
The Reserve Bank's new approach to holding and managing its foreign reserves

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The structure and management of the Reserve Bank's balance sheet has changed significantly over the last five years. A big area of change has been in the way that foreign reserves are financed. The Reserve Bank no longer finances its foreign reserves on a fully currency-hedged basis, and now predominantly uses the long-term funds on its balance sheet that naturally arise from its core statutory functions to finance foreign reserves more cheaply and more flexibly than was possible in the past. These efficiency gains have been made possible by changing the way we manage our balance sheet from a model where the financial aspects of different business functions were managed separately to a new integrated asset and liability management model. These changes have been designed to improve the Reserve Bank's ability to meet its policy functions in a more efficient and cost-effective manner. Our experience of the global financial crisis has shown the Reserve Bank's new balance sheet structure to be effective and resilient at the time when its financial resources have been most in demand.

Introduction

Over the last five years, the Reserve Bank has devoted considerable effort to assessing whether its balance sheet is structured and managed in a way that best helps deliver on its statutory policy obligations. This 'Balance Sheet Review' (hereafter, the Review) began in the 2005-06 year and was largely completed and implemented by the 2007-08 year.¹

A review was appropriate as recent years have seen large changes in how the Reserve Bank uses its balance sheet to implement its policy responsibilities. In 2004, the Bank decided to widen the use of foreign exchange intervention from a crisis-only market dysfunction instrument to encompass intervention as a monetary policy tool. In addition, in 2006 the Bank reviewed the way it provided liquidity to the domestic banking system. Both of these changes implied that implementing monetary and liquidity management policy required the Reserve Bank to use its balance sheet and financial resources more intensively. In addition, changes to the financial accounting landscape and the development of the New Zealand capital markets have given the Bank more options to manage its balance sheet. These options were either unavailable or more difficult

to contemplate than in the last significant Balance Sheet Review in the late 1980s/early 1990s.

The Review took account of the Reserve Bank's various statutory responsibilities and aimed to develop an approach that would best help it meet its policy obligations in the most effective and least-cost manner given the current operating environment. The desired outcome was a 'fit for purpose' balance sheet structure and financial management regime that would leave the Reserve Bank well placed to deliver on its policy responsibilities while keeping costs and risks constrained at desirable levels.

This article describes the key components of how the Reserve Bank manages the balance sheet and provides an early assessment of the effectiveness of the new approach in light of the performance of the Reserve Bank's balance sheet over the recent global financial crisis. Section 1 discusses the Bank's statutory functions and how these relate to the Bank's balance sheet. Section 2 describes the criteria that were taken account of while developing the Bank's new balance sheet structure. Section 3 describes the adjustments to the Reserve Bank's Asset and Liability Management (ALM) model and the associated increased use of internal versus external financing of the Bank's foreign reserves. Section 4 shows the rationale for moving from holding foreign reserves on a fully hedged to partially hedged basis with respect to foreign exchange risk. Section 5 discusses the

¹ Discussions and progress reports on the Review can be found in pages 27-29 of the Bank's 2005-06 annual report, pages 25-26 of the 2006-07 annual report and pages 25-28 of the 2007-2008 annual report, see RBNZ (2007, 2008, 2009).

downstream implications of the Review for the Reserve Bank's dividend and capital management policy. Section 6 provides an assessment of the performance of the new balance sheet structure during the recent global financial crisis and section 7 concludes the article and outlines the future work programme.

1 The Reserve Bank's statutory functions and their relation to its balance sheet

The structure of the Reserve Bank's balance sheet and its policy functions

Figure 1 below provides a stylised view of the Reserve Bank's balance sheet. The Bank's statutory functions play an important role in determining the structure and characteristics of the balance sheet.

The Reserve Bank's statutory functions are:

- Provision of currency – one of the most basic functions of the Bank is to provide a medium of exchange for the public to use in transactions of goods and services. Currency on issue is a Reserve Bank liability – albeit one with no maturity date and no interest rate.
- Banker to the Crown – section 34 of the Reserve Bank of New Zealand Act 1989 (the Act) provides for the Bank to provide banking services to the Crown. The government maintains a bank account at the Reserve Bank, which it uses to meet its day to day expenses (similar to a standard cheque account). Usually the Crown's account is in surplus; that is, a liability from the perspective of the Reserve Bank.
- Banker to the banks – several areas of the Reserve Bank's functions require that it provide banking facilities to commercial banks. One example is the provision of liquidity to the banking system and the oversight of payments systems (sections 32 and Part 5B of the Act). Another is the implementation of monetary policy (section 10 of the Act). In practical terms, these functions are represented on the balance sheet in the form of NZD-denominated assets financed via NZD-denominated liabilities. New Zealand denominated assets are purchased when liquidity needs to be injected into the banking system. The Reserve Bank's New Zealand denominated liabilities are typically commercial bank accounts held at the Reserve Bank and the Reserve Bank's own NZD debt instruments issued when NZD liquidity needs to be removed from the banking system.
- Crisis management – the Reserve Bank has specific responsibilities to manage dysfunction in the FX market and in the financial system. The Reserve Bank is the Crown's FX market intervention agent (section 16 of the Act) and has responsibilities as the Lender of Last Resort to the banking system (section 31 of the Act). These responsibilities drive a need for the Reserve Bank to maintain FX reserves and the financial capacity to provide funding to the financial system.

Figure 1
The Reserve Bank of New Zealand balance sheet

Assets	Liabilities and equity
Foreign reserve assets (non-NZD)	Foreign reserves liabilities (non-NZD)
	• F/X loans from NZDMO
Domestic market assets (NZD)	Settlement accounts (NZD)
• F/X assets (hedged)	• Crown account
• Reserve repo/NZD securities	• Commercial bank accounts
	Reserve Bank Bills (NZD)
Investment portfolio	Currency in circulation (NZD)
• NZ govt securities	Equity and retained earnings (NZD)
• Other investments	

The Reserve Bank's balance sheet affects its ability to carry out its statutory functions in three ways:

- The balance sheet gives the Reserve Bank the financial capacity to carry out its policy functions
- Managing the balance sheet assists the Reserve Bank to develop staff with skills associated with conducting operations and giving advice associated with our policy functions
- Interaction with markets while conducting financial market operations allows the Reserve Bank to maintain relationships that facilitate the flow of relevant and timely information useful for the conduct of the Bank's policy functions

The Reserve Bank's historical balance sheet management approach

Historically the Reserve Bank has used an asset and liability matching approach by broad business line or function to manage its balance sheet. The Bank's balance sheet was segregated and managed separately, like layers of a cake, with the layers being:

- Foreign reserves – foreign currency assets were matched with foreign currency liabilities, leaving little FX or interest rate risk.
- Domestic liquidity management – the NZD denominated liabilities represented by the Crown and commercial bank settlement accounts as well as any Reserve Bank bills outstanding were matched off against short term NZD denominated investments leaving no FX risk and a small amount of interest rate risk
- Currency in circulation and equity – the funds provided through the issue of currency and via the government's equity interest in the Reserve Bank were held in the Bank's investment portfolio – predominantly in the form of investments in New Zealand government bonds. These long-term government bonds expose the Bank to interest rate risk. Accounting rules were such that the Bank's portfolio of government bonds did not need to be marked-to-market, hence these bonds provided a sizeable and relatively stable earnings stream.

