

Grimes, Arthur

Working Paper

Crown Financial Asset Management: Objectives and Practice

New Zealand Treasury Working Paper, No. 01/12

Provided in Cooperation with:

The Treasury, New Zealand Government

Suggested Citation: Grimes, Arthur (2001) : Crown Financial Asset Management: Objectives and Practice, New Zealand Treasury Working Paper, No. 01/12, New Zealand Government, The Treasury, Wellington

This Version is available at:

<https://hdl.handle.net/10419/205453>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

TREASURY WORKING PAPER

01/12

Crown Financial Asset Management: Objectives and Practice

Arthur Grimes^{*}

Abstract

This paper analyses key issues that may be relevant to setting the Crown's overall objectives and practices for financial asset and liability management. It examines implications of the nature of the Crown's balance sheet for asset and liability management and investigates the appropriate approach of the Crown towards managing risk (concluding that a risk averse approach is warranted). The issue of centralisation versus decentralisation of Crown asset and liability management is analysed both from a portfolio management perspective and from an organisational design perspective. Insights from private sector financial conglomerates are also incorporated. The paper concludes that individual Crown financial entities should each continue to be responsible for setting their own strategic asset allocation, after taking into account the nature of their liabilities. A central Crown body should, however, monitor and aggregate information from each of these entities and be delegated the responsibility and power to manage risks to the overall Crown balance sheet.

JEL Classification: H11, H63

Keywords: Crown balance sheet; Public debt management

^{*} Institute of Policy Studies, Victoria University of Wellington. I wish to thank, without in any way implicating, the following for valuable comments received on earlier drafts of this paper: Glenn Boyle, Bob Buckle, Steve Cantwell, Geoff Dangerfield, Graham Guthrie, Greg Horman, Jeff Huther, Andrew Kibblewhite, Brian McCulloch, Chris Pinfield, David Rafferty, Michael Reddell, Jared Sharma and David Skilling. The views expressed in this paper should be attributed solely to the author and should in no way be taken to reflect the views of the New Zealand Treasury.

DISCLAIMER: The views expressed are those of the authors and do not necessarily reflect the views of the New Zealand Treasury.

Contents

Abstract	1
1. Outline of Issues.....	3
2. Crown Balance Sheet.....	5
3. Crown Attitude Towards Risk.....	11
4. Optimal Investment Strategies for a Financial Entity.....	13
5. Centralisation versus Decentralisation: Portfolio Approach.....	16
6. Centralisation versus Decentralisation: Organisational Approach	19
7. Practical Insights	24
8. Criteria for Evaluating Crown Financial Asset Management	29
9. Implications for Crown Financial Asset Management.....	30
10. Concluding Comments.....	35
Appendix: Crown Financial Institutions: Current Portfolios.....	37
References	47

1. Outline of Issues

The power to tax, and the obligation to provide certain services, sets the Crown apart from a conventional corporate in terms of its balance sheet. The purpose of this paper is to distil key issues that may be relevant to setting the Crown's overall objectives and practices for financial asset and liability management.

The Crown has an interest in over \$19 billion worth of financial assets within portfolios managed by ACC, EQC, GSF, NPF, PTO¹ and the foreign reserves portfolio of the RBNZ (Reserve Bank of New Zealand). It holds outstanding debt of around \$36 billion through DMO (Debt Management Office of the Treasury). The Appendix presents details of these organisations and their assets and liabilities.

The size of these figures indicates the importance of ensuring that the strategic and tactical management of these assets and liabilities is handled in the best possible manner to achieve the Crown's objectives. For instance, a 0.1% p.a. improvement in returns for a given level of risk on the existing financial asset portfolio yields a benefit to the Crown of \$19 million p.a., an outcome that is well worth achieving. If NZSF (New Zealand Superannuation Fund) becomes a reality and builds to a fund of \$100 billion, a 0.1% p.a. return improvement will yield an annual financial benefit to the Crown of around \$120 million p.a.

Unlike a standard corporate, the Crown's balance sheet is a nebulous concept. The Crown has a number of explicit liabilities (e.g. government debt) and explicit assets (e.g. the ACC asset portfolio) which are listed on its statement of net worth; however it also has a number of implicit liabilities (e.g. future NZS payments) and assets (especially future tax revenues) which are not so listed.

This paper discusses the *Crown's objectives* in financial asset management. In doing so, it analyses the definition of the Crown balance sheet and examines the Crown's attitude towards risk. The paper also addresses *organisational design* issues which are relevant to considering appropriate criteria for evaluating proposed institutional arrangements.

Section 2 examines relevant definitional issues pertaining to the balance sheet using foregoing Treasury papers as input. This examination is a crucial forerunner to any work on institutional arrangements to manage Crown assets. The reason for this is that except where certain "separation theorems" hold, sub-sets of assets cannot in theory be managed efficiently in isolation from other assets and liabilities of the same organisation owing to interactions amongst returns across different parts of the portfolio. In practice, as will be discussed, there may be some sub-portfolios where separation theorems hold and so can be managed independently of the rest of the balance sheet. Even where there are not such sub-portfolios, it may be optimal to manage some sub-portfolios separately for efficient management purposes, but those

¹ Accident Compensation Corporation, Earthquake Commission, Government Superannuation Fund, National Provident Fund and Public Trust Office.

sub-portfolios should only be established once an appreciation of the full dimension of the problem is recognised.

Section 3 deals with the question of the Crown's attitude towards risk. It brings together insights of earlier Treasury work with external contributions to show that risk aversion on the part of the Crown is warranted, even in cases where risk aversion is not displayed by citizens.

Section 4 deals with a specific aspect of balance sheet interactions: that of managing assets and liabilities within a specific activity (e.g. GSF). The principal insights gained here relate to the manner in which assets should be structured, taking a given structure of liabilities into account. As Elton and Gruber (1992) show, the riskless asset portfolio is no longer represented by the one period government bond; instead the risk profile of the liabilities will determine the riskless asset portfolio. We take these results further, and link them to issues relevant to centralisation versus decentralisation of asset/liability management.

