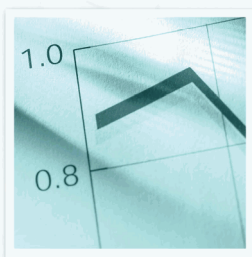


ARE HIGH FOREIGN EXCHANGE RESERVES IN EMERGING MARKETS A BLESSING OR A BURDEN?

OCCASIONAL PAPER NO. 6
MARCH 2007



BY RUSSELL GREEN AND TOM TORGERSON

DEPARTMENT OF THE TREASURY • OFFICE OF INTERNATIONAL AFFAIRS

Department of the Treasury: Office of International Affairs
Occasional Paper No. 6
March, 2007

Are High Foreign Exchange Reserves in Emerging Markets a Blessing or a Burden?

By Russell Green and Tom Torgerson

DISCLAIMER

This is the Sixth in a series of Occasional Papers from the Treasury Department's Office of International Affairs. These papers examine international economic issues of current relevance in an effort to identify underlying trends and issues for policymakers. These papers are not statements of U.S. Government, Department of the Treasury, or Administration policy and reflect solely the views of the authors.¹

Economic policymakers in emerging market countries have typically viewed foreign exchange reserves as money in the bank—the more, the better. Over the past three decades, a shift to flexible exchange rate regimes and an ability to borrow in domestic currency eased pressure on industrial countries to accumulate reserves. Meanwhile, emerging market and developing countries continued to struggle with maintaining adequate reserve levels. Only recently has the large scale of reserve accumulation in emerging markets raised questions about its necessity and even its wisdom.

This paper examines the motivations and costs of foreign exchange reserve accumulation among the world's largest emerging market holders of reserves. We consider the costs of holding reserves, including sterilization costs, opportunity costs, and potential central bank balance sheet losses. We find the top seven emerging market reserve holders to have all exceeded standard reserve adequacy measures. Our analysis suggests the net marginal return to additional reserves is low, if not extremely negative, yielding scant support for the proposition that the largest reserve holders are holding foreign exchange reserves ex-

clusively for precautionary purposes. The policy implication is not about the allocation of existing reserve stocks, but about further reserve accumulation. What is needed is the removal of distortions—such as limited exchange rate flexibility—that lead to excess reserve accumulation in the first place.

FOCUS ON PRECAUTIONARY HOLDINGS OF RESERVES

The most obvious reason for an emerging market economy to hold a stock of foreign exchange reserves is to *insure against currency crises*. However, countries hold reserves for a number of other reasons.

- Central banks can use reserves for *intervention in non-crisis times*. Countries with rigid declared exchange arrangements such as pegs or crawling bands—and, in fact, many countries with flexible declared exchange arrangements—intervene to reduce volatility or maintain a target exchange rate.² If the currency is fundamentally near equilibrium but volatility remains high, intervention may be in two directions, resulting in little net

¹We wish to thank Marvin Barth, Andy Baukol, Bill Block, Gavin Buckley, Alain Chaboud, Joe Gagnon, Mike Leahy, Robert Kaproth, Kurt Schuler, Mark Sobel, and Charlie Thomas for their insightful suggestions, though we bear responsibility for all errors.

²Most analyses of the effectiveness of foreign exchange intervention conclude that intervention has at best modest and transitory effects on the exchange rate and/or on exchange rate volatility. Disyatat and Galati (2005), for example, provide a review of literature on the effectiveness of intervention in emerging markets.



change in reserve holdings. Intervention can also act as a tool against deflation, both by mitigating nominal appreciation, and, unsterilized, by expanding the money supply.

- Central banks in dollarized financial systems may need foreign exchange reserves to serve as a *lender of last resort* to banks with high levels of foreign currency liabilities. Central banks may desire to provide liquidity to banks in foreign currency outside times of systemic crisis. Due to the unique nature of the risk of bank runs, the mere presence of reserves may ensure that the need to use them never arises (Diamond and Dybvig 1983).
- Countries use reserves for *day-to-day transactions* such as purchases of foreign goods or payment of obligations to international organizations.

Fairly minimal reserve levels may be adequate for these sources of demand outside a currency crisis. Generally, non-currency crisis reserve demand will not exceed demand for reserves to insure against a currency crisis. In other words, the marginal benefit of additional reserve holdings for non-crisis purposes has already approached zero by the time reserves reach levels sufficient to insure against a currency crisis.

Alternatively, countries may be interested in reserve acquisition rather than reserve stocks. Intervention to respond to terms of trade shocks, to fight deflation, or to support export-led growth may result in stocks of reserves. Once acquired, however, these reserves have limited use beyond precautionary purposes. Consequently, we will use insurance against currency crisis, or “precautionary demand” for reserves, as the criterion to assess reserve adequacy in emerging economies.