This balance sheet structure and the segregated management approach tended to deliver a very low-risk balance sheet on a day-to-day basis as the financial characteristics of the assets and liabilities in each business area were closely matched delivering the Reserve Bank a very stable earnings stream.

2 The Balance Sheet Review – approach and criteria for assessment

The Review was aimed at trying to structure the balance sheet in a way that would deliver the best range of policy tools. This was subject to the Reserve Bank's balance sheet delivering an acceptable level of risk adjusted returns (net of costs) without creating an unduly negative impact on the wider Crown balance sheet. Criteria were developed of varying relative levels of importance for use in assessing the various options available for structuring and managing the Reserve Bank's balance sheet. The criteria were:

- The degree to which the balance sheet offers tools useful in delivering the Reserve Bank's statutory policy objectives
- The level of risk-adjusted returns and costs associated with any particular balance sheet structure
- The degree of flexibility available to the Reserve Bank when managing its financial resources
- The degree to which the balance sheet helps the Reserve Bank maintain skills relevant in discharging its core policy responsibilities.
- The fit with the Reserve Bank's contribution to the efficient management of the Crown balance sheet.

Most important was a desire to give the Reserve Bank the tools and skills to be able to effectively carry out its statutory policy functions. Flexibility in managing resources was seen as a useful part of the balance sheet 'tool-kit'. The levels of returns/risks and the impact of the Reserve Bank on the aggregate Crown balance sheet were considered as important constraints on the types of balance sheet structures that could be contemplated rather than being targets in their own right.

Main areas of focus for review

A key advantage of the Reserve Bank's historical balance sheet strategy was that the balance sheet was of low risk as the matching of assets with specific liabilities of a similar currency and maturity/duration across business areas meant stability in the Reserve Bank's earnings.

However, the segregation of business lines tended to mean that the Reserve Bank's balance sheet was less flexible and less efficient than what otherwise might possibly be the case. As it wasn't possible to cross-lend funds between business areas, the Reserve Bank's balance sheet tended to be larger than could have been the case.²

There were also some questions about the Reserve Bank's exposure to risk in a crisis. The Reserve Bank's foreign reserves were all held on a hedged basis, with foreign currency loans backing the Reserve Bank's foreign reserves portfolio. This meant a low exposure to FX risk most of the time. However, in a crisis where intervention might require the Reserve Bank to sell down its FX assets to fund purchases of NZD, the Reserve Bank's FX exposure would rise significantly.

Thus, there were two key areas of focus in the Review:

- The management of the balance sheet across business lines with a focus on the use of internal versus external funding of foreign reserves
- The holding of hedged versus un-hedged foreign reserves.

These elements of the review are discussed in more detail in the next two sections of this article.

3 Mixing the cake: reviewing the Reserve Bank's Asset and Liability Management approach

Historically, the Reserve Bank has employed what is known as an Asset and Liability Management approach to managing its balance sheet. An ALM approach means that we match up and manage our financial assets against the liabilities that fund those assets. There are two ways of implementing an ALM approach; it can be done on:

- a business line basis – this is where the assets and liabilities associated with a particular function are grouped together and managed as a package; or on
- an integrated basis – this is where liabilities are treated as fungible across the entire balance sheet and hence there is no specific matching of a particular asset against a specific liability.

There are advantages and disadvantages of these two ALM approaches. A key advantage of the business line-based segregated model is that it is relatively simple to operate. It also provides a natural objective benchmark for assessing the financial returns of a particular business function. Thus, for example, it is easy to assess the cost of holding foreign reserves, as it is merely the difference between the returns earned on the assets invested in and the interest paid on the liabilities raised to finance those foreign reserves.

Management of financial risk is straightforward. All a business manager has to do is try and match the financial characteristics of the assets in a function with the liabilities (that is, duration or maturity and currency denomination of the assets and liabilities). Historically, this sort of approach suited the Reserve Bank, as the three main business functions (Foreign Reserves, Domestic Markets and Currency/Equity) were fairly separate businesses with little financial interaction.

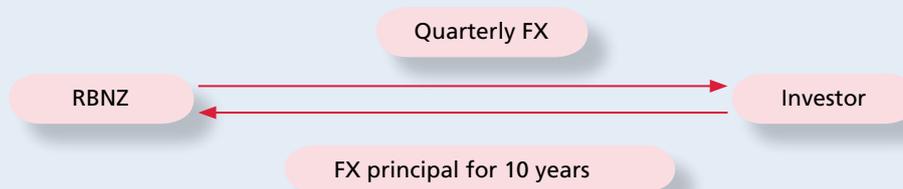
This lack of financial interaction reflected various factors including: the level of development of the New Zealand capital markets; the Reserve Bank's policy towards its holding of foreign reserves on a hedged basis; and the Bank's policy on FX intervention. In particular, in the late 1980s/

² A notable example was with transactions between the government and the Reserve Bank. The existing balance sheet meant it was commonplace for the Bank to be simultaneously borrowing funds from the Crown (to fund foreign reserves, for example) while investing funds with the Crown (by holding New Zealand government securities in the Bank's Investment Portfolio). No netting of flows was possible given the segregated nature of the Foreign Reserves and Currency functions.

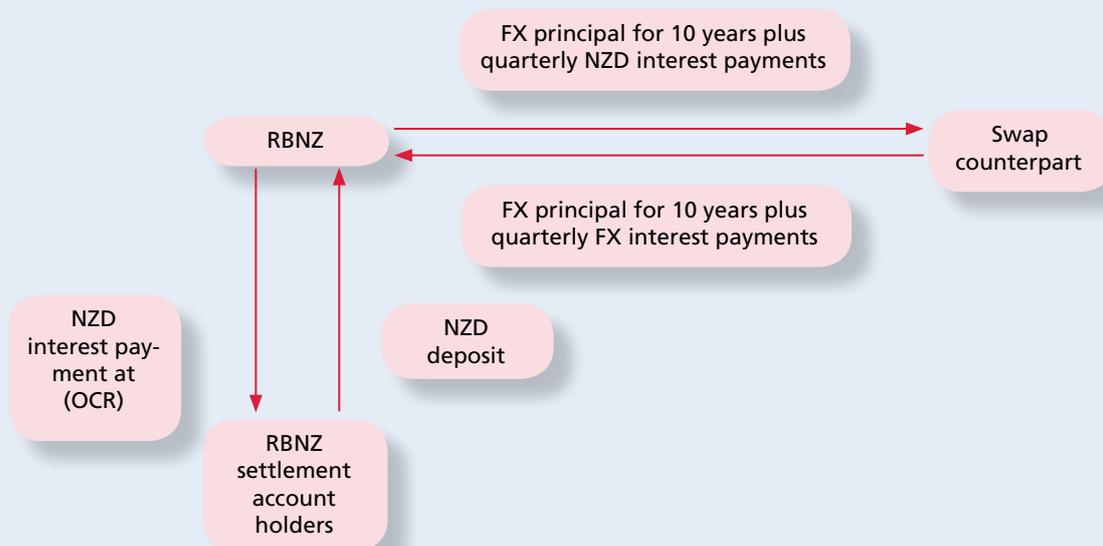
Box 1

Comparison of a long term FX loan and cross currency swap-based funding of hedged foreign reserves

Long-term FX loan



Swap transaction



early 1990s it was not practically feasible for the Bank to raise the long-term foreign currency-denominated liabilities needed to fund foreign reserves. Rather the only way that the Bank could raise long term FX loans was to borrow the funds from the NZ Debt Management Office of The Treasury who then issued foreign currency bonds in the name of the Crown in the international markets. There was no way that the Bank could use its own sources of funds (which are NZD denominated) to fund foreign currency reserves. Box 1 compares a long-term FX loan and cross-currency swap-based funding of hedged foreign reserves.

