

FOREIGN RESERVES AND THE MANAGEMENT OF RISK

In this article by Neil Humphries, with the assistance of Lin Wang (a representative from the Peoples Bank of China), the risk management of New Zealand's foreign exchange reserves is discussed.

Executive Summary

The Reserve Bank of New Zealand holds foreign exchange reserves to support - and to be seen to be able to support - the Bank's objective of maintaining order in the foreign exchange market. Disorder in the foreign exchange market may impose direct costs on New Zealanders wanting to buy or sell foreign exchange and may cause foreign investors to require higher risk premiums for investing in New Zealand. By holding reserves, and demonstrating its capacity to intervene, the Bank raises confidence that official assistance is available in extreme conditions to help restore order to the foreign exchange market. The holding of foreign reserves also positively influences the international assessment of New Zealand's creditworthiness.

The criteria established by the Bank to manage the foreign reserves relate to liquidity, security and the rate of return. The prime objective for the reserves portfolio is to meet the potential immediate liquidity needs for direct intervention in the foreign exchange market. Around one quarter of the reserves are held in a form which ensures their availability in two working days - the normal settlement for international foreign currency transactions. Short-term credit facilities supplement the liquid reserves while longer-term assets are converted into cash.

The security of the foreign exchange reserves is maximised by minimising the credit, interest rate and foreign exchange risk. Credit risk is the risk of default on a contract. It is minimised by the Bank placing limits on the investment of reserves in particular countries, centres, institutions and instruments and by limiting the exposure to counterparties. Interest rate risk is minimised by using duration analysis to structure the interest and principal payments on assets and liabilities so that interest rate changes that alter the market price of assets will also alter the market price of liabilities by a similar amount. Foreign exchange risk is minimised by matching the currency of denomination of assets with the currency of denomination of liabilities. Therefore a change in the exchange rate will have a minimal impact on the net value of the portfolio.

Subject to liquidity and security considerations the Bank seeks to maximise the rate of return on the reserves. Because this can generally only be done by accepting an increased risk of potential loss, the risks taken are generally small and always within clearly defined limits set by senior management.

INTRODUCTION

One of the functions of the Reserve Bank of New Zealand is to implement the Government's exchange rate policy. More specifically it is the Bank's responsibility to monitor the foreign exchange market; to advise the Government when foreign exchange intervention should be undertaken so as to maintain order in the foreign exchange market; and to carry out foreign exchange intervention when directed by the Minister of Finance.

The Bank holds New Zealand's official foreign currency reserves specifically for exchange market intervention purposes. The Bank manages these foreign reserves, primarily to ensure the funds are secure and liquid but also to generate as high a return as possible. The article initially outlines why the Bank holds foreign reserves. It then reviews the funds management procedures followed by the Bank to ensure that the objectives of security, liquidity and return are met.

WHY THE BANK HOLDS FOREIGN RESERVES

A major reason for the Reserve Bank holding foreign reserves is to support - and be seen to be able to support - the Bank's objective of maintaining order in the foreign exchange market. Since the New Zealand dollar was floated in March 1985 there has been no official intervention in the foreign exchange market to restore order. The Reserve Bank has been active in the foreign exchange market only for the purpose of meeting the Government's regular foreign exchange needs. However, the Bank reserves the right to support the functioning of the foreign exchange market should serious disorder arise.

The 'price' of foreign exchange, the exchange rate, is a reflection of fundamental, political and psychological factors. Any event that causes uncertainty about any of these factors leads to uncertainty about the future direction of the exchange rate. In turn, this may lead to disorder in the foreign exchange market, causing it to cease functioning efficiently. Disorder may cause foreign currency dealers to suspend their dealing or widen the spread quoted between foreign currency purchases and sales. New Zealand corporates therefore might find themselves unable to complete transactions, meet debt commitments or repatriate export income for the period of the disruption. Such disruption to payments will impose direct costs but, more importantly, could lead to demands by foreign investors for higher risk premiums when investing in New Zealand or financing New Zealand trade.

