

MANAGEMENT OF FOREIGN CURRENCY RESERVES¹

Overview

Although central banks and fund managers appear to be quite similar in regards to their management of foreign currency portfolios there are some important differences. Whereas fund managers are expected to make investment decisions in such a way as to maximise the value of the assets under their management subject to their client's investment mandate, central banks must manage their reserves portfolios subject to a range of policy-related constraints. Most obviously, central banks hold foreign currency reserves to fund foreign exchange market operations that arise as part of their broader monetary policy functions. Under a fixed exchange rate regime, foreign currency reserves are used to maintain a particular exchange rate. However, even under a floating exchange rate regime, foreign currency reserves are often used to provide liquidity in the event of extreme market movements to maintain investor confidence in markets. Foreign currency transactions are also used by many countries to augment their domestic liquidity operations while other countries use foreign currency reserves to manage the impact of government transactions. Reflecting the nature of these policy objectives, central banks understandably place a relatively high premium on ensuring the liquidity of their foreign currency reserves.

This doesn't mean that income generation and capital preservation are not also important to central banks. Indeed, depending on a central bank's circumstances, income generation and capital preservation may be extremely important. For example, in the case of central banks that borrow their reserves (rather than own them outright), the income generated by their reserve assets ideally should exceed their cost of funding. For other countries, where the income generated by these foreign assets constitutes a significant source of public sector revenue, shortfalls can have significant political ramifications.

While it is relatively easy to enunciate the broad objectives of reserves management in respect of their security, liquidity and return characteristics, it is much more difficult to translate those characteristics into a functional investment mandate: a framework that essentially describes the broad parameters of the reserves management process. When defining an investment mandate, the central bank executive needs to articulate the desired level of reserves, the extent to which the reserves are to be managed in separate investment tranches, the instruments that may be invested in and the preferred management style. These aspects of an investment mandate are examined below.

Once an investment mandate has been agreed on, the operational areas of the central bank need to develop systems and processes that define how this mandate is to be efficiently and

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prudently implemented. Essentially an ‘operational’ mandate is a roadmap for how portfolio returns are maximised subject to the prudent management of the risks associated with managing the reserves portfolio. Details of the performance measurement and risk management aspects of the operational mandate are discussed in detail below. Details of the Reserve Bank of Australia’s objectives and mandates are presented separately.

Investment Mandate

While it is relatively easy to enunciate the broad objectives of reserves management in respect of security, liquidity and return characteristics, it is much more difficult to translate those characteristics into a workable investment mandate; a framework that ensures that the desired characteristics of the foreign currency reserve portfolio are achieved. When defining an investment mandate, the central bank executive needs to consider the desired level of reserves, whether and to what extent the reserves are to be managed in separate investment tranches, the instruments that may be invested in and the preferred management style. These elements are considered in more detail below.

Level of Reserves

One important consideration for all central banks is the need to identify a desired range for the level of reserves within which they feel that they can achieve their nominated objectives. To a large extent, the decision may simply be a function of the policy environment that prevails at the time. However, when determining the optimal size of a reserves portfolio consideration should be given to a number of factors including the size of the central bank’s balance sheet, the opportunity costs of maintaining an unhedged portfolio of foreign assets, the relative depth of the domestic and foreign exchange markets, the size and openness of the domestic economy and the extent to which an economy is reliant on external sources of short-term funding.

Investment Tranches

One consequence of a central bank managing its foreign currency portfolio to meet a number of policy objectives is that these objectives often have conflicting liquidity and return characteristics. For example, a central bank that uses its foreign currency reserves to supplement domestic liquidity operations would place a relatively high emphasis on investing in highly liquid, short-term investments. The same central bank may also consider that its foreign currency reserves are an important national asset that are expected to meet long-term public financing obligations (such as pension obligations). In this circumstance, the relative importance of liquidity and wealth generation (income) is unclear.

When presented with conflicting policy objectives, some central banks (such as Norway, Korea and Singapore) have established independent investment vehicles with their own unique investment mandates. Even in the case of countries that don’t create separate investment vehicles, many address this problem by segregating their foreign currency portfolios into smaller portfolio tranches – the most common of these being a liquidity tranche and an investment tranche – and manage each of them against a unique investment mandate designed to reflect a specific policy objective.

A multi-tranche approach may not be particularly practical, however, even when there are several conflicting policy objectives. Consideration needs to be given to the size and relative stability of the reserves portfolio. A multi-tranche approach would be more appropriate in the case of a country that has experienced a sharp (and permanent) increase in the size of its reserves portfolio; for example, as a result of intervention or from the sale of a national asset such as oil reserves or fishing rights. On the other hand, in the case of countries where the size of foreign currency reserves is relatively stable, a single mandate can be readily designed that meets all security, liquidity and return objectives. Even in the case of countries where there is an expectation that the level of reserves is variable, a single investment mandate may be more practical as it would eliminate the need for regular (and costly) top-ups or draw-downs between the investment and liquidity tranches.

Investment Universe

Implicit in any reserves management mandate is the need to ensure that the instruments available to portfolio managers are consistent with the security, liquidity and return characteristics associated with the identified policy objectives. Given the trade off between these characteristics, central bank mandates are often restricted to combinations of short-dated cash instruments and medium-term securities that are issued by highly-rated governments and supranational agencies.

Again, the amount of reserves under management is an important consideration when mandating the eligible range of instruments. Mandating too many instruments could stretch available resources too thinly and, in the case of credit products, may not result in sufficient diversification within the particular instrument class.

