stable and increased marginally from US$8.4 billion in 1998–99 to US$8.8 billion in 2000–01 before falling back to US$8.5 billion in 2001–02. Net capital inflows started to accelerate since October 2002 and increased to US$10.8 billion in 2002–03, and further to US$29 billion in 2004–05. However, the rising current account deficit since 2004–05 meant that the pace of reserve accumulation had slowed down after April 2004.

Unlike the earlier episode, the central bank resorted to sterilization in a significant way. To keep the reserve money growing at a stable rate, the increase in the net non-foreign assets of the RBI were largely matched by a decrease in RBI credit to the government. As a percentage of RBI's asset components of the reserve money, the share of RBI credit to the government decreased from 39.6 percent in November 2001 to 2.4 percent in April 2004.[4]

3. The decision to not sterilize the capital inflows could have been necessitated by the illiquid bond markets prevailing at that time.

4. The asset components include RBI's claims on government (net), commercial, and co-operative banks, National Bank for Agriculture and Rural Development (NABARD), and the commercial sector. It also includes net foreign exchange assets of the RBI and government's currency liabilities to the public. Deducting the net non-monetary liabilities of the RBI from the asset components would yield the reserve money.

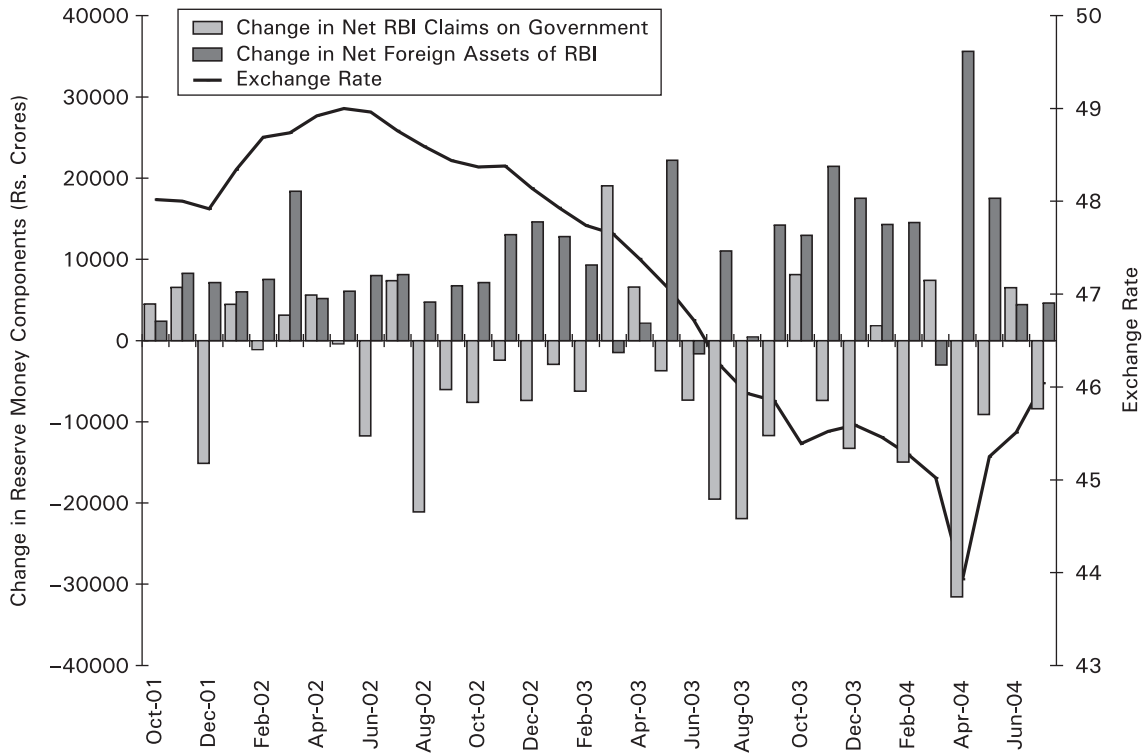
Over the period, the share of net foreign assets increased from 54.4 percent to 95.2 percent. Moreover, as can be seen from figure 4, there was a clear inverse relationship between the foreign and domestic asset accumulation: months with high foreign asset accumulation also witnessed a significant sale of government bonds.

As pointed out in Patnaik (2005), unlike Episode I, there was no increase in CRR during this episode. Instead, the CRR was steadily decreased from 5.75 percent in November 2001 to 4.5 percent in April 2004. In the early part of the episode, the rupee was allowed to depreciate and it weakened to nearly Rs. 49 per US dollar in May 2002. Given the prolonged downturn in the global market prevailing at that point, it was decided to keep the exchange rate competitive to boost exports. However, subsequently, it was allowed to appreciate to Rs. 44 per US dollar as reserves attained a comfortable level and the dollar weakened against several other currencies.

The most recent episode of reserve accumulation began in November 2006 when reserve holdings jumped by US$7.25 billion compared to the previous month (figure 5). This episode continued till February 2008, by when India had added more than US$126 billion as international reserves. This reserve accumulation was largely the result of an increase in foreign capital flowing into the country. While in 2004–05 India witnessed net foreign investment of US$13 billion, by 2007–08 this had jumped more than three times to US$45 billion. While foreign direct investment rose from US$3.7 billion to nearly US$16 billion during this period, portfolio investment increased from US$9.3 billion to US$29 billion. There was also a significant increase in the medium-term and long-term external commercial borrowings as Indian business sought out cheap credit from abroad.

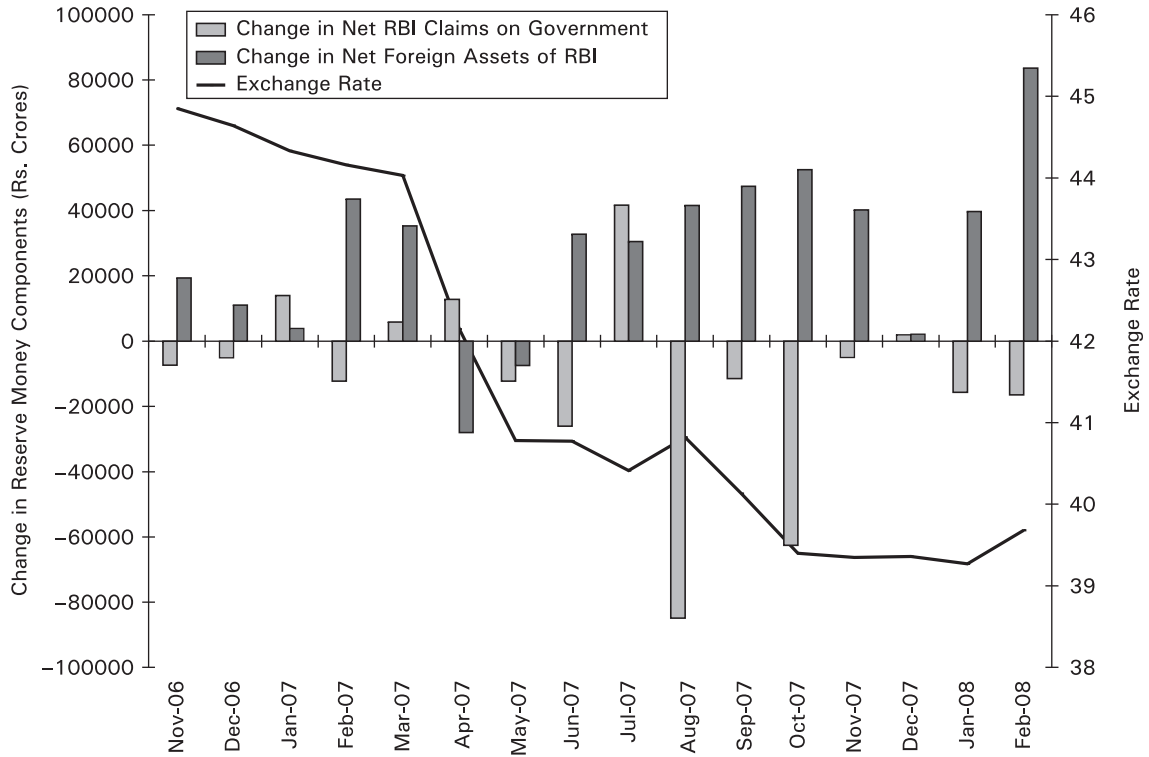
Toward the end of Episode II, the central bank started facing shortages of bonds for the purpose of sterilization. To overcome this constrain, a new mechanism was initiated in February 2004—Market Stabilization Scheme (MSS). Under this scheme, the Government of India authorized the RBI to issue bills and securities exclusively for the purpose of sterilizing foreign capital inflows. The outstanding obligations of the government by way of these bills and securities under the MSS were originally capped at Rs. 600 billion. To ensure that these issues do not have a significant impact on the monetary and fiscal system, it was decided that the proceeds of the sale would be kept in an escrow account. The balance in this account is used to redeem the securities on maturity while the interest cost is borne by the government. The ceiling was revised upwards to Rs. 800 billion in August 2004 and remained at that level till April 2007. However, owing to heavy capital coming into the economy, the ceiling was revised five times

FIGURE 4. Reserve Accumulation and Policy Response in Episode II



Source: RBI's database on Indian economy.