A recurring theme in any analysis of the organisational structure of conglomerates is the issue of when it is appropriate to centralise and when to decentralise activities or functions. Currently, the Crown has a decentralised approach to asset management (both in terms of financial and non-financial assets), but a reasonably centralised approach (through DMO) to liability management. In section 5, we use a portfolio management approach to examine when (de)centralisation may be appropriate. In section 6 we examine the question of centralisation versus decentralisation further, based on organisational design considerations, an aspect of which is appropriate decentralisation of governance. Section 7 examines more practical issues of which financial activities may be best (de)centralised, drawing on a number of surveys of private sector corporate behaviour.

The foregoing sections each raise issues relevant to appropriate criteria by which to evaluate institutional arrangements for managing the Crown's financial assets (and its balance sheet more generally). Relevant criteria are spelt out in section 8.

Section 9 brings together insights from the definition of the Crown's balance sheet, the Crown's attitude towards risk, issues of asset/liability management, and issues of (de)centralisation in the design of institutional arrangements for managing the Crown's financial assets. These issues are addressed in light of the foregoing criteria for evaluating alternative arrangements. Inevitably, judgements – rather than hard and fast measurements – will be involved in determining appropriate structures. The preceding analysis provides a framework for making those judgements.

Section 10 provides some brief conclusions. The analysis indicates that the Crown should continue with aspects of the current decentralised approach to balance sheet management. For instance, individual entities should in general each continue to be responsible for setting their own strategic asset allocation, after taking into account the nature of their liabilities. A central Crown body should, however, monitor and aggregate information from each of these entities and be delegated the responsibility and power to manage risks to the overall Crown balance sheet. It can do so partly through its choice of debt structure, although it may need to supplement this activity by having the

ability also to direct the strategic asset allocation of at least one other entity. The central body also needs to monitor and control aggregate Crown credit exposures and may help co-ordinate structures (e.g. for back offices) that minimise Crown-wide investment management costs.

The approach outlined above is designed to ensure that there is decentralised analysis of the nature of each entity's liabilities, with corresponding incentives to allocate assets so as to hedge each entity's net worth against economic shocks. At the same time, the central body has the responsibility to hedge the overall Crown balance sheet in order to achieve broader Crown objectives. It is, however, difficult to be precise as to the optimal nature of the Crown's balance sheet management objectives. These could include hedging shocks to reported net worth, or to hedging a more comprehensive definition of Crown net worth (with the effect of smoothing tax rates over time), or potentially to some other objective (such as smoothing cash flows). Hence legislation and structures need to be flexible enough to accommodate changing objectives over time. Nevertheless, whatever its final objective function, the analysis here indicates that the Crown should maintain a risk averse attitude towards its balance sheet management.

2. Crown Balance Sheet

A number of Treasury papers² (informed by key academic treatments³) have in recent years analysed balance sheet management implications of relevant issues. Bradbury *et al* (1999) provide a useful explication of the definitional issues. They examine which concept of net worth (or other balance sheet variable) should be targeted by government. In doing so, they analyse which types of assets (and liabilities) should be included in the Crown balance sheet when balance sheet management issues are being considered. Assumptions about future paths of these variables also have to be made.

Their inter-temporal budget constraint (IBC) approach – which is akin to conventional household life-time optimisation approaches – incorporates the present discounted value of future revenue (including tax) and expenditure flows, based on “existing policies”, as Crown assets and liabilities.⁴ This gives a measure of “comprehensive net worth” (CNW) for the Crown, which is considerably wider than the current accounting measure of “reported net worth” (RNW). Under CNW, the “solvency” consideration for the Crown becomes whether the current tax rate is greater or less than the required (constant) tax rate to finance future plans. If the actual tax rate is less than the required rate, there is a need to increase the tax rate in order to make existing expenditure policies sustainable.⁵

² See Bradbury *et al* (1999), Davis (1998), Huther (1998a and 1998b), Pinfield (1998), Skilling (1996 and 1997).

³ E.g. Barro (1979), Bohn (1990), Lucas and Stokey (1983).

⁴ This approach implies exclusion from the balance sheet of assets that cannot or will not be sold (e.g. national parks).

⁵ By standard tax smoothing arguments (e.g. Barro, 1979) tax rates should be constant over time. An “insolvency” result should be rectified through an immediate increase in the tax rate so as to minimise the size of the tax rate increase, hence minimising deadweight losses. Of

The CNW approach shows the dangers of targeting net debt and/or targeting RNW. For instance, a government that wishes to implement sustainable policies with least distortion, will aim optimally to target a zero or small positive value⁶ of CNW with stable tax rates through time. Stability of tax rates is required to minimise distortions caused by inter-temporal mis-allocations (Barro, 1979). However, such a policy could lead to a path for RNW that is negative (or positive) for extended periods; it could also lead to periods of rising net public debt over certain periods. These are optimal adjustments in financial asset/liability situations and ideally should not be cause for concern.⁷

This insight has implications for Crown asset management. If an Asset/Liability Management Office (ALMO) were to be established and set the task of co-ordinating Crown balance sheet management, it would need to consider which definition of the balance sheet is being adopted, and which targets have been adopted corresponding to that definition, in designing an optimal portfolio. The optimal asset portfolio corresponding to a RNW concept will be quite different from that corresponding to a CNW concept.

The appropriate balance sheet concept also has relevance to the management of Crown liabilities. This is apparent from the analysis of Fowlie and Wright (1997) who use the Bohn (1990) tax-smoothing approach to determining optimal public debt structure, applying this approach to New Zealand. They find that under a tax-smoothing approach (akin to use of CNW), it is optimal for all New Zealand public debt to be denominated in foreign currency (Yen and Deutschmark), with no debt denominated in NZD. If foreign currency debt were ruled out for some reason, it would be optimal to issue 100% indexed debt and still issue no nominal NZD debt.

Fowlie and Wright demonstrate that these results contrast with a simple mean-variance approach (akin to use of RNW). In the latter case, it is optimal for 100% of the portfolio to be denominated in nominal NZD. Thus optimal debt structure is shown to be extremely sensitive to specification of the objective function. In Fowlie and Wright's case, the tax-smoothing approach is welfare-optimal (there is a complete absence of principal agent issues) and the current practice of issuing nominal NZD denominated debt, based on an RNW approach, is sub-optimal.⁸

Huther (1998a) provides another example of the importance of using the CNW concept. He uses modern portfolio theory to analyse the risk-return trade-offs facing the New Zealand Crown's balance sheet, defined to include both assets and liabilities and incorporating future tax and social expenditure "obligations". According to his

course, the Crown is not actually "insolvent" if the required tax rate is higher than the current tax rate; the implication is just that some change in taxation rates or expenditures will be required now or in future.