CONVENTIONAL PRECAUTIONARY RESERVE BENCHMARKS

Country circumstances vary, and there is no precise level of reserves universally considered either sufficient or optimal. Advanced economies with highly liquid, floating currencies and stable financial market access in domestic currency are unlikely to derive any significant value from large precautionary reserve holdings. Where currencies are less liquid and market access less than assured, reserves may reduce both the risk and impact of current account shocks or capital account crises. There is an extensive literature that attempts to define specific benchmarks for reserve adequacy. We discuss four simple and commonly cited ratios.

- *Reserves to short-term external debt*: The so-called Greenspan-Guidotti rule – named after Alan Greenspan and Pablo Guidotti, a former Argentine finance official, who called for developing countries to amass reserves equal to all external debt coming due within the next year – has become the most widely preferred benchmark for measuring vulnerability to capital account crises.³ This benchmark’s relevance to currency crisis prevention also has the greatest empirical support (Bussière and Mulder 1999; García and Soto 2004; Jeanne and Rancière 2005).⁴
- *Reserves to M2*: Countries facing a risk of capital flight may follow money-based measures, as reserve balances held against a portion of the monetary base can increase confidence in the value of local currency. Given the difficulty in measuring capital flight there is no conventional minimum adequate level of reserves, but Wijnholds and Kapteyn (2001), suggest reserves equivalent to 5-20% of M2, depending on the exchange

³A few observers have suggested also holding reserves to cover at least a small fraction of foreign holdings of equity securities.

⁴The results of Jeanne and Rancière (2005), in fact, support the Greenspan-Guidotti rule as the *optimal* rather than merely *adequate* level of reserves for countries with relatively low external interest rates.



rate regime, as an appropriate buffer. Wijnholds and Kapteyn argue that the risk that residents will wish to convert domestic into foreign liquidity will be greater for countries with a currency peg than for countries with a flexible exchange rate. Fixed exchange rates rely in part on the credibility of the central bank's ability to maintain a specific parity.

- *Reserves to imports*: Import-based measures can be useful for low-income countries without significant access to capital markets and vulnerable to current account shocks, such as a fall in the price of a country's main export or a drop in tourism receipts due to natural disaster. Reserves worth three to four months of imports is perhaps the most frequently cited benchmark.
- *Reserves to GDP*: This ratio is sometimes spuriously cited as an adequacy measure, with little theoretical or empirical justification. GDP does not represent a vulnerability that must somehow be covered in a crisis, and there is little reason countries should aim for reserves to match some proportion of it. We do not consider this measure in our analysis below.

EXCEEDING ADEQUATE

Some countries have acquired such high levels of international reserves that the conventional benchmarks for reserve adequacy have been met several times over. Table 1 presents the ten economies with the largest absolute holdings of total gross reserves minus gold, as measured by the IMF. At the end of 2005 eight of the largest reserve stockpiles were located in East Asia, with the other two held by major oil exporters. Japan tops the list, but by the time of this writing in 2006, China

had become the largest reserve holder. Both hold levels of reserves far greater than the rest.

Table 1: Top Ten Reserve Holders

Rank	Country	Gross Reserves minus Gold 2005	Change in Reserves 2004-5	Rate of Increase
		(USD Billions)	(USD Billions)	
1	Japan	834	0	0.0%
2	China	822	207	25%
3	Taiwan	257	29	11%
4	S. Korea	210	11	5%
5	Russia	176	55	31%
6	India	132	5	4%
7	Hong Kong	124	1	1%
8	Singapore	116	4	3%
9	Mexico	74	10	13%
10	Malaysia	70	4	5%

Source: IMF

Reserves have grown significantly in recent years, and 2005 was no exception. Among the top ten reserve holders, the fastest rates of increase occurred in two countries that had explicit exchange rate pegs (China and Malaysia, although not Hong Kong) and among oil exporters.