FIGURE 5. Reserve Accumulation and Policy Response in Episode III



Source: RBI's database on Indian economy.

in 2007–08 and currently stands at Rs. 2.5 trillion. In mid-August 2008, total outstanding MSS bonds stood at Rs. 1.71 trillion.

A number of measures aimed at restraining flow of capital into India were also introduced during this episode. In August 2007, restrictions were imposed on External Commercial Borrowings (ECBs) with allowing only foreign currency expenditures for permissible end uses ECBs of more than US$20 million per borrowing company. Companies raising ECBs of more than US$20 million had to park the proceeds overseas. Moreover, even in the case of companies undertaking ECB up to US$20 million to be used as foreign currency expenditure for specified end uses under the Automatic Route, the funds would have to be parked overseas and not remitted to India. In October 2007, Securities and Exchange Board of India (SEBI) approved new trading norms for foreign institutional investor (FII) investment by allowing only "regulated" entities to invest in India through the Participatory Notes (PN) route. According to these new guidelines, entities with notional value of PNs constituting over 40 percent of Assets Under Custody (AUC) were able to issue new PNs only on redemption or cancellation or closing out of existing PNs of equivalent amount. Entities with PNs of less than 40 percent of their AUC were to be allowed incremental issuance of only 5 percent per year till they reach the 40 percent ceiling.

Measures were also undertaken to encourage foreign exchange outflow. The limit on investment in overseas Joint Ventures (JV)/Wholly Owned Subsidiaries (WOS) by Indian companies was increased to 400 percent of the net worth of the Indian company under the Automatic Route. The limit for existing listed companies to undertake portfolio investment abroad was increased from 35 percent of the net worth to 50 percent. The existing limit for prepayment of ECBs without RBI approval was increased from US$400 million to US$500 million while the aggregate ceiling for overseas investments by mutual funds, registered with SEBI was increased from US$4 billion to US$5 billion. Finally, the INR was allowed to appreciate by more than 14 percent over this period and stood at INR 39.36 per US dollar in October 2007 compared to INR 46.45 in August 2006.

The three episodes outlined above account for more than US$220 billion worth of reserve accumulation out of the current stock of nearly US-$300 billion. It is also evident that bulk of this reserve accumulation has been on the back of strong capital inflows, except for the early part of Episode II, when India experienced a current account surplus due to declining merchandise imports and rising services exports and remittances.

The current level of reserve accumulation has meant that India is in a

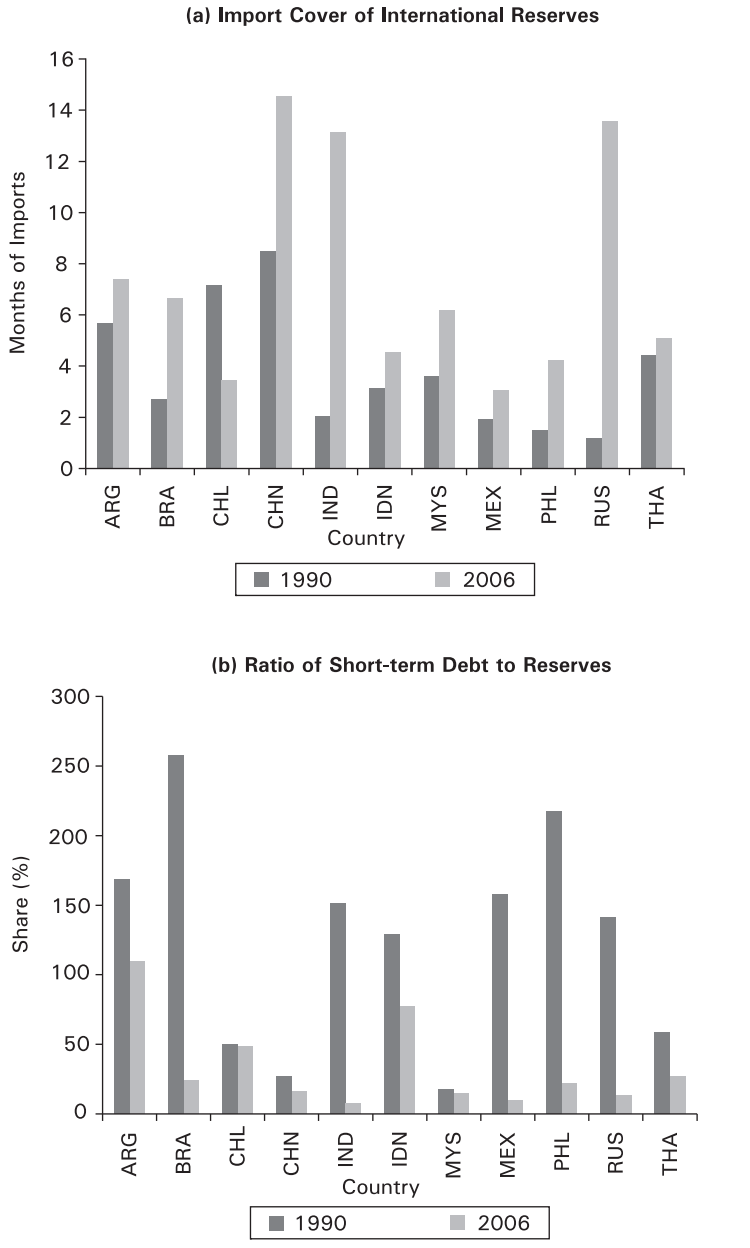
relatively comfortable position according to the various popular reserve adequacy indicators. The current stock of reserves is able to finance more than a year's imports, providing a comfortable cushion in the case of a terms-of-trade shock or a sudden reversal of capital flow. The ratio of short-term debt to international reserves has also witnessed a steep decline from nearly 150 percent in 1990–91 to below 7 percent in 2006–07.[5] This ratio is well below the Greenspan–Guidotti rule, which stresses that sufficient international reserves must be maintained to meet external obligations for about a year, without any external assistance. The ratio of short-term debt and portfolio stocks to reserves declined from 146.6 percent in end-March 1991 to 44.4 percent as in end-March 2008.

India has not been the only country engaging in reserve accumulation. Several East Asian and Latin American economies have also been indulging in this kind of a behavior. This has been the primary response to currency crises these economies faced in the 1990s. Looking across some of the key reserve adequacy indicators in figure 6, it can be clearly seen that barring Chile, most of the emerging economies have witnessed a significant increase in their import cover of international reserves as well as the ratio of reserves to M2. Again, Chile was the only major developing country that did not experience an increase in the ratio of international reserves to GDP. All the major developing countries also witnessed a fall in the ratio of short-term debt to reserves. The fall was again smallest for Argentina and Chile.

A cross country comparison shows that India has clearly outperformed several other emerging markets in terms of reserve accumulation. Looking at import cover of international reserves, we find India to be better covered than most other major emerging markets, barring China. Similarly, India is well placed in terms of ratio of short-term debt to international reserves. At 7 percent, this ratio is also smaller than most other developing countries. Even with the other two indicators, India is relatively comfortably placed. In terms of ratio of international reserves to GDP, India is behind economies like China, Thailand, Russia, and Malaysia but ahead of most Latin American economies. On the other hand, at 25.53 percent, the ratio of international reserves to M2 in India is higher than China and Brazil but lower than most of the Latin American economies and Korea.

5. Short-term debt has been redefined since 2005–06 to include suppliers' credit up to 180 days. However, to maintain consistency we stick to the original definition. As per the new definition, the ratio of short-term debt to the foreign exchange reserves stood at 12.5 percent as in end-March 2005, but increased slightly to 12.9 percent as in end-March 2006 and further to 13.2 percent in end-March 2007, but declined to 12.4 percent in end-September 2007.