⁶ A small positive target value for CNW will generally be optimal in an uncertain environment in which deadweight losses are an increasing function of tax rates.

⁷ Except for principal-agent and related problems referred to below.

⁸ These empirical results may be highly dependent on the chosen time period and country of the study. In an analysis of similar issues for 9 OECD countries, Hawkesby and Wright (1997) find that issuance of domestic short-term debt is generally preferable to issuance of long-term domestic debt, indexed debt or foreign currency debt.

methodology, the present value of tax revenues constitutes approximately 90% of total Crown assets⁹, with a similar proportion for social expenditures as a ratio of total Crown liabilities.¹⁰

Using this CNW definition, Huther examines the effect on the Crown's total risk-return outcome of four alternative \$5 billion changes to the Crown's balance sheet:

- reduce foreign-denominated debt;
- reduce domestic-denominated debt;
- increase equity;
- increase student loans.

His results demonstrate a beneficial effect of increasing the Crown's equity holdings (assumed to be 80% offshore and 20% domestic) both in raising expected return and reducing the standard deviation of quarterly returns. These results raise questions concerning the then-existing policy (based on RNW) of paying down Crown debt; a CNW approach would indicate a preference for using surpluses to build an equity fund¹¹ while maintaining debt constant.¹²

Bohn (1998) has recently examined related issues, but using a quite different approach. He examines the impact of government debt, social security and taxation policies on the allocation of aggregate risks in an overlapping generations model with stochastic production. Government has an important role as an institution that can act on behalf of future generations. These generations cannot contract out of risk that they will face when they are young since they are not yet born. Hence government policy will affect the allocation of risks (essentially by supplying a "missing market") and theoretically, in this case, can improve *ex ante* efficiency.

Efficiency requires that the impact of all economic shocks is shared by the current young, the current old, and the unborn. The market allocation is generally inefficient because it tends to impose too much risk on the young who cannot insure themselves in advance. In contrast, government policy can improve risk sharing.

For instance, if government is able to operate a time-consistent wage-indexed social security (superannuation) fund, all cohorts share the risk of uncertain future productivity growth. By contrast, if government issues safe debt, it provides safety to the current old. But because they are thereby insulated from the effects of an economic shock, the impact of that shock is borne purely by future generations. Future young have an

⁹ If anything, Huther's methodology understates this percentage since it assumes that tax revenues are constant rather than using the more reasonable assumption that they grow with real GDP.

¹⁰ Huther estimates that total assets (at 30 June 1997) are \$666.8 billion of which the present value of taxes are \$602.2 billion; he estimates total liabilities at \$627.1 billion of which social obligations are \$563.6 billion.

¹¹ For example, to fund the GSF's existing unfunded liability through issuing Crown debt, enabling the purchase of equities within the fund.

¹² Huther's results (Figure 2) indicate that a reduction in foreign-denominated debt increases portfolio volatility by more than a reduction in domestically-denominated debt, as well as resulting in a slightly lower average return than for the case of domestic-debt reduction.

increase in the volatility of their after-tax incomes since they have to pay a non-contingent debt service out of stochastic income. This leads to a relatively high (low) tax rate to service the debt when pre-tax incomes are unexpectedly low (high) which is clearly sub-optimal. Thus governments should look to implement wage-indexed social security but seek to avoid issuing safe debt. Proposals to replace social security by government debt coupled with “individual retirement accounts” are thereby shown to be inefficient on two counts.

A further implication of this approach (which Bohn only hints at) is that governments should seek to structure their net financial liabilities (assets) so that liability service rises (asset returns fall) when pre-tax incomes (productivity) rise. In other words, if government is holding net financial assets it should be investing in assets that are negatively correlated with domestic incomes. If it has net financial liabilities, it should issue debt with returns positively related to domestic incomes.

Bohn’s analysis in this case is effectively in terms of a model with lump sum taxes (savings and labour supply are invariant with respect to tax choices) and hence misses out on the richness of models which include inefficiencies due to agents’ behavioural responses to changes in tax rates. Compensating for this is his ability to examine inter-temporal risk-sharing issues in a comprehensive fashion.

The key insight of the model, however, is similar to other models which examine risk implications of government debt/asset management: Setting appropriate risk parameters for managing these funds necessarily entails a Crown-wide perspective involving taxation and social spending objectives. Examining the “risk” characteristics of the financial liabilities/assets in isolation may not only lead to the Crown missing out on valuable information, it may even worsen existing inefficiencies within the economy.

Norway is one country which implements an investment policy informed partly by the CNW approach. The Norwegian government has established the Government Petroleum Fund to invest proceeds from North Sea oil and gas for the benefit of future generations. In managing the fund, the Norges Bank (1997) notes that central government wealth considerably exceeds Petroleum Fund proceeds, so that, in principle, a management strategy should be devised for total central government wealth (which includes foreign exchange reserves, the National Insurance Fund, ownership in commercial activities, real capital and oil/gas wealth in the North Sea).

In practice, they consider that such an overall strategy is not currently feasible. However, they can, and do, look at the relationship between the Petroleum Fund and North Sea oil/gas wealth. Norges Bank states:

This implies that the management of the Fund should be based on a relatively long investment horizon, and that emphasis is placed on investments which, through negative covariance with the oil price, reduces the total risk.

This investment policy is essentially in accord with Bohn’s (1998) implied optimal strategy: the value of financial assets will be high when the value of physical wealth (determined by oil prices) is low, and vice versa. This result is also in accordance with portfolio structures driven by tax-smoothing arguments.

The result is an investment mandate with clearly defined measures for management of the Fund, including clarity concerning the concept of return. The Norges Bank concludes that the long-term horizon and need to invest in assets with a negative covariance with oil prices imply a need to invest a large proportion of capital in diversified foreign equities:

*The Petroleum Fund can be looked upon as wealth that has been converted from oil and gas to foreign financial assets. Historical data show that whereas equities have had negative covariance with the oil price in the long term, there has been some positive covariance between bonds and the oil price. This indicates that greater stability in the value of total national wealth can be achieved by including a substantial proportion of equities in the Petroleum Fund.*¹³

The Norges Bank recognition that adopting a full CNW definition is not currently feasible points to a major issue in attempting to adopt a CNW approach: the information required to implement this approach is massive and realistically the quality of much of this information will be tenuous at best. In practice, therefore, if a CNW concept is adopted, some sub-set of net worth will be targeted. RNW might be the minimum definition considered but realistically may be expanded to include certain revenues and expenditures for which reasonably quantifiable risk/return parameters exist. This may include, for instance, superannuation expenditures committed to (in a “social contract” sense) by the state. Provided the operational net worth definition was not changed substantially over short time periods and provided assets/liabilities with known risk/return properties are not omitted, the adoption of a wider net worth definition in this manner will generally be preferable to a narrower definition for reasons addressed above.