By holding reserves and demonstrating its capacity to intervene, the Bank raises confidence that official assistance is available, in extreme conditions, to help restore stability.

On 31 July 1990 New Zealand's official reserves available for intervention purposes stood at approximately NZ\$3,900 million. An additional NZ\$600 million intervention capability is maintained in committed credit facilities with international banks, and a larger amount in the form of uncommitted credit facilities.

Without foreign reserves the Bank could still intervene directly in the foreign exchange market, but only on one side. The Bank would have the ability to sell unlimited quantities of domestic currency on the foreign exchange market and thus lower the

value of the New Zealand dollar. However, seldom is such action likely to be the appropriate means for restoring confidence in a disorderly market. For example, where foreign currency dealers are unwilling to deal because of uncertainty about the future direction of the exchange rate, the sale of New Zealand dollars alone, by the Reserve Bank, is unlikely to restore order.

The Bank also has the ability to place upward pressure on the value of the New Zealand dollar by raising domestic interest rates.¹ However, such action is also unlikely to re-establish order where foreign currency dealers lack the confidence to remain active in the foreign exchange market. Furthermore, this option is only an indirect means of influencing the exchange rate as the exchange rate will not always react immediately to interest rate movements. The use of the Bank's foreign exchange reserves to re-establish a market for foreign exchange, in conditions of extreme disorder, is likely to be a more effective means of countering disorder.

One-sided manipulation of the exchange rate over the short run in an attempt to counter disorder in the foreign exchange market has the potential to undermine the Bank's prime objective - price stability. The nominal exchange rate has a significant impact on the domestic price level. Therefore, the Bank's monetary policy objective of price stability remains the prime consideration determining the nominal exchange rate in the long run.

Foreign reserves held for intervention purposes also provide other benefits. The level of a nation's foreign reserves positively influences the international assessment of its creditworthiness, and thus the terms on which access is gained to overseas loans. Moreover, as the credit rating assigned to a government effectively acts as a ceiling for ratings on all organisations based in that country, overseas reserves held by the Government affect the overseas borrowing costs of all New Zealanders. Foreign reserves also allow for the possibility of the Government implementing exchange rate regimes other than the 'clean' float that has been in place since March 1985.

At present there is a net cost for New Zealand in holding foreign reserves. New Zealand is a net debtor internationally so all the foreign reserves are borrowed. Interest rates on borrowed funds generally exceed the rates at which the funds can be deposited. The margin between borrowing and lending rates reflects both the normal margin by which financial intermediaries generate their income and the cost of ensuring that the foreign reserves are always available at short notice. This need for availability means that while the reserves are borrowed at rates that reflect New Zealand's good (but not the highest possible) international credit rating, they are invested only in very highly rated liquid financial assets (this is discussed further below). The rates of return available on such assets are normally lower than those at which the reserves are borrowed.

In addition to these costs, there are administration costs incurred by the Bank. The net interest and administration costs of managing the reserves pool of about NZ\$4 billion is estimated at around NZ\$20 million (or 0.5 per cent of the reserves pool) for the year ending March 1991.

¹ This action can also be taken to sterilise the direct sale of New Zealand dollars in the foreign exchange market, i.e. offset the impact of the sale of New Zealand dollars on the domestic money supply. The Bank can also place downward pressure on the exchange rate through indirect action on the domestic money market to lower domestic interest rates.

PORTFOLIO MANAGEMENT OBJECTIVES

The main management objective for the reserves portfolio is to have sufficient funds available at all times to meet foreseeable foreign exchange market intervention requirements. Because of this the Bank's investment strategy is different from that of a commercial operation which has profit as its prime objective.

The criteria established by the Bank to manage the foreign reserves it holds are (in order of importance):

1. To maintain an asset portfolio, of a given value, structured to meet immediate liquidity requirements for exchange market intervention purposes;
2. To ensure the portfolio meets prudent risk management standards; and only then
3. To maximise net earnings (minimise net costs) of the portfolio.