FIGURE 6. Cross-Country Comparison of Reserve Adequacy Measures



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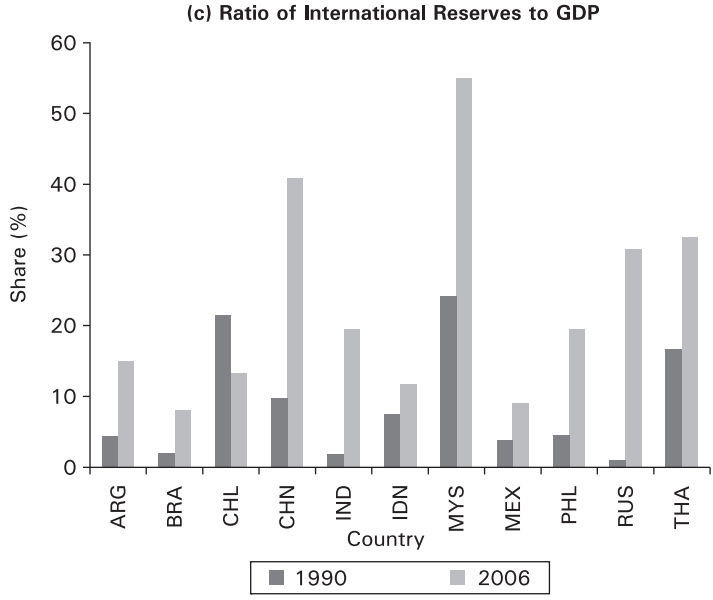
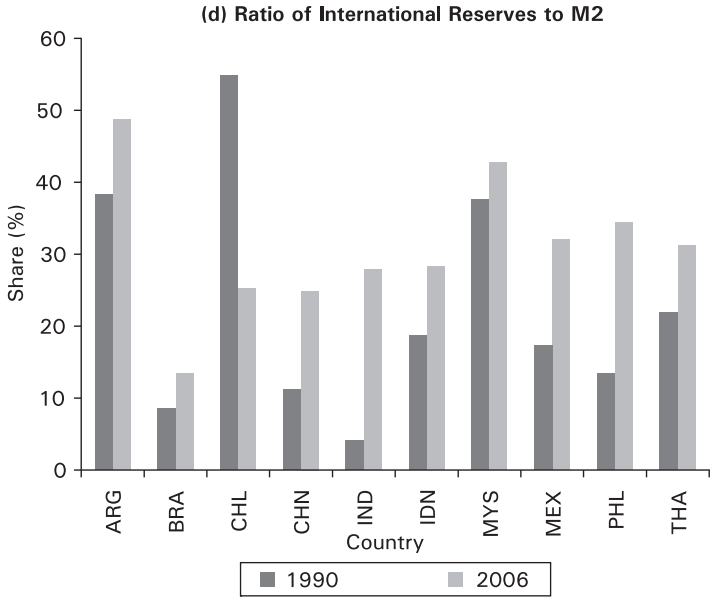




Source: World Development Indicators 2008.

Comparing figure 6 with figure 1, it can be seen that countries that have significantly improved on reserve adequacy indicators like China, Malaysia, India, and Russia are also the ones that have accumulated reserves in excess of the international norm predicted by the empirical model. On the other hand, some of the Latin American economies like Brazil and Argentina, which have performed more modestly on these measures, have accumulated reserves that have been lower than the international norm for most of the period under study.

Cost of Excess Reserve Accumulation

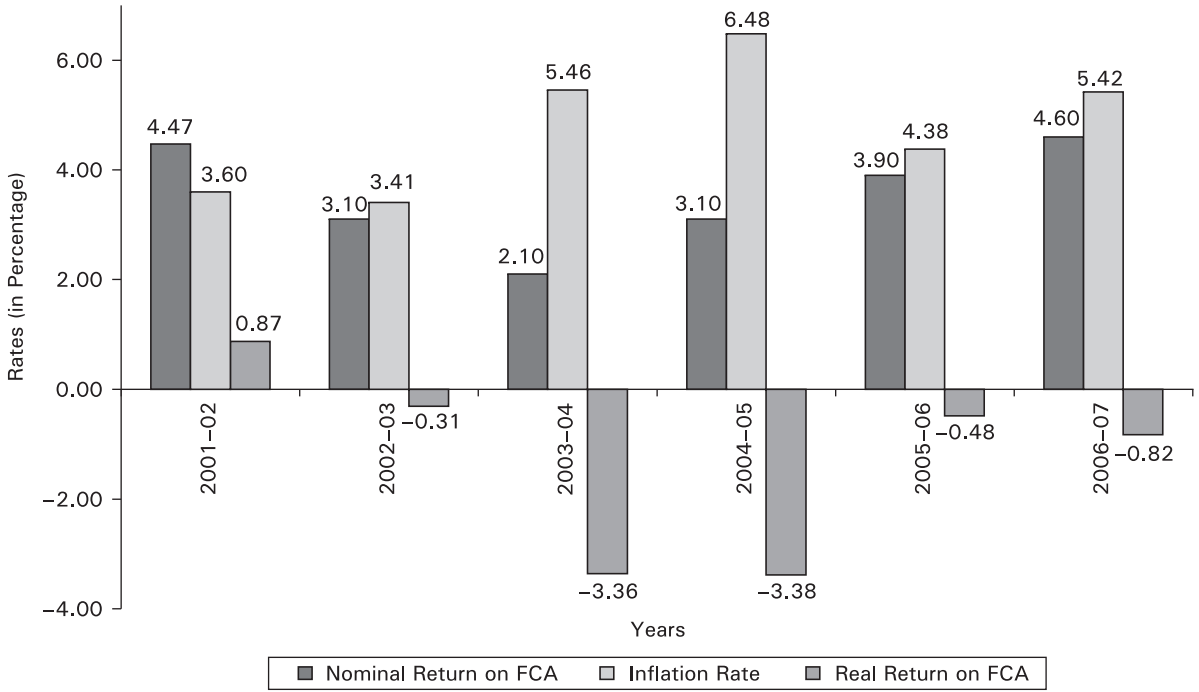
Given the comfortable reserve position enjoyed by India, one has to look at the deployment pattern of these reserves. In India, the stated objectives of reserve management are liquidity and safety with due attention being paid to the currency composition and duration of investment, so that a substantial part can be converted to liquid form at a short notice. Consequently, the bulk of these reserves are being held in the form of securities or deposits with foreign central banks and international organizations.

The strategy to focus on safety and liquidity at the expense of return has had implications for the rate of returns on investment of the international reserves. Given the low interest rate prevailing in most of industrialized countries, the direct financial return on holdings of international reserves has been low. RBI (2007) points out that the rate of earning on foreign currency assets (FCA) and gold, after accounting for depreciation, was only 4.6 percent in 2006–07 and 3.9 percent in 2005–06. The inflation rates during these two years were around 5.42 percent and 4.38 percent respectively, implying a real rate of return of –0.82 percent in 2006–07 and –0.48 percent in 2005–06. Indeed as shown in figure 7, in recent years, the real rates of return on foreign currency assets have been largely negative.

While undoubtedly holding reserves in liquid assets is prudent from the point of view of precautionary motive, some questions remain about Indian reserve management strategy. Specifically, one might be tempted to ask if there are ways to increase the returns on these reserves significantly without unduly raising risk to the country's ability to service its external debt and sustain current account deficits required for investment purposes.

The reserve management strategy of India has been extensively questioned in Lal et al. (2003), who argue that with current reserves being able to finance more than a year's import and India doing exceptionally well on all reserve adequacy measures, continuation of such a policy is highly

FIGURE 7. Rates of Return on Foreign Currency Assets



Source: Reserve Bank of India, *Handbook of Statistics*.

questionable given the high costs associated with such a policy. Lal et al. (2003, 2005) conclude that if capital flows were fully absorbed and invested instead of being neutralized by building up of foreign reserves, growth could have been significantly higher. Similarly, Summers (2006) argued that by investing excess national reserves in global assets India could earn extra returns to the tune of 1 to 1.5 percent of GDP each year. Bhagwati (2006) also claims that it should be possible to earn an additional 5 percent, compared to current reserve earnings by investing excess Indian reserves through a dedicated investment platform set up by the RBI/Ministry of Finance. Thus by investing US$100 billion with such an investment platform, it is possible to earn an additional 0.6 percent of Indian GDP.

In contrast, Joshi (2004, 2006) and Joshi and Sanyal (2004) have pointed out that the strategy of absorbing capital flows in the form of reserves has let to marginal sacrifice of growth, if any. Bhalla (2007) has argued that the strategy of having an undervalued exchange rate and consequent reserve accumulation has provided huge benefits to the economy. Bhalla points out that in India, the benefits in terms of additional GDP growth outweighed the costs due to sterilization by six times.

As shown in the third section, India is one of the countries that have accumulated reserves in excess of the international norm predicted by our model. As a percentage of GDP, by 2005 India's actual reserve holding was 16.37 percent as opposed to the 14.46 percent predicted by our model, implying excess reserves of around US$16 billion. The rapid rate of reserve accumulation during the next two years meant that the gap between actual reserves and predicted reserves based on an international norm widened significantly in 2006 and 2007.[6] By 2007 India had excess reserves of nearly US$58 billion compared to the international norm predicted by our model.

Next, we compute the cost of holding reserves in excess of the international norm predicted by our model in low yielding foreign bonds, instead of utilizing these excess reserves to increase the productive capacity of the economy. The costs are reported in terms of income foregone as well as loss in terms of percentage of GDP. In the literature, different measures have been used to calculate the cost of hoarding reserves. We look at three different measures and calculate the costs of holding excess reserves in India.

6. We extend the data on India for 2006 and 2007 by looking at various publications of the RBI and Ministry of Finance, Government of India. We re-estimated our model using the additional information. However, there were only marginal changes in the coefficients and their significance levels (changes were only at the second decimal point).