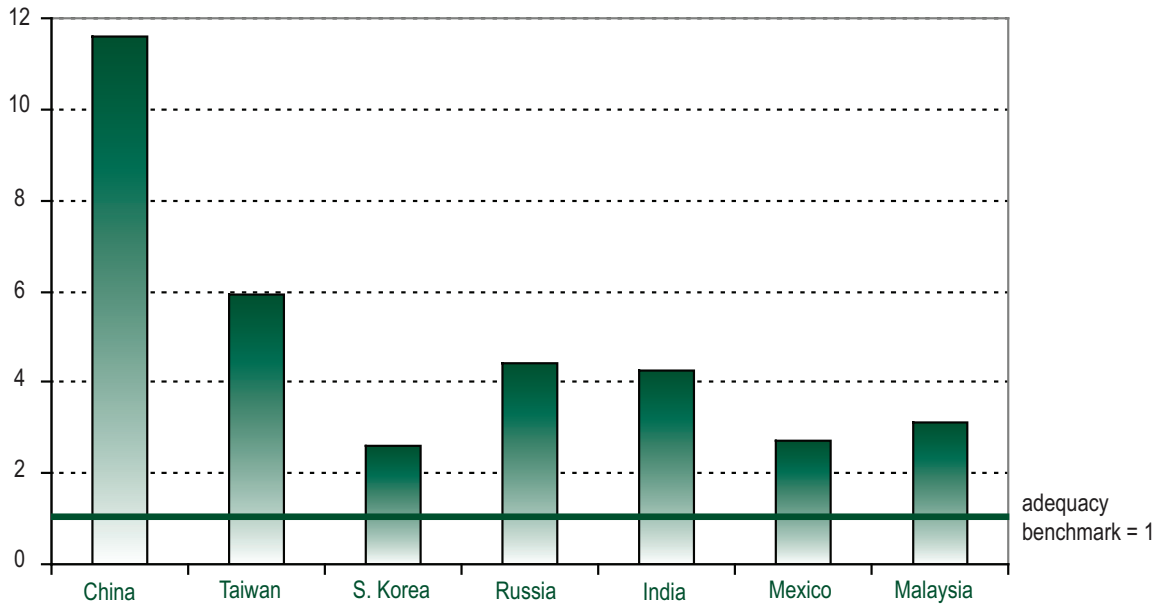
In this paper we focus on the seven economies in this list typically categorized as emerging markets, applying the standard benchmarks outlined above.^{5,6} Figure 1 shows how the seven match up to the Greenspan-Guidotti threshold for reserves/short-term debt. All hold several multiples of their short-term debt in reserves, with China far ahead of the rest at more than eleven times short-term debt.

⁵ As mentioned above, advanced economies with highly liquid currencies and stable financial market access are unlikely to derive any significant value from reserve holdings as a precautionary fund. Accordingly, we omit Japan, Hong Kong and Singapore from these benchmark comparisons.

⁶ In these comparisons we use reserves held by the country. However, most of the adequacy standards were developed before the meaningful development of multilateral swap arrangements such as the Chiang Mai Initiative. It may be appropriate to add available reserves from swaps to actual reserves held to measure reserve adequacy, but in the absence of experience or empirical guidance, and in the interest of making conservative assumptions, we omit them.



Figure 1: Reserves/Short-term Debt, 2005

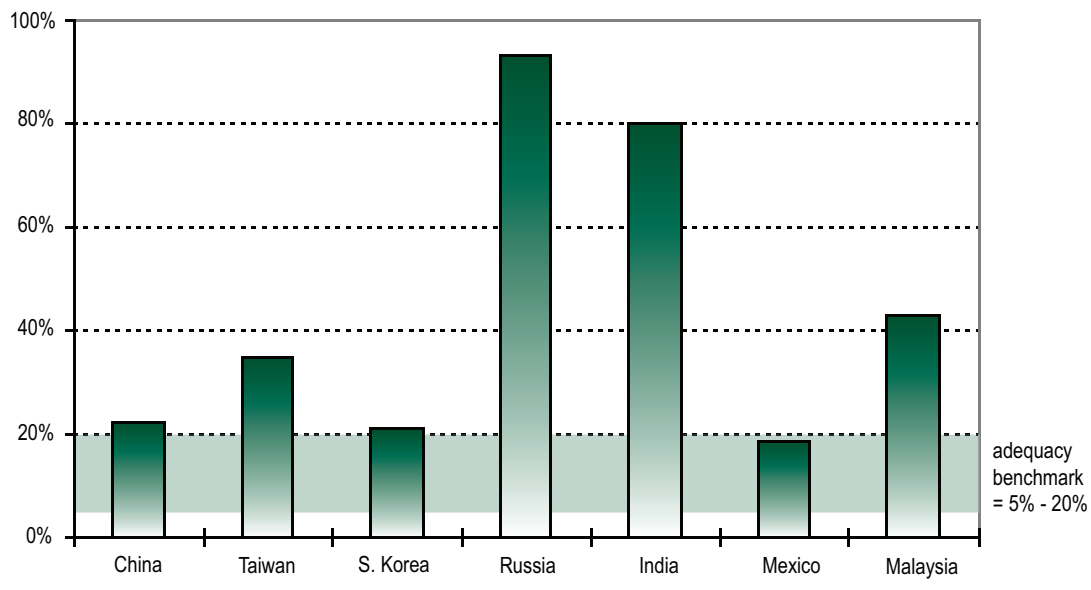


Source: IMF and BIS

Coverage of the money supply, M2, in Figure 2 shows a similar picture. On this measure all economies are adequately reserved. Russia and India approach coverage of their entire broad money supply. Even countries with a specific domestic need for adequate reserves – China is liberalizing controls on outward investment while facing a large, weak banking sector; India is consider-

ing liberalizing its capital account and has a large budget deficit; and Mexico has a history of capital flight into dollars – have reached levels of reserves that appear more than adequate for protecting against capital flight. Indeed, Mexico and India should perhaps be measured against the low end of the 5-20% benchmark range as countries with a flexible exchange rate.

