11

The Case for Building International Reserves

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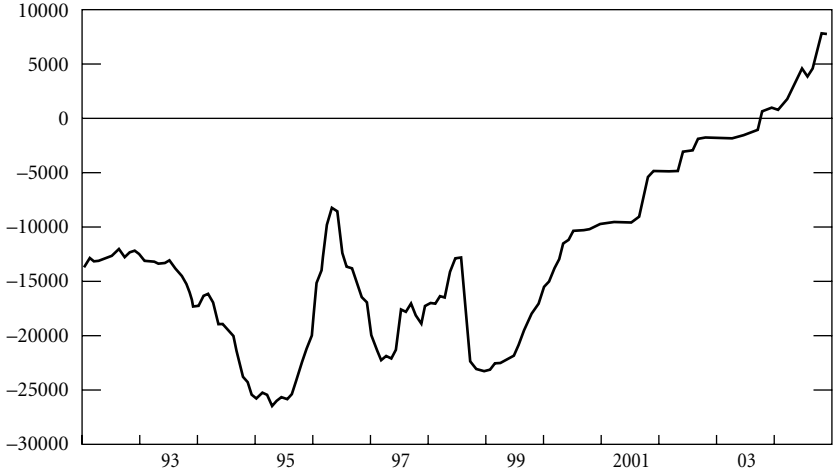
The South African Reserve Bank (SARB) achieved a milestone in May 2003. By eliminating the negative net open forward exchange position (NOFP),[1] a source of external vulnerability was removed (Figure 11.1). Since then, the SARB has continued to strengthen its reserve position, first by eliminating the forward book and then by accumulating additional gross reserves, reaching the same as its stock of short-term external debt by mid-2004 (Figure 11.2). This begs the question: how large a stock of reserves should South Africa accumulate? Or, more fundamentally, why should a country with a credible floating exchange rate build up reserves at all?

This chapter presents an analytical framework that can be used to determine an appropriate reserve target for South Africa. It is suggested that this target can be usefully analyzed as depending on the perceived value of these benefits—identified as stemming from a reduction in the probability of a currency crisis, in the volatility of the exchange rate, and in the cost of borrowing—weighed against the cost of holding reserves. The chapter also highlights that some of the benefits of holding reserves apply to floaters and nonfloaters alike, and are independent of the foreign exchange intervention. More concretely, it is argued that the net benefits of holding

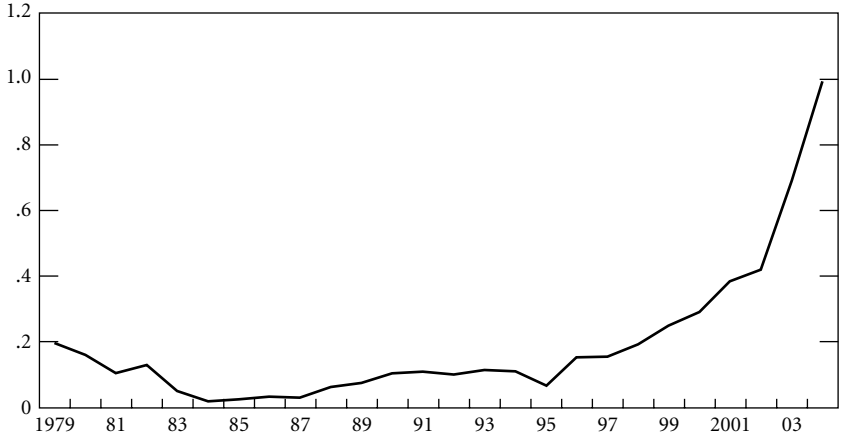
[1]The NOFP was defined as gross international reserves of the SARB minus its foreign currency liabilities and net forward sales of foreign exchange. In March 2004, the NOFP was renamed "international liquidity position," reflecting the closing of the forward book.

Figure 11.1. Net Open Forward Position
(In millions of U.S. dollars)



Source: South African Reserve Bank.

Figure 11.2. Ratio of Reserves to Short-Term Debt[1]
(In percent)



Sources: South African Reserve Bank and author's calculations.
[1]Including net forward foreign exchange sales.

reserves diminish once reserves exceed the stock of short-term debt, and that holding reserves far in excess of this level may involve costs with little tangible returns.