Cost in Terms of Physical Investment Foregone

Several papers like Ben-Bassat and Gottlieb (1992b) and Neely (2000) have pointed out that the opportunity cost of reserve holdings can be equated to the marginal product of capital. The underlying rationale being that resources that could have been used to increase the domestic capital have been employed in hoarding reserves. In such cases, the cost of holding reserves is given by the interest rate spread between the return on foreign currency assets and marginal product of capital, which is a proxy for the return on physical investment. We look at the opportunity cost in terms of actual income foregone as well as a percentage of the GDP.

Typically, the marginal product of capital is seen as the inverse of the incremental capital output ratio (ICOR), with the latter reflecting the amount of additional capital required to generate a unit increase in output. The growth rate of the real output y can be stated as

$$y = \frac{1}{Y}\frac{\Delta Y}{\Delta T}, \tag{3}$$

where Y is the real output, T is time, and Δ is the first difference operator. Multiplying the numerator and the denominator $\frac{\Delta K}{\Delta Y}$ by we obtain

$$y = \frac{1}{Y}\frac{\frac{\Delta K}{\Delta T}}{\frac{\Delta K}{\Delta Y}}, \tag{4}$$

where K is the capital stock of the economy. In the above equation $\frac{\Delta K}{\Delta T}$ refers to the change in capital stock from one period to next and is equal to the investment undertaken (I). Similarly, $\frac{\Delta K}{\Delta Y}$ reflects the amount of capital required to raise output by one unit and can be approximated by the ICOR. Thus the above equation can be rewritten as

$$y = \frac{1}{Y}\frac{I}{ICOR} \tag{5}$$

Thus the marginal product of capital, which is the inverse of the ICOR, is given by

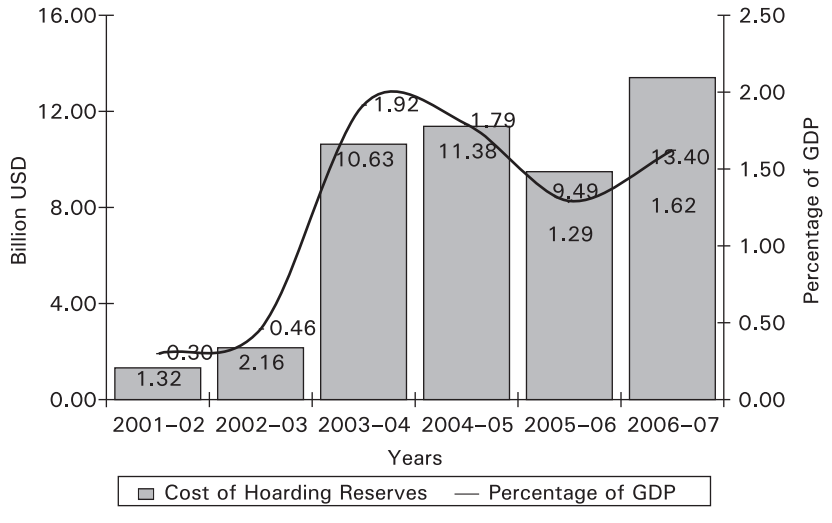
$$MP_K = \frac{y}{\frac{I}{Y}} \tag{6}$$

Data on investment and output is obtained from Central Statistical Organisation (CSO). While the model calculates the gross rate of return on physical capital, an important issue must be kept in mind: The benefits of diverting resources away from reserve accumulation, and toward creation of a stock of capital, will decline over a period of time as the value of capital gets eroded through depreciation.

The opportunity cost of holding reserves in excess of the international norm predicted by our model in low yielding assets is shown in figure 8. We find that the cost based on this measure showed a rise from 2003–04 onwards, and has continued to remain high till 2006–07. India lost more than US$11 billion or 1.79 percent of the GDP in 2004–05, which declined to 1.29 percent of GDP in the next year. In 2006–07, the sharp increase in excess reserves resulted in the cost rising to US$13.4 billion or 1.6 percent of GDP.

The proposal to use reserves for physical investment continues to be a sensitive issue with the Planning Commission's proposal to divert reserves to address the infrastructure deficit being aggressively debated. Critics of the proposal have pointed out that use of reserves to finance the infrastructure will overheat the economy due to additional domestic liquidity, and the country may lose hard-currency cover in the event of a run on the rupee. Moreover, such

FIGURE 8. Cost in Terms of Physical Investment Foregone



Source: Author's calculations.

a move involves the Government of India borrowing from the RBI thereby increasing the fiscal deficit as well as overall stock of liabilities held by India. The current account deficit could also rise if much of the spending on infrastructure is on imported goods to alleviate domestic liquidity pressures.

While some of these concerns are legitimate, it must be recognized that after growing at around 9 percent for four consecutive years, the excess capacity created during the turn of the century has largely been exhausted. Government of India (2007) has estimated that to sustain faster, broad-based, and inclusive growth, investment of about US$500 billion in infrastructure is warranted before the end of the Eleventh Five Year Plan in March 2012.

While India continues to invest an average of 4.5 percent of GDP every year in infrastructure, to attain the GOI objective, infrastructure investment will have to be raised by nearly 1 percent of GDP every year over the Plan period. Global recession, financial turmoil, and worsening economic outlook make it improbable that the private saving (corporate and household) will be able to provide the additional resources. While the public sector has reversed the trend of dissaving during the past few years, the outlays of the Sixth Pay Commission, commodity subsidies, and farm loan waiver has meant that the public sector is unlikely to have resources available that could be diverted toward infrastructure investment.

Thus diverting some of the excess reserves toward such investment will address the financing deficit to some extent. Moreover, as pointed out in Mohan (2008), capital has been typically employed productively in India. The ICOR has largely stayed around four since Independence, barring the decade of 1970s. During the post-reform period, the ICOR had significantly improved in the period 2003–04 to 2006–07 compared to earlier periods 1991–92 to 1996–97 and 1997–98 to 2002–03. Using cross-country data, Mohan (2008) argues that ICOR has been one of the lowest in the world, especially since the 1980s. Thus diverting resources toward physical investment is likely to yield much higher dividends than holding them in low-yield foreign government bonds.

Cost in Terms of Excess External Commercial Borrowings

Another opportunity cost of holding reserves can be formulated in terms of short-term borrowings that the private sector has to undertake. A country living by the Greenspan–Guidotti–IMF rule will increase reserves by the same

amount by which the private sector increases its external short-term liabilities. In a recent paper, Rodrik (2006) calculates the social cost of holding reserves based on this idea.

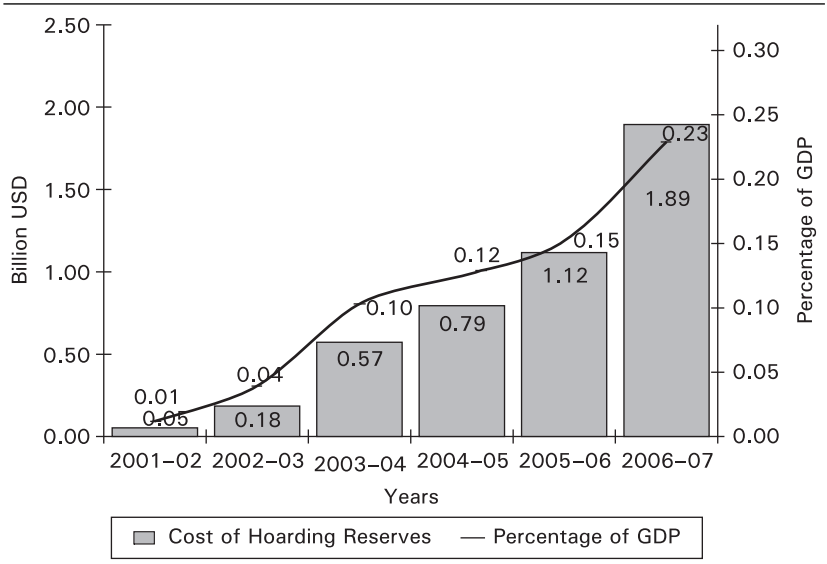
Consider an economy that is made up of the central bank and the private sector. Now suppose that this country is abiding by the Greenspan–Guidotti–IMF rule. The private sector takes a short-term loan from abroad of X dollars. The central bank has to increase its reserves by an equivalent amount. The central bank will purchase foreign currency worth this amount in the domestic market to invest in short-term foreign securities. Thus its stock of international reserves will go up by X dollars. By selling domestic currency worth X dollars to the private sector, the overall money supply has gone up by X dollars. To sterilize the effect of this intervention on the money supply, the central bank will sell some of the private sector domestic bonds it holds back to the private sector. Thus as it sells back X dollars worth of domestic bonds issued by the private sector, its stock of domestic bonds decreases by X dollars. Similarly, due to this sell back, the value of domestic bonds outstanding for the private sector decreases by X dollars.