So far, this discussion has been conducted without reference to principal-agent or time consistency concerns. Bradbury *et al* consider the importance of these types of concerns. Crown expenditure decisions may become less efficient as the Crown’s surplus cash rises, in a similar fashion to the principal-agent issues studied by Jensen and Meckling (1976) in a corporate setting. If efficiency of Crown spending is affected by the Crown’s financial position in this way, there is a case for limiting the degree of reported (and/or financial) assets that the Crown amasses over time (even though in the absence of these inefficiencies, such a build-up of assets may be on the optimal time path). The result of such inefficiencies may be to favour a targeting policy that lies between targeting CNW and targeting RNW.

Davis (1998) examines governance and agency problems associated with management of the Crown’s financial asset portfolio more closely, pointing to two key agency relationships:

¹³ In managing the fund, emphasis is placed on ensuring that risk limits are observed at all times, requiring continuous monitoring and adjustment of investments to market conditions. The monitoring requirement indicates a need to appoint a global custodian to monitor all investments, whoever manages the fund. The intention is to manage some portions of the fund in-house (e.g. bonds are to be managed internally because of internal expertise) but to out-source other areas (e.g. equities).

- (a) between the electorate and the Executive; and
- (b) between the Executive and the investment manager(s).

Three forms of inefficiency are potentially connected to (a):

- Direct Raiding: Poor performance resulting from misappropriation of dividends or asset sales proceeds, or inefficient imposition of asset management constraints (e.g. excessive prudence);
- Indirect Raiding: Inefficient spending or investment decisions arising from having surplus cash resulting in high risk and/or low returns (i.e. “slacking”);
- Adverse Impact on Private Sector Behaviour: E.g. interference in commercial decisions.

These issues are forms of time consistency (commitment) problems. Pinfield (1998) shows that where such commitment problems exist (in his case relating to “expenditure creep” resulting from prior surpluses) the initial tax rate should be set lower than would be optimal in the pure tax-smoothing (CNW) approach. In some cases, institutional design can mitigate the problems; for example, legislative constraints can be adopted (the Reserve Bank of New Zealand Act 1989 is one such example).

With respect to (b), a number of potential problems may arise:

- Potential for under-performance (especially in departmental-type public bodies);
- Board composition could be subject to political influence leading to subsequent politically-motivated decisions;
- Heavy reporting requirements on public-sector entities can lead to a short-term investment approach to the detriment of long-term returns;
- If board members/trustees are “too close” to managers, insufficient monitoring of managers may occur (especially if accountability arrangements for trustees/board members are not clear).

Evidence on these issues is sparse and may be case-specific; however, some evidence is given in Mitchell (1993). She examines 201 state and local pension systems (covering 269 plans) in the United States in order to ascertain effects of various governance issues on fund performance. Issues include legislative or regulatory constraints; setting appropriate accounting standards (e.g. assumptions regarding discount rates); the types of people who are appointed to pension boards and whether external advisers, actuaries and managers are used. In her empirical work she found, *inter alia*, that increasing the percentage of retired employees on the board reduces returns (and increases variability of returns) and investing in-state strongly reduces returns. Perhaps surprisingly, the use of in-house versus external management made no significant difference to returns or variability of returns, once other factors had been accounted for.

Some of the issues raised by Davis and studied by Mitchell may be mitigated by implementing good governance arrangements. These are not dealt with in detail here, but may include:

- appointment of independent trustees/board members with limited tenures;
- appointment of an independent custodian;
- use of independent investment experts to advise on fund allocation;
- use of arms length management contracts;
- periodic re-tendering of investment management contracts;
- external monitoring of trustee/board performance.

On balance, a sensible strategy is to manage the Crown's assets and liabilities in the context of a balance sheet that is defined more widely than for RNW, where additional assets/liabilities are included on the basis that they are material and have reasonably measurable risk/return characteristics. Over time, the operational balance sheet definition may be expanded as the set of assets on which there is the required information increases. This approach should be supplemented by imposition of good governance arrangements at fund-specific levels and with legislative fiscal constraints (such as New Zealand's Fiscal Responsibility Act) to encourage time consistency in order to mitigate "raiding" and associated problems.

Given the practical inability to manage a pure CNW definition, it is virtually certain that the practice of defining Crown net worth for balance sheet management purposes will change over time. An implication is that the asset management structure will have to be flexible enough to accommodate changing targets over time.

While there is an implication that the balance sheet should be defined more widely for balance sheet management purposes than in the current RNW definition, there is a strong case for not legislating that a particular net worth definition be targeted. Instead, legislation should require that the existing target be declared transparently at all times, with reasoning behind this choice being made transparent. To enable such a target to be implemented, an ALMO needs to be established to manage, or at least co-ordinate management of, the balance sheet. Later sections discuss whether the ALMO should manage the assets and liabilities itself, or should devolve part or all such management to other entities.

3. Crown Attitude Towards Risk

Whatever balance sheet definition the Crown adopts, an ALMO will have to adopt some clear objective function to provide a basis for its asset allocation. A key aspect to consider in formulating this objective function is the attitude that the Crown should take towards risk. In turn, this should derive from citizens' attitudes towards risk, but – as discussed below – the Crown's and citizens' attitudes to risk will not necessarily coincide; constraints and non-linearities may cause an optimal divergence between the two.

Bohn (1990), building on the work of Lucas and Stokey (1983), shows that government should behave in a risk-averse manner even when agents in the economy are risk

neutral. Despite agents' risk neutrality, it is optimal for government to take a risk averse approach to structuring its portfolio so as to smooth tax rates over time and over states of nature. This result arises from the welfare losses associated with distortionary taxes, which are a convex function of tax rates. Thus it is better to have a certain tax rate of 30% than a 50:50 chance of having a 29% or 31% tax rate depending on exogenous factors. This is because the welfare losses of an extra 1% tax rate exceed the welfare gains arising from a reduced tax rate by 1% due to labour supply and other distortions which are an increasing function of the tax rate.