LIQUIDITY REQUIREMENTS

The most important requirement is to be able to meet potential immediate liquidity needs for direct intervention in the foreign exchange market, and the consequent need to manage liquidity risk. Liquidity risk, in the extreme case, is the risk of not being able to sell an asset for cash. More often, though, the risk is that of receiving an unfavourable price when being forced to sell an asset.

To hold all reserves in the most liquid form possible (i.e. all funds available within two working days - the normal settlement period for international foreign currency transactions) would involve substantial cost because of the low rate of return relative to the cost of reserves. The Bank recognises the need to hold a proportion of the reserves in this very liquid form but minimises the cost by establishing short-term credit facilities which can be used to immediately supplement liquid funds while longer term assets are converted into cash.² This means that more of the reserves can be invested in less liquid securities that earn higher yields. Currently about one quarter of the reserves are held in a form which ensures their availability within two working days. The remaining funds are invested in a range of marketable instruments and deposits - the bulk of which would be available within one working week (see to Figure 1).

The management of liquidity risk is, however, only one of several risks that must be considered. Credit, interest rate and foreign exchange risks are also managed:

CREDIT RISK

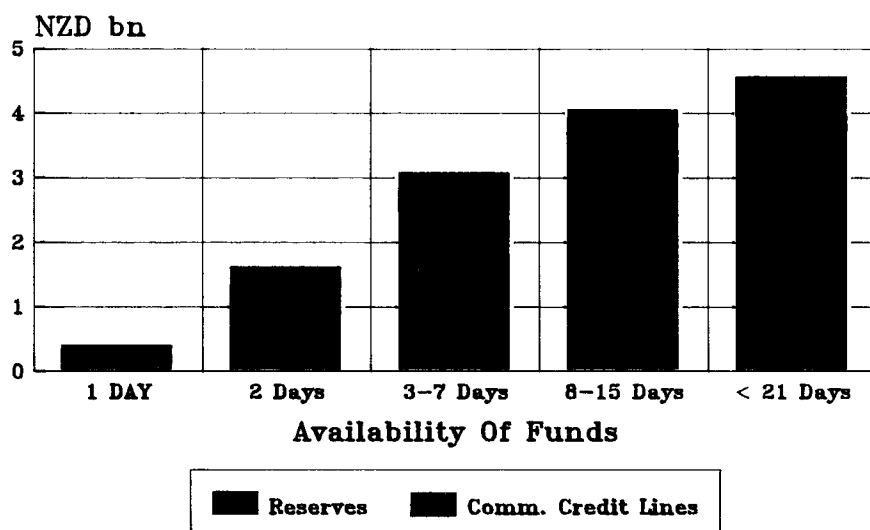
Credit risk is the risk of default on a contract. The possibility that counterparties, whether sovereign or commercial, will default on a contract can arise because of either financial difficulties or legal restrictions. The full principal amount is not always at risk.

² Short-term credit facilities provide a more cost effective form of obtaining liquid funds than reserves in very liquid form. However, there is also a risk that committed credit facilities may not be made available when required. Therefore credit facilities are not relied on to the exclusion of reserves.

Figure 1

LIQUIDITY RISK

Time Dimension



As at July 31 1990

One form of credit risk is where a counterparty defaults after a contract is arranged but prior to settlement, and the contract must be renegotiated with another party. The maximum loss in this case is the cost of renegotiating the contract with someone else when the market price (either the foreign exchange rate or interest rate) has changed in the interim. This risk category, often called exchange risk, includes unsettled securities transactions as well as unsettled foreign exchange deals.

Capital risk is a more serious type of credit risk. It involves the risk of losing the entire contract amount, rather than just the price difference between the original and replacement transaction. This can arise as a result of default by an institution with whom deposits are placed; default by a securities issuer when their securities are held; or default during the settlement process where one side of a foreign exchange deal has been delivered but the counterparty fails to deliver on the other side.