Rodrik (2006) points out three consequences of such transactions. First, there is no net resource transfer from abroad as the increase in private sector's liability is matched by an increase in central bank's international reserves. Second, the short-term borrowing does not increase the availability of liquid resources available to the private sector for investment. The decline in total amount of debt issued by the private sector through domestic bonds is equivalent to the rise in short-term foreign debt. Finally, aggregating the balance sheets of the various sectors, it can be seen that the economy has borrowed short-term abroad (at the domestic private sector's cost of foreign borrowing) and has invested the proceeds in short-term foreign assets.

In such a setting, the cost of holding reserves would be measured by the interest rate spread between the private sectors' cost of short-term borrowing abroad and the yield that the central bank earns on its liquid assets. Generally, there is no direct source of information on costs of short-term borrowing. Most of the short-term borrowing takes the form of commercial bank lending, information on which is generally not publicly available. In a recent article, Bhagwati (2006) pointed out that the average cost of short-term external commercial borrowings for the India private sector is roughly about 3-month LIBOR +2.5 percent. Figure 9 shows the cost of hoarding excess reserves using this measure.

It can be seen that the cost of excess reserves has been increasing steadily and in 2006–07 it stood close to US$1.9 billion or 0.23 percent of the GDP.

FIGURE 9. Cost in Terms of Excess External Commercial Borrowings



Source: Author's calculations.

The sharp increase in the cost in 2003–04, compared to previous years, is largely because of the low return on foreign currency assets that year. On the other hand, the increase in cost in 2005–06 and 2006–07 is largely explained by a sharp rise in the average 3-month LIBOR rate to 4.11 percent and 5.36 percent respectively. As a result of monetary tightening in several industrialized countries, there was a sharp increase in the cost of borrowing. On the other hand, during this period the dollar had become marginally stronger thereby providing some boost to the returns on international reserves.

This opportunity cost measure is particularly important for India as recent years have witnessed an upsurge in short-term debt in absolute terms. The stock of outstanding short-term debt has increased from US$17.7 billion in 2005 to US$19.6 billion in 2006 and further to US$30.8 billion in 2007. With much of this short-term debt being accessed at rates much higher than the returns on reserves, India is paying a big cost for excess re-serve accumulation.

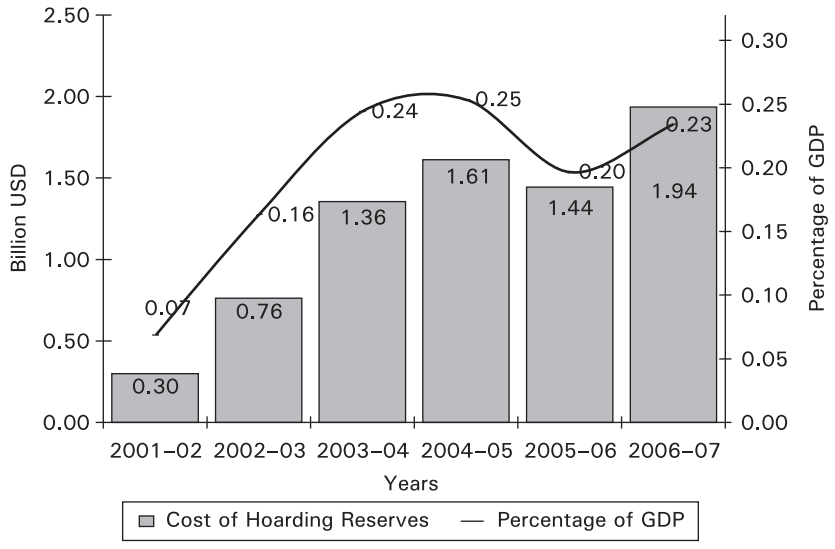
Cost in Terms of Public Sector Borrowing

The rising burden of public debt and gross fiscal deficit should be an issue of serious concern for the Indian economy. The combined domestic liabilities

of the Center and the states have increased from 40.52 percent of GDP in 1980–81 to 77.25 percent in 2006–07. Ahluwalia (2002) points out that the growth of public debt in India has equaled or exceeded that in Russia, Turkey, and Argentina before these countries hit a crisis. Using yields on public debt issued domestically to evaluate debt sustainability, Kletzer (2004) provides a strong argument for a fiscal adjustment. Following Kletzer (2004) and Mohan (2002), we use the weighted average yield on Central and state government securities to calculate the opportunity cost of hoarding reserves. The results are shown in figure 10.

It can be clearly seen that using the spread between interest rate on domestic government bonds and the yield on reserves, the cost is again quite significant and in excess of US$1.9 billion or 0.23 percent of GDP in 2006–07. Again, the sharp increase in the cost in 2003–04 is explained by the low yield on foreign assets. In contrast, the increase in cost by US$0.5 billion between 2005–06 and 2006–07 is largely explained by significant increase in the volume of excess reserves as well as an increase in the cost of borrowing for the public sector. The extent of this cost has been mitigated to an extent by the ability of the government to borrow at concessional rates. Since 1995–96, there has been a steady decline in the yield of Central Government

FIGURE 10. Cost in Terms of Public Sector Borrowing



Source: Author's calculations.

securities along with a rise in maturity. However, this trend was reversed in 2004–05 and 2005–06, when there was a sharp increase in interest rates. With global hardening of monetary policy and opening up of the Indian economy to capital flows, domestic interest rates will have to align themselves with international rates. This would imply that the government's ability to borrow at concessional terms might get severely eroded in recent years, thereby increasing the cost of hoarding reserves.

As discussed in the fourth section, one of the ways to counter the rapid flow of foreign capital into the country during episodes II and III was to sterilize the capital flows by the use of government bonds, especially the MSS bonds. With an increase in these bonds, there is also a rise in the interest burden. The interest payments on MSS bonds stood at Rs. 30.88 billion in 2005–06. It declined to Rs. 26.08 billion in 2006–07, but since then has increased at a rapid pace. While Rs. 83.51 billion was paid as net interest on these bonds in 2007–08, the government has budgeted nearly Rs. 140 billion to be paid out in 2008–09. The rising interest burden could well have been one of the reasons why issuance of MSS bonds was checked at around Rs. 1.7 trillion even though the ceiling had been hiked to Rs. 2.5 trillion.

Conclusion

The primary objective of this paper is to evaluate the cost of holding excessive reserves. We employ empirical methods to identify the major determinants of international reserve holdings. Using the results of our empirical model we create an international norm of reserve holdings based on the primary objectives of reserve accumulation. This is in contrast to most of the existing literature, which generally use a single measure to calculate excess reserves.

Using this international norm we find that Indonesia, Argentina, and Philippines have accumulated reserves close to the amount predicted by our model. On the other hand, Brazil's reserve accumulation efforts have fallen short of our model's prediction. Finally, China, India, Korea, Russia, and Malaysia have accumulated significantly more reserves than the international norm.

Next, focusing on India, we find that by end of 2007, India had accumulated more than US$58 billion of excess reserves. We impute the costs of holding these reserves by considering various alternative uses of the resources employed in building up reserves. The cost is substantial across all

specifications, both in terms of actual income foregone as well as loss in terms of percentage of GDP. India could gain as much as 1.6 percent of its GDP by diverting resources invested in low yield foreign bonds toward physical investment. Even by utilizing these resources to reduce private or public sector borrowings, the gain could be around 0.23 percent of the GDP.

While the cost of holding excess reserves in low yield securities is significant, it is very important to calculate the volume of excess reserves periodically due to changing fundamentals of the economy. As a country opens up to foreign trade and capital flows, increases extent of monetization and exposure to short term flows, and so on, the volume of excess reserves will change. For example according to our analysis, Korea was one of the countries that had accumulated excess reserves to the tune of US$24 billion by 2005. However since then, Korea's short-term debt had increased by more than three times to over US$175 billion in 2008. Consequently, the international norm of reserve holding for Korea would be much higher in 2008 than it was in 2005.

Appendix 1: Correlation Matrices

TABLE A-1. Correlation Matrix of Key Explanatory Variables (Full Sample)

	pol_stab	*exch_regime*	*pcgdp*	*imp_share*	*m2_gdp*	*overval*	*stdebt_gdp*	*kaopen*
Political Stability (pol_stab)	1.00							
Exchange Rate Regime (exch_regime)	–0.04	1.00						
Per Capita GDP (pcgdp)	0.37	–0.06	1.00					
Import Share (imp_share)	0.20	0.28	0.06	1.00				
Financial Depth (m2_gdp)	0.01	–0.02	0.02	0.00	1.00			
Exchange Rate Overvaluation (overval)	0.12	0.11	0.29	–0.10	0.00	1.00		
Short-term Debt/GDP (stdebt_gdp)	0.13	–0.06	0.27	0.05	0.00	–0.03	1.00	
Capital Account Openness (kaopen)	0.51	–0.01	0.39	0.15	0.05	0.17	0.07	1.00

Source: Author's calculation.