Management Styles

Although there is a great deal of commonality between their respective reserves management objectives, central banks often adopt quite different approaches, or investment styles, when managing reserves. Investment styles are generally defined in respect of two extreme styles:

- Passive management provides very little discretion to portfolio managers. One example of a passive strategy involves buying foreign currency assets and holding them to maturity. Another is where the portfolio managers regularly rebalance their foreign currency portfolios to replicate a benchmark such as a market standard benchmark (for example one of the Lehmans Aggregate Indices).
- An active management framework gives portfolio managers scope to change positions in the expectation of market developments. This style implicitly assumes that a portfolio manager is able to identify and exploit short-term market anomalies or that they have a comparative advantage in identifying longer-term economic developments.

There are differing views on the relative merits of each investment style. One of the challenges for a central bank is to decide which of these styles best suits its objectives and risk tolerances. Ultimately, the decision will depend on the central bank's particular circumstances – in particular, senior management's confidence in the capacity of their staff, internal procedures and systems to

control financial and operational risks.² Generally speaking, however, the more rigorous the risk management framework, the more comfortable senior management are likely to be approving a more active style.

Performance Measurement

Benchmarks

It is widely accepted that central banks should manage their foreign currency portfolios against benchmark portfolios that are designed to reflect the risk appetite embodied in their investment mandates. Subject to this constraint, a well defined benchmark should also ensure that the return on the foreign currency portfolio is maximised and that returns in excess of the benchmark return are readily attributable to the individuals that made any discretionary portfolio management decisions.

Generally, a good benchmark should be:

- Representative – the benchmark should reflect the central bank’s broad objectives in regards to reserves management as well as the range of eligible instruments specified in the investment mandate;
- Replicable – all instruments represented in the benchmark should be eligible instruments and should be readily tradable;
- Transparent – the benchmark should be clearly defined and easily understood; and
- Computable – portfolio managers should be able to review the benchmark portfolios and assess their relative exposures on a continuous basis.

A three-month instrument (such as a Treasury Bill) is often used as a reserves management benchmark as it represents the funding (opportunity) cost of managing the reserves portfolio. Superficially, it appears to satisfy the required characteristics of a good benchmark – it is replicable, it is transparent and it is computable. It is, however, unlikely to be representative of the range of instruments available to the central bank and, because it is relatively easy to achieve, it is not likely to represent the highest portfolio return that the central bank could reasonably expect to achieve.

Many central banks rely on indices generated by global investment houses.³ These indices are attractive benchmark options – they are transparent, they are computable, they represent a significant proportion of a bank’s investment mandate and (importantly for central banks that face resource constraints) they are updated daily and are usually available at no cost. One limitation with them is, however, that while they are superficially replicable their coverage is so wide that it is often not possible for a central bank to purchase all the securities that they represent. Further, notwithstanding that these indices can be aggregated together and therefore can represent a significant proportion of a central bank’s investment mandate, they are often narrowly defined in terms of instrument types (i.e. US Treasury Notes) and, as such, are unlikely to incorporate the range of investment alternatives available to a central bank.

2 *Central banks with large foreign currency portfolios may also be reluctant to aggressively manage their portfolios if they believe that they may adversely affect financial markets.*

3 *Most of these indices are capitalisation-weighted, i.e. they are return indices based on the total supply of securities on issue with a particular characteristic. For example, a 3 to 5-year US Treasury Index would include all US Treasury securities which have between three and five years to maturity.*

Another alternative is for central banks to customise their own benchmarks. Although these benchmarks can be readily designed to meet all the characteristics identified above, they may expose the central bank to criticism about their appropriateness and effectiveness. A benchmark that is customised by an external consultant overcomes some of this criticism but this is not a costless solution.

Benchmark Composition

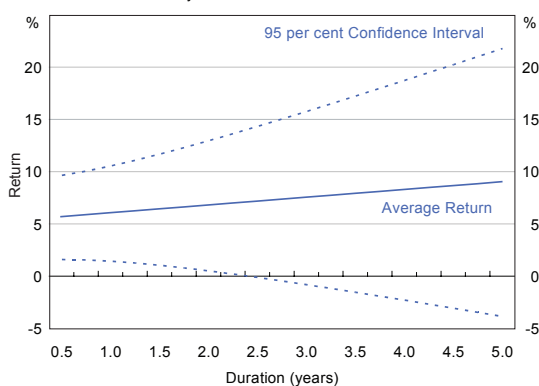
Irrespective of the decision about whether to use an internally or externally generated benchmark, a central bank has to determine the optimal composition of its benchmarks – in terms of their duration, their composition and their currency composition.

Portfolio Duration

A decision about the duration of the benchmark portfolio is essentially a decision about managing interest rate risk – the risk that the value of the instruments will decline as interest rates increase. This decision involves three competing factors – a central bank’s investment horizon, the expected return on the assets and the expected variability of these returns. Taking a simple example of an investor with a one-year investment horizon and assuming normal (upward sloping) yield curves, average portfolio returns should increase as the duration of the portfolio increases (Graph 1). The risk in this case is, however, that the variability of expected returns around this average also increases as the duration of the portfolio increases. Taking the example in Graph 1, there would be a 1 in 40-year probability of a negative return if the duration of the portfolio were 2½ years (the point where the 95 per cent confidence interval transects the x axis). The impact of increasing the initial investment horizon restriction from one to two years is illustrated in Graph 2. Here the variability of returns is reduced in such a way that the duration of the portfolio and, as a result, the return on the foreign currency portfolio can be higher for a given portfolio mandate (risk tolerance).

