The currency denomination of New Zealand's unhedged foreign reserves

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In July 2007 the Reserve Bank added un-hedged foreign currency assets to its foreign reserves portfolio. This means that some of the Bank's reserves are now funded directly in New Zealand dollar (NZD)-denominated borrowings as opposed to in foreign currency. When reserves are fully hedged, foreign currency assets are matched with foreign currency liabilities, leaving little net foreign exchange (FX) risk. When reserves are held on an unhedged basis, the level of FX risk is greater and the relative rate of return associated with alternative foreign reserve currencies are more variable. These different properties make the composition of the basket of foreign reserve currencies the Reserve Bank holds more important and requires the development of a strategic FX benchmark to guide the investment of the Bank's unhedged reserves. This article describes the development and implementation of the Reserve Bank's new strategic FX benchmark.

1 Introduction

This article takes a look at how the Reserve Bank manages the foreign exchange risk on its unhedged foreign reserves. Since July 2007 the Reserve Bank has had a policy of maintaining a portion of its foreign reserves on a currency unhedged basis, that is, as unhedged foreign reserves. This means that some of the Reserve Bank's FX assets are funded via outright sales of New Zealand dollars (NZD)s (raised from the Reserve Bank's NZD) liabilities, such as the issue of currency or via the settlement account balances of commercial Reserve Banks or the government) leaving the Reserve Bank exposed to fluctuations in the value of the NZD against the currencies in which the Reserve Bank holds unhedged foreign reserves. The level of unhedged reserves is determined by the Governor and is available as a policy tool (albeit one with relatively modest effectiveness in moderating the broader cyclical movements in the NZD) – either through passive foreign exchange purchases/sales or via outright FX intervention operations.[1] The Reserve Bank's strategic FX benchmark takes the level of unhedged reserves as given and then looks at how to allocate the Bank's open foreign currency position among various alternative foreign currencies.

The article is structured as follows. Section 2 describes how the Reserve Bank's foreign reserves are structured and shows how the Bank's strategic FX benchmark fits into the Bank's broader balance sheet. Section 3 describes how the Reserve Bank developed its strategic FX benchmark and describes the trade-offs associated with different currency allocations within the FX benchmark. Section 4 describes the Reserve Bank's chosen benchmark and the framework used to manage tactical deviations away from the strategic benchmark. Section 5 concludes.

2 The structure of the Reserve Bank's foreign reserves

Hedged versus unhedged foreign reserves

The Reserve Bank's total foreign reserves consist of a portfolio of high quality liquid foreign-currency denominated financial assets. The main purpose of the Reserve Bank's reserves is to make available foreign exchange for FX intervention purposes in the event of dysfunction in the NZD FX market – perhaps due to some NZ specific shock (for example, an earthquake or disease outbreak) or perhaps due to some kind of global financial shock. In these circumstances, the Reserve Bank stands ready to liquidate its stock of foreign currency assets to fund purchases of NZD in the FX market in order to keep that market functioning at some basic level.

The Reserve Bank's reserves need to be invested in resilient, highly liquid and safe instruments and markets to ensure that the Bank's reserves will be available for intervention in what might be very difficult financial market conditions.

[1] See Eckhold and Hunt (2005) for detail on the Bank's FX intervention policy and Eckhold (2010) for detail on the Bank's Open FX management regime.

Table 1

RBNZ asset allocation as at June 30 2010

	Currency/Market (NZD m, % of total reserves)			
	US dollars	Euros	Japanese yen	Total
Government securities	4230 (41 %)	2711 (26 %)	858 (8 %)	7799 (75 %)
Reverse repos[2]	0 (0 %)	0 (0 %)	0 (0 %)	0 (0 %)
Quasi-sovereign securities[3]	2652 (25 %)	0 (0 %)	0 (0 %)	2652 (25 %)
Total	6882 (66 %)	2711 (26 %)	858 (8 %)	10 451 (100 %)

This means that the Reserve Bank typically only invests in instruments that are of a high credit quality (that is, AAA rated sovereign or quasi sovereign bonds or treasury bills) and in markets that exhibit a high and resilient level of liquidity in most circumstances. The table above summarises the Reserve Bank's allocation of investments in its foreign reserves portfolio as at the end of June 2010.