Further, until 2004, the Bank had a policy of only using FX intervention in periods of severe market dysfunction. Even

³ The Reserve Bank Act gives the Reserve Bank the power to intervene on its own account for any of its policy functions including FX market dysfunction. However, notwithstanding these powers, the Bank's policy has been to only intervene in crisis markets as an agent of the Minister of Finance and has signed a Memorandum of Understanding with the Minister to this effect.

then, this was only in an agency capacity on behalf of the Crown.³ This meant that the Treasury would ultimately be responsible for funding FX intervention and would bear the financial risks. It was not envisaged that the Bank would hold foreign reserves on an un-hedged basis – thus opening up the possibility of using the Bank's NZD liabilities to finance foreign reserves. As a consequence, it made sense to segregate the Bank's foreign reserves-related balance sheet from its other functions.

The biggest advantage of managing the balance sheet on an integrated basis is that, in some cases, the Reserve Bank would have more flexibility, thus reducing the risks and costs associated with managing the balance sheet. In the late 1980s/early 1990s, these benefits were fairly modest if available at all. However through the 1990s, development in the capital markets meant that additional balance sheet management options became more feasible, opening up

the possibility of different, less costly, and more flexible arrangements.

The growth of the cross-currency swap market in New Zealand was a particularly important development. Cross-currency swaps allow market participants to exchange funds in one currency into another currency for a potentially long period (in New Zealand up to 15 or 20 years, and for longer in some of the major markets) while fully managing the associated exchange rate risks. From the Reserve Bank's perspective, this was a useful development as the Bank has assured access to NZD via its statutory roles as issuer of NZD currency and through being banker to the Crown and the commercial banks which could then be used to finance foreign reserves. In some circumstances, this funding approach is very useful, since the Reserve Bank often has a comparative advantage in raising NZD over the Crown's ability to raise long-term foreign currency-denominated loans. This means that it is often less costly to fund reserves using the Reserve Bank's internal NZD resources swapped into foreign currencies for long periods.

An additional benefit of cross-currency swaps for funding reserves is that swaps are more customisable and liquid than long-term FX loans. A cross currency swap can be negotiated for any term and against any of the currencies in the Reserve Bank's foreign reserves at any time. An FX loan is typically structured to take account of the desires of the investors buying the bond – which may not exactly match the needs of the Reserve Bank at any point in time. Cross currency swaps are also easily restructured should changes in the size or structure of the Bank's reserves occur. FX loans, once issued, are often difficult or costly to cancel or buy back – the ability of the Reserve Bank to retire an FX loan depends on the willingness of investors to sell their bonds back to the Crown. There is no deep and liquid market in New Zealand government foreign currency debt.

The Reserve Bank's policy on FX intervention in 2004 widened to include the possibility of intervention aimed at leaning against extreme movements in the NZD for monetary policy purposes. This change increased the benefits associated with managing the balance sheet on an integrated basis. Historically, the Reserve Bank had no need to use NZD to fund reserves since reserves were always hedged. The expansion

of the Reserve Bank's FX intervention policy meant that there were greater prospects of the Bank holding reserves on an un-hedged basis, thus requiring NZD liabilities to fund those reserves.

Furthermore, changes to the way the Reserve Bank provides the Reserve Banking system with liquidity have increased the amount of NZD funds available to the Reserve Bank that could be used to fund its functions. In 2006 the Reserve Bank moved to a 'cashed up' payments system. This meant commercial Reserve Banks significantly increased their regular cash balances held in their accounts at the Reserve Bank from around NZD 20m to between NZD 6000m and NZD 11000m.⁴ By using some of these additional liabilities to fund reserves, the Reserve Bank managed to reduce the extent to which the change in liquidity provision arrangements increased the size of the Reserve Bank's balance sheet and overall gross Crown debt.

Outcome: Change in ALM strategy to an integrated approach

The outcome of this part of the Review clearly pointed to the desirability of a change in our ALM approach. The Reserve Bank decided to allow cross-lending between business functions and to use the Bank's internal sources of NZD funds in conjunction with long-term cross-currency swaps to finance the Reserve Bank's hedged reserves portfolio.

This implies a reduction in the size of the Reserve Bank's balance sheet over time. Under the previous strategy the Reserve Bank would have more liabilities in the form of FX loans from the NZDMO on its balance sheet than with the new ALM approach. Under the new ALM approach, the Bank can use funds it already has raised to fund reserves. The impact on the asset side of the Reserve Bank's balance sheet is a reduction in NZD-denominated assets it would otherwise have held. In practice this means a gradual reduction in the amount of New Zealand government bonds in the Reserve Bank's Investment Portfolio (which, historically, has matched the amount of currency on issue and total equity). Furthermore, the amount of short-term NZD-denominated

⁴ See Nield (2006) and Nield (2008) for details on the Reserve Bank's review of domestic market liquidity provision.

assets held in the Reserve Bank's Domestic Markets Portfolio (reverse repos or short term foreign currency assets hedged back into NZD using short-term FX swaps) has reduced as some of these excess funds are now used to finance foreign reserves.

The Reserve Bank intends to continue to use the NZDMO to provide foreign currency funds in situations where it is sensible on a whole-of-Crown basis to do so. Specifically, if it is cheaper for the Crown to borrow foreign exchange than the Reserve Bank can, or if the Bank has insufficient financial resources to finance the desired amount of foreign reserves, then the Bank will ask the NZDMO to raise FX funds on its behalf.

4 Hedged versus un-hedged reserves

What are hedged, un-hedged reserves, and the Reserve Bank's Open FX Position?

The second significant element of the Review was a consideration of the nature of the foreign reserves the Reserve Bank holds on its balance sheet. Historically the Bank has held all of its reserves on a hedged basis – which means that FX assets are matched with FX liabilities in the same currency. The effect of this matching of the currency denomination of the Reserve Bank's assets and liabilities means the Bank is fully insulated or hedged against movements in the NZD exchange rate.

The alternative is for the Reserve Bank to hold its foreign reserves on an un-hedged basis. This means that the Reserve Bank funds its foreign currency asset portfolio through sales

of NZD for foreign currencies, leaving the Reserve Bank to raise NZD to fund reserves. The result is a mis-match on the Reserve Bank's balance sheet. Its assets are FX denominated while its liabilities are in NZD leaving an exposure to movements in the NZD exchange rate. The size of the FX mis-match is called the Reserve Bank's Open FX Position. Central banks almost universally hold the majority of their foreign reserves on an un-hedged basis – the exceptions to this have been the Reserve Bank of New Zealand and the Bank of Canada.

Regardless of whether the Reserve Bank holds hedged or un-hedged reserves, the actual portfolio of assets available for use in intervention is the same. The difference arises purely in the currency denomination of the liabilities funding those reserves.