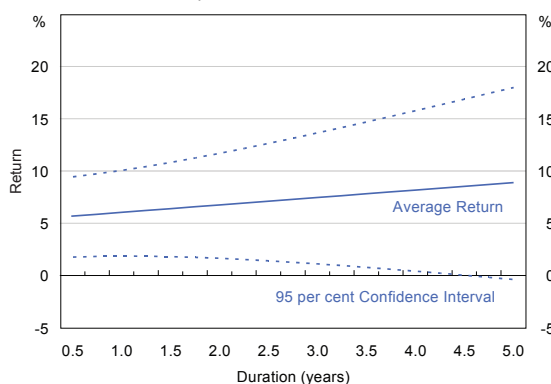
Graph 1

Horizon Analysis
1-year Investment Horizon



Graph 2

Horizon Analysis
2-year Investment Horizon



Portfolio Composition

A decision about the duration of a portfolio benchmark simply identifies the interest rate risk that a central bank is prepared to accept given its broad investment objectives. Even with the narrowest of investment mandates, however, there are an infinite range of combinations of instrument types and terms to maturity that could be chosen to represent this duration and these are likely to have quite different risk and return profiles. For example, a benchmark of 2½ years can be achieved by holding only 3-year securities or alternatively by holding a weighted combination of 3-month and 10-year securities. While the returns on these portfolios will be identical for a parallel shift in the yield curve, it will not be the case if the slope of the curve changes. Similarly, if the investment universe were to also include products with different credit risk profiles, benchmark returns would vary depending on the extent to which these instruments were included even if the duration of the instruments held were identical.

Another important consideration is whether the benchmark is replicable and liquid. A benchmark that includes a multitude of ‘off-the-run’ securities meets neither of these objectives – it is unlikely that a portfolio manager would be able to hold all the instruments and, by definition, if they were to hold them then they may have difficulty selling them at a fair price at short notice. Similarly, a diversified portfolio of corporate bonds may earn a higher return over the long run, but may require an investment in so many securities that it may only be possible to liquidate the portfolio at short notice at a substantial discount.

To some extent, however, these replication and liquidity issues can be overstated. Portfolio management techniques enable market-capitalisation indices to be readily replicated using a considerably smaller sample of securities than is contained in the indices. Indeed, in many cases, the tracking error or deviations from benchmark can be relatively small (and still be consistent with a central bank’s broad investment mandate). Similarly, with the development of deep and liquid secondary markets and the plethora of hedging and funding instruments that have been developed over the past two decades (such as futures and repurchase agreements), the liquidity requirements of a fixed-income portfolio can be readily achieved.

Currency Composition

When selecting the currency composition of the foreign currency portfolio, consideration needs to be given to the ultimate objective of holding the reserves. If reserves are being held for intervention purposes then the portfolio may need to be relatively overweight the intervention currency(s) of choice. On the other hand, if foreign currency reserves are being held as a hedge against official or non-official foreign currency liabilities or are funded with foreign currency loans, it may be appropriate to match their currency composition. Finally, if foreign currency reserves are used to fund imports or cover current account deficits, consideration should be given to a currency composition that reflects the numeraire of trade flows.

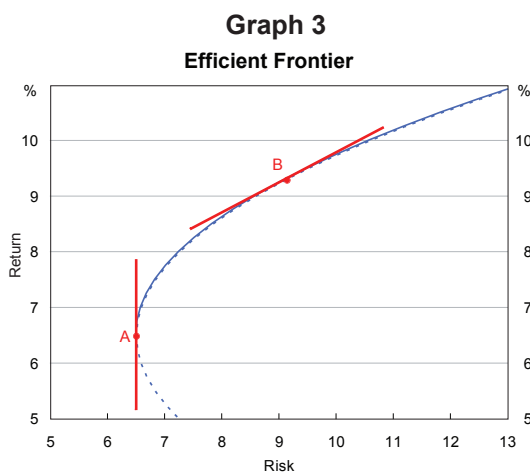
Consideration also needs to be given to the degree to which prospective currencies are correlated and whether, for operational reasons, larger portfolio allocations would be more efficient. For example, the currency allocation to Australian and New Zealand dollar assets is likely to be relatively small in most foreign currency portfolios. Assuming that the high correlation between these currencies were to persist, it may be practical to merge the benchmark allocation

and only have an exposure to one or the other currency. This doesn't preclude investments in either market but it does make the benchmark easier to maintain and easier to replicate.

Benchmark Optimisation

Once the duration, composition and currency composition of the benchmark portfolios has been determined, the next task is to assign weights to each portfolio to determine the amount of funds to be allocated to each one. This process involves optimising returns subject to a number of policy-related operational constraints (such as minimum portfolio sizes). Using mean-variance analytical tools, an efficient frontier can be determined which indicates the highest return achievable for each level of risk (return variability).

The choice of where to operate along the efficient frontier is somewhat arbitrary. At one extreme, a portfolio can be chosen such that the diversification benefits are maximised. This point (A in Graph 3) represents the least risky point on the efficient frontier but, by definition, also represents the lowest expected return. An alternative strategy is to select the point where the marginal compensation for an additional unit of risk is equal to the marginal return (B).