Preserving the liquidity and safety of the Reserve Bank's foreign currency investments is just one facet of what is required to maintain an adequate foreign currency intervention capacity. Another important consideration is the manner in which the Reserve Bank's foreign reserves portfolio is funded. FX intervention requires the Bank to physically sell its FX assets and use the money raised to fund purchases of NZDs in the FX market. This restricts the options available to the Bank in an intervention event. Consider the following scenario. If the Reserve Bank chose to fund its foreign reserves portfolio by borrowing foreign currencies for a relatively short term, this could be problematic. Should the Reserve Bank need to intervene in the foreign exchange market, this requires the reserves portfolio to be liquidated. After intervention, the Reserve Bank would be left with outstanding FX-denominated liabilities maturing quite soon but with no FX assets left to cover those maturing liabilities. We need to manage this foreign currency refinancing risk to make our FX intervention capacity truly effective.

We have options available to organise the funding of foreign reserves and to manage this foreign currency refinancing risk. These are:

- Fund with long-term foreign currency liabilities. For example, we could raise FX loans of a long maturity of, say, 5-10 years. Under this scenario, if intervention was required, the Reserve Bank would have a longer period to organize the repayment of refinancing of its FX loans. The Bank could either resell NZD and repurchase FX after the FX crisis has passed, or refinance maturing FX loans with new long-term FX loans.
- Fund with NZD – The Reserve Bank has ready access to NZD as it is the New Zealand central Reserve Bank. At the extreme, the Reserve Bank can print NZD although it has ongoing access to NZD from banks via our role as provider of liquidity to the Reserve Banking system. This means physically selling NZD and purchasing the foreign currency used to fund the foreign reserves portfolio. If the Reserve Bank intervenes, it has no remaining FX exposure, as there were no FX liabilities created to fund the foreign reserves sold for intervention purposes.

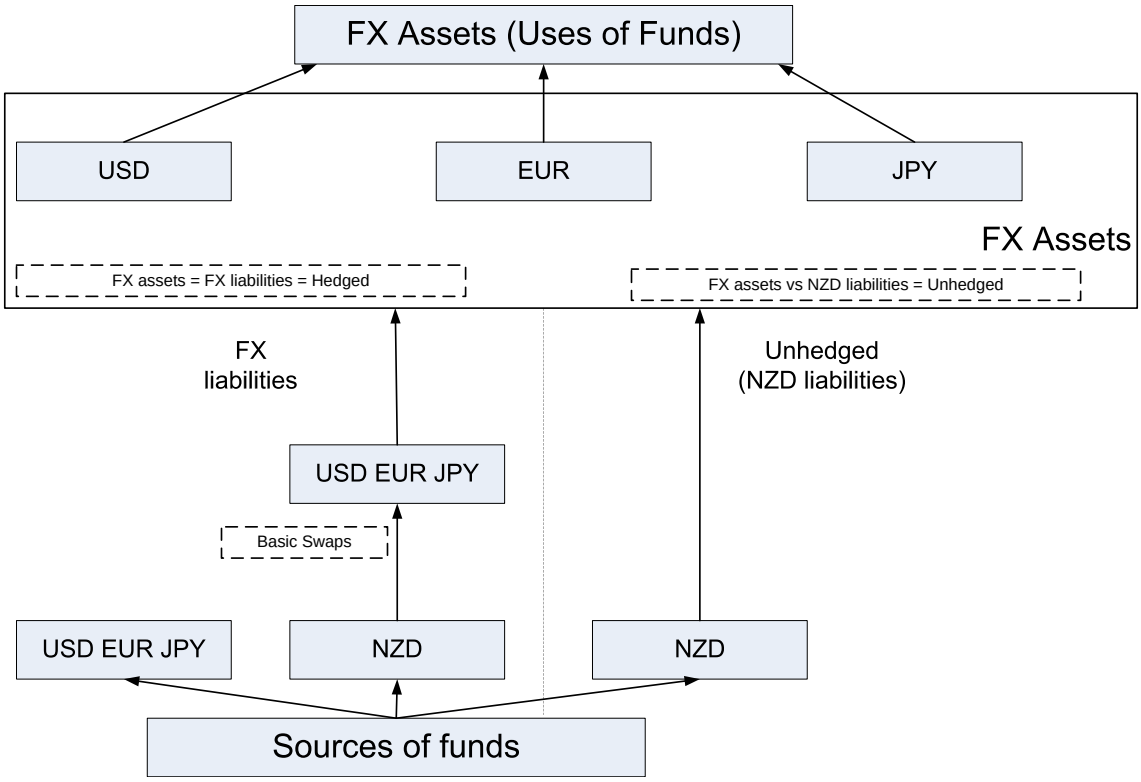
In normal times, funding reserves with FX liabilities leaves the Reserve Bank hedged against movements in the NZD against the currencies in its foreign reserves portfolio. The portion of total reserves funded via FX liabilities is known as the Reserve Bank's hedged reserves. Funding reserves with NZD leaves the Bank fully exposed to fluctuations in the NZD on its foreign reserves portfolio. These reserves are known as unhedged reserves. In the case of both hedged and unhedged reserves the actual foreign currency assets are exactly the same (government securities, for example) and are indistinguishable from each other on the Reserve Bank's balance sheet. The sole difference is the currency