Financial characteristics of hedged versus un-hedged reserves in normal times

The table below summarises some of the key characteristics of hedged and un-hedged reserves during periods when they are not being used – i.e., most of the time.

In normal times, hedged reserves are relatively cheap to maintain and are very low risk. This is because the largest risk associated with owning foreign currency assets – changes in exchange rate – is fully hedged. The cost associated with hedging the FX risk on foreign reserves is modest for countries like New Zealand that have a relatively strong credit standing. Hedging the FX risk requires that the Reserve Bank borrows foreign exchange. The interest rate applicable to these borrowings is typically close to the rates

Table 1
Hedged versus un-hedged reserves in normal times

	Hedged reserves	Un-hedged reserves
FX risk	No exposure	High exposure – can cause significant swings in un-realized income
Carrying costs ⁵	Modest – sometimes can be held at a profit	Can be costly as NZ interest rates are higher than in reserve currency markets
Refinancing risk	Modest – depends on level of risk aversion in global financial markets	Very low – RBNZ has assured access to NZD to fund reserves

⁵ Carrying costs are defined as the difference between the returns earned on foreign reserves and the interest costs paid to finance those reserves.

of return that are earned on the foreign assets invested in the reserves portfolio – that is, sovereign and near government investments in major international markets. Sometimes, it is even the case that the Reserve Bank can actually earn profits on foreign reserves. This occurs if there is particularly strong demand for the New Zealand government's debt by investors such that New Zealand credit spreads are wider than credit spreads offshore.

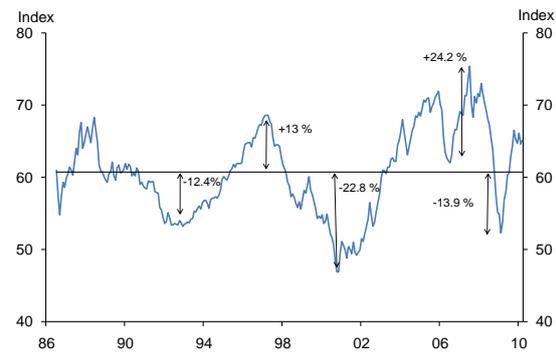
The main issue with hedged reserves is the management of the refinancing risk associated with the Reserve Bank's foreign exchange liabilities. The Reserve Bank has assured access to NZD, however, the availability of foreign currency funding to the Reserve Bank depends on factors like the state of the capital markets and the level of risk aversion investors wish to take on. Typically, this refinancing risk is managed by structuring our FX liabilities such that they have relatively long maturity dates and mature relatively evenly through time.

Un-hedged reserves exhibit more volatility and thus appear more risky on the Reserve Bank's balance sheet in normal times. This is because the NZD exchange rate varies significantly over time – since the float of the NZD in 1984, the NZD Trade Weighted Index has fluctuated within a range of +/- 25 percent around a broadly stable long-term average level (see figure 1). This significant exchange rate volatility translates directly into gains and losses on the Reserve Bank's balance sheet if it held un-hedged reserves. When the NZD is relatively high, the NZD value of un-hedged reserves is relatively low compared to the fixed NZD value of the liabilities financing those reserves. Similarly, when the NZD is relatively low the opposite is the case and the Reserve Bank has FX gains on its balance sheet.

It's important to note that, while the FX gains and losses are quite significant, they are unrealized and cancel out over time as long as the exchange rate cycles around a stable long-term level. FX gains and losses only become realized or locked in and permanent if the level of un-hedged reserves changes over time – for example, through FX intervention or through 'squaring up' transactions to adjust the level of un-hedged reserves back to some benchmark level.

Another less attractive aspect of un-hedged reserves in normal times is that they have higher ongoing carrying costs. This is

Figure 1
NZ Trade Weighted Index – 1986-2010



because the NZD needed to fund the reserves portfolio costs NZ interest rates, which are typically significantly higher than interest rates in reserve currency markets. A benefit is that there is no real refinancing risk associated with maintaining un-hedged reserves as the Reserve Bank has ready access to NZD through its various statutory functions. In normal times though, this benefit is fairly modest, as the alternative option of funding reserves with FX liabilities is also a low risk.

How FX intervention affects the Reserve Reserve Bank balance sheet in a crisis

There are some important differences in the Reserve Bank's position while intervening, depending on whether the Bank is using hedged or un-hedged reserves. Intervention to support the NZD market in a crisis would see us liquidate our foreign asset portfolio to fund sales of FX and purchases of NZD in the spot FX market.

If the Reserve Bank intervenes with hedged reserves, the act of intervention results in the Bank opening up a long NZD – short foreign currency position on the balance sheet (see table 2). The foreign currency component of the Reserve Bank's liabilities remains the same size (and ultimately will need to be repaid or refinanced), but the currency composition of the assets changes (from foreign currency reserves to NZD assets).

Table 2
RBNZ balance sheet: hedged reserves

Pre Crisis Intervention				Post Intervention								
Assets		Liabilities		Assets		Liabilities						
	NZD	F/C		NZD	F/C		NZD	F/C				
FRM		+	Loans		-	FRM	+	0	Loans		-	
	0	+		0	-		+	0		0	-	
Net FX Position				Net FX Position								
	NZD				NZD					NZD		+
	F/C				F/C					F/C		-

In the case of holding un-hedged reserves (see table 3) the Reserve Bank closes down its short NZD – long foreign currency position (inherent in maintaining reserves on an un-hedged basis before the crisis) with the act of intervention. The foreign reserves component of the Reserve Bank's balance sheet contracts as holdings of foreign currency reserve assets fall and the NZD proceeds of intervention are used to repay NZD loans previously financing reserves.⁶

It is possible to manage this refinancing risk by arranging foreign currency loans such that they mature evenly over long periods. However, a prolonged crisis that limited the New Zealand government's ability to borrow in foreign currency on adequate terms could see the Reserve Bank forced to sell NZD and buy FX in order to repay maturing FX loans. In a crisis situation, the perception that the Reserve Bank is exposed to refinancing risk and might be required to reverse its FX intervention would likely reduce the credibility of the Bank's intervention operations, limiting their effectiveness.

Table 3
RBNZ balance sheet: un-hedged reserves

Pre Crisis Intervention				Post Intervention				
Assets		Liabilities		Assets		Liabilities		
	NZD	F/C		NZD	F/C		NZD	F/C
FRM		+	Loans	-		FRM		0
	0	+		-	0		0	
Net FX Position				Net FX Position				
NZD						NZD		0
F/C		+				F/C		0

Intervention with un-hedged reserves is less risky, as the Reserve Bank is left with no residual foreign exchange exposure or refinancing risk after intervention. The behaviour of the exchange rate, interest rates or the state of funding markets has no impact on the Bank after intervention.

Intervening with hedged reserves is different as the Reserve Bank is left with a net short foreign currency/long NZD FX exposure. This means the Reserve Bank will bear losses if the NZD falls after intervention occurs (a possibility in a severe crisis). In addition, intervention with hedged reserves leaves the Reserve Bank with net foreign currency liabilities that need to be repaid or refinanced at some stage.