One limitation with this approach is that it is based on historical price movements and, as such, there is no guarantee that these returns will be repeated in the future. What this methodology does, however, is provide an objective means by which a central bank can gauge the portfolio composition that would have generated the highest returns for a particular risk profile in the past.

Reporting Issues

Numeraire

When reporting foreign currency portfolio returns, a central bank can choose from a variety of numeraires (or units of account). Ideally, a numeraire should represent a risk-free measure for the value of the foreign currency portfolio such that the purchasing power of the reserves is unaffected by currency movements. Three types of numeraire are usually considered:

- Most private sector fund managers report portfolio returns in the domestic currency of their clients. Although this numeraire has greatest relevance when reporting portfolio returns to a domestic audience, it is likely to represent a significant moral hazard problem for central banks that actively intervene in their own currency.
- Using a non-domestic currency (such as the US dollar or euro) as the numeraire avoids the moral hazard problem and may be attractive if it is the currency of choice for intervening

in foreign currency markets. The downside to such a numeraire is that it is likely to distort portfolio management decisions. For example, if the US dollar were used as the numeraire and it is one of the investment currencies it is quite likely that the ‘optimal’ currency composition of the portfolio would only contain US dollar assets. This is because a portfolio that only consists of assets expressed in the numeraire would involve no currency risk and would therefore tend to have the lowest risk profile.

- Reporting returns in a weighted currency basket, such as Special Drawing Rights (SDRs), eliminates the moral hazard problem and trading distortions associated with the previous two measures. It does, however, suffer because it has very little relevance to a domestic audience.

Ultimately, the choice of numeraire is very much dependent on its actual use. In Australia’s case, the optimal portfolio composition is estimated using portfolio returns expressed in SDRs. For operational purposes, returns are reported in US dollar terms on a daily basis and the portfolio’s actual and relative performance is reported in the Annual Report in Australian dollar terms.

Financial vs Accounting Returns

Best practice suggests that foreign currency portfolios should be marked-to-market each day using publicly available bid prices (i.e. the prices that would be achieved in the event that the reserve assets were liquidated). Importantly, performance data should reflect the interest earned as well as all realised and unrealised capital gains and losses on all financial exposures (including all contracted and settled transactions as well as all on- and off-balance sheet exposures). Depending on a country’s accounting standards, this measure of portfolio performance may, however, differ from returns published in the Annual Report. This may especially be the case where the accounting standards do not recognise income on off-balance sheet and contracted exposures or which exclude unrealised capital gains and losses. As with the decision about the numeraire, it may be that a central bank will choose to report returns on a different basis depending on its ultimate purpose.

Risk Management

Risk Management Framework

It is generally well accepted that a central bank should adopt the most rigorous risk management practices in respect of all aspects of its reserves management processes. At the most general level, this is reflected in the need for the complete separation of functions between the Front, Middle and Back Offices, the Audit Department, the Accounting Department and the Risk Management Unit (Figure 1). Separation of these functions is designed to ensure that exposures are within established limits and to minimise the opportunities for fraudulent behavior. While there is not a unique ‘blueprint’ for this framework, a number of basic elements should be considered:

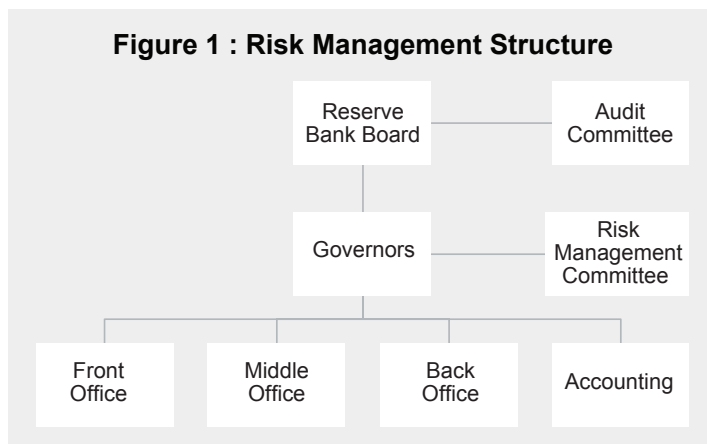
- At the very highest level, the decision-making hierarchy for the investment of reserves should be clearly defined. This hierarchy would normally be established by the Governor or Board of Directors and would include the overall objectives of reserves management,

the specification of the investment mandate and would identify who is responsible for implementing this mandate.

- To reduce the risk of fraud, the separation of functions must be transparent and enforceable. Most importantly, there should be complete separation of those who initiate transactions (Front Office) and those who arrange the settlement of transactions (Back Office). Depending on a central bank's particular circumstances, this separation may not be readily achievable but at a very minimum must be controlled by restricting staff access to sensitive systems (for example, SWIFT).
- The separation of functions extends beyond the separation of the transaction and settlement functions. Just as important is the separation of the responsibility for managing financial exposures (Front Office) and measuring them (Middle Office). Specifically, a Middle Office would be responsible for setting (and reviewing) operational guidelines and limits, would be responsible for performance measurement and attribution and should be responsible for ensuring the continued relevance of the benchmark.
- Notwithstanding the role that the Middle Office plays as an on-line auditor, provision should also be made for regular independent audits of the reserves management process.