[2] Reverse repos are essentially short-term cash investments secured on high-quality government securities as collateral. Reverse repos are transactions where the Reserve Bank buys foreign government securities for cash while simultaneously agreeing to sell those securities back at an agreed price in the future. The difference in the purchase and sales price is equivalent to the interest rate on the reverse repo.

[3] Includes investments in the securities of government guaranteed entities, AAA-rated state agencies and the Bank for International Settlements.

Figure 1

Hedged and unhedged FX reserves



denomination of the liabilities funding those reserves. Figure 1 illustrates how the hedged and unhedged components of the Reserve Bank's reserves portfolio fit together.

3 Historical development of the Reserve Bank's strategic FX benchmark

From the mid-1980s to 2004 , the Reserve Bank had a policy of holding all of its foreign reserves on a fully hedged basis. The currency denomination of its FX liabilities matched its foreign reserves through that period. There was no strategic FX benchmark required, since the Reserve Bank had no net exposure to FX risk through its foreign reserves. The Bank merely ensured that it raised sufficient long-term FX liabilities to match its desired foreign reserve holdings in various currencies and markets.

In 2004, the Reserve Bank proposed – and the Minister of Finance agreed – a change to the Bank's long-standing policy on FX intervention. From the mid-1980s to 2004, the Reserve Bank's policy had been to preserve FX intervention solely for managing market disruption in a crisis. Beyond that, the Reserve Bank would not intervene for any other purpose and would not intervene to lean against movements in the NZD that might be thought to be fundamentally unjustified. In 2004, the Reserve Bank changed its policy to allow intervention when the exchange rate moves significantly away from fundamentally justified levels, effectively adding FX intervention to its monetary policy tool-kit.[4] The new policy left open the possibility of the Reserve Bank intervening to try and lean against extreme cyclical movements in the NZD. This intervention has the effect of either adding unhedged foreign reserves to its stock of hedged reserves when the exchange rate is judged to be relatively overvalued, or by actually going short on foreign currency and long on the NZD, when the exchange rate is judged to be relatively undervalued. The objective of this new intervention approach is to lean against exceptional and unjustified deviations of the exchange rate

[4] See Eckhold and Hunt (2005).

from fundamentally justified levels, if it is judged that the exchange rate is creating a problem for the implementation of monetary policy.

The Reserve Bank needed a strategic FX benchmark to help guide the management of its open FX position if intervention was used. Intervention itself typically involves the purchase or sales of NZDs against the US dollar (USD) as the NZD/USD cross rate is the main traded market. Intervention aims to influence the value of the NZD through operations in the NZD/USD market – however, after that it might not be necessarily optimal to leave the FX position obtained in the USD. It might be more sensible to diversify the Reserve Bank's FX risk by spreading the exposure across more currencies, thus protecting the Reserve Bank from a shock to the USD. It might also be the case that there are better returns available in currencies aside from the USD, as interest rates differ across currencies. A strategic benchmark is designed to account for the differing levels of risk and returns that are available in alternative currencies.