TABLE A-2. Correlation Matrix of Key Explanatory Variables (Emerging Markets)

	pol_stab	*exch_regime*	*pcgdp*	*imp_share*	*m2_gdp*	*overval*	*stdebt_gdp*	*kaopen*
Political Stability (pol_stab)	1.00							
Exchange Rate Regime (exch_regime)	0.02	1.00						
Per Capita GDP (pcgdp)	0.39	–0.08	1.00					
Import Share (imp_share)	0.30	0.04	0.21	1.00				
Financial Depth (m2_gdp)	0.21	0.15	0.10	0.67	1.00			
Exchange Rate Overvaluation (overval)	0.10	0.08	0.30	–0.04	0.00	1.00		
Short-term Debt/GDP (stdebt_gdp)	0.22	–0.05	0.47	0.22	0.09	–0.05	1.00	
Capital Account Openness (kaopen)	0.23	0.08	0.15	0.31	0.20	0.13	0.17	1.00

Source: Author's calculation.

Comments and Discussion

Kenneth Kletzer: The accumulation of official reserves by the central banks of emerging market economies over the last several years is a bit of a puzzle for international economists. The spate of currency and financial crises in emerging markets between 1997 and 2001 focused attention on the importance of capital flows and financial exposure for determining international reserve stocks. However, the growth of reserves in several countries, including China and India, is difficult to explain in terms of protection against possible capital account crises, and have drawn attention to the motives and costs of holding such high levels of net foreign assets on the balance sheets of central banks.

In this paper, Abhijit Sen Gupta estimates the opportunity cost to India of the Reserve Bank of India's (RBI's) holdings of foreign reserves. The approach is to first estimate a benchmark for reserve holdings derived from an empirical model of reserve holdings by a large sample of emerging market economies. The level of reserves held by the RBI in the last few years of the sample exceeds the prediction of the model and this difference is used by the author as an estimate of reserve hoarding. The cost is derived by comparing the return on reserve assets to three estimates of the opportunity cost of public investment. These are the average marginal return to capital in India, the interest cost of public debt, and the interest rate on private foreign portfolio borrowing.

In this comment, let me begin with the specifics of the paper and then move on to the policy question posed by the RBI's reserve accumulation. The essential elements of the paper are the explanation of reserve holding in the econometric model and implicit assumptions about the returns to alternative assets. The regression equation is a contemporary model of precautionary motives for reserve holding by central banks. It incorporates the objectives of holding reserves against a sudden need for international liquidity arising in either current account or capital account transactions conditional on the exchange rate regime. Comparing the predicted and actual time series of reserves using this model indicates how well the model explains reserve accumulation across a cross-section of countries. The predicted value should not be interpreted as a target for a hypothetical central bank with a

precautionary reserve-holding motive. Even the caution of stating that the estimate of excess reserves for India is calculated relative to an "international norm" implicitly assumes that the regression estimates an optimizing rule around which central banks deviate by holding too few or too many reserves given a prior or exogenous choice of exchange rate regime.

The second part of the estimation is the comparison of rates of return on central bank assets and assets held by the public. Investments in domestic capital or portfolio loans to enterprises carry different risks for investors than do US treasury bills and notes. We expect domestic equity or bonds to pay a risk premium over conventional international reserve assets in equilibrium. Risk premiums equate the expected marginal utilities of holding alternative risky assets. For example, recently UK residents earned higher interest on bank deposits in Iceland and some US mortgage securities than on UK treasuries. These holdings have not worked very well for investors.

Similarly, the interest rates on public debt issued by developing countries exceed the interest rates on advanced industrialized country public debt due to the risk of default or, when denominated in domestic currency, depreciation. The calculation of the interest differential on Government of India bonds and US treasury bills is a measure of the quasi-fiscal costs of sterilization (as named by Guillermo Calvo) by the RBI. In the absence of a history of government default, we still need to correct the interest rates for exchange rate risk. Under the managed float, interest rates on rupee-denominated debt should incorporate a premium reflecting the possibility of unanticipated depreciation or appreciation of the rupee. Any data series includes periods of a stable exchange rate and typically end in the midst of such a period. Therefore, estimates of the expected return to rupee debt need to account for the "peso problem"—the return is systematically overestimated. The comparison of rates of return to GOI debt and US treasury debt in this paper is subject to this problem.

A prior question to estimating the cost of the reserve holdings of the RBI is—why the RBI has accumulated reserves so rapidly since 2001? Over this period, India ran a current account deficit and progressively liberalized capital inflows. The natural question is whether the growth of reserves is the objective of policy or the consequence of the central bank pursuing other objectives. The stability of the rupee–dollar rate certainly suggests a concern with exchange market intervention that would include sterilization of capital inflows. Patnaik (2005) shows that the nominal exchange rate, but not the real exchange rate, has been stabilized persistently by monetary policy. The net benefits of the RBI's reserves need to include any benefits of exchange rate management including reductions in relative price volatility or

resistance to appreciation. These also need to account for the consequences of a *de facto* peg which can include the risk of a currency crisis in the form of a sudden large depreciation.

The need to accumulate reserves as precautionary balances against financial crises depends on the (*de facto*) exchange rate regime, as in the regression in Abhijit's paper. Reserve objectives include import cover in months, short-term external debt repayment, and insurance against international illiquidity. In his original speech advocating debt-based objectives for reserves, Alan Greenspan argued for covering "liquidity at risk" (Greenspan, 1999) which includes short-term foreign currency debt amortization and other forms of net foreign currency exposure of the domestic financial system. This is not quite captured by the short-term debt to GDP ratio, so Sen Gupta includes, following the literature, the M2 to GDP ratio. As emphasized by Obstfeld et al. (2008), reserve holdings also insure against a domestic bank run under a convertible currency. They show that the addition of this variable, representing domestic financial depth, helps considerably in explaining reserve levels in both advanced and emerging market economies.

The importance of a drain of domestic deposits, even if denominated in domestic currency, can be seen in two crises—in Argentina and Turkey in just a single year, 2001. Bank deposits and central bank reserves in Argentina declined steeply and steadily together for several months leading up to the collapse of the peso–dollar peg. Residents sought to avoid the risk of a freezing of accounts and conversion of dollar-denominated deposits to devalued pesos by holding dollars in safety deposit boxes or off-shore accounts. Similarly in Turkey in February 2001, a run on domestic lire deposits financed purchases of foreign currency from the central bank that precipitated that crisis.

In the light of this, it is interesting to look at the appendix to the Tarapore Committee's "Report on Fuller Capital Account Convertibility" of 2006 (RBI, 2006). Annex K of the report provides a table of measures of reserve adequacy based on precautionary motives for several countries. In the few years before each of these crises, Argentina and Turkey had about the same ratios of reserve to broad money as India does currently. A quick glance over the tables reveals low ratios of short-term debt and portfolio stocks to reserves for India and China, relative to the other reporting countries. The extraordinarily low ratio of reserves to short-term debt exposure reported by Sen Gupta for India is the prominent outlier in these tables and a reasonable suspect to associate with his predicted excess reserve holdings by India.

Two natural concerns about moving to a convertible rupee would be the increase in potential foreign currency liquidity risk to include domestic

deposits and the growth of gross short-term foreign currency debt. It is possible to hypothesize that the reserve accumulation by the central bank is not simply endogenous to exchange rate management but a forward-looking policy of building precautionary balances in anticipation of possible further international financial integration for India. If this is a possibility, then the analysis of reserves in the Sen Gupta paper should be interpreted as an estimation of reserve holding in the *status quo ante* policy regime. Note that changes in capital account regulation and monetary policy over the period of the regressions is a policy regime. The relaxation of outward capital flows or full convertibility of the rupee would lead to a structural change in capital flows.

A back-of-the-envelope calculation that just substitutes values for the explanatory variables based on other emerging markets post liberalization may be misleading. For example, Chilean reserve holdings reflect years of policy reform and adjustment to liberalization after a crisis-bearing initial liberalization. The appropriate level of precautionary reserves for the transition to full capital account convertibility could be larger than the equilibrium level years after liberalization. Hence, even further partial liberalization may justify the buildup of reserves beyond that predicted by comparison to already open emerging market economies.

There will be many lessons from the US financial crisis and its counterparts in Europe. Among the first is the importance of the capacity of the central bank to provide liquidity to domestic financial markets. The balance sheet of the Federal Reserve has grown dramatically with its accumulation of private debt obligations. The ability of the RBI to act similarly depends on its capacity to sell securities regarded by financial markets as safe havens—that is, debt issued by the governments of advanced industrialized economies with long histories of repayment and not higher interest securities issued by emerging market governments or quasi-governmental agencies in the advanced economies. A second lesson is that central bankers should probably concern themselves with the possibility of improbable but severe financial crises.

The international economic environment of the last several years favored the accumulation of reserves by the RBI and other Asian central banks. The current international environment of a US-centered financial crisis disfavors large capital inflows in the near term. Capital inflows and export revenues have already declined justifying some of the demand for international liquidity by the RBI. The contraction in the emerging markets may be modest or just beginning. Only in retrospect will we learn if the reserve buildup in

the emerging markets, especially in East Asia, India, and Russia, over the last several years, was a transitory and appropriate response to temporary yield-seeking capital inflows.