Figure 2: Reserves/M2



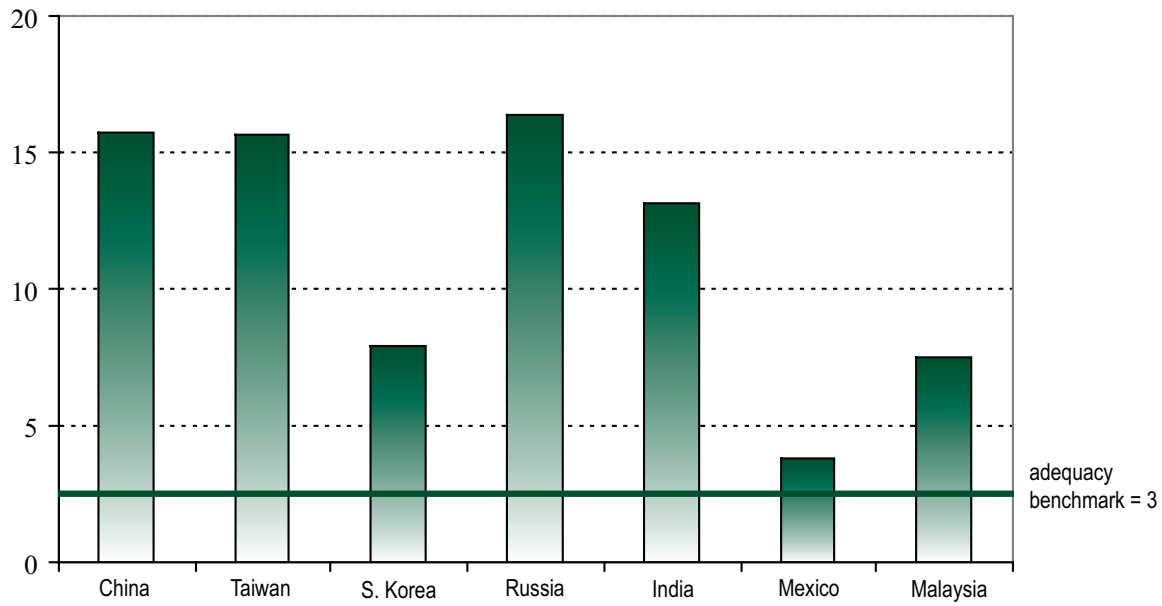
Source: IMF and national sources.



As discussed, import coverage may be less relevant for economies with capital market access. Even so, none of the top reserve holders demonstrate vulnerability in Figure 3. Mexico has the

lowest import coverage ratio at 3.8 months. Every other economy is well beyond four months of import coverage. In fact, half of the top reserve holders have well more than a year of import coverage.

Figure 3: Months of Import Coverage, 2005



Source: IMF and national sources.

The comparisons presented thus far involve benchmarks against single statistics, but another approach is to consider a full range of fundamentals by estimating the demand for reserves in a multivariate setting. These estimates capture the relative weight put on various sources of vulnerability. This approach does not necessarily indicate divergence from appropriate levels of reserves, as countries may have followed suboptimal reserve policies in the past. However, under the assumption that countries generally hold adequate levels of reserves relative to their fundamentals, the estimates can be used to determine whether out of sample reserve levels are adequate.

- Aizenman and Marion (2003) measure reserve demand in a broad cross-section of countries before 1997 and compare predicted

to observed reserves outside the sample period in 1997-9. They find reserve accumulation exceeding that predicted by fundamentals in China and South Korea, but not Malaysia.

- Edison (2003) performs a similar exercise to predict reserve levels in 2002. She finds observed reserve levels above predicted reserves for Mexico; Russia; and (aggregated together) China, India, Hong Kong, and Malaysia.
- Gosselin and Parent (2005) restrict their estimation sample to Asian emerging economies, which isolates any unique Asian pattern of reserve demand, but find similar results when predicting reserves in 2003-4.⁷

⁷Gosselin and Parent (2005) include China, South Korea, India, Singapore, Malaysia, Philippines, Indonesia, and Thailand in "Asia."



The new pattern may reveal a previously unrecognized need for reserves. Some have suggested that after the Asian financial crisis Asian economies became less willing to rely on IMF lending to supplement their reserves. If their calculus for appropriate precautionary reserve levels had previously included some degree of borrowing from the Fund, then removing that buffer from consideration would require expanding net reserves to meet the same precautionary target. Table 2 explores this theory by comparing 2005 reserves with the year before the Asian financial crisis (when reserves were presumably closest to their pre-crisis target) in terms of IMF quota, the benchmark for a country's ability to borrow.⁸

Table 2: Post-Crisis Change in Reserves vs. IMF Quota

Pre-Crisis Rank	Country	Pre-Crisis Peak Reserves ¹	Change in Reserves to 2005	Quota ² in 2005	Reserve Change/Quota
		(USD Billions)	(USD Billions)	(USD Billions)	
2	China	144	678	9.2	73
4	Taiwan	91	166	n/a	n/a
14	S. Korea	34	176	2.4	74
38	Russia	20	155	8.6	18
18	India	27	105	6.0	17
14	Mexico	29	45	3.8	12
16	Malaysia	27	43	2.2	20

¹China measured in 1998, Mexico in 1994. All others measured in 1997.