An important element of any risk management framework is that the management policies and procedures are clearly understood by all staff involved in the process. This is best achieved by documenting all aspects of the investment mandate as well as all operational controls in a single document. Specifically this documentation should include:

- The reporting lines and responsibilities of all functional areas involved in the management of foreign reserves.
- All limits and controls extended to portfolio managers.
- Details of the performance benchmark and systems used for performance attribution.
- The list of all authorised instruments and any limits that may apply to them.
- The eligibility criteria for the selection of trading counterparties.
- The framework for determining the maximum credit exposures permitted with each counterparty.



- Details of the methodology for measuring risk exposures (both market risk and credit risk).
- Clear procedures for notifying senior management of limit breaches or any other ‘exceptional’ events relating to the reserves management process.

Procedures also need to be established for how changes can be made to the investment mandate such as a proposal for the introduction of a new instrument or a change in the composition of the benchmark. These procedures need to include which level of senior management is authorised to approve changes and which functional areas need to be consulted before changes can be implemented.

Risk Management Tools

At a more operational level, there are a variety of possible risk management tools available to central banks. Explicit in the design of the foreign currency benchmark is a decision about the acceptable level of market, credit and currency risk that a central bank is prepared to accept in light of its investment objectives and investment universe. In addition to this, central banks may give their portfolio managers latitude to deviate from these benchmarks. This discretion can be expressed in many ways – as variations in duration, variations in portfolio composition or variations in currency shares. A challenge for central banks is to quantify these risks on a consistent basis and incorporate these measures in the limit processes.

At a very basic level, the likely return (dollars-at-risk) from portfolio manager exposures can be readily approximated from the duration of the actual and benchmark portfolios. As a general rule, if the duration of the actual portfolio is one year longer than the duration of the benchmark portfolio, this would represent a dollars-at-risk exposure equal to one per cent of the value of the portfolio for every 100 basis point change in yields. In this case it is relatively easy to nominate a trading limit based on a maximum acceptable dollars-at-risk exposure.

The attractiveness of a dollars-at-risk measure is its simplicity. Unfortunately, this also represents its biggest limitation as it fails to capture the effect of changes in the shape of the yield curve (it assumes that the yield curve move is parallel) and it fails to capture the unique price sensitivity of individual instruments (convexity). To some extent, this deficiency can be overcome by granulating the limit by, for example, specifying dollars-at-risk limits at a more disaggregated level such as by maturity band or even by instrument.

Another related deficiency of dollars-at-risk measures is that they are not necessarily additive across portfolios as they make no allowance for price volatilities and the correlation in price movements between securities and between portfolios. For example, although US and European yields often move in the same direction, the size of the moves will not necessarily be in the same magnitude. This means that in the event of a global rally in yields, the gains on a long US security position may not completely offset the loss on a short European security position. This widely recognised deficiency has, to some extent, been overcome by the increased reliance on Value at Risk (VaR) measures.⁴ Although VaR measures have a number of advantages (most notably

⁴ A VaR measure estimates the maximum expected dollar loss on a given position (or portfolio) over a given holding period with a particular level of confidence. Alternatively, it can be described as the potential loss that is expected to be exceeded on a given number of occasions (determined by the confidence interval). The holding period reflects the time it takes to liquidate, neutralise or reassess a position and, as such, should reflect the nature of the portfolio. A daily holding period is appropriate for institutions which trade highly liquid instruments. A one-week holding period may be more suitable for institutions which adjust their portfolios less frequently or trade illiquid instruments.

that they enable exposures across a variety of instruments and portfolios to be aggregated into a single number), the implicit assumption about the normal distribution of asset returns and the use of historical price relationships mean that they are likely to be poor estimates of portfolio returns in the event of extreme market movements.

The VaR and dollars-at-risk measures tend to focus on more narrowly measuring the market risk of portfolio exposures. Neither measure is particularly good at quantifying the risk that an issuer of securities or a counterparty to a transaction will fail to meet their financial obligations at maturity or at settlement. While variations in the probability of default is implicit in the price of all securities and is therefore captured in the VaR and dollars-at-risk measures, there are many dimensions to measuring and managing credit risk that a central bank needs to consider:

- Credit exposures to particular issuers can be controlled by limiting the range of eligible securities to those of highly-rated issuers. Where investment mandates permit investment in less highly-rated instruments (such as corporate securities) individual instrument or issuer limits may be required.
- Individual counterparty limits tend to have two dimensions – the level of capital that a central bank is prepared to expose to a particular counterparty and the maximum potential financial loss associated with each instrument type. In the case of the acceptable capital exposure, this tends to be a function of the credit rating of the counterparty and its capital base (or the capital base of the central bank) while the maximum instrument-specific exposure is based on the likely financial cost of any counterparty failing to meet its financial obligations in regards to that instrument.⁵

Derivative Risk Management

Trading derivative instruments is generally perceived to be more risky than trading physical securities. This perception tends to be more a reflection of bad risk management practices in the past than a reflection of the products themselves. At the very basic level, a futures contract has essentially the same market risk characteristics as the underlying instrument and, in the case of exchange-traded derivatives, virtually all of the counterparty credit risk exposure is eliminated by the clearing house. In these simple cases, central banks should be relatively relaxed about using derivative products so long as the exposures are fully reflected in the balance sheet and they are not used to gear the portfolio beyond the value of the portfolio. On the other hand, derivatives which have non-linear payment characteristics (such as options) require specialist knowledge and complex risk management systems that are likely to exceed the resources available to many central banks.