The Reserve Bank ultimately chose a benchmark for its open FX position consisting of three currencies – the USD, the euro and the Japanese yen – with weights of 45 percent, 45 percent and 10 percent respectively. This choice reflected a desire to implement a simple while diversified benchmark that featured the most liquid currencies in markets where the Reserve Bank's foreign reserves team had established expertise.

In 2007, the Reserve Bank decided to make another significant shift in its foreign reserves financing strategy, as part of the review of its balance sheet that had been ongoing from 2005.[5] The outcome was the introduction of a permanent benchmark amount of unhedged foreign reserves to the Reserve Bank's balance sheet of SDR 1000 million (around NZD 2250 million) or about 20 percent of the Reserve Bank's total FX reserves. The Reserve Bank retained the option to adjust the actual amount of unhedged reserves, depending on the level of the exchange rate and macroeconomic considerations. It appeared likely that the Reserve Bank would have a significant ongoing net positive level of un-hedged reserves in most circumstances and hence a routine ongoing exposure to FX fluctuations on its un-hedged foreign reserves. This significant and ongoing exchange rate exposure drives a need for a more detailed strategic FX benchmark to ensure the Reserve Bank achieves the best risk-adjusted returns from its unhedged foreign reserves.

The Reserve Bank has adopted an FX overlay strategic benchmark that implies the addition of unhedged reserves to its foreign reserves portfolio does not have a direct effect on the composition of the assets the Reserve Bank holds in its portfolio. Box 1 discusses in more detail the concept of an FX overlay system compared to the alternative.

4 Developing a strategic benchmark for the Reserve Bank's unhedged reserves

Desirable properties of potential reserve currencies

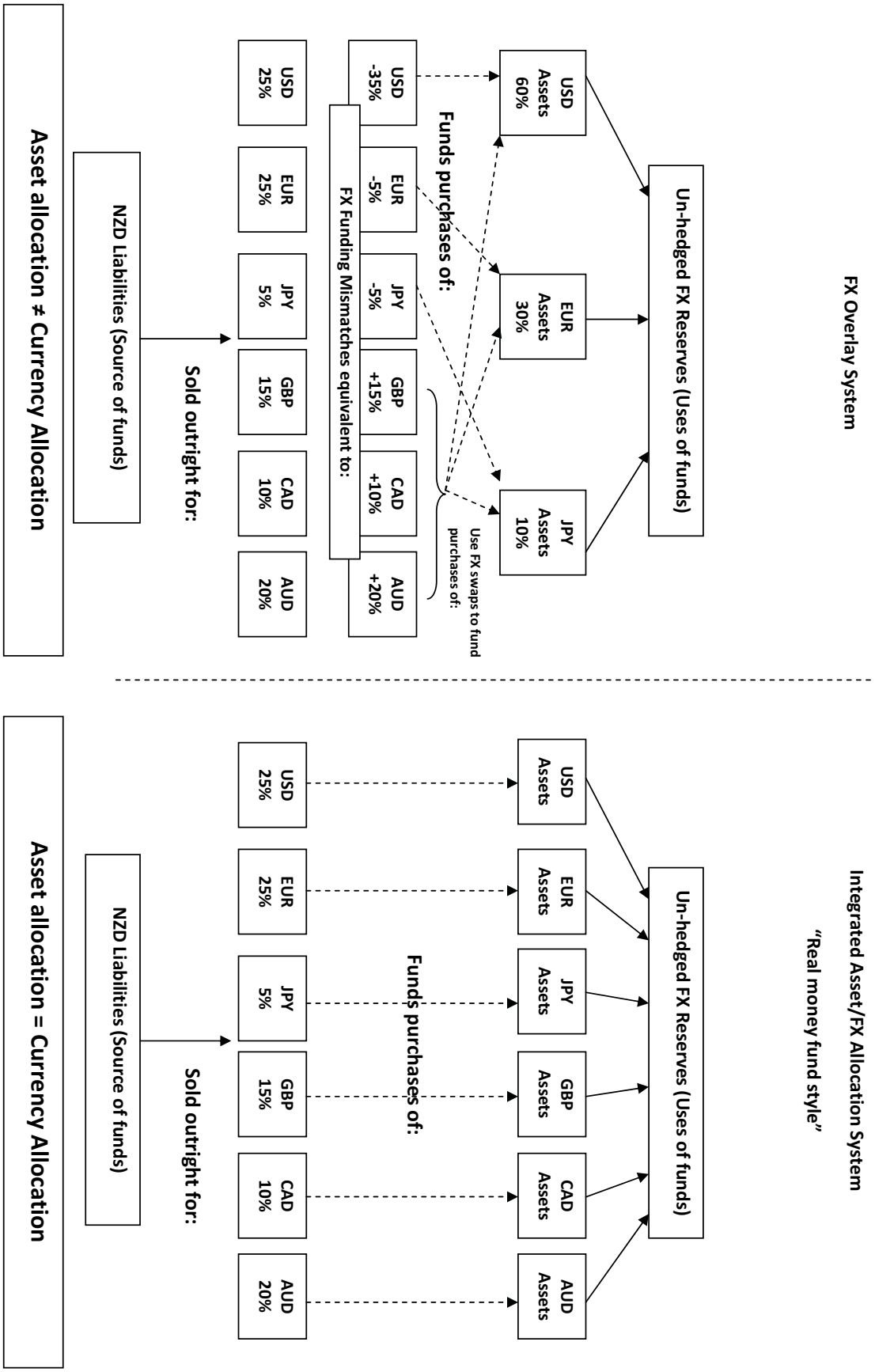
When developing a strategic benchmark for the Reserve Bank's unhedged reserves, it is important to consider the properties we would want constituent currencies to satisfy in both normal times, and in a crisis when intervention might be occurring. In normal times we would ideally prefer currencies that:

- Have an adequate level of liquidity that allows traders to build and manage the portfolio without incurring undue transactions costs.
- Have developed hedging and capital markets that allow the Reserve Bank to manage changes in the relative size of the hedged versus unhedged portion of the reserves portfolio without incurring undue transactions costs. In addition, this gives the Reserve Bank an adequate range of instruments in which to invest reserves, should we choose to hold physical investments in the currencies concerned. Well developed hedging and capital markets will generally lead to a wider range of participants in the currency and thus better liquidity.
- Provide a high, or at least adequate risk-adjusted return thus helping the Reserve Bank maximise returns or minimize costs associated with holding foreign reserves.

[5] See Eckhold (2010) for details.

Box 1

Approaches to implementing a strategic FX benchmark



Both the level of interest rates and the volatility of the currency are important factors in determining the risk-adjusted return of a particular currency.

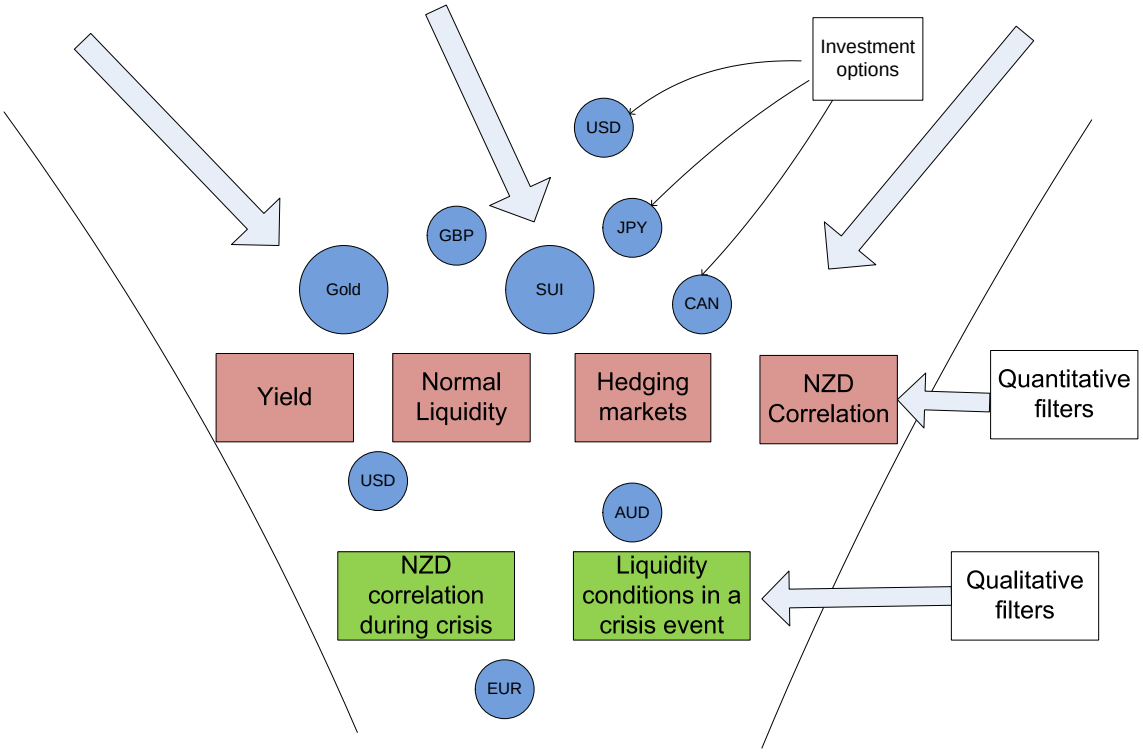
- Have a positive correlation to the NZD. Currencies that are positively correlated with the NZD (for example commodity currencies) are less risky to the Reserve Bank as unhedged reserves are financed through sales of the NZD. The stronger the positive correlation, the lower the risk as the value of the Reserve Bank's unhedged foreign currencies assets will tend to vary less in NZD terms compared to less correlated currencies.