²Taiwan, P.O.C. is not an independent member of the IMF, so it has no quota.

To put this in perspective, Turkey and South Korea hold the records for the largest programs relative to quota at just over fifteen times quota in 1999 and 1997, respectively. Of course, predicting the nature and response requirements of future crises is difficult, and the volume of capital

flows continues to grow. However, all of these economies except Mexico have reserve levels that exceed – several times over for some – the funds they could expect if they borrowed at the level of the largest previous IMF programs.

Costs of “Excess” Reserves

Reserve growth of the largest holders has significantly accelerated from previous patterns of accumulation, and in nearly all instances exceeded standard benchmarks for reserve adequacy. Is there a limit to gains from reserve accumulation, or is more always better? The marginal benefit of accumulating more reserves is sure to decline at some point.⁹ Furthermore, basic economics reminds us of the need to match *marginal returns with marginal costs*. Reserves are an expensive insurance mechanism, with costs coming from many different – and often difficult to quantify – sources.

- *Sterilization costs*: Sterilization neutralizes the inflationary monetary impact of reserve accumulation by offsetting the associated increase in money supply with a domestic money market operation, typically domestic debt issuance. Two costs of sterilization merit concern, the direct fiscal cost to the monetary authorities and the indirect systemic cost of preventing current account adjustment, with the direct cost being the most commonly considered. Fiscal cost represents the difference between what the central bank earns on international reserves and what it pays on the domestic debt issued to sterilize the reserves. For a few economies with low domestic interest rates, the fiscal cost may even be negative. Poor data on holdings of international reserves or the full extent and composition of sterilization make

⁸We use Mexican reserve levels as of 1994, though no similar sentiment has been postulated regarding either Mexico's or Russia's views of Fund lending.

⁹For a well-behaved distribution of events that require use of reserves, events large enough to require use of the marginal reserve dollar occur less frequently as total reserves increase. By bolstering confidence, additional reserves also shift the distribution to the left, making their use even less likely (assuming other macroeconomic fundamentals and policies are broadly sustainable – if not, additional reserves are no guarantee against a crisis). Hviding, Nowak, and Ricci (2004) find a strong nonlinear effect of reserves to short-term debt on exchange rate volatility, implying diminishing marginal returns.



fiscal costs difficult to measure consistently for the whole sample.¹⁰ Anecdotal evidence indicates, however, that substantial sterilization has been taking place in East Asia over the past few years (e.g. International Relations Committee Task Force 2006; Mohanty and Turner 2005).

By stifling the monetary impact of foreign exchange intervention, sterilization allows a central bank to influence the real exchange rate.¹¹ The practice of preventing upward real exchange rate adjustment, made feasible through sterilization, can be harmful by distorting the price signal for resource allocation. It can lead to overinvestment in tradable sectors at the expense of non-tradables. Expectations of eventual adjustment can attract speculative capital inflows and hence asset bubbles, although these flows also tend to lower domestic interest rates and therefore may lower direct fiscal costs. Without capital inflows interest rates will likely rise, potentially crowding out private investment. Along with many other important factors, prevention of real exchange rate appreciation has recently contributed to a global current account imbalance, one of the IMF's primary concerns for the world economic outlook (IMF 2006).

- *Opportunity cost:* The resources used to purchase international reserves could be used in a number of alternative ways.¹² A government could pay down its sovereign short-

term external debt, since the interest cost of a given amount of short-term external debt – though difficult to measure – likely exceeds the earnings on an equivalent amount of reserves.¹³ Paying down sovereign short-term external debt therefore has an equal vulnerability-reducing effect to holding reserves, when following a Greenspan-Guidotti rule, with a lower net cost.

A government could also spend the reserves on investment projects, with the constraint that reserves cannot be converted back into local currency if authorities wish to avoid an impact on the exchange rate. For example, reserves could be used to purchase foreign medical supplies or equipment. Most high reserve countries have lower capital-to-labor ratios than the industrial countries in whose bonds reserves are held. Thus, the returns from public investment may be significantly higher than current earnings on reserves as long as they are allocated efficiently. Some monetary authorities have recently been managing their reserves more actively in order to improve their return.