The Benefits of Holding Reserves

Traditional models of optimal reserve holdings typically apply only to fixed or pegged exchange regimes. These highlight the need to maintain a high level of reserves to offset current and capital account shocks. The "buffer stock model," for example, postulates that reserves are held at an optimal level, balancing, on the one hand, the benefits from using reserves to shield the economy against balance of payments shocks, and, on the other hand, the opportunity cost of holding reserves.[2] For a given level of reserves, the higher the volatility of the shocks affecting the balance of payments and reserves, the more often policy adjustment has to be taken; this can be costly. Flood and Marion (2002) find that, while this model explains variations in a country's reserve holdings over time, it throws little light on cross-country variations.

Since the international financial crises in the mid- to late–1990s, the focus has shifted to crisis prevention as a rationale for holding reserves. Reserves are considered as providing self-insurance against run-type behavior in international capital markets.[3] This phenomenon is thought to be particularly relevant for countries with fixed or pegged exchange rates, but is not exclusively limited to these countries. Even in the case of countries with a floating rate regime, the sudden unwillingness of international lenders to renew credit lines could result in a sudden large depreciation of the exchange rate or a significant compression in imports. Reserve holdings would in extreme circumstances allow the market to work more smoothly and reduce the risk of such "sudden stops."[4] The level of reserves may also have a soothing effect on financial market, as the potential for foreign exchange intervention may reduce the willingness of financial operators to take bets on the exchange rate.

Empirically, three main benefits of holding reserves have been identified in recent literature:

- Reserves tend to reduce the likelihood of a currency crisis;
- Reserves help reduce the cost of borrowing from abroad; and
- Reserves contribute to reducing the volatility of the real exchange rate.

[2]See Frenkel and Jovanovic (1981) and Flood and Marion (2002).
[3]See, for example, Sachs, Tornell, and Velasco (1996) and Lee (2004).
[4]See, for example, Calvo and Reinhart (2000).

Reserves Tend to Reduce the Risk of a Currency Crisis

Bussière and Mulder (1999) find that a higher level of reserves relative to short-term debt significantly reduces the probability of a currency or balance of payments crisis. They also find reserves relative to short-term debt to be a superior crisis predictor than other reserve adequacy measures, such as the ratio of reserves to GDP or different monetary aggregates.

The relationship between the ratio of reserves to short-term debt and the probability of a crisis was moreover found to be highly nonlinear. Bussière and Mulder (1999) conclude that, as a rule of thumb, in countries with modest current account deficits and real exchange rates that are not significantly misaligned, a level of gross reserves equal to the stock of short-term debt is broadly consistent with avoiding contagion. They also show that, for a country with no misalignment of the real effective exchange rate and a current account deficit of around 3 percent of GDP, the probability of a crisis falls to very low levels when the ratio of reserves to short-term debt reaches about 1½.

Similarly, Mody and Taylor (2002) find that the ratio of reserves to short-term debt plays an important role in determining the supply of international capital in all of the four countries investigated (Brazil, Korea, Mexico, and Thailand), while a higher level of reserves relative to imports has the effect of lowering the demand for international capital. Higher reserves may also serve to reduce the risk of sovereign default (Manasse, Roubini, and Schimmelpfennig, 2003). Caramazza, Ricci, and Salgado (2004) show that high reserves relative to short-term debt reduce the likelihood of international financial contagion.

Reserves Help Reduce Borrowing Costs

Some empirical literature suggests that reserves provide benefits in addition to insurance against a currency crisis. One important benefit is through lower external borrowing costs. International evidence for this was found by Christofides, Mulder, and Tiffin (2003), mainly through its effect on credit ratings. Such an effect has broad economic consequences as, due to arbitrage, lower risk spread tends to be reflected in lower domestic borrowing costs.