In a crisis situation, where we might need to liquidate the portfolio, a different set of properties is important. In particular, we would ideally prefer currencies that:

- Exhibit a strong level of liquidity in a range of circumstances, including situations of global financial market stress. First and foremost, we need to ensure that we can liquidate our portfolio when we need it most. The purpose of holding reserves is defeated if the portfolio is unavailable for intervention when required. Liquidity of the spot FX market is particularly paramount, as we will need to sell down our FX holdings for US dollars and then ultimately for NZ dollars in intervention operations.
- Have an absence of capital controls, and a low likelihood of these being introduced in a global stress event. It is not helpful to have our reserves tied up because of currency controls.
- Exhibit a high level of resiliency to New Zealand-specific shocks. It is unhelpful to have reserves invested in markets whose liquidity conditions are highly affected by developments in the NZD market.
- Exhibit a low and ideally negative correlation to the NZD in a crisis situation. The ideal would be for the value of our foreign reserves to be rising, or at least not falling, in line with the NZD in a crisis event. This better preserves our FX intervention capacity.

There are some currency choices that are clearly attractive in both normal markets and in a crisis situation. Highly liquid and widely traded currencies such as the USD and the Euro will always be highly favoured in the strategic benchmark. But some of the factors that make a currency attractive in normal markets make them less attractive in

Figure 2
Stylised investment choice "Hopper"



a crisis. For example commodity currencies like Canadian and Australian dollars look good most of the time but could cause us difficulty if a global commodity crisis was putting stress on the NZD. Also, there are, typically, trade-offs to be considered. Often higher yielding currencies are less liquid. A framework is required to assess the risk-adjusted trade-offs inherent in different currency choices so we can balance the attractive aspects of alternatives against their costs and risks.

Analyzing the trade-offs of alternative strategic benchmark choices

Box 2 describes the technical analytical framework employed to analyze the trade-offs between alternative currency allocations. Figure 2 provides a stylised view of the analytical process.

The potential investment universe constitutes a lengthy list of candidate currencies. The approach taken was to look at all of these and then assess them according to their normal and crisis properties. The analogy is like sifting wheat from chaff by emptying everything into a hopper and filtering

Box 2

Analysing the strategic benchmark allocation within a Markowitz portfolio optimisation framework

Portfolio choice problem

Maximise expected returns on un-hedged reserves

$$E(R) = \sum w_i R_i - R_{NZ}$$

Where:

- R_i is currency i's 90-day interest rate (or 5-year swap rate in some scenarios)
- w_i is currency i's weight in the benchmark ($0 \le w_i \le 1$), $\sum w_i = 1$
- R_{NZ} is the New Zealand 90-day interest rate (or 5-year swap in some scenarios)

Subject to a level of portfolio risk

$$\sigma_p = \sum\sum w_i w_j \sigma_i \sigma_j$$

Where w_i and w_j are measures of the standard deviations of weekly returns in currencies i and j respectively against the NZD.