A more efficient solution might be to forgo some reserve accumulation, allowing the private sector to determine the best allocation of foreign exchange earnings. By acquiring reserves, the central bank is essentially allocating that portion of national income into a particular form of savings. Absent some use that requires public coordination – such as

¹⁰ Sterilization is sometimes approximated over a short time horizon by the difference between changes in net foreign assets and net domestic assets, since sterilization aims to keep the money supply unchanged and the monetary base accounting identity gives us $\Delta \text{Monetary Base} = \Delta \text{NFA} + \Delta \text{NDA}$. Even in the absence of foreign exchange intervention, however, the monetary base will not stay constant in a fast growing economy with a developing financial sector and active monetary policy. Money supply growth to match natural growth in money demand introduces too much noise to reliably identify even large-scale sterilization by this method. Even if sterilization rates were known, unavoidable imprecision in interest differentials between reserves and sterilization instruments would strongly influence estimates.

¹¹ Intervention would ordinarily have a small impact on the real exchange rate because reserve accumulation raises the monetary base and hence inflation. Inflation will tend to keep the real exchange rate constant as the nominal exchange rate depreciates. Therefore, by eliminating an effect on the monetary base, sterilization allows a central bank to influence the real exchange rate, which helps determine trade and capital flows.

¹² See Kletzer and Spiegel (2004) for academic treatment of the opportunity cost of reserves.

¹³ This idea has been recently discussed by Genberg, et al (2005) and Rodrik (2006).



crisis insurance or paying for public goods – private sector allocation of foreign exchange earnings would almost certainly be welfare enhancing. It is difficult to imagine welfare-maximizing behavior apportioning so much income to savings, or holding a portfolio so dominated by low-yield foreign government bonds.

Various methods of approximating these foregone returns have been suggested, from selecting market interest rates or liquidity premia to deriving the return from an assumed national production function. In the absence of a definitive method and with wide differences in results among methods, we follow

Summers's (2006) admittedly ad hoc construct and assume a 6% real return – net of earnings on risk-free reserve assets in domestic terms – on domestic infrastructure investment, paying down short-term external debt or portfolio diversification. We calculate an approximation of the opportunity cost in Table 3 by multiplying the 6% return times those reserves held above adequacy standards.¹⁴ By this calculation the annual opportunity cost is substantial for almost all of the largest reserve holders by almost any measure of reserve adequacy.

Table 3: Calculated Annual Opportunity Cost of Excess Reserves (%GDP)

Country	Reserve Adequacy Criteria		
	100% of Short-term Debt	20% of M2	3 Months Import Coverage
China	2.0%	0.2%	1.9%
Taiwan	3.7%	1.9%	3.8%
South Korea	1.0%	0.1%	1.1%
Russia	1.1%	1.1%	1.2%
India	0.8%	0.7%	0.8%
Mexico	0.4%	0.0%	0.2%
Malaysia	2.2%	1.7%	2.2%

Note: Annual opportunity cost is the foregone return every year on reserves held above the adequacy criteria, assuming a 6% net return on alternatives.

Source: IMF and Economist Intelligence Unit

- *Central bank balance sheet risk:* Foreign exchange reserves, just like any other foreign currency asset, can lose their value in local terms when the exchange rate appreciates. In cases where foreign assets form a large share of a central bank's balance sheet, the institution faces the risk of significant losses. Of course, a central bank may account for these losses over several years, depending in part on the maturity profile of its foreign assets and on the pace of appreciation.

Furthermore, as long as interest margins and cash flows remain positive, it may be feasible for central banks to operate with negative capital for a considerable period. However, leaving itself undercapitalized could in time jeopardize the central bank's credibility and ability to target price stability, to intermediate government foreign borrowing, to act as lender of last resort, or to maintain a domestic payments system. This represents a particular risk for central banks with expectations of high future expenses, such as

¹⁴ Alternative opportunity cost scenarios are easily calculated because the cost varies proportionally with the assumed return. For instance if the future marginal product of capital were different from our assumed return by 50%, the opportunity cost would also change 50%.

large interest-bearing liabilities or a potential bank bail-out. Stella's (2003) casual comparison found double the rate of inflation in countries with financially weak versus strong central banks.¹⁵

Capital injections or recurrent loss coverage from the national treasury generate fiscal costs to the government and could undesirably impact central bank independence from the government. Even if the central bank recapitalizes from retained profits, those profits represent revenue forgone by the treasury. Thus the cost ultimately impacts fiscal accounts.¹⁶

How would appreciation of the domestic currency impact the balance sheet of emerging market central banks? Foreign exchange reserves are invested in a number of currencies, including the dollar, euro, yen, and pound sterling. We do not take a view on the projected movement of individual exchange rates, but simply assume for a simplified stress test that the domestic currency appreciates by an equal amount relative to all reserve currencies. We present a range of currency movement magnitudes, 10, 20, and 30 percent, which could occur over any length of time.¹⁷ We apply the exchange rate to the valuations of the central bank net foreign assets, presented in Table 4.