For South Africa, Jonsson (2001) finds a significant impact of the NOFP on the default risk premium of foreign-currency-denominated sovereign bonds (i.e., the sovereign risk spread), even when controlling for other determinants of the risk, such as external public and domestic debt, average maturity of the debt, inflation, exchange rate depreciation, and real growth. The effect appears to be sizable; other things being equal, a $1 bil-

lion increase in the NOFP was estimated to reduce the spread by around 10–15 basis points. Ahmed and Ricci (2004) derive similar results with more recent data: they estimate that a 1 percentage point increase in the ratio of gross reserves to short-term debt results in a ¼ percentage point reduction in the spread.

And Reserves Can Contribute to Reducing Currency Volatility

Figure 11.3 plots reserves against currency volatility in emerging market countries during 2001 and 2002.[5] A casual observation suggests that an increase in the ratio of reserves to short-term debt is negatively related to the volatility of the exchange rate. Econometric evidence lends support to these observations. Based on panel data for a set of 28 emerging market countries, Hviding, Nowak, and Ricci (2004) find a robust relationship between the reserve adequacy and the volatility of the real effective exchange rate. This relationship holds when controlling for foreign exchange intervention.

Such an effect could work through several different channels:

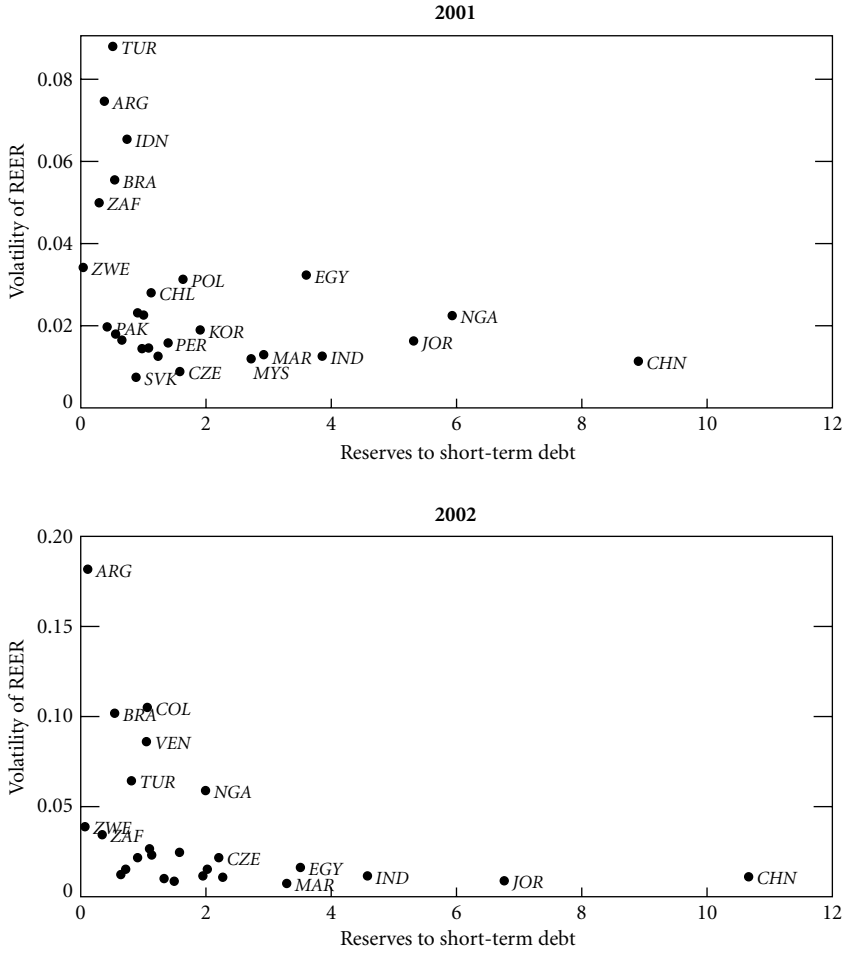
- A higher level of reserves may allow for more active intervention to stabilize the exchange rate. While the academic literature finds sterilized intervention often ineffective,[6] many central banks, particularly in emerging market and developing countries, resort to some form of sterilized intervention.
- The effect may be more indirect and operate through signaling the ability to use reserves at times of potential currency market pressure even though intervention may not actually take place.
- As indicated above, Bussière and Mulder (1999) show that the probability of a currency crisis falls significantly with higher reserves as speculative attacks are less likely. Similarly, the perceived risk of default on external debt, as reflected in the sovereign risks spreads, drops when reserves rise. A lower probability of these extreme events may induce calmer trading activity and reduce exchange rate volatility.