Other constraints include diversification constraints (i.e., w_i can't be too large) and liquidity constraints (i.e., certain currencies can have minimum or maximum weightings in some scenarios).

Figure 4a

Portfolio risk and portfolio return

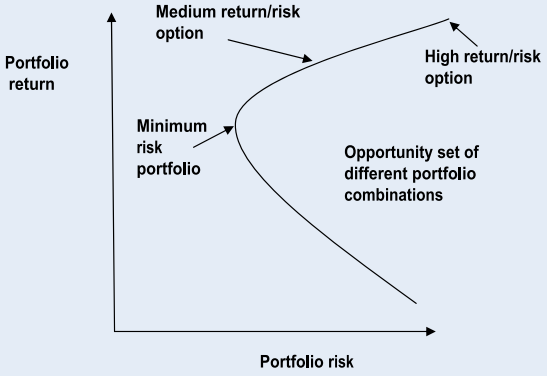
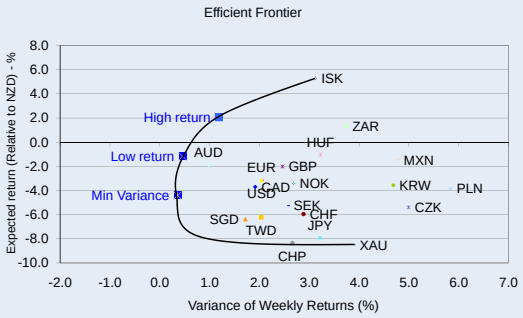


Figure 4b

The efficient frontier



everything, leaving the best options at the end of the process. In this case, we used both quantitative and qualitative filters. Quantitative factors include the returns, correlations and volatilities of various currencies. The quantitative factors were analysed within a standard Markowitz mean-variance optimization model (see box 2). This model found a set of portfolio combinations that delivered the best possible combination of currencies that maximised the returns on the Reserve Bank's unhedged returns, subject to a given level of risk. Qualitative factors (for example, liquidity of markets or the prospect of capital controls) were taken account of by putting constraints on the relative amounts of currencies that could appear in the optimal portfolios. Stress tests of portfolio outcomes were done to assess the robustness of the choices available. The final strategic benchmark was selected by means of judgement, taking account of the insights obtained from the analysis, rather than from any one particular set of data/assumptions of scenarios.

Insights from the analysis

The fact that there are few constraints to account for the lack of liquidity in some currencies suggests that in simple risk-return terms the Reserve Bank's FX benchmark should consist of:

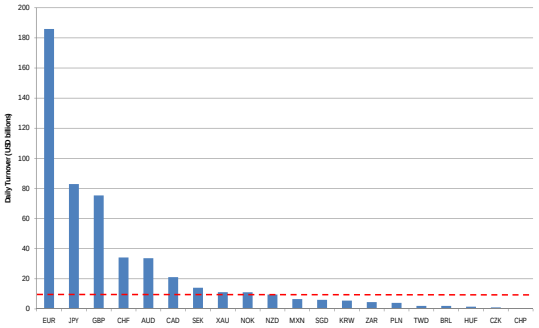
- A high weight in the Australian dollar
- High weightings of some emerging market currencies such as the South African rand, Chilean peso and Icelandic krona, due to their very high interest rates
- Some gold (around 20-30 percent of the portfolio) as a commodity hedge against the NZD

There are a number of problems with this 'optimal' portfolio, from a risk management perspective. In particular, this sort of portfolio ignores the negative properties most of those choices would have in a crisis, as well as the generally low levels of liquidity and more limited capital and hedging markets in emerging-market currencies. The application of judgement and the imposition of appropriate constraints are critically important to capture these more qualitative factors in the portfolio allocation process.