Vijay Joshi: Abhijit Sen Gupta's paper is an interesting assessment of India's reserve accumulation policy. He begins by estimating an "international norm" of reserve adequacy that takes account of various determinants of reserve holding. Most of the independent variables in his empirical model are familiar from the literature on the subject, for example, trade and capital account openness, financial depth, and short-term external debt. But he introduces a new variable, namely, "exchange rate overvaluation," postulated to vary inversely with reserve holdings, to allow for the well-known fact that several emerging countries have lately accumulated reserves as a by-product of an exchange rate undervaluation strategy to pursue export-led growth. This variable turns out to be significant at the 5 percent level in the emerging countries sample. (A lagged export growth variable, intended to capture the same phenomenon, turns out to be insignificant. But the choice of this variable does not make much sense. My guess is that if Sen Gupta had chosen "current account imbalance" as the variable instead, it would have been significant.)

Sen Gupta then calculates "excess reserves" held by countries, relative to the "international norm" established by his empirical model. India turns out to have held substantial "excess reserves" from 2002–06. It should be noted, though Sen Gupta does not emphasize it, that his model also shows that India had reserves below the "international norm" from 1998–2001 (see figure 1). He argues that India suffered a loss by holding an excess of reserves after 2002. But by the same token, India also suffered a loss by holding deficient reserves from 1998–2001. Of course, neither of the above assertions is strictly correct since Sen Gupta does not have a welfare-theoretic framework underlying his model. Neither "excess reserves" nor "deficient reserves", as measured by him, have any clear significance for national welfare.

Sen Gupta ends by estimating the opportunity cost of India's "excess reserve holdings" from 2002–06 in three different ways. I have some comments on each of these apart from the general point made in the preceding paragraph. Sen Gupta takes the returns in three different foregone alternatives as representative of the gross cost of reserve accumulation. The net cost is estimated by subtracting therefrom the return on reserves (taken to equal the yield on US treasury bills).

The first method focuses on output foregone. He assumes that excess reserves could have been invested domestically at a yield given by the marginal product of capital (taken to be the inverse of ICOR). Here it is relevant to ask whether absorbing the excess reserves would in fact have resulted in a one-for-one increase in investment. Surely a sizeable fraction of the absorption would have led to increased consumption.

The second method takes the relevant counterfactual to be the paying down of short-term external debt, thus resulting in a saving of interest charges. This assumes that short-term debt does not yield a benefit. We must remember that India has controls on short-term capital inflows and, in consequence, the stock of short-term external debt is small compared to most other countries. The current level of short-term debt may be genuinely useful in oiling the wheels of trade and foreign direct investment.

The third method takes the foregone alternative to be a reduction in the sales of government debt undertaken to sterilize reserve accumulation. Note that this cost is a very different kettle of fish from the above two. It is a quasi-fiscal cost incurred by the government and the central bank as a combined entity, but not a cost to the nation as a whole. This is because the interest paid by the government constitutes income received by the holders of government bonds.

In conclusion, I return to my earlier observation that Sen Gupta's estimates are not derived from an optimizing model. Such a model would *inter alia* have to allow for the crucial point that the benefit of reserves extends beyond their use in cushioning the economy against a currency crisis. Possession of a large stock of reserves also reduces the probability of occurrence of capital flight and currency crises.[1] It is a sobering thought that India is fortunate in having "excess reserves" during the current global economic turmoil.

General Discussion

Kaushik Basu opened the general discussion by suggesting two additional aspects that should be included in modeling decisions about the desired level of reserves. First, the various institutions participating in the decision will have different objectives. For example, the central bank may be most interested in preventing a crisis, compared with the finance ministry which might be more focused on the cost of holding reserves. Second, countries

1. This point is explicit in models of self-fulfilling currency crises. See, for example, Obstfeld (1996).

might differ in the emphasis that they place on concomitant goals such as maintaining an undervalued currency as a means of building a brand name and the institutional links required to support future trade.

Rajnish Mehra argued for a greater consideration of risk concerns. The conceptual framework needs to incorporate the risk–return tradeoff when evaluating the investment options faced by a central bank. Similarly, there is a cost to investing in highly liquid assets.

Robert Lawrence suggested a broader consideration of the role of the central bank in the process: What is the motivation and what is the function? In the case of China, reserve holdings are approaching US$2 trillion. One dimension of the decision-making may well be a desire to keep the currency undervalued. An alternative interpretation, however, would start with the observation that China has generated a large amount of savings and the central bank may be an investment program for its citizens. In the second case, the central bank resembles a national investment manager, which is considerably different than the traditional view that it seeks to cushion temporary shocks.

Suman Bery summarized the two different ways of thinking about reserve accumulation. First, there is a risk management approach, which is the more traditional purpose of reserves; and second, there is the undervaluation approach, where a real exchange rate goal is related to a broader development strategy. Regarding the first approach, Bery noted that some researchers have argued that that the building up of reserves can make a country more of a target of a speculative attack. He also noted that the conversion of the central bank into a portfolio manager raises a host of questions regarding its accountability.

References

Acharya, Shankar. 2002. "Managing India's External Economic Challenges in the 1990s." In *Macroeconomics and Monetary Policy: Issues for Reforming the Economy,* edited by Montek Singh Ahluwalia, Yaga Venugopal Reddy, and Savak Sohrab Tarapore, pp. 215–46. New Delhi: Oxford University Press.

Aghion, Philippe, Philippe Bachetta, Romain Ranciere, and Kenneth Rogoff. 2006. "Exchange Rate Volatility and Productivity Growth: The Role of Financial Development." Working Paper 12117, National Bureau of Economic Re-search, Cambridge, MA.

Ahluwalia, Montek Singh. 2002. "India's Vulnerability to External Crisis." In *Macroeconomics and Monetary Policy: Issues for Reforming the Economy,* edited by Montek Singh Ahluwalia, Yaga Venugopal Reddy, and Savak Sohrab Tarapore, pp. 183–214. New Delhi: Oxford University Press.

Aizenman, Joshua and Jaewoo Lee. 2006. "Financial Versus Monetary Mercantilism: Long Run View of Large International Reserve Hoarding." Working Paper WP/06/280, International Monetary Fund, Washington D.C.

Aizenman, Joshua and Nancy Peregrim Marion. 2004. "International Reserve Holdings with Sovereign Risk and Costly Tax Collection." *Economic Journal* 114 (497): 569–91.

Aizenman, Joshua, Yeonho Lee, and Yeongseop Rhee. 2004. "International Reserves Management and Capital Mobility in a Volatile World." Working Paper 10534, National Bureau of Economic Research, Cambridge, MA.

Bahmani-Oskooee, Mohsen. 1987. "Effects of Rising Price of Gold on the LDCs, Demand for International Reserves." *International Economic Journal* 1(4) 35–44.

Baker, Dean and Karl Walentin. 2001. "Money for Nothing: The Increasing Cost of Foreign Reserve Holdings to Developing Nations." CEPR Briefing Paper.

Ben-Bassat, Avraham and Daniel Gottlieb. 1992a. "Optimal International Reserves and Sovereign Risk." *Journal of International Economics* 33 (3–4): 345–62.

———. 1992b. "On the Effect of Opportunity Cost on International Reserve Holdings." *The Review of Economics and Statistics* 74: 329–32.

Bhagwati, Jaimini. 2006. "Return on FCA." *Business Standard.* 14 December. Available online at http://bsl.co.in/india/storypage.php?autono=267918 (downloaded on 19 September 2008).

Bhalla, Surjit S. 2007. "Second among Equals: The Middle Class Kingdoms of India and China." Draft May 2007, Peterson Institute of International Economics.

Burke, Dominic and Philip Lane. 2001. "The Empirics of Foreign Reserves." *Open Economics Review* 12 (4): 423–34.

Bussière, Matthieu and Christian B. Mulder. 1999. "External Vulnerability in Emerging Market Economies: How High Liquidity can Offset Weak Fundamentals and the Effects of Contagion." Working Paper 99/88, International Monetary Fund, Washington D.C.

Calvo, Guillermo A. and Carmen M. Reinhart. 2000. "When Capital Flows Come to a Sudden Stop: Consequences and Policy." In *Reforming the International Monetary and Financial System*, edited by Peter B. Kenen and Alexander K. Swoboda. Washington, D.C.: International Monetary Fund.

Cerra, Valerie and Sweta Chaman Saxena. 2002. "What Caused the 1991 Currency Crisis in India?" *IMF Staff Papers*, Palgrave Macmillan Journals, 49 (3): 395–425.

Chinn, Menzie David and Hiro Ito. 2006. "What Matters For Financial Development? Capital Controls, Institutions and Interactions." *Journal of Development Economics* 81 (1): 163–92.