Operational Risk Management

Aside from the direct financial risks associated with managing a portfolio of assets, central banks also face a significant range of procedural or operational issues that pose a significant reputational exposure to the institution. Examples of these operational risks include:

⁵ A risk factor on a deposit would be significantly higher than the risk factor applying to a fully collateralised loan. In the case of the latter, the expected loss is restricted to any forgone interest and any possible collateral shortfall (which can be minimised with expedient use of haircuts and margin calls). Similarly, the financial loss on a foreign exchange swap prior to settlement is limited to the movement in the respective exchange rate. That said, on the settlement date, the replacement cost increases sharply in the circumstance that one leg of the transaction settles well before the other.

- failure to deliver on contractual obligations resulting from trading and settlement system failures;
- ineffective backup arrangements in the event of a contingency event;
- failure to prevent fraudulent behaviour or to prevent excessive risk taking (including executing transactions in ineligible securities or with unauthorised counterparties).

Operational risks are fairly easy to identify and can often be eliminated through system enhancements and well documented procedures. Identifying and, more importantly, eliminating these risks isn't costless, however. Introducing new trading and settlement systems, for example, may involve a significant commitment of staff that were previously involved in the reserves management process and may take several years to fully implement.

Recent Challenges

Resource Constraints

In our experience, central banks have had to grapple with a variety of resource constraints. These issues are obviously most relevant to countries managing relatively small foreign currency reserve portfolios but can even be an issue for countries that are rapidly accumulating foreign currency reserves (although, in their case, this is not a permanent problem but is more transitory).

The most important of these resource constraints relates to staffing, both in terms of the number of staff as well as their experience with financial market products. These problems tend to be exacerbated by two, largely self imposed, constraints – a reluctance by many central banks to hire staff from the private sector and the fact that the remuneration offered to these staff is often not competitive with the remuneration offered by the private sector. The consequence of these policies is that central banks must recruit staff from other areas of their bank and spend considerable resources training them as financial market analysts, traders and risk managers. Having trained them, it is often difficult to retain them.

The effectiveness of the reserves management operation, and the ability to control operational risks, also depends on the adequacy and efficacy of the central bank's technology infrastructure. A comprehensive reserves management platform needs to provide for the capture, confirmation and approval of transactions, the preparation of settlement messages, the reconciliation of nostro and security accounts, the generation of accounting data and a full audit trail of all transaction events. In addition to its trade entry and settlement systems, a reserves management operation must be supported by a sophisticated global telecommunications capability, real-time electronic media systems, risk management systems and analytical databases. While the costs of these systems have declined and their reliability and flexibility have increased over the past decade or so, these benefits are often diffused by the need to undertake regular system upgrades. In addition to the financial cost of these new systems, the implementation of these upgrades also involves a significant commitment of trading and technical resources to ensure that they are fully integrated within existing risk management systems.

Another important resource-related consideration for any reserves management operation is where to locate the trading, risk management and settlement staff. Many central banks manage the potential staff and technology constraints of a 24-hour operation entirely from their head

offices while others, such as the Reserve Bank of Australia, have established dealing operations in several time zones. Essentially the decision comes down to whether the costs of a decentralised trading operation (both the financial costs and the costs relating to the fragmentation of resources and risk management) outweigh the benefits (more effective portfolio management, staff training and market liaison).

External Management of Reserves

One option considered by many central banks to overcome the resource-related problems highlighted above is to engage external funds managers to manage a portion or all of their foreign currency reserves. Superficially, this involves very little additional work. Aside from the initial due diligence aspects involved in engaging a manager, a central bank should only need to provide the external manager with the objectives and investment mandate developed internally.

The benefits of such an arrangement appear to be significant. In exchange for a management fee, central banks are able to indirectly access the institutional expertise of the manager and a wide range of sophisticated trading, settlement and risk management systems that they would otherwise not have access to. The benefits also often extend beyond the direct management of reserves. For example, external managers often assist in training central bank staff involved in reserves management (through secondments and client conferences). Further, some central banks also use the returns on the externally managed funds to validate their own internal benchmarks.

The costs associated with using external managers are not, however, limited to the readily identifiable management fees. Central banks need to recognise that there are significant costs associated with verifying the manager's performance and ensuring their compliance with the nominated investment mandate. Indeed, some central banks have found these costs to be so prohibitive that they have reduced their reliance on them in recent years.

Central banks should also recognise that their options aren't restricted to either managing reserves internally or placing them with a private fund manager. Central banks can also invest their reserves with the Bank for International Settlements (BIS) either through their funds management division or directly in BIS instruments. Further, some central banks, including the Reserve Bank of Australia, offer central banks some limited reserves management facilities in terms of cash management, custodial and investment services at relatively competitive prices.

Increasing Portfolio Returns

When formalising the investment mandate for the management of foreign currency reserves, an implicit trade off is made between liquidity and return. The rationale is that although instruments with shorter terms to maturity have lower rates of return, they provide the portfolio with greater liquidity. In recent years, this tradeoff has become less relevant. Indeed, the growth of a range of derivative market instruments such as foreign currency swaps and interest rate futures and the evolution of very liquid repurchase agreement (collateralised loan) markets has meant that central banks are now able to maintain significant exposures along the yield curve while at the same time being able to access a considerable amount of funds at very short notice.

The opportunity to increase portfolio returns without forgoing the liquidity characteristic of the foreign currency portfolio has been particularly timely as a combination of low inflation, reductions in public deficits and a concentration of funds under management have resulted in historically low portfolio yields. Although the strategy of increasing portfolio returns by increasing the average duration of the portfolio is attractive to many investors, it is worth noting that it would be accompanied by a commensurate increase in the variability of portfolio returns which may not be acceptable.