The effect of this result is that government should structure its debt (and other parts of its) portfolio to offset movements in its overall net worth, thereby stabilising tax rates. Thus it should display risk averse behaviour, even though private agents may be risk neutral.

Grimes (1992) takes this result further. He shows that even where a risk averse private sector is able to hedge using the same instruments as government, it is still optimal for government to act to hedge its net worth through choice of its asset/liability structure. The paper combines the government's portfolio choice problem with its decisions regarding the setting of optimal tax rates on each of financial and non-financial income.

In this environment, private sector agents hedge only post-tax income while government levies taxes on all income. This disparity causes government revenue to be stochastic unless it is corrected by having unequal tax rates applied to financial and non-financial income. Stochastic government revenue causes stochastic tax rates, which is welfare decreasing (compared with stable tax rates) as a result of the use of distortionary taxes. Thus if government wishes to stabilise taxes, it must choose a certain combination of tax rates on financial and non-financial income; but the combination of taxes which yields stability does not generally coincide with the optimal tax rates on each of financial and non-financial income.

In order for government to be able to choose the optimal combination of tax rates, it must structure its portfolio to hedge its income (i.e. adopt a risk averse investment approach). Thus adoption of an appropriate risk averse investment strategy is a key ingredient in enabling government to adopt an optimal fiscal policy.

Skilling (1997) comes to a similar conclusion, extending the argument to the case where the Crown acts, in part, as a risk-manager on behalf of citizens, acting, in effect, as a mutual fund.

Huther (1998b), using a variant of Froot and Stein's (1998) model, further argues that the appropriate degree of risk aversion for government in designing its asset and investment decisions depends on the state of its existing balance sheet. A government with low (current and expected future) taxes can be less risk averse than a high-tax government since the deadweight costs of taxes rise as tax rates rise. These approaches favour a portfolio-wide approach to managing Crown assets in order to implement optimal Crown risk management practices. (Note that this conclusion does not necessarily favour centralised management of all assets and liabilities. Portfolio-wide considerations could still be operationalised through decentralised management given appropriate co-ordination.)

A number of approaches, therefore, point to a similar conclusion: The Crown should act as a risk-averse investor. It must manage risk (to the Crown-wide balance sheet) as well as return. The degree of risk aversion which the Crown should display will vary according to the state of the balance sheet, and its ability to manage risk will be subject to constraints (e.g. on eligible investment instruments). Again, therefore, there is a strong case for not legislating a particular approach to risk (except that “prudent” – generally interpreted to be risk averse – management be adopted); however, transparency as to the actual approach to risk being followed is important.

4. Optimal Investment Strategies for a Financial Entity

Previous sections have examined the degree of aggregation at which the Crown should address balance sheet issues. Section 5 takes this issue further. Before doing so, however, it is useful to consider how a financial firm, with a given set of liabilities should structure its balance sheet (specifically its assets) in order to hedge its operations. For instance, it may be that specific “subsidiaries” of the Crown can structure assets in order to hedge their individual liabilities, in which case the Crown as a whole then has to manage only the sum of the net positions of each subsidiary plus any “central portfolio”.

The problem facing the subsidiary manager is essentially that examined by Elton and Gruber (1992). Elton and Gruber (EG) aim to assess how a financial institution with given liabilities should allocate its assets if it is concerned with changes in its net worth (i.e. the net return). The rate of return on a portfolio's net worth is a function of the size and rate of return on each of its assets and its liabilities, leading them to conclude:

In traditional analysis a one period government bill is considered the riskless investment. When liabilities are considered, the riskless strategy is no longer a single instrument but rather a portfolio of 'risky assets' plus the one period government bill ... the definition of the riskless portfolio is not 100% of assets in the one period pure discount government bill, and the return on the risky portfolio is different from and more complex than the return on the risky portfolio in standard analysis. (pp. 873-874)

An implication of this finding is that different investors face different efficient frontiers because of different liabilities. Further, the ratio of assets to liabilities is important in structuring the asset portfolio. If an immunisation strategy is being adopted to match risks on each side of the balance sheet – e.g. duration matching – then:

Immunisation does not involve holding assets with an average duration equal to that of liabilities, rather the duration of liabilities must be adjusted by the ratio of liabilities to assets. (p.877)

To demonstrate, and extend, EG's findings, consider a fund with given liabilities and a given quantity of assets whose task is to structure its assets so as to maximise return subject to a given level of risk. Let:

A = initial sum to be invested;
 L = present value of the liabilities of the fund;
 R_1 = the one period (riskless) spot rate;
 R_A = the rate of return on assets, a random variable;
 R_L = the rate of return on liabilities, a random variable;
 W_0 = initial net worth [= $A-L$];
 W_1 = net worth at the end of period 1;
 R_N = rate of return on net worth, a random variable
 $\equiv \{(W_1/W_0)-1\}$
 $\equiv \{[A(1+R_A)-L(1+R_L)]/(A-L)-1\}$

If a riskless¹⁴ portfolio is desired, and if (as assumed by EG) arbitrage implies that $E(R_A) = E(R_L)$, where E is the expectations operator, then the portfolio will be invested so that the quantity L of assets will be invested in the “risky” security and the rest will be placed into the riskless bill. Thus:

$$\begin{aligned}
 E(R_N) &= \{(A-L)[1+R_1] + L[1+E(R_A)] - L[1+E(R_L)]\}/(A-L) - 1 \\
 &= R_1
 \end{aligned}$$

In other words, a riskless portfolio will comprise a combination of investments in “risky” assets and the riskless bond.

This derivation has been discussed (here and by EG) in terms of a solvent fund, i.e. one that has $A \geq L$. What does it mean for a fund (such as GSF¹⁵), in which $A < L$?

The implication is that such a fund should go short on (i.e. borrow) the riskless asset and invest the proceeds in the risky asset. This apparently highly risky leveraged strategy is designed to deliver an expected net return equal to the riskless rate. Normally lenders will be unwilling to make a loan to an insolvent fund. If the fund is a government entity, the implication is that if government wishes a particular subsidiary to minimise risk, it should be prepared to lend $L-A$ to the fund to enable it to adopt this fund-specific risk-minimisation strategy. If an insolvent fund cannot borrow at all, then (on the above assumptions) it will minimise risk (i.e. achieve an expected net return as close as possible to the riskless rate) by investing all assets into the “risky” asset.