Trade-offs associated with hedged and un-hedged reserves

The table below summarises the trade-offs inherent in the choice between hedged and un-hedged reserves. Hedged reserves are undoubtedly better in normal times, as they are less volatile and cheaper in terms of carrying costs. The refinancing risks associated with hedged reserves are modest in normal market conditions for a country such as New Zealand.

Un-hedged reserves perform better in the times where intervention is required in a crisis. The falling exchange rate in a crisis will tend to see the value of un-hedged reserves increase in a crisis and there is no refinancing risk left with the Reserve Bank once foreign reserves are used.

Table 4
Trade-offs between hedged and un-hedged reserves

	Normal times		Crisis times	
	Hedged	Un-hedged	Hedged	Un-hedged
FX risk				
Realized gains/losses	Yes	Yes	No	Yes
Un-realized gains/losses	Yes	No	No	Yes
Carrying costs	Yes	No	No	Yes
Refinancing risk	Yes	Yes	No	Yes

⁶ This abstracts from the liquidity management impacts on the Reserve Bank's balance sheet, associated with sterilising intervention.

Analysing the trade-offs between hedged and un-hedged reserves

The issue of deciding whether hedged or un-hedged reserves are best and the relative proportions in which they should be held is complex. As table 4 shows, the answer depends on how we expect the future to play out. For example, if we are sure that a crisis would never occur, or if the likelihood of crisis was very low (or if crises are expected to be very mild) then this suggests we should hold predominantly hedged reserves, as most of the time they perform better. At the extreme, if we believed strongly that crises would not occur then we might even conclude that reserves are not required at all!

The choice is between the cheap, safe option of holding hedged reserves that might prove risky or ineffective in a crisis, as opposed to the more expensive, more volatile option of holding un-hedged reserves that might be superior in a crisis intervention situation. We analysed this choice in an insurance framework, where foreign reserves are thought of as a type of insurance policy against the problems that might arise in a crisis. Hedged and un-hedged reserves can be considered as alternative insurance choices. Hedged reserves are akin to a policy with a low annual premium (the carrying cost) but providing less cover should a crisis hit. Un-hedged

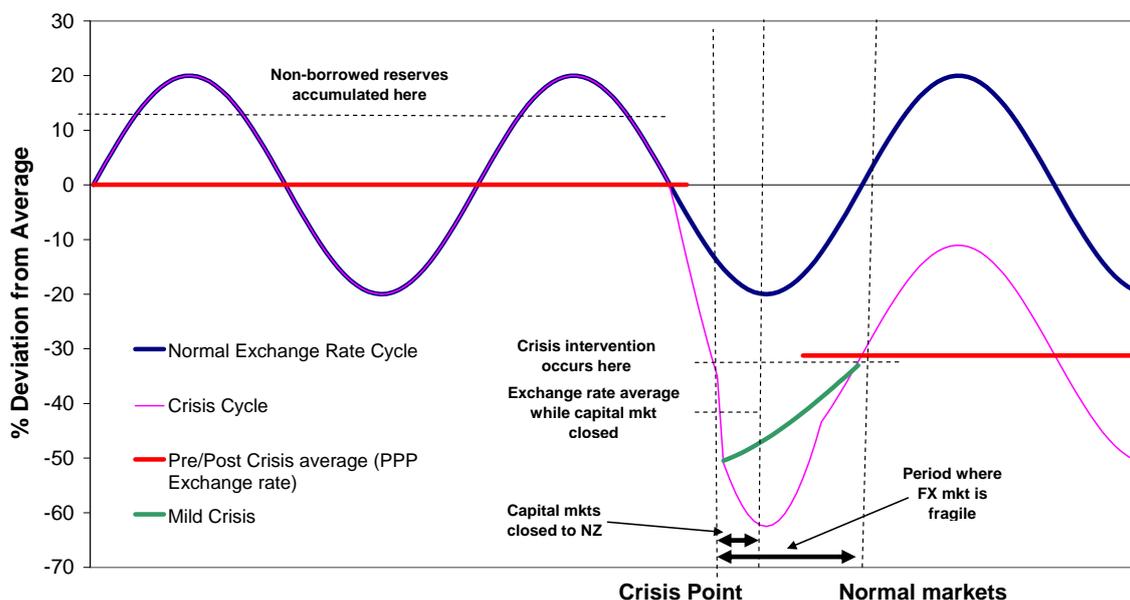
reserves are like an insurance policy that is more costly but provides more robust protection.

At a high level, the problem was to find the proportion of total reserves held on a hedged basis that best smoothed volatility in the Reserve Bank's balance sheet while maximising the Bank's net income (or minimising the Bank's net loss) over both normal and crisis periods.

Figure 2 illustrates the key points of a stylised scenario the Reserve Bank considered when deciding on the type of reserves it will hold. Across most of the scenario, markets behave normally and the Reserve Bank accumulates the un-hedged reserves it needs (by selling NZD and purchasing FX) and then passively holds its Open FX Position as the exchange rate cycles through time. In these normal periods, the Bank will pay a net cost associated with maintaining its foreign reserves equivalent to the weighted average carrying costs of its hedged and un-hedged reserves.

The focus of the analysis was on realized gains and losses – hence the unrealized fluctuations in value associated with the changing NZD value of the Reserve Bank's un-hedged portfolio in normal times, was not explicitly considered in the analysis. In normal times the main distinguishing feature was the different levels of carrying costs associated with un-

Figure 2
Stylized crisis intervention scenario



hedged reserves (assumed to be financed by relatively high NZD interest rates) compared with cheaper hedged reserves (assumed to have a modest ongoing cost to maintain).

To include the costs of managing a FX crisis, we assumed that two kind of crisis could occur, with differing probabilities:

- mild crises characterised by:
 - a relatively small fall in the exchange rate from the normal cyclical range before intervention occurs
 - a relatively short period of time when markets are fragile
 - and a quick recovery of the exchange rate to normal levels
 - a short period of time where capital markets are closed to New Zealand
 - higher foreign currency borrowing margins and higher domestic interest rates than usual
- severe crises characterised by:
 - a larger (and potentially permanent) drop in the exchange rate before intervention occurs
 - a market that is fragile for longer and takes longer to recover
 - capital markets that are closed for longer
 - higher foreign currency borrowing margins and higher domestic interest rates than usual.

The financial outcome for the Reserve Bank of having intervened depends on the type of crisis it encounters and the mix of foreign reserves it has available to intervene with. The mild crisis, should it occur, will be cheaper, as it is shallower and shorter. This means that it is less costly to refinance the foreign currency loans funding any hedged reserves it holds. Also, there is only a relatively short period when the capital markets are actually closed to refinancing foreign currency debt – hence there are few costs associated with the Reserve Bank needing to reverse its FX interventions at a loss, as there is a lower chance that the Reserve Bank is forced into selling NZD and buying FX before the exchange rate has recovered from the crisis.

A severe crisis is a potentially much more risky and costly

outcome for the Reserve Bank – particularly if un-hedged reserves are used to fund FX intervention. This is because, once capital markets reopen after the crisis, the exchange rate remains lower than the level where the Reserve Bank intervened for longer and perhaps never recovers its pre-crisis or intervention level. In this situation, intervention with hedged reserves ultimately results in a realised FX loss to the Reserve Bank. However, with un-hedged reserves, the opposite is true – when the Reserve Bank intervenes it closes out the Open FX position it held all through the normal times and realizes profits. The Reserve Bank is left with no residual FX or refinancing exposure from its un-hedged reserves – hence it doesn't matter how long it takes for the markets to recover.