Even a 10 percent appreciation of their currency would completely wipe out the capital of every central bank except Malaysia. On the high end of the range, the severity of the simulated loss could require injections of capital on the order of several percentage

points of GDP. Because balance sheet losses are a potential cost rather than a current cost, central banks should consider their marginal discounted expected value when comparing them with other marginal costs and benefits of reserve holdings.

Table 4: Simulated Exchange Rate Revaluation Loss on Central Bank Net Foreign Assets, 2005

Appreciation of:	% of Central Bank Capital			% of GDP		
	10%	20%	30%	10%	20%	30%
China	2,542%	5,084%	7,625%	3%	7%	10%
Taiwan	303%	606%	909%	24%	48%	71%
S. Korea	1,851%	3,703%	5,554%	3%	5%	8%
Russia	280%	560%	840%	2%	5%	7%
India	583%	1,166%	1,749%	2%	4%	5%
Mexico	1,452%	2,903%	4,355%	1%	2%	3%
Malaysia	73%	146%	218%	5%	11%	16%

Central bank capital includes provisions for losses.

Source: IMF, national sources, and Economist Intelligence Unit

- *Other costs:* Reserve accumulation may render a false sense of security, delaying necessary reforms. While reserves may provide some protection against external crises, otherwise unsustainable policies cause undesirable distortions even when they do not end in crisis. Large fiscal deficits, for instance, may crowd out private sector investment or create debt overhang problems. And these vulnerabilities, if allowed to grow too large, may overwhelm the insulating effect of reserves and surprise a country previously considered secure. All measures of reserve adequacy come with the proviso that other fundamentals remain sound (e.g. Bussière and Mulder 1999).

¹⁵ See Stella (2002) for a review of the literature on the effects of central bank financial weakness. Stella (2003) and Frait (2005) argue that reserve valuation losses need not immediately impact a central bank's effectiveness, conditioned on financial health and inflation roughly at desired levels. Risk arises when those conditions change.

¹⁶ The fiscal cost diminishes or even eclipses gains from the lower value of foreign-currency public debt.

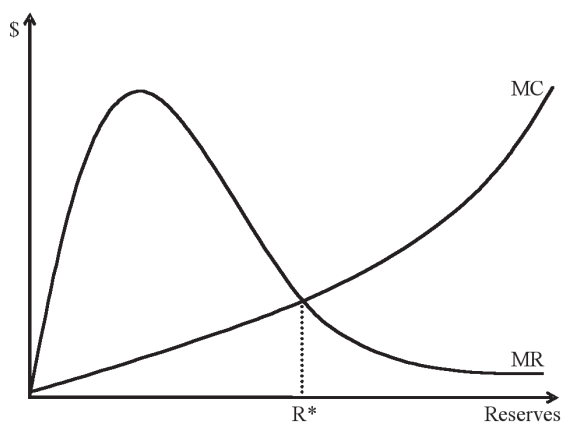
¹⁷ The top of the range was chosen to match the magnitude used in the sensitivity analysis component of the IMF's Debt Sustainability Framework in Article IV reviews, although in our simulation the appreciation need not represent a "shock" in the sense of a precipitous adjustment.



Finally, reserve accumulation adds another variable to the sometimes difficult formulation of monetary policy under flexible exchange rates. The difficulty of coordinating monetary policy with intervention and the risk of being distracted from monetary goals by exchange rate goals can result in undesirable volatility in macroeconomic variables.

Returning to the idea of matching marginal costs to marginal benefits, we consider the possible shapes of the curves. As mentioned before, the crisis reduction benefits of additional reserves decline after a certain point. Most of the marginal costs described above rise as reserves grow: the cost of issuing additional debt for sterilization, the opportunity cost of diverted resources, and the potential to impair central bank activity all rise faster than one-for-one. Figure 4 illustrates possible curves, marking R^* as the optimal level of reserves. The key question is where actual reserves lie relative to R^* .

Figure 4: Possible Reserve Accumulation Marginal Return and Marginal Cost Curves



Some studies have attempted to use subsets of the costs and benefits of reserves to explicitly estimate optimal reserve holdings. García and Soto

(2004) match the precautionary benefits of holding reserves across a range of crisis costs against the opportunity cost. They find reserve levels in Korea and Malaysia in 2003 to be plausibly optimal, but China's reserves were inconsistently high. Jeanne and Rancière (2005) examine similar trade-offs using a model that allows for risk aversion. They find Asian reserves in 2000 to be above optimal levels, even at the limits of plausible input values.¹⁸

CONCLUSION

The largest reserve holders have far exceeded precautionary levels of foreign exchange reserves by most reasonable measures. This would imply that the marginal precautionary return to additional reserve accumulation is quite low. Marginal costs are potentially very high. In light of the low, if not substantially negative, net return to holding reserves, the idea that the largest reserve holders are holding foreign exchange reserves exclusively for precautionary purposes appears difficult to support. Rather, most excess reserve accumulation appears in countries with exchange rates closely tied to the U.S. dollar, and the desire to limit exchange rate flexibility likely underlies much of the recent reserve accumulation. The policy implication is not what to do with the existing stock of reserves, but the removal of distortions - such as limited exchange rate flexibility - that lead to excess reserve accumulation in the first place.