At lower levels of reserves, the estimated impact of reserves on currency volatility is large. With a ratio of reserves to short-term debt of about 70

[5]Reserve adequacy is measured as gross reserves relative to short-term debt, while currency volatility is measured as the annual standard deviation of monthly percent changes in the real effective exchange rate.

[6]Edison (1993); Almekinders (1995); and Baillie, Humpage, and Osterberg (2000). World Bank (1997) discusses the conditions under which sterilization can be effective.

Figure 11.3. Ratio of Reserves to Short-Term Debt and Volatility of the Real Effective Exchange Rate



Sources: South African Reserve Bank and author's calculations.
Note: Three-letter country codes correspond to World Bank classification.

percent, the level prevailing in South Africa at end-2003, a 10 percentage point increase in this ratio would reduce the volatility of the real effective exchange rate by about 7 percent. The impact is, however, highly nonlinear: at a reserve ratio of, say, 100 percent, the effect of the same increase would only reduce the volatility of the real exchange rate by 5 percent, and at a ratio of 150 percent the impact would fall to about 3 percent.

This leads to the question as to whether real exchange rate volatility has any real economic costs. While most research suggests that there is a significant negative relationship between exchange rate volatility and trade, this relationship may not be robust to different specifications (Clark and others, 2003). In a recent study, Bagella, Becchetti, and Hasan (2004) find that higher exchange rate volatility is associated with a lower income level.

The Costs of Holding Reserves

It is assumed that the current account is unaffected by the accumulation of reserves, thereby implying that the country's net international investment position remains unchanged. The cost to the overall economy of holding reserves can be measured as the cost of external borrowing (or, broadly equivalently, of a reduction in external assets) for the nation (private or public sectors), net of the return on reserves.[7] The magnitude of these costs depends on how reserves are being accumulated. If, on the one hand, reserves are being financed by official external borrowing, the costs of holding reserves can be measured as the external borrowing costs net of the expected return on reserves. If, on the other hand, reserves are accumulated as a result of purchases in the foreign exchange market, the external financing might take place in the private sector as it builds up net foreign liabilities—for example, by borrowing from abroad—in order to maintain the same level of net foreign liabilities.[8]

A precise estimate of these costs is beyond the scope of this chapter, since much of the data needed, such as the return on reserves, are not publicly available or are poorly measured. This section limits itself, therefore, to an illustrative calculation using South Africa's sovereign bonds (denominated in U.S. dollars) as a proxy for the nation's external borrowing costs and the six-month London interbank offered rate (LIBOR) as a proxy for the return on reserves.

The estimated costs can be decomposed into two main components: (1) "the liquidity premium," arising from the need to hold reserves in assets that are more liquid than alternative risk-free foreign currency assets; and

[7]This way of looking at the calculation of the costs of holding reserves abstracts from potential effects on the real exchange rate.

[8]Any additional cost of sterilization is just a redistribution of income from the public sector to the private sector, and does not affect the costs of the whole economy.