In some cases, because of non-marketable liabilities (e.g. public pensions), $E(R_A) \neq E(R_L)$. In this case, for the fund to have an expected net return equal to the riskless return (R_1) it would need to place X into the “risky” asset and $A-X$ into the riskless asset where:

$$X = L[E(R_L) - R_1]/[E(R_A) - R_1]$$

¹⁴ By “riskless”, we mean a portfolio with an expected net return equal to the riskless return and which has zero covariance with the net return on the CNW of the Crown. Section 5 demonstrates why this is the appropriate “riskless” concept and why – in certain (unconstrained) circumstances – adoption of such a portfolio is appropriate for a financial subsidiary of the type being considered.

¹⁵ Here A and L are the fund’s explicit assets and liabilities. In practice, if a fund has $A < L$, it is technically insolvent and can exist only because it has implicit assets such as a Crown guarantee as in the case of GSF.

Again if $A < X$, then the fund must borrow to invest in “risky” assets to deliver the riskless portfolio.

Another way of thinking of this issue is to consider the case where a fund is technically insolvent and is unable to borrow, but where it is able to invest in a leveraged asset with a return of R_A^* . To obtain an expected net return equal to the riskless rate, the fund would have to invest all its assets (A) in an asset with sufficient leverage to yield:

$$E(R_A^*) = E(R_L) + [E(R_L) - R_1](L - A)/A$$

For instance, if liabilities were three times assets (akin to the GSF), $E(R_L) = 8\%$ and $R_1 = 6\%$, then the fund would have to invest in a leveraged asset yielding an expected return of 12%. On the face of it, this may look like a highly speculative investment, but it is required for the portfolio to yield an expected net return equal to the riskless yield.

The results listed above (which extend those in EG) demonstrate that the objective given to a Crown fund is of crucial importance in determining how a fund structures its assets. It is particularly important when the fund has a major mis-match in the value of its assets and liabilities.

In the case where a fund has a major unfunded liability, the Crown may consider a number of approaches¹⁶, such as:

- a) Lend the fund an amount equal to the unfunded liability and then require the fund to invest the assets so as to achieve the desired risk-return combination.
- b) Specify that the fund should adopt the asset mix which it would adopt if it were fully funded. The fund can then communicate that asset mix to a central ALMO which can factor this mix of assets into the “central” portfolio. Thus if the fund’s preferred asset allocation under this approach was, say, 70% foreign equities and 30% domestic debt, and it had an unfunded liability of \$7 billion, then the central ALMO could hold assets (if it had them) of \$7 billion in this combination, so hedging the risks pertaining to the unfunded liabilities of the specific fund.
- c) Specify a risk level which it wishes the fund to meet (or alternatively a net rate of return relative to the riskless rate). If it chooses this option, it must be prepared to allow the fund to invest in leveraged assets if it requires a net rate of return in excess of what unleveraged investments could yield.
- d) Specify the asset mix of the fund (e.g. all assets invested in “foreign equities”) in which case it has to accept the risk and net return of that fund and incorporate those parameters into its overall risk management exercise pertaining to its total balance sheet.

¹⁶ Each of these approaches implies that the Crown wishes to guide the fund’s decisions. Another option is simply to select a Board and instruct them to invest the assets “prudently” (without defining explicitly what this might mean), ensuring that the Board reports comprehensively to a centralised ALMO on both its assets and liabilities.

Options (a) and (b) are the cleanest options, and ones which suit a decentralised approach with accompanying accountabilities. Option (a) is particularly suitable in this regard, being virtually identical to a regime whereby debt is raised by the Crown and then placed as equity in the relevant fund.

Option (d) suits a more activist centralised asset management role. In this case, the centralised fund would have to understand and continuously monitor the underlying risks of the subsidiary fund. Option (c) is somewhere in between, but is likely to result in more complex monitoring than either (a) or (b).

5. Centralisation versus Decentralisation: Portfolio Approach

Two analytical approaches may assist in considering whether management of the Crown's balance sheet should be conducted at a centralised or decentralised level: a financial portfolio management approach and a general organisational design approach. We consider the portfolio management approach in this section, leaving examination of organisational approaches to section 6.

We begin with the optimal structuring of assets in a private sector defined benefit superannuation scheme. This example is relevant since the Crown's financial liabilities include defined benefit superannuation liabilities and, in each case, management of the scheme's assets is not the core business of the parent (i.e. of the private firm or of the Crown). Exley *et al* (1997) examine asset allocation of corporate defined benefit pension schemes from a modern finance theory perspective. They emphasise that companies do not exist purely for the purpose of providing pension benefits, but are set up with a core business in mind; for example, supplying goods or services to customers. Despite the creation of a separate pension fund, the ultimate liability to meet employee benefits continues to reside with the employer. As a result:

If assets and liabilities are mismatched in a defined benefit scheme, for example if a high equity investment strategy is adopted, the level of market value volatility could generate a far greater source of uncertainty in the value of the firm than that resulting from normal management of the underlying business. (p. 842)

This approach leads Exley *et al* to note that, except for the option of default, shareholders bear the investment risk arising within a pension fund:

In shareholder value terms, the effect is therefore much the same as if the assets and liabilities were directly held on the balance sheet, or, taking the analysis a step further, held directly by the shareholders of the company. (p. 843)

The ability of shareholders and individual pension fund members to rearrange the remainder of their portfolios could be taken to imply that there is no optimal asset allocation for a specific fund. But other factors suggest that a 'matched' or fully hedged portfolio is optimal. The authors argue in favour of matching on the basis that departure from a matched position may result in an increase in the variability of a company's value, giving rise to risk that outside events will divert management effort away from

enhancing shareholder value, having to attend instead to costly remedial actions. They make the case that:

Closer matching of pension scheme liabilities, could reduce the volatility of corporate earnings, increase a company's ability to raise debt and enhance company value. (p. 847)

They note that to determine an optimal funding stance, there must be a wedge between scheme members and the sponsor, to find cash flows which benefit one but which are not exactly offset by costs to the other. One such example is the common interest in avoiding circumstances where pension shortfall triggers bankruptcy. Employees benefit through retention of jobs and superannuation rights from avoiding bankruptcy, while firm value is enhanced by reducing the probability of incurring bankruptcy costs.