Central banks have also sought to increase the returns on their foreign currency reserves by modifying their investment mandate to include higher-yielding asset classes such as mortgage-backed securities, asset-backed securities and corporate bonds. This strategy is not, however, without its risks. In addition to increasing the likely variability of portfolio returns, these instruments require a greater commitment to developing appropriate risk management tools and educating staff about how to manage them. As discussed earlier, one option available to central banks is to engage external managers who have a comparative advantage in managing these instruments. While this addresses the explicit risk management issues associated with these instruments, central banks need to be aware that much of the increase in portfolio returns may be eroded by management service charges, and that they would still need to make a significant investment in terms of both staff and technology to monitor the managers.

The RBA's Reserves Management Framework

Objectives

Australia's foreign currency reserves are owned and managed by the Reserve Bank of Australia (RBA). The RBA's responsibility to manage Australia's foreign exchange reserves is established through the broad legislative powers that allow the Bank to deal in foreign exchange to achieve its monetary policy objectives primarily by maintaining a capacity to intervene in foreign currency markets. Foreign currency reserves are also used to augment our domestic liquidity operations and to manage the day-to-day foreign currency requirements of the Australian Government. Reflecting these objectives, an emphasis is placed on maintaining a relatively liquid portfolio.

Investment Mandate

Australia does not target a particular level of reserves either on an outright basis or relative to the size of the economy or its financial markets. Notwithstanding this, we find that Australia's reserve ratios are comparable with those of other industrialised nations (Table 1).

Given the size and relative stability of our foreign currency portfolio, the RBA also does not manage separate liquidity and investment reserve tranches. That said, foreign asset holdings resulting from domestic liquidity transactions are included in ORA but are managed separately on a fully hedged basis.

In terms of management style, significant scope was provided for the active management of the Bank's foreign currency portfolio against its benchmark when the reserves mandate was specified in the early 1990s. Experience showed, however, that while managers were on average adding to returns, the volatility of returns relative to benchmark was high. As a result, in 2000 the RBA adopted a management style that was largely passive. In order to retain the benefits

Table 1 : Foreign Currency Reserves Ratios (2005) ¹

	Australia	Industrialised Nations ²		
		Average	Low	High
Reserves to GDP (%)	6	6 (4)	1	17 (11)
Reserves Import Cover (months)	3	3 (1)	0	17 (3)
Reserves to Short-Term Debt ³ (%)	23	41 (12)	2	213 (29)
Reserves to FX Turnover (days) ⁴	0.9	1.2 (0.7)	0.1	4.5 (1.1)

1 Official Reserves Assets (ORA) as defined by the IMF.

2 These countries include the US, UK, Japan, the Euro-Area, Switzerland, New Zealand and Canada. The figures in brackets exclude Japan.

3 Non-resident banking claims and debt securities outstanding with a residual maturity less than 1-year as published by the Bank for International Settlements.

4 Turnover figures from Triennial Central Bank Survey 2004, as published by the Bank for International Settlements.

from trading market anomalies and managing day-to-day flows of reserves, however, portfolio managers did retain a small amount of discretion to take positions against the benchmark.

The RBA has typically maintained a very conservative universe of eligible instruments in its foreign exchange portfolio – investing in securities issued by highly-rated supranational agencies and governments (US, Japan, Germany, UK, France, Netherlands and Switzerland), repurchase agreements (collateralised loans) and commercial bank deposits. The term to maturity of all instruments is limited to 10½ years.

In 1994, the RBA began trading interest rate futures contracts. This decision was driven by a desire to improve our management of market risk, and in particular to provide a liquid hedging instrument to minimise the risk of capital losses when interest rates were rising. The RBA does not use any other over-the-counter or exchange-traded derivatives in its reserves management operations.

The RBA also uses foreign currency swaps in its management of its assets. These swaps are the main instrument that the Bank uses to sterilise its intervention activities and they have also been increasingly used as part of the Bank’s domestic liquidity management operations as an alternative to domestic currency instruments.

Operational Mandate

Risk Management Structure

Responsibility for the management of foreign currency reserves is delegated by the Governor to the Bank’s Financial Markets Group (FM). Within this group, International Department is responsible for the Bank’s Front Office operations in markets for foreign exchange, gold, and offshore assets.

The Front Office is charged with managing the currency, asset allocation and duration exposures of the portfolio. The Front Office comprises three dealing centres: Head Office in Sydney, and one each in New York and London. These centres execute trades and have some discretion for taking positions. They also examine policy issues relating to the investment of reserves including evaluating new products and reviewing the structure of benchmarks. The Front Office is supported by a separate analytical group with the responsibility of providing

in-depth analysis of international financial and macroeconomic developments that may impact on the value of the reserves portfolio.

The Middle Office has an independent reporting line to the Assistant Governor responsible for Financial Markets Group and is responsible for all aspect of performance and risk measurement. This performance and risk measurement information is provided to the Front Office and to senior management on a daily basis. The Middle Office also monitors compliance with credit and market risk limits. Compliance with limits is reported on a daily basis to senior management as well as to the Bank’s Risk Management Unit. The Middle Office is also responsible for maintaining all Front Office trading and analytical systems.