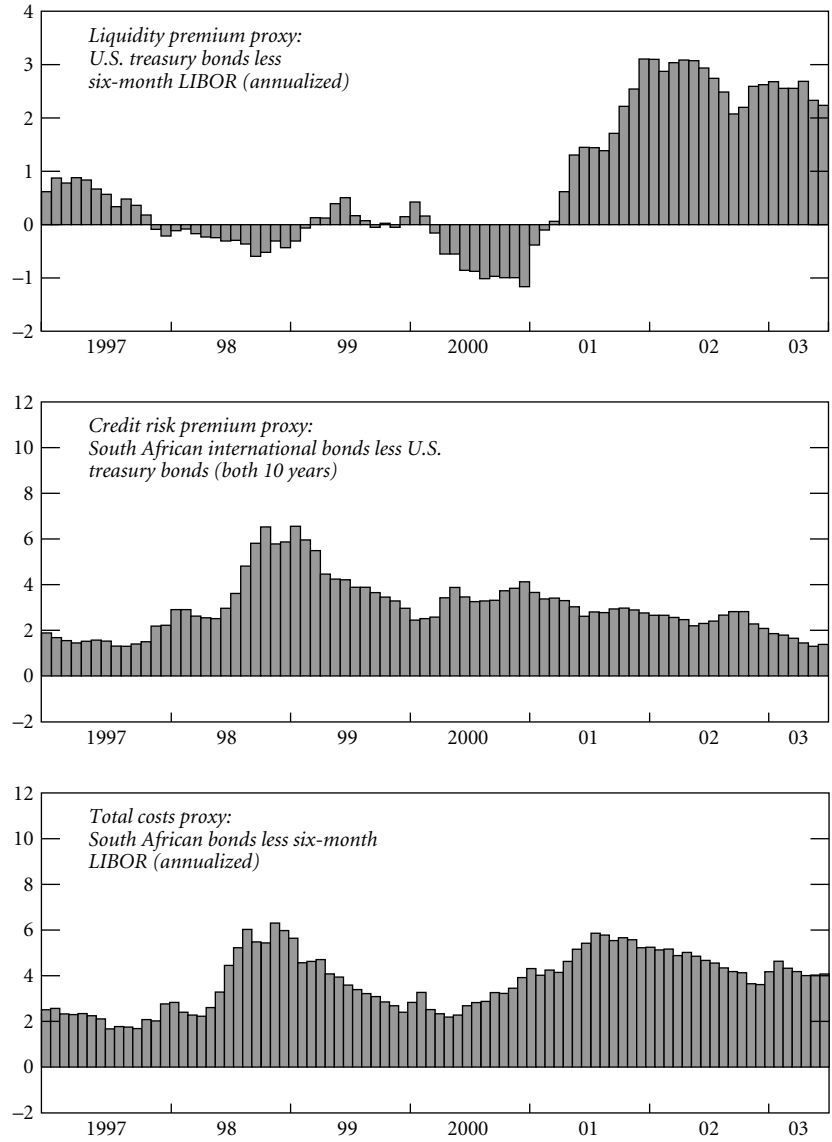
(2) "the credit risk premium," arising from a higher default risk associated with the holder of the reserves, as compared with the country where the reserves are invested. Figure 11.4 presents three panels with estimates of these individual components, as well as their sum:

- The first panel presents the proxy for the "liquidity premium," based on the subtraction of six-month LIBOR from the yield on U.S. long-term government bonds. During 1997–2003, this premium was on average about 0.9 percent.
- In the second panel, the "credit risk premium" was proxied by subtracting the yield on U.S. long-term government bonds from South Africa's sovereign bonds. During the same period, this premium was on average around 2.9 percent.
- The final panel presents an estimate of the overall cost of holding reserves. This measure is equal to the sum of the two previous panels or the difference between the yield on South Africa's sovereign bonds and six-month LIBOR. From 1997 to 2003, the average cost of holding reserves was around 3.8 percent.

This estimate is, however, at best a rough approximation of the costs of holding reserves. First, the estimates are based on historical averages over a period with large variations in the perception of default risk and market conditions more generally. Second, despite the fact that South Africa's reserves are largely held in very short-term assets, six-month LIBOR is an imperfect proxy of the return on reserves as some reserves are held in longer-term assets and currencies other than the U.S. dollar. The latter bias is, however, to some extent offset by a similar bias arising from using the yield on government bonds as in a proxy for the nation's external borrowing costs.[9] Third, if the financing of the reserves takes place through the reduction in foreign assets, either by the private or public sectors, it may be argued that the credit risk premium is not relevant, just the opportunity cost from the loss in the investment income.

[9]The yield on rand-denominated corporate bonds of some South African large corporations carries a margin of ½ to 1 percentage point over a similar rand-denominated government bond. An alternative measure of the external borrowing cost could be based on South Africa's net negative investment income as a percent of net external liabilities (using balance of payments and international investment position data). This measure would be broader in scope—as it includes both public sector and private sector liabilities—but it is very hard to measure accurately, given the existence of valuation changes and incomplete data coverage.