The Bank manages credit risk by restricting the counterparties it deals with to those of the highest standing and by setting limits on the amount that can be invested with individual counterparties. The most liquid portion of the portfolio is held in US dollar sovereign securities. The remainder of the portfolio can be held in a mix of sovereign and non sovereign assets subject to further constraints. Particular limits are:

- (i) **Country limits:** The Bank restricts the maximum exposure to any individual country by limiting the total value that may be placed on deposit with banks of each country and in investments in securities of any one nationality.

- (ii) **Centre Limits:** Similarly, exposures to events such as natural disasters are controlled by limiting the total value of deposits or investments in securities issued in any one dealing centre.
- (iii) **Institution limits:** Exposure to any one institution is restricted in various ways. Limits are placed on the total of deposits and contingent deposits (i.e. deposits agreed but not yet settled) allowed to be outstanding with each institution. The specific limit set for each institution depends upon an assessment of its financial standing.

Limits are placed on the total value of all, as yet unsettled, foreign exchange deals with a single institution. As the deals have not been settled (i.e. the Bank is still in possession of the funds it will use in the transaction) the risk is only an exchange risk and not a capital risk.

Limits are placed on the maximum amount of foreign exchange deals maturing on any one day in order to minimise the loss due to adverse market price movements in the interim. Limits are also placed on outstanding securities transactions.

Finally, an overall exposure limit is set for each institution which limits the total exposure arising from deposits, contingent deposits and foreign exchange deals. The overall limit is normally less than the total of the separate limits which have been set on each type of transaction so that it is not possible to utilise all the limits to the maximum at one time.

- (iv) **Deposits and instruments limits:** Investments may be made only in deposits with approved institutions or in securities issued by approved issuers. The purpose of these limits is to ensure that the Reserve Bank deals only with high quality secure institutions and governments and only in high quality secure instruments. Limits are also placed on the proportion of any one security issue the Bank may hold.

INTEREST RATE RISK

Interest rate risk is a market price risk. It arises as changes in interest rates typically impact on the value, or price, of interest-bearing assets. In particular, when market interest rates rise, *ceteris paribus*, the price of fixed-interest securities falls (see Appendix 1) and when market interest rates fall, the price of fixed-interest securities rises. Movements in market interest rates affect the value of both assets and liabilities in the same direction.

The sensitivity of price movements due to interest rate changes, however, varies between instruments. Generally, the sensitivity of an instrument's price increases as maturity increases. However, this is not a simple relationship as the timing of such factors as interest flows associated with the instrument will also impact on the price change. The actual price sensitivity can be approximated using a technique called duration analysis. The calculation is complex (see Appendix 2 for more details) for an entire portfolio but computer software packages are available which assist in such calculations.

Duration analysis can be used to help immunize a portfolio from interest rate changes by matching the duration of assets and liabilities. By so doing, price changes of assets and liabilities due to changes in interest rates will be largely offset and so reduce variation in net asset values. As duration is only an approximate measure, and works only for small changes in interest rates, interest rate risk cannot be completely removed.

Duration analysis is used to help control interest rate risk on the Bank's foreign currency asset and liability portfolio. This is important as it avoids exposing the Reserve Bank to arbitrary and unnecessary risk arising from overseas interest rate movements. The Bank does actively assume some interest rate risk but the magnitude involved is very small and is kept within parameters approved by senior management.

FOREIGN EXCHANGE RISK

Foreign exchange risk is the risk that exchange rates will change thus changing the value of foreign assets and liabilities. The Bank is able to manage this risk on its portfolio by matching the currency of denomination of its assets and liabilities. This natural hedge is possible because all official overseas reserves held are borrowed overseas as New Zealand is a net debtor internationally.³ In the case of the intervention reserves held by the Bank, the Treasury borrows offshore and deposits with the Bank the agreed amounts of each currency (currently US Dollars, Japanese Yen and German Marks). These deposits are liabilities of the Bank which match the intervention assets. As exchange rates change therefore, the value of the Bank's foreign asset and foreign liability portfolios change by about the same amount so that changes in the value of the Bank's foreign portfolio in net terms are very small.