Thus they conclude that one cannot look at pension fund assets and liabilities in isolation; one needs to devote attention to the interaction between the company and the pension fund. This results in important advantages to a matching strategy:¹⁷

So we have a blueprint ... the benchmark given to the fund manager would reflect a minimum risk portfolio which most closely hedged the liabilities. (p. 867)¹⁸

This approach is akin to the tax-smoothing argument pertaining to government. Both favour a risk-averse (fully hedged) strategy being adopted.

In terms of governance and appropriate decentralisation, Exley *et al*, emphasise that decentralisation of asset choice to the pension fund is optimal provided asset structure is chosen to match (or hedge) the characteristics of the fund's liabilities.¹⁹ However, this decentralisation is actually driven by "the benefits of integrating actuarial management of a pension scheme into the financial risk management of the firm as a whole." (p. 923)

In order to undertake an explicit treatment of these sorts of issues in a Crown framework, assume that the Crown is concerned with the expected value and variance

¹⁷ In implementing this strategy, Exley *et al* note that assets and liabilities should always be valued at market values.

¹⁸ This analysis assumes that financial assets are fairly priced to reflect risk, and that there are no significant economies of scale in risk-bearing.

¹⁹ In passing, Exley *et al* examine the issue of whether equities are a useful hedge for salaries and conclude that they are not and, therefore, should not form a material part of a defined benefit fund. However, the series that they use for equity returns is dividends which is entirely at odds with their market-based approach: The return should be dividends plus capital gains. Also, they confine their attention to domestic equities rather than international equities. Hence their empirical work in this respect may have little merit. It is an empirical question as to whether equities, bonds, inflation-indexed instruments, etc are a useful hedge for wage developments.

of its net wealth (W) next period.²⁰ For our purposes, conceptualise the Crown's net wealth as comprising two components as follows:

1. A "balanced" pool of assets and liabilities (e.g. RBNZ foreign reserves backed by DMO's foreign denominated borrowing) with assets A_1 and liabilities L_1 where $A_1 = L_1$.
2. An "unbalanced" pool of all other net assets, A_2 .²¹

With these assets and liabilities, in what circumstances can the Crown match certain assets (A_1) against certain liabilities (L_1) and thereafter "ignore" that portion of the portfolio in managing its total portfolio? (Technically, when can we invoke a separation theorem?)

Letting lower case letters denote the expected value of each asset/liability next period, E be the expectations operator, Var the variance, and Cov the covariance, we have:

$$E(W) = E(A_1 + A_2 - L_1)$$

$$\begin{aligned} \text{Var}(W) &= E\{(A_1 + A_2 - L_1 - a_1 - a_2 - l_1)(A_1 + A_2 - L_1 - a_1 - a_2 - l_1)\} \\ &= \text{Var}(A_1) + \text{Var}(A_2) + \text{Var}(L_1) + 2\text{Cov}(A_1, A_2) - 2\text{Cov}(A_1, L_1) - 2\text{Cov}(A_2, L_1) \end{aligned}$$

If the assets comprising A_1 are structured so as to match the liabilities in L_1 then:

$$\text{Cov}(A_1, A_2) = \text{Cov}(A_2, L_1)$$

and:

$$\text{Cov}(A_1, L_1) = \text{Var}(A_1) = \text{Var}(L_1)$$

in which case:

$$\text{Var}(W) = \text{Var}(A_2)$$

This expression demonstrates that the Crown's centralised portfolio manager (interested in the expected value and variance of Crown net wealth) can "ignore" one of its entities in its portfolio management if that entity structures its assets so as to have:

- identical expected return as its liabilities;
- identical variance as its liabilities; and
- an identical covariance with Crown net worth as exists between the liabilities and Crown net worth.

²⁰ This may derive from quadratic utility on the part of the Crown. The period under consideration may conceptually be one quarter or 50 years.

²¹ This may comprise assets/liabilities in a fund such as GSF in which $A \neq L$; a pool of liabilities that are subject to changing allocations (e.g. DMO's liabilities); a pool of assets that are subject to changing allocations (e.g. NZSF); a pool of given liabilities (e.g. the discounted value of future superannuation expenditures); and a pool of given assets (e.g. the discounted value of future taxes).

In this case, managing the assets in A_2 is an equivalent problem to managing the whole of net worth (W).

However, this is no longer the case if there are constraints on structuring the assets in A_2 . If, for instance, political (or other) considerations prevent the sub-portfolio A_2 being structured “optimally”, then it may be preferable from a Crown-wide perspective to jointly manage the assets in A_1 and A_2 given the liabilities in L_1 . In such circumstances, A_1 would not be structured so as to match the liabilities in L_1 .

The question of whether the sub-portfolio A_1 can be delegated to a portfolio manager within a specific entity taking into account solely the liabilities in L_1 is, therefore, an empirical issue depending on the size and constraints on all other asset and liability portfolios. It may be that the size and constraints are such that delegation is possible without causing any portfolio management problems. In this case, other arguments concerning costs and benefits of centralisation and decentralisation, discussed below, should determine the decentralisation decision.²²

If the size and constraints are such that complete delegation implies the Crown-wide balance sheet is not “optimally managed” from a portfolio sense, then these costs must be weighed against the issues discussed below. It may still be optimal in some cases to decentralise, but this would have to be driven by governance and organisational issues rather than by narrow portfolio management considerations.

6. Centralisation versus Decentralisation: Organisational Approach

A considerable body of microeconomic literature has recently examined issues of when corporates should centralise or decentralise their activities. A number of different approaches have been incorporated; here we pull together key relevant insights.

Harris and Raviv (2000) deal with reasons for choosing different organisational structures for conglomerates. Choices may include a hierarchical structure (decentralised or centralised), a flat structure (decentralised or centralised) or a matrix structure, which involves dual-authority relations that combine divisional and functional structures. If a hierarchical structure is adopted, there are choices of whether it should be grouped on a “divisional” basis (e.g. GSF, ACC, etc) versus a “functional” basis” (e.g. corporate treasury, asset management, liability management, etc) and of how many levels might be required.

They argue that the advantage of a divisional structure is that it allows better coordination amongst the various functions, such as manufacturing, product design, personnel, and marketing required to produce and sell a product. Segregating these functions by product divisions, however, results in the failure to exploit economies of scale available if, for example, marketing for all products is handled by a central marketing department. Trading off these advantages helps determine whether one adopts a divisional or functional hierarchy.