Figure 11.4. Decomposition of the Cost of Holding Reserves



Sources: South African Reserve Bank; IMF, *International Financial Statistics*; and author's calculations.

Summary Assessment

The chapter outlines the benefits and costs associated with holding reserves in a country like South Africa. The potential benefits of holding reserves results from a lower probability of a currency crisis, a narrower spread on external borrowing, and reduced volatility of the exchange rate. The costs relate mainly to liquidity and credit-risk premia: the former is associated with holding reserves in assets that are more liquid than alternative risk-free foreign currency assets; the latter arises from a higher default risk of South Africa compared to the country where the reserves are invested.

The economic value of these costs and benefits is hard to measure precisely. The Appendix provides an illustrative evaluation of the net benefit from increasing reserves from the 2002 level to the one reached in 2004. In sum, it is estimated that the net annual economic benefits amounted to 0.1 percent of GDP. These calculations are very approximate and do not include benefits resulting from reduced chance of financial market disruption or from confidence effects on investment.

Looking forward, it is unclear whether further increase in reserves would yield the same net benefits. First, some of the factors underlying the evaluation—such as the interest rates—change substantially over time. Second, further increase in reserves are likely to be associated with declining benefits, reflecting nonlinear relationships between economic benefits and reserves. Finally, recent research suggests that the likelihood of a currency or balance of payment crisis becomes very small once the level of reserves relative to short-term debt reaches about 150 percent.

South Africa has steadily improved its reserve position and gross reserves cover currently the stock of short-term debt. Such a position seems in the appropriate range to enable South Africa to reap the benefits of reserve holdings, while avoiding the excessive costs of holding reserves.

Appendix. Net Benefits from Increased Reserve Holdings: An Illustration

From the end of 2002 to 2004, the SARB accumulated about $7.3 billion additional reserves, increasing the ratio of reserves to short-term debt from 40 percent to around 120 percent. This appendix presents an illustrative calculation of the potential net benefits from the reserve accumulation, using parameter estimates from the literature as well as observed spreads.

Costs and Benefits of Reserve Increase, 2002–04
(In percent of GDP, per annum)

Costs	0.17
Liquidity	0.04
Credit risk and premium	0.13
Benefits	0.28
Reduced spread	0.24
Reduced volatility	0.04
Net gain	0.11

Source: Authors' calculations.

On the cost side, using spreads between long-term and short-term domestic and foreign financial assets during 1997–2003, we derive an estimate of the liquidity and credit risk premiums of 0.9 percent and 2.9 percent, respectively. When evaluated at these premia, the total annual costs of holding the additional reserves amount to around 0.17 percent of GDP (see table above).

On the benefit side, we focus on the quantifiable benefits of reduced spread and real exchange rate volatility:

- The analysis in Chapter 13 suggests that the observed increase in reserves could have contributed to a 100 basis points reduction in South Africa's external borrowing costs (given a coefficient for the logarithm of reserves to short-term debt of about 0.4). On the basis of an average external indebtedness of about 25 percent of GDP, this would imply a saving of about ¼ of a percent of GDP per annum.
- Hviding, Nowak, and Ricci (2004) suggest that the observed increase in reserves has reduced expected real exchange rate volatility by 12 percent, while Bagella, Becchetti, and Hasan (2004) find that for a sample of 100 countries, a doubling of the volatility of the real exchange rate would—over a five-year period—reduce income by 1 percent to 2 percent. Combining the two estimates implies a net annual benefit of about 0.04 percent of GDP.

In sum, it is estimated that the net annual economic benefits from the reserve accumulated amount to slightly more than 0.1 percent of GDP (see table). It should, however, be noted that this calculation is purely indicative, given the large degree of uncertainty attached to the parameter estimates and the spreads used to calculate the net gains. Moreover, the benefit from self-insurance against disruption in capital markets, and potential long-term confidence effects on investment are not included in

the estimate. It is also important to bear in mind that due to nonlinearities, further reserve accumulation may not generate the same benefits as estimated above.

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