Stress testing the analysis provided the following key insights:

- Diversification is important, as idiosyncratic risk can be an important driver of the attractiveness of a particular currency.
- Yield is only important at the margin if we restrict our attention to the most liquid and resilient currency markets.
- Commodity currencies and gold are useful diversifiers in most circumstances – although there needs to be caution in not having too high a weight of these sorts of currencies in the event of a commodity currency shock.

Figure 3
Global FX turnover April 2008 – BIS triennial survey



Note: **The red dotted line indicates the level of turnover of the NZD in the survey.**

The idiosyncratic risk associated with individual currencies proved to be important in determining the weight of most currencies within the optimal strategic benchmark. In particular, a common theme was that the optimal portfolio allocation was sensitive to the level of volatility in particular currencies. Hence, even the deepest and most liquid currencies such as the USD or euro still tended to be down-weighted significantly in scenarios where those currencies were subject to idiosyncratic shocks. An implication of this is that diversification is important as we cannot know for certain which currencies might be subject to shocks in the future.

In an unconstrained setting where liquidity is not taken into account, the best portfolio combinations tended to feature currencies with relatively high interest rates. This is unsurprising and consistent with the literature on the

Table 2

The Reserve Bank's FX benchmark allocation

Currency	Benchmark allocation (%)	Tactical deviation range (%)
USD	25	+/- 5
EUR	25	+/- 5
JPY	5	+/- 5
GBP	15	+/- 5
CAD	10	+/- 5
AUD	20	+/- 5
Total	100	VaR limit NZD 5 m[6]

application of the Markowitz framework in asset allocation. However, what was interesting was that if more weight was put on liquidity in selecting the investment universe then yield was much less important in determining the optimal currency benchmark. Put another way, if we restrict ourselves to choosing between the 8 or 10 most liquid currencies in the world, then their relative rates of return, while being important at the margin, were much less important in determining their importance in the strategic benchmark portfolio.

The risk-reduction properties associated with alternative currencies proved much more important. In particular, an enduring theme was that currencies that have a correlation with the NZD, such as the Australian dollar and Canadian dollar (and, to a lesser extent, the South African rand and Scandinavian currencies), tended to consistently feature in the optimal portfolios. This result reflected their risk-reduction benefits as opposed to their interest rates (which have tended to be higher than in traditional core reserves markets of the US, Europe and Japan). Gold also proved to be a resilient risk diversifier for the same reasons.

The Reserve Bank's final strategic allocation is shown in table 2 below.

The rationale for the final choice of strategic benchmark reflects the following considerations:

- Diversification – we have widened the currency basket to include three additional currencies – GBP, CAD and AUD - to help spread the previous concentration of risks in the USD and euro (previously 45 percent each)
- Risk reduction/correlation to the NZD – the three new currencies tend to have a reasonable correlation to the NZD in most circumstances, hence helping reduce the volatility of the value of the Reserve Bank's unhedged reserves in NZD terms.
- Liquidity – the currencies included in the Reserve Bank's strategic FX benchmark are the most heavily and widely traded currencies in the world. Figure 3 illustrates the global turnover of the top 20 currencies as given by the most recent BIS FX turnover survey.
- Yield – on average, the currencies included in the new currency basket have maintained a higher yield as compared to the Reserve Bank's previous, more narrowly defined, benchmark portfolio.

The Reserve Bank has allowed itself scope to move away from the strategic benchmark from time to time for tactical trading purposes. The rationale for this is to allow scope for the Reserve Bank to protect the value of the Reserve Bank's reserves against longer term adverse trends in one or more of the currencies inside the strategic benchmark while still preserving the integrity of the portfolio. Table 2 summarises the extent of allowed tactical deviations from the strategic benchmark.

5 Conclusion

The inclusion of unhedged foreign reserves into the Reserve Bank's foreign reserves implied a significant increase in the Reserve Bank's exposure to FX risk and required a close examination of the choice of currencies included in the Reserve Bank's reserves portfolio to ensure this higher level of risk is appropriately managed. The Reserve Bank's new

[6] **VaR refers to Value at Risk – this being the level of daily losses the Reserve Bank might expect to exceed on one in every hundred trading days.**

strategic benchmark achieves this by systematically trading off the risk and return associated with alternative currency choices, giving the Reserve Bank the best combination of risk and return.

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