One problem with holding un-hedged reserves is that the Reserve Bank can take losses if the exchange rate rises through time. However, these concerns are balanced by several factors. Higher movements in exchange rates are typically modest compared to the wide cyclical variation and the potential for significant negative adjustments down in the exchange rate in a crisis. Furthermore, uncovered interest parity would suggest that any expected permanent appreciation in the exchange rate would be balanced by lower New Zealand interest rates – thus lower carrying costs. Carrying costs tend to be higher in New Zealand, suggesting a risk of, if anything, depreciation in the NZD over time.

Permanent currency rises would typically be due to some improvement in New Zealand's competitiveness or terms of trade. Overall, the gains to New Zealand of these would likely be well in excess of any marked-to-market losses on FX reserves. To date, New Zealand has high accumulated current account deficits and offshore debt – holding FX reserves is insurance against the possibility (hopefully low) of any future negative consequences of that.

The optimal mix of hedged and un-hedged reserves in this situation depends on the particular assumptions of the scenarios discussed. Specifically:

- How frequent are crises and are they mild or severe crises?
- How large are the relative carrying costs of hedged versus un-hedged reserves in normal times?

- How long after a crisis might capital markets remain closed to the New Zealand government trying to refinance its FX debt?
- How far and for how long might the exchange rate fall from the point where the Reserve Bank intervenes in a crisis and how permanent is the exchange rate fall after intervention occurs?
- What does the normal cyclical behaviour of the exchange rate look like, and how important is an up-trend or down-trend in the exchange rate over the medium term to the choice between hedged and un-hedged reserves?

Most of the answers to these questions are unknown (and possibly unknowable) – hence the approach taken was to simulate the framework using plausible ranges of the key factors identified above. The objective was to identify which factors are most important in determining the choice between hedged and un-hedged reserves.

Key insights/results of the analysis

The main result of the analysis was that, in general, it is appropriate to have a mix of hedged and un-hedged reserves in the Reserve Bank's portfolio. The framework did suggest that it is sometimes appropriate to maintain either a totally hedged or un-hedged portfolio. But more often, a mixed approach proved best, since it best diversified the Reserve Bank's exposure to the full range of outcomes that could occur in the future. The main messages of the analysis were that a higher proportion of un-hedged versus hedged reserves are desirable, if we believe:

- New Zealand interest rates will be relatively low compared to rates of return available on foreign currency assets included in the Reserve Bank's reserves portfolio – i.e., when carrying costs of un-hedged reserves are relatively low, making the enhanced level of insurance protection offered by un-hedged reserves in a crisis cheaper to afford – not the usual situation for New Zealand.
- There is a higher possibility of a crisis – and, in particular, more severe crises where losses associated with prolonged/deep crises might be incurred.

- Crises might be prolonged and/or deep in terms of the movement lower in the exchange rate after intervention has occurred. The prospect of prolonged crises most strongly points to the desirability of holding un-hedged reserves, as these insulate the Reserve Bank from the after-effects of long crises
- That a severe crisis would lead to a significant and permanent move lower in the exchange rate (for example, if the crisis was caused by some kind of economic shock such as a terms of trade shock/risk premium adjustment etc).
- There is a significant prospect that capital markets could remain closed to the New Zealand government for a significant length of time during/after a crisis.

5 Implications for the Reserve Bank's foreign reserves funding strategy

We concluded that it was appropriate that we shift the mix of our reserves from being entirely hedged to including some un-hedged reserves. To some extent, the Reserve Bank's historical policy of maintaining solely hedged reserves was unusual compared to international central Reserve Bank practice, where almost all other central Reserve Banks maintain most, if not all of their foreign reserves on an un-hedged basis. Hence, we concluded a move back towards the international norm was appropriate.

Practically, the decision was taken to hold SDR 1000m of the Reserve Bank's foreign reserves on an un-hedged basis. This is roughly 25 percent of the Reserve Bank's current target minimum level of reserves – so around 75 percent of the Bank's reserves would continue to be fully hedged. This relatively low level of un-hedged reserves (compared to most central banks, which tend to hold all of their reserves on an un-hedged basis) reflects our judgement that the costs/risks of holding and using hedged reserves in a crisis are sufficiently manageable to justify maintaining a relatively high hedged proportion of total reserves. Further, in the case of New Zealand, the costs of funding un-hedged reserves are high given New Zealand's relatively high interest

rates compared to other countries where interest rates are closer to global norms.

The SDR 1000m un-hedged reserves target is expressed as a medium-term benchmark Open FX Position. The Governor has discretion to vary the actual Open FX Position around the benchmark depending on circumstances. In 2004, the Reserve Bank introduced a new FX intervention policy, which has been adapted to incorporate the Bank's new SDR 1000m benchmark Open FX Position. The adjusted FX management regime has two main features:

- A portion of our foreign reserves are funded on an un-hedged basis by financing SDR 1000m of our reserves in NZD (as opposed to our historical approach of holding all reserves on a FX hedged basis by matching our foreign currency reserve assets with foreign currency loans). This means that the Reserve Bank has a benchmark long-term average Open FX position of SDR 1000 m.
- The actual level of un-hedged reserves, and thus the Open FX Position, may be varied over the exchange rate cycle. We have the option to build un-hedged reserves when the exchange rate is judged to be relatively high and run un-hedged reserves down when the exchange rate is relatively low. When the exchange rate is around average levels, we would generally expect to be moving the level of un-hedged reserves towards the SDR 1000m benchmark level.

Movements of the level of un-hedged reserves away from the benchmark level can be done passively or actively depending on the objective. A passive movement up (or down) in the level of the Open FX Position can occur when both the exchange rate is judged to be exceptionally high (or low) and we judge that the exchange rate is unjustified by economic fundamentals. In these circumstances we are merely 'leaning against the wind' in the FX market by using our balance sheet to lean against prevailing FX flows, while signalling that we see the exchange rate as inconsistent with medium term fundamentals.

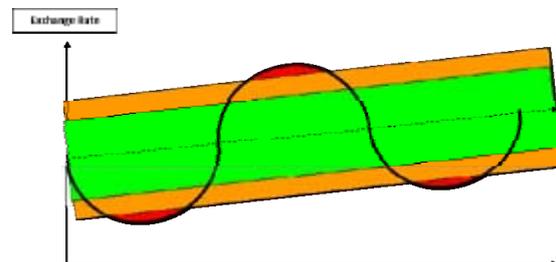
An active movement in the Open FX Position occurs when the Reserve Bank is actively intervening in the FX market. In these circumstances, we are aiming to influence the level of the exchange rate directly via our transactions with

market participants, while sending a firm signal regarding the outlook for the exchange rate and its appropriateness. We consider intervention appropriate when the exchange rate is exceptionally high (or low); when it is unjustified by fundamentals; when intervention is judged to be consistent with the Policy Targets Agreement (PTA); and when we judge that intervention has a chance of actually influencing the FX market (i.e., when we think it is 'opportune' to intervene).

When the exchange rate is near the middle of its historical range, the Reserve Bank will generally be looking to return its Open FX position back to the SDR 1000m benchmark level. Such transactions are done passively, with the objective of having no discernible effect on the exchange rate.