The Treasury is not exposed to any additional foreign exchange risk as a result of the Bank's holding of foreign exchange assets and liabilities. The Bank's foreign currency liabilities are the Treasury's foreign currency assets. The Treasury raises these funds by borrowing abroad and therefore automatically matches the currency of denomination of these assets and liabilities. Therefore the Treasury is not exposed to foreign currency risk on this portion of its portfolio. The Treasury however still faces foreign currency risk on the remainder of the public debt held overseas.

The management of the Bank's exchange risk is achieved in practical terms by targeting a 'net asset position' equal to zero for both the overall portfolio and each individual currency portfolio. The proportion of foreign currency assets and liabilities held in each currency is shown in Figure 2. The market value of the Bank's foreign currency liabilities and net forward commitments are offset against the market value of the Bank's holdings of foreign currency assets, i.e.:

$$\begin{array}{l} \text{Foreign Currency Assets} \\ - \text{Foreign Currency Liabilities} \\ +/- \text{Forward Contracts and Swaps Outstanding} \\ \hline = \text{Net Asset Position (= 0)} \end{array}$$

³ Official reserves consist of Reserve Bank and Treasury foreign currency reserves. The Treasury holds a small amount of foreign currency reserves to meet foreign currency debt servicing requirements.

Market values, rather than book values, are used in the calculation so as to account for the impact of interest rate changes as well as accrued interest income.

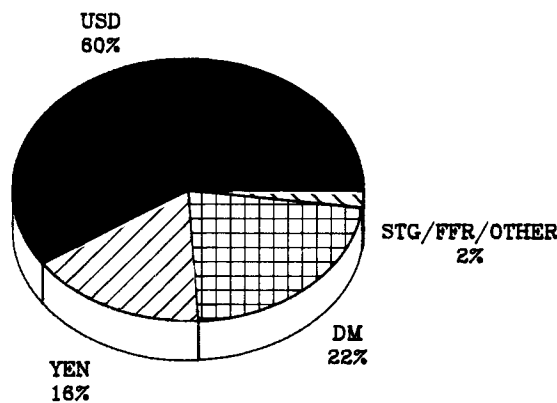
Properly accounting for accrued interest income and expenditure is a significant issue for the Bank because the size and timing of interest cash flows on the Bank's assets and liabilities differ. Interest payment cash flows are larger and less frequent than interest income cash flows. However, in accrual terms both interest income and payment flows accrue at about the same rate and provide a natural foreign exchange hedge for each other.

Mismatches can occur between asset and liability values in each currency because the Bank assumes some foreign exchange risk at times. These risks are limited to small exposures in line with guidelines agreed to by senior management. Furthermore, they are generally only for very short periods of time - often within a day - as normal foreign exchange business is carried out for clients.

CONCLUSION

Investing in overseas markets gives rise to many risks. Many of these risks can be substantially reduced. Because the foreign reserves managed by the Bank are public funds held for the purpose of discharging a public policy function, the Bank adopts investment strategies aimed at reducing risk as much as possible so as to maintain the value and liquidity of the reserves.

Figure 2
CURRENCY COMPOSITION OF
FOREIGN EXCHANGE RESERVES



As at July 31 1990

A subsidiary objective of the Bank's foreign reserves management strategy is to increase income from investment. However, this can generally only be done by accepting an increased risk of potential loss. Consequently the risks taken are generally small and always within very clearly defined limits set by senior management.

APPENDIX 1

The price (or present value) of a financial asset equals the sum of the discounted value of the stream of revenues (interest payments and principal repayments) which the asset is expected to generate over its life:

$$PV = \sum_t \frac{c_t}{(1+r_t)^t}$$

PV = Present value of the asset

C_t = Cash flows expected from the asset (including interest payments and principal repayments)

r_t = Market rate of interest for that particular type of asset (sometimes called opportunity cost or discount factor).

t = time period.