¹⁸ There are non-precautionary benefits which may be considered. Reserves may reduce the cost as well as the likelihood of crisis, and lowering that likelihood may push external interest rates lower for domestic borrowers, although studies which consider these effects do not find them to justify current reserve levels (Hauner 2005; Jeanne and Rancière 2005).

¹⁹ See, for example, Dooley, Folkert-Landau, and Garber (2003); Hanke (2005); or Lachman (2006).

REFERENCES

- Aizenman, Joshua and Nancy Marion, 2003, "The High Demand for International Reserves in the Far East: What Is Going On?" *Journal of the Japanese and International Economies*, 17(3):370-400.
- Bussière, Matthieu and Christian Mulder, 1999, "External Vulnerability in Emerging Market Economies: How High Liquidity Can Offset Weak Fundamentals and the Effects of Contagion," IMF Working Paper No. WP/99/88.
- Diamond, David W. and Philip H. Dybvig, 1983, "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy*, 91(3):401-419.
- Disyatat, Piti and Gabriele Galati, 2005, "The Effectiveness of Foreign Exchange Intervention in Emerging Market Countries," *Foreign Exchange Market Intervention in Emerging Markets: Motives Techniques, and Implications*, BIS Papers, No. 24.
- Dooley, Michael P., David Folkerts-Landau and Peter Garber, 2004, "The Revised Bretton Woods System," *International Journal of Finance and Economics*, 9(4):307-313.
- Edison, Hali, 2003, "Are Foreign Reserves Too High?" *World Economic Outlook*, IMF, September.
- Frait, Jan, 2005, "Managing with Negative Capital," *Central Banking*, 16(2):36-42.
- García, Pablo and Claudio Soto, 2004, "Large Hoardings of International Reserves: Are They Worth It?" Central Bank of Chile Working Papers No. 299.
- Genberg, Hans, Robert McCauley, Yung Chul Park and Avinash Persaud, 2005, "Official Reserves and Currency Management in Asia: Myth, Reality and the Future," *Geneva Reports on the World Economy 7*, Centre for Economic Policy Research.
- Gosselin, Marc-André and Nicolas Parent, 2005, "An Empirical Analysis of Foreign Exchange Reserves in Emerging Asia," Bank of Canada Working Papers No. 05-38.
- Hanke, Steve H., 2005, "Stop The Mercantilists," *Forbes*, June 20.
- Hauner, David, 2005, "A Fiscal Price Tag for International Reserves," IMF Working Paper No. WP/05/81.
- Hviding, Ketil, Michael Nowak, and Luca Antonio Ricci, 2004, "Can Higher Reserves Help Reduce Exchange Rate Volatility?" IMF Working Paper No. WP/04/189.
- IMF, 2006, *World Economic Outlook*, April.
- International Relations Committee Task Force, 2006, "The Accumulation of Foreign Reserves," European Central Bank Occasional Paper No.43.
- Jeanne, Olivier and Romain Rancière, 2005 "The Optimal Level of International Reserves for Emerging Market Economies: Formulas and Applications," IMF Research Department mimeo.
- Kletzer, Kenneth and Mark M. Spiegel, 2004, "Sterilization Costs and Exchange Rate Targeting," *Journal of International Money and Finance*, 23(6):897-915.
- Lachman, Desmond, 2006, "Don't Overestimate the Dragon's Power," *Australian Financial Review*, January 4.
- Mohanty, M. S. and Philip Turner, 2005, "Intervention: What Are the Domestic Consequences?" *Foreign Exchange Market Intervention in Emerging Markets: Motives Techniques, and Implications*, BIS Papers, No. 24.
- Rodrik, Dani, 2006, "The Social Cost of Foreign Exchange Reserves," *International Economic Journal*, forthcoming.
- Stella, Peter, 2002, "Central Bank Financial Strength, Transparency, and Policy Credibility," IMF Working Paper No. 02/137.
- Stella, Peter, 2003, "Why Central Banks Need Financial Strength," *Central Banking*, 14(2):23-29.
- Summers, Lawrence H., 2006, "Reflections on Global Account Imbalances and Emerging Markets Reserve Accumulation," L.K. Jha Memorial Lecture, Reserve Bank of India, Mumbai, India.
- Wijnholds, J. Onno De Beaufort and Arend Kapteyn, 2001, "Reserve Adequacy In Emerging Market Economies," IMF Working Paper No. 01/143.