The figure below illustrates when the Reserve Bank's FX management criteria apply and the types of Reserve Bank FX activity that might occur in each zone.

Figure 3
Stylised exchange rate cycle and FX management zones



		Relevant Criterion			
		Exceptional	Unjustified	PTA Consistent	Opportune
Potential Squaring Up of discretionary position zone		×	×		
Passive Reserve Building/run down zone		✓	✓	?	
Intervention Zone		✓	✓	✓	✓

Other implications of the Review for the Reserve Bank's financial management

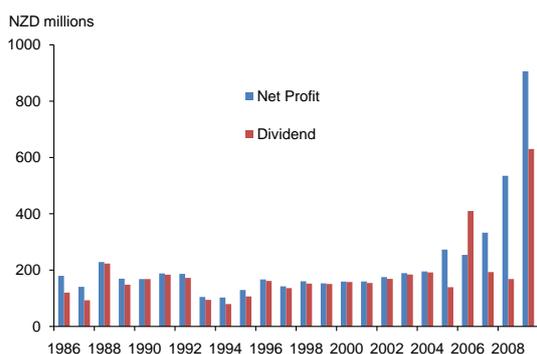
The Review, in conjunction with other factors such as changes to accounting standards, has meant that the Reserve Bank's year-to-year income volatility has increased compared to the past. Turning firstly to accounting standards, adjustments to International Financial Reporting Standards (IFRS) in the last 10 years has meant that the Reserve Bank has needed

to move to marking-to-market the long term government bonds and the long term FX liabilities funding hedged reserves. This means that, even in the absence of the Review, the Reserve Bank's annual net income volatility would have increased relative to that in the 1990s (see figure 4).

The addition of un-hedged reserves has further increased the Reserve Bank's annual income volatility, through the unrealised swings in the NZD value of its new un-hedged reserves as the exchange rate moves through the cycle.

This significant change in the underlying volatility of the Reserve Bank's annual income has driven a need to reconsider its dividend policy and the level of its capital.

Figure 4
RBNZ annual net profit and dividend – 1986–2009



Adjustments to the Reserve Bank's dividend policy

The increase in the volatility of the Reserve Bank's annual income reflecting significant year-to-year variability in unrealised gains and losses, required an adjustment to the specification of the Bank's dividend policy. The issue was that, historically, because the Reserve Bank's income stream had been relatively stable, the Reserve Bank had been able to operate a mechanical calculation of the annual dividend amount due to the Crown, based on a formula known as 'notional surplus income'.⁷

Amendments were made to the Reserve Reserve Bank Act in 2008 to establish a new framework governing payment by the Reserve Bank of an annual dividend to the Crown. From 2009, the Bank's dividend is determined using a principles-based approach.

Specifically, the concept of notional surplus income was removed from the Act and, instead, the Act requires the Reserve Bank to publish in its *Statement of Intent* a 'Statement of dividend principles' that it must apply in determining its dividend recommendation each year. The Bank's current statement of dividend principles is:⁸

"The Reserve Bank should maintain sufficient equity for the financial risks of performing its functions. Equity in excess of that required to cover those risks will be distributed to the Crown.

In general, unrealised gains should be retained by the Reserve Bank until they are realised in New Zealand dollars. However, the Bank may recommend the distribution of unrealised gains where the Reserve Bank believes that the probability of the gain being realised is high."

The objective is to use a principles-based approach to calculate the amount of dividend payable to the Crown each year with the objective being to pay the Crown the Reserve Bank's realized earnings for the year adjusted for any changes in the level of capital that is judged to be required to support the Reserve Bank's balance sheet.

Adjustments to the Reserve Bank's capital

Historically, the Reserve Bank's capital was relatively modest at around NZD \$400m and reflected past years' retained earnings that were invested back with the Crown in NZ government bonds. The Reserve Bank held this capital as a buffer against the potential for losses on its balance sheet arising from its operations. The significant risk driver was credit risk on the Reserve Bank's foreign reserves portfolio, as some of the reserves were invested in non AAA rated foreign currency assets (e.g., certificates of deposits in highly rated international Reserve Banks etc).

⁷ "Notional surplus income" broadly speaking, was an estimate of the Reserve Bank's realized net income for the year, adjusted for the Bank's spending relative to the amount allowed in the Bank's 5-year funding agreement with the Minister of Finance.

⁸ See RBNZ (2009b), the Reserve Bank's *Statement of Intent* 1 July 2009 – 30 June 2010.

The expansion of the Reserve Bank's FX intervention policy in 2004 added another significant source of risk to the Reserve Bank's balance sheet, requiring a larger capital buffer of NZD 1000m. The government provided this capital injection in mid 2004, which the Reserve Bank invested back with the government in the form of New Zealand government bonds.

The further changes to accounting standards (requiring marked-to-market accounting of the Reserve Bank's long-term FX liabilities and its portfolio of NZ government bonds) along with the increased risk profile associated with the Bank's move to holding un-hedged FX reserves, required a first-principles reassessment of the capital needs of the Bank.

The approach taken was to model the sources of risk across the whole balance sheet and derive an estimate of the amount of equity the Reserve Bank required to ensure a sufficient buffer to offset any net loss over an entire year.⁹ The outcome has been an increase in the amount of capital the Bank holds as a buffer against fluctuations in the value of the balance sheet. This capital is reinvested back with the Crown in New Zealand government securities at no net cost to the Crown as long as the Reserve Bank does not realize losses. Roughly, half of the Reserve Bank's capital is held as a buffer against FX risk on un-hedged foreign reserves, whereas around a third being required to balance against interest rate risk on the balance sheet with risk mainly relating to credit risks associated with the assets the Bank holds in both foreign and domestic market instruments.

The Reserve Bank now reviews its level of capital at least annually, as part of the process to determine the amount of the annual dividend. If the Reserve Bank's risk exposures change, then the implied capital requirement changes and can trigger a request for a capital injection (for example by retaining earnings that would otherwise have been paid as dividends) or a repayment of capital to the Crown (as occurred in the first half of 2010 when a reduction in temporary liquidity facilities after the global financial crisis led to a reduced credit and interest rate risk exposure.

⁹ Technically, the level of equity was calibrated to a level that would cover the Bank against losses that might be expected over a one year period 99.9 percent of the time.

6 The RBNZ's experience of the new balance sheet regime through the crisis

The last few years have been a period of turmoil in the financial markets, reflecting the effects of the global financial crisis beginning in mid-2007. Much of the operational changes implied by the Review were in place by the beginning of the financial crisis, allowing a real stress test of the arrangements put in place as a result of the Review.

The change from using external to internal funding of foreign reserves and the adoption of an integrated ALM approach has generally stood up well through the crisis. Global funding markets have been difficult at times, but the flexibility offered by our new ALM approach and the use of cross-currency swaps to fund hedged reserves has proven to be useful. At times, it may have proven difficult to raise FX directly in the international markets for the maturities and currencies required for our foreign reserves.