A rise in interest rates will increase the term $(1+r_t)^t$, thereby decreasing the price (PV) of the security and vice versa. This assumes that C_t are fixed, which is not the case with a floating rate security.

APPENDIX 2 DURATION

Duration is a measure of the price sensitivity of an instrument to interest rate changes. Duration is preferable to using the maturity of an instrument as a measure of price sensitivity as it takes account of the timing of cash flows on the instrument.

The duration of an instrument (portfolio or any cash flow series) is a weighted average of the maturities of all the cash flows (interest and principal) relating to the instrument over its term. The weights are present values of each cash flow divided by the sum of these present values:

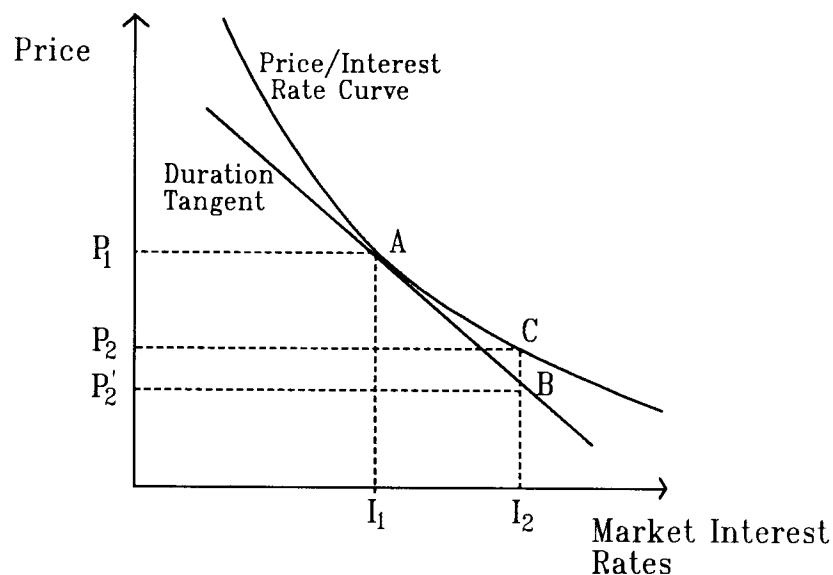
$$D = \sum_{i=1}^n \frac{w_i}{\sum w_i} * t_i$$

where: D = Duration
n = number of cash flows
w_i = net present value of the ith cash flow
t_i = period to the ith cash flow

The duration of a portfolio is the price weighted average of the durations of the individual bonds in the portfolio. Duration is measured in years, but can be interpreted as the percentage change in the market value of a fixed-interest instrument (or portfolio of fixed interest instruments) for a given change in the market interest rate. A larger duration implies a larger change in the market value of the instrument or portfolio, for a given change in market interest rates. Duration analysis is therefore useful to immunise a portfolio from interest rate risk. This can be done by matching the duration (or percentage response to interest rate changes) of assets and liabilities.

When interest rates change the market value of prices of most instruments respond in a non-linear way - the price/interest rate relationship is convex (see Figure A). The greater the degree of non-linearity, i.e. the greater the curvature, the more convex the price/interest rate curve.

Figure A - Duration and the Price/Interest Rate Curve



Duration analysis assumes that the price of an instrument changes (in response to a change in interest rates) along a straight line, tangent to the price/interest rate curve at the initial point (Point A in Figure A). Duration analysis works best for small parallel shifts in the yield curve because duration is only a linear approximation of price sensitivity. Where changes in market interest rates are expected to be sizeable then more complex analysis than duration analysis is necessary to predict the impact of the change in market interest rates on the price of an instrument.

For example, if interest rates change from I_1 to I_2 , the price changes from A to C. Using duration the estimated price would be B with an error of $P_2 - P_2'$. Further analysis, taking into account the shape of the price/interest rate curve, is necessary to reduce the error resulting from solely using duration analysis.