Cooper, Richard, N. 1968. "The Relevance of International Liquidity to Developed Countries."*American Economic Review* 58 (2): 625–36.

Courchene, Thomas J. and G. M. Youssef. 1967. "The Demand for International Reserves." *Journal of Political Economy* 75 (4): 404–13.

Dooley, Michael P., David Folkerts-Landau, and Peter M. Garber. 2003. "An Essay on the Revived Bretton Woods System." Working Paper 9971, NBER, Cambridge, MA.

Edison, Hali. 2003. "Are Foreign Reserves in Asia Too High?" In *World Economic Outlook and Staff Studies for the World Economic Outlook* (WEO). Washington D.C.: International Monetary Fund.

Edwards, Sebastian. 1983. "The Demand for International Reserves and Exchange Rate Adjustments: The Case of the LDCs: 1964–1972." *Economica* 50 (199): 269–80.

Eichengreen, Barry and Jeffrey Alexender Frankel. 1996. "The SDR, Reserve Currencies and the Future of the International Monetary System." In *The Future of the SDR*, edited by Michael Mussa, James Boughton, and Peter Isard, pp. 337–77. Washington, D.C.: International Monetary Fund.

Feldstein, Martin. 1999. "A Self-Help Guide for Emerging Markets." *Foreign Affairs*, March/April. Available online at http://www.foreignaffairs.org/19990301faessay970/martin-feldstein/a-self-help-guide-for-emerging-markets.html (downloaded on 19 September 2008).

Frenkel, Jacob A. and Boyan Jovanovic. 1981. "Optimal International Reserves: A Stochastic Framework." *Economic Journal* 91 (392): 507–14.

Frenkel, Jacob A. and Jeffrey Alexender. 1974a. "Openness and the Demand for International Reserves." In *National Monetary Policies and the International Financial System*, edited by R. Albier, University of Chicago Press, Chicago.

———. 1974b. "The Demand for International Reserves by Developed and Less Developed Countries." *Economica* 41 (61): 14–24.

Frenkel, Jacob A. 1978. "International Reserves: Pegged Exchange Rates and Managed Float." Carnegie Rochester Conference Series on Public Policy, Vol. 9, pp. 114–40.

———. "The Demand for International Reserves under Pegged and Flexible Exchange Rate Regimes and Aspects of the Economics of Managed Float." In *The*

Functioning of Floating Exchange Rates: Theory Evidence and Policy Implications, edited by David Bigman and Teizo Taya, pp. 169–95. Cambridge, Massachusetts: Ballinger Publishing Co.

Frenkel, Jacob A. 1983. "International Liquidity and Monetary Control." In *International Money and Credit: The Policy Roles*, edited by George Von Furstenberg, pp. 65–109. Washington, D.C.: International Monetary Fund.

Gosselin, Marc-André and Nicolas Parent. 2005. "An Empirical Analysis of Foreign Exchange Reserves in Emerging Asia." Working Paper 38, Bank of Canada, Ottawa.

Government of India. 2007. *Eleventh Five Year Plan (2007–12)*, Volume I. New Delhi: Planning Commission, Government of India.

Greenspan, Alan. 1999. "The Federal Reserve's Semi-annual Report on Monetary Policy." Testimony before the Committee on Banking and Financial Service U.S. House of Representatives on July 28, 1999, Washington DC. Available online at http://www.federalreserve.gov/boarddocs/hh/1999/july/testimony.htm.

Hausmann, Ricardo, Ugo Panizza, and Ernesto Stein. 2001. "Why do Countries Float the Way they Float?" *Journal of Development Economics* 66 (2): 3 87–414.

Haberler, Gottfried. 1977. "How Important is Control over International Reserves? In *The New International Monetary System*, edited by Robert A. Mundell and Jacques J. Polak, pp. 111–32. New York: Columbia University Press.

Heller, Robert H. 1966. "Optimal International Reserves." *The Economic Journal* 96 (302): 296–311.

Heller, Robert H. and Mohsin S. Khan. 1978. "The Demand for International Reserves under Fixed and Floating Exchange Rates." *IMF Staff Papers* 25 (4): 623–49.

Islam, Anjsul, Moosa Khan, and Mazhar M. Islam. 1994. "An Empirical Test of the Demand for International Reserves." In *The Changing Environment of International Financial Markets: Issues and Analysis*, edited by Dilip Ghosh and Edgar Oritz, pp. 83–94. London: The Macmillan Press.

Iyoha, Milton Ame. 1976. "Demand for International Reserves in Less Developed Countries: A Distributed Lag Specification," *The Review of Economics and Statistics* 58 (3): 351–55.

Johnson, Simon, Jonathan D. Ostry, and Arvind Subramanian. 2007. "The Prospects for Sustained Growth in Africa: Benchmarking the Constraints." Working Paper 07/52, International Monetary Fund, Washington D.C.

Joshi, Vijay. 2004. "The Real Exchange Rate, Fiscal Deficits and Capital Flows: A Refutation." *Economic and Political Weekly* 39 (13): 1434–36.

———. 2006. "The Real Exchange Rate, Fiscal Deficits and Capital Flows: Refutation Again." *Economic and Political Weekly* 41 (5): 446–47.

Joshi, Vijay and Sanjeev Sanyal. 2004. "Foreign Inflows and Macroeconomic Policy in India." In *The India Policy Forum,* edited by Suman Bery, Barry Bosworth, and Arvind Panagariya, pp. 135–88. Washington D.C: Brookings Institution Press and NCAER.

Kenen, Peter B. and Eliner B. Yudin. 1965. "The Demand for International Reserve." *Review of Economics and Statistics* 47 (3): 242–50.

Kletzer, Kenneth M. 2004. "Liberalizing Capital Flows in India: Financial Repression, Macroeconomic Policy and Gradual Reforms." Working Paper 04–16, Santa Cruz Center for International Economics, Santa Cruz.

Lal, Deepak, Suman Bery, and Devendra. K. Pant. 2003. "The Real Exchange Rate, Fiscal Deficits and Capital Flows." *Economic and Political Weekly* 38 (47): 4965– 76.

———. 2005. "The Real Exchange Rate, Fiscal Deficits and Capital Flows: Erratum and Addendum." *Economic and Political Weekly* 40 (16): 1650–55.

Levy-Yeyati, Eduardo and Federico Sturzenegger. 2005. "Classifying Exchange Rate Regimes: Deeds vs. Words." *European Economic Review* 49 (6): 1603–35.

Lizondo, Jose Saul and Donald J. Mathieson. 1987. "The Stability of the Demand for International Reserves." *Journal of International Money and Finance* 6 (3): 251–82.

Mohan, Rakesh. 2002. "Transforming Indian Banking: In Search of a Better Tomorrow." Speech given at the Bank Economists' Conference 2002, December 29, Reserve Bank of India, Bangalore.

———. 2008. Keynote Address at the Conference "Growth and Macroeconomic Issues and Challenges in India" organized by the Institute of Economic Growth, New Delhi on February 14.

Neely, Christopher J. 2000. "Are Changes in Foreign Exchange Reserves Well Correlated with Official Intervention," *Federal Reserve Bank of St. Louis Review* 42 (5): 17–32.

Obstfeld, Maurice. 1996. "A Model of Currency Crises with Self-Fulfilling Features." *European Economic Review* 40 (3–5): 1037–47.

Obstfeld, Maurice, Jay C. Shambaugh, and Alan M. Taylor. 2008. "Financial Stability, the Trilemma and International Reserves." Working Paper 14217, NBER, Cambridge, MA.

Patnaik, Ila. 2005. "India's Experience with a Pegged Exchange Rate." In *India Policy Forum*, edited by Suman Bery, Barry Bosworth, and Arvind Panagariya, pp. 189–226. Brookings Institution Press and NCAER: New Delhi.

Reserve Bank of India. 2006. "Report of the Committee on Fuller Capital Account Convertibility." Mumbai: Reserve Bank of India.

———. 2007. *Half Yearly Report on Foreign Exchange Reserves*. Mumbai: RBI.

Rodrik, Dani. 2006. "The Social Cost of Foreign Reserves." *International Economic Journal* 20 (3): 253–66.

Sachs, Jeffrey D. Aaron Tornell, and André Velasco. 1996. "Financial Crises in Emerging Markets: The Lessons from 1995." *Brookings Papers on Economic Activity* 27 (1996-1): pp. 147–216. Economic Studies Program, The Brookings Institution.

Shinkai, Yoichi. 1979. "Demand for International Reserves in Less Developed Countries: A Comment." *The Review of Economics and Statistics* 61 (4): 614–15.

Summers, Lawrence H. 2006. "Reflections on Global Account Imbalances and Emerging Markets Reserve Accumulation." L.K. Jha Memorial Lecture, March 24, 2006, Reserve Bank of India, Mumbai.

Thorn, Richard S. 1967. "The Demand for International Reserves: A Note on Behalf of the Rejected Hypothesis." *Review of Economics and Statistics* 46: 623–27.