Figure 5
NZ government credit default spread (5 year government bonds)

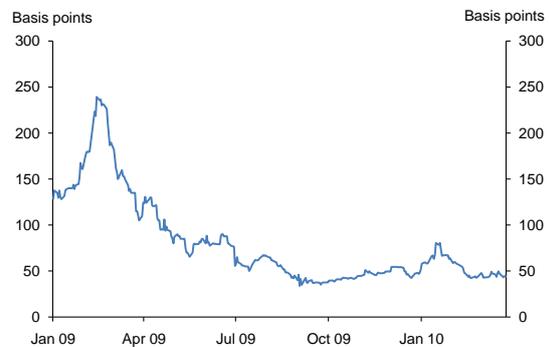
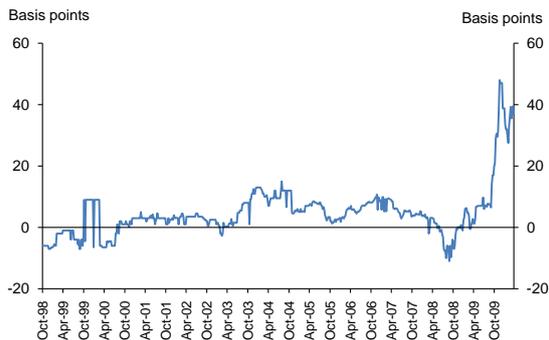


Figure 5 shows that credit spreads have been reasonably variable over the last few years, resulting in marked volatility in the marked-to-market value of our long-term FX liabilities (i.e., cross-currency basis swaps and foreign currency loans). Notwithstanding this volatility, the Reserve Bank has had sufficient capital to buffer against this variability.¹⁰

¹⁰ Note that because of the change to marked-to-market accounting for long-term FX liabilities due to changes in IFRS this volatility would have flowed through to the Reserve Bank's balance sheet even in the absence of the Balance Sheet Review changes described in this article.

Figure 6
NZD/USD 10 year basis swap margin



The crisis has had the biggest impact on the Reserve Bank's balance sheet through the changes in the value of the Reserve Bank's new un-hedged FX reserves. The Reserve Bank accumulated its un-hedged FX reserves up to the SDR 1000m benchmark level in mid-2007 – immediately before the crisis. Some of these un-hedged reserves were accumulated via active FX intervention while some were passively accumulated. These actions were motivated by our view that the exchange rate was sufficiently overvalued that intervention/passive NZD selling operations would help meet the Reserve Bank's monetary policy PTA objectives.

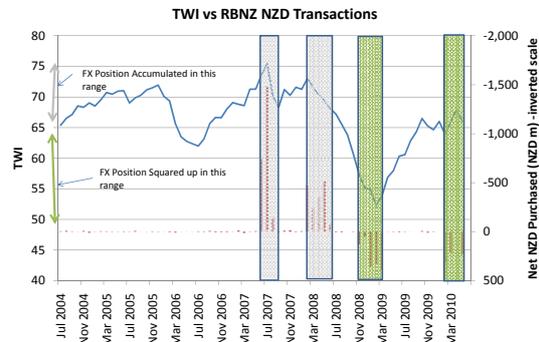
In early/mid-2008, as the global financial crisis intensified we took the step of further increasing our un-hedged FX reserves as a precaution against the possibility of prolonged dysfunction in the FX market. These additional un-hedged reserves were accumulated passively at a time when it seemed that the NZD was unexpectedly holding up while the economic outlook was deteriorating and risks increasing.

By late 2008/early 2009, the NZD had fallen to relatively low levels, prompting us to reduce the level of un-hedged reserves (and thus buying back some of the NZD sold earlier in the year, realising FX gains on those un-hedged reserves). We chose to retain a relatively high level of un-hedged reserves given the level of the exchange rate (around SDR 1500m versus the SDR 1000m benchmark level) reflecting our sense that there were still significant risks to the New Zealand markets coming from the financial crisis.

The worth of un-hedged reserves were proven through this period, as the crisis meant that financial markets had come under significant pressure and had, in some cases, closed

altogether. Un-hedged reserves thus gave the Reserve Bank the potential ability to intervene without worrying about the refinancing consequences (although such intervention was not ultimately required – hence the recent crisis did not provide a comprehensive test of the worth of un-hedged reserves in an actual intervention situation). Additionally, the crisis did lead to a significant fall in the value of the NZD which benefited the Reserve Bank's new balance sheet structure, as the value of its un-hedged reserves increased significantly through the crisis. A significant portion of these gains were transitory as ultimately the exchange rate recovered. However, the Reserve Bank's active approach in reducing un-hedged reserves (while still maintaining a significant un-hedged intervention capacity) meant that some of these gains were locked in and realised permanently. The Reserve Bank was able to pay a substantially larger dividend in the 2008-09 financial year (see figure 7 below) reflecting to a large extent these significant realised FX gains.

Figure 7
TWI vs RBNZ NZD transactions



7 Conclusion

Over the past five years, we have made significant changes to the way the Reserve Bank's balance sheet is managed. No longer are foreign reserves held on a fully currency-hedged basis. These changes have been a response to the evolution of some of the Reserve Bank's policy functions. The global financial crisis has shown the force with which markets can propagate shocks. Our experience of the global financial crisis, while not testing our FX intervention capability, has proven the Reserve Bank's new balance sheet structure to be effective and resilient at the time when the Bank's financial resources have been most in demand.

While the Reserve Bank has made substantial progress in restructuring its balance sheet, there remains further work on the agenda. The initiatives described here are, for the most part, a review of the liability structure of the Reserve Bank's balance sheet. Other work looking at the currency and market composition of the Reserve Bank's foreign reserves has been conducted and is ongoing.

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Appendix – Main changes in the RBNZ balance sheet

Figure 8 below summarises the changes in the structure of the Reserve Bank's balance sheet from 2005 when the Review process began.

The key changes are that:

- The change in ALM strategy means that the balance sheet assets and liabilities no longer match by function – for example, the amount of NZDMO FX loans has reduced as loans have matured and been replaced with long term currency and interest rate swaps, whose funding source is NZD provided from currency in circulation and settlement account liabilities.
- The balance sheet is smaller than would otherwise have been the case, as the Reserve Bank now owns fewer New Zealand government bonds than it used to – these funds have instead been used to finance foreign reserves.
- Settlement account balances are significantly higher than in 2005, reflecting the change in liquidity provision regime in 2006 rather than the Balance Sheet Review
- The Reserve Bank's equity is larger, reflecting the review in RBNZ capital requirements driven by the Review and changes in accounting standards
- Foreign reserves are larger in part reflecting the additional un-hedged reserves built up during the crisis as a precautionary measure. The Reserve Bank also built additional hedged reserves through the global financial crisis.

Figure 8
RBNZ balance sheet – 2005 to now

June 30 2005				April 30 2010			
Assets		Liabilities		Assets		Liabilities	
Foreign Reserves	4,150	FX Loans from NZDMO	4,000	Foreign Reserves	11,000	FX Loans from NZDMO	2,900
Domestic Market Assets	700	Settlement Accounts		Domestic Market Assets	8,000	Settlement Accounts	
		• Crown	650			• Crown	5,000
		• Commercial Banks	50			• Commercial Banks	8,000
Investment Portfolio		Currency in Circulation	3,200	Investment Portfolio		Currency in Circulation	4,000
• NZ Govt Securities	4,500			• NZ Govt Securities	3,400		
• Other investments	100			• Other investments	200		
		Equity and retained earnings	1,550			Equity and retained earnings	2,700
	9,450		9,450		22,600		22,600