There are several other areas outside of FM that supplement and scrutinise the actions of the Front Office but which report to different Assistant Governors:

- The Back Office provides standard settlement and communication services for the Front Office operation and is responsible for the final approval of all transactions – dealers in the Front Office cannot confirm nor arrange the settlement of trades. The Back Office also perform cash and inventory reconciliations in order to ensure that counterparties and custodians have correctly reflected all transaction events. Reflecting operational practicalities, there are Back Office operations in each of the RBA’s three dealing centres, although Payments Settlements Department in Head Office has overall responsibility.
- The Financial Administration Department is responsible for the preparation of the RBA’s financial accounts that are published in the RBA’s Annual Report.
- The Internal Audit Department is responsible for ensuring compliance with procedures and other internal controls. It reports to the RBA’s Audit Committee, which also includes a non-executive member of the RBA Board as well as an external appointee. When the RBA is preparing its annual financial accounts, external auditors are employed to provide independent support to Internal Audit.
- The Risk Management Unit is responsible for the RBA’s enterprise-wide risk management policy and is in charge of risk assessment and reporting. It reports directly to the RBA’s Risk Management Committee. Compliance with limits is also reported to this Committee on a quarterly basis.

Benchmark

The RBA’s foreign currency reserves have been managed against internal benchmarks since 1991. The current composition of the currency and asset benchmarks, and the duration benchmark for each asset portfolio, are presented in Table 2.

When defining the asset benchmarks, consideration is given to a number of factors including portfolio return, creditworthiness and liquidity as well as the more practical economies of scale

	US	Europe	Japan
Currency allocation (%)	45	45	10
Asset allocation (%)	45	45	10
Duration (months)	30	30	30

considerations relating to the management of a diversified portfolio. As a result, benchmark investments are restricted to sovereign securities and cash instruments. Typically, around 75 per cent of the RBA's benchmark portfolios are held in sovereign paper (Table 3). This includes Treasury bills and notes in the US portfolio, and Japanese government bills and bonds in the Japanese portfolio. In the European portfolio, the RBA invests in a combination of French and German government securities. Consistent with our investment mandate, the maximum term to maturity of these securities is 10½ years.

Table 3: Benchmark Composition
(per cent)

	US	Europe	Japan
Deposits	9	18	2
Repurchase Agreements	15	12	16
Short-Term Securities ¹	28	20	42
Long-Term Securities	48	50	40
Total	100	100	100

¹ Sovereign instruments with terms to maturity not exceeding twelve months.

The benchmarks are reviewed periodically to ensure that they continue to reflect the RBA's long-term objectives. Despite this, there have been few changes to the RBA's benchmarks since their introduction in the early 1990s. These changes were made to take account of structural changes to markets (such as the introduction of the euro) or for changes in the nature of the Bank's operations.

Risk Measurement

The trading discretion around the duration benchmark for each asset portfolio is based on the concept of a dollars-at-risk exposure. This limit applies to the aggregate exposure and, in order to control the amount of curve risk, it also applies to the exposures in each maturity bucket of the portfolio.⁶ The dealing centres are required to maintain their dollars-at-risk exposure within this limit at all times. Adherence to limits is also independently monitored by the Middle Office with daily reports provided to senior management.

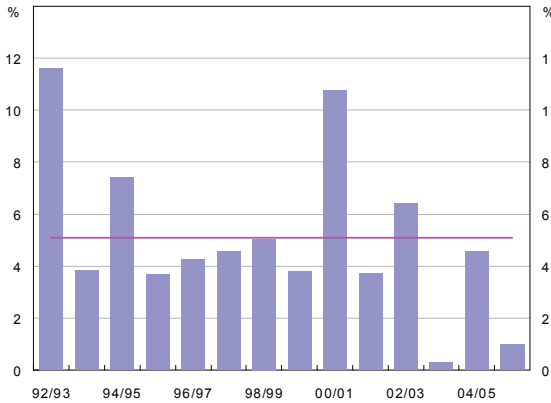
The dollars-at-risk measure also forms the basis of the Value at Risk (VaR) methodology which the RBA has used since 1995 to estimate the consolidated exposure of the Bank's foreign currency reserves to market risk. Although the overall limits to control market risk – that is, the discretionary trading bands around the benchmark – are not defined in terms of VaR, the RBA has nonetheless found it to be a useful tool for conveying information about the overall portfolio exposure to senior management and staff involved in reserves management.

The VaR exposure represents the portfolio loss which the RBA would reasonably expect to incur once every 20 business days in normal market conditions. Two VaR measures are calculated each day – one based on a correlation methodology and the other based on historical simulation methodology. The assumptions underlying these VaR methodologies are reviewed periodically and their performance is back tested.

⁶ Each portfolio is segmented into twelve maturity buckets ranging from 3 months to 10 years.

The Middle Office has also developed a range of instrument and counterparty-specific limits to restrict the concentration of credit risk between issuers and counterparties. These limits are expressed relative to the size of the portfolios and as absolute amounts. While it is the responsibility of the Front Office to adhere to these limits at all times, the Middle Office also independently verifies their compliance each day and reports any breaches to senior management in Financial Markets and to the Bank's Risk Management Unit.

Graph 4
SDR Benchmark Returns



Performance Measurement

Each day the Middle Office calculates portfolio returns on an absolute basis and relative to the benchmark. Since the introduction of the risk management framework 15 years ago, the average annual return on the RBA's benchmark (in SDRs) has been 5.1 per cent (Graph 4). Decisions taken by RBA portfolio managers have added a further 23 basis points to that return.