²² For a discussion of such issues in a corporate context, see Froot, Scharfstein and Stein (1993).

Coordinating interactions of any kind requires costly expertise embodied in managers. The optimal organisational structure trades off the benefits of coordination against the cost of the necessary expertise. Organisational design will, therefore, depend on the costs and payoffs associated with hiring (middle) managers (i.e. co-ordinators of either divisional or functional groups). Harris and Raviv argue that middle managers have two functions. One is to coordinate projects when they interact. The other is to generate information that allows more efficient use of the CEO (i.e. of top-level decision-making). In particular, middle managers allow a more accurate assessment of whether a company-wide interaction is present, enabling the firm to reap benefits of company-wide coordination.

The authors argue that, in empirical terms, an organization will follow a life-cycle pattern as it becomes more complex and grows:

The structure will progress from a flat, but highly centralized structure, to a divisional hierarchy to a functional hierarchy and then either to a matrix structure or to a flat, highly decentralized structure. We also show that conglomerates that are organised as hierarchies may be expected to exhibit divisional, as opposed to functional, hierarchies. Finally, we show that firms that do not face tight resource constraints, highly regulated firms, and firms in stable environments will tend to have decentralized organizational structures. (p. 7)

Essentially, as a firm becomes more complex, decentralisation becomes necessary, in effect producing more “CEOs”. This finding is consistent with organisation behaviour literature which documents a positive relationship between size and extent of decentralization within corporates. However, in accordance with intuition, increases in synergy gains from exploiting company-wide interaction may cause the optimal design to change from a decentralized to a centralized structure. Hart and Moore (1999) also relate the extent of centralization to the size of coordination benefits.

The Harris and Raviv paper abstracts from incentive problems. They note that these would introduce considerations of providing incentives to transfer information truthfully across managers within the organisation structure. In particular, centralisation of decisions would become more costly in such situations.

Additional issues are highlighted by other authors. For instance, Radner (1993) assumes that information processing takes time. Hence it is better to use “parallel processing” rather than “centralised processing” in some cases.

Stein (2000) also emphasises information issues. He examines “decentralisation” versus “hierarchy” (centralisation) within an organisation as preferred ways of allocating a fixed amount of capital. If information is “soft” (i.e. cannot be directly verified by anyone other than the agent who produces it) then decentralisation is preferred; but hierarchy is preferred when information is hard (absent other complications). Decentralisation is advantageous with soft information because it strengthens the research incentives of line managers; the manager knows his research effort will not be wasted (which could happen if someone else were to make the decisions). The

countervailing cost is that decentralisation does not allow for efficient reallocations (decisions) across operating units, while a hierarchical design does.

If information can be hardened, then hierarchies may be superior because they give an incentive to managers to generate more and better research (especially in an environment when entities are competing for capital). But if hardness of information is not exogenous, then hierarchies can lead to inefficient over-production of information.

Stein questions why one might choose to decentralise a firm (that uses soft information) rather than break it up. The resolution lies partly in the potential for synergies. If synergies are small, it may make sense to resort to maximum decentralisation – i.e. to break up the firm. If synergies are larger, it may be better to keep the firm integrated but do as much as possible to mimic decentralisation in terms of division-manager incentives.

From a Crown asset management perspective, these analyses suggest that decentralisation of some activities requiring decentralised information (e.g. choosing asset allocations to match liability characteristics) may be optimal. However, it may also be optimal to retain centralisation of other components (e.g. back office functions) where synergies are greatest.

Bolton and Dewatripont (1994) examine the importance of costly communication arising from the time it takes an agent to absorb new information sent by others. Agents can reduce this time by specialising in the processing of particular types of information. When these returns to specialisation outweigh costs of communication, it is efficient for several agents to collaborate within a firm. They quote Chandler (1966):

The basic reason for the success (of the multidivisional form) was simply that it clearly removed the executives responsible for the destiny of the entire enterprise from the more routine operational activities, and so gave them time, information, and even psychological commitment for long-term planning and appraisal.

This insight could be relevant to the issues at hand. It would be consistent with a centralised asset/liability management function responsible for strategic decisions and co-ordination across “divisions”, combined with decentralised matching of assets to liabilities at the individual entity level.

Williamson (1988), applying transaction cost economics to corporate finance, argues that transaction cost differences between markets and hierarchies are principally responsible for the decision to use markets for some transactions and hierarchical forms of organisation for others. Firms are a governance structure in which agents possess bounded rationality but also may display opportunism. The goal is to craft governance structures resulting in credible commitments.

This entails aligning transactions (especially of asset specificity combined with incomplete contracts) with appropriate governance structures. He treats hierarchical decomposition and control as part of the organisation-form issue including unitary versus multi-divisional structures. Williamson concludes that governance structures which mitigate hazards and facilitate adaptation have much to commend them.

In this light, decentralised structures, which tend to enable adaptation, may have merits in a field such as asset management, in particular where the circumstances of particular entities are changing over time.

A number of papers have examined centralisation issues in the context of firms deciding on a portfolio of physical capital investments. A recent example is Vayanos (1999), who assumes that:

- (a) aggregation results in a loss of useful information, and
- (b) decisions of agents in different parts of the organization interact – or should do so – since agents' information sets are relevant to agents in other parts of the organisation.

He examines the extent to which aggregation results in a loss of information that is useful to the CEO, especially when the organisation has potentially important internal synergies or interactions. In light of this question, he questions how to optimally decentralise information processing and decision-making through adoption of hierarchical or other structures.

These questions are closely related to the issues at hand, and indeed Vayanos motivates the issues by referring to how investment companies form their portfolios. He cites Sharpe and Litterman, who both note that investment companies usually form their portfolios in a hierarchical manner – e.g. a bond portfolio, equity portfolio, etc. The result is that sector portfolios are not “globally” optimal. For instance, an analyst may have information on all the stocks within his sector, but communicates only the sector portfolio to the country expert, even though the analyst's detailed information would be useful to the country expert. When changing asset allocation within or between countries, country experts generally scale analysts' portfolios up or down without changing their composition, even though conceptually it may be optimal to do so.

To explain this behaviour, Vayanos assumes:

- (i) a “processing constraint”, i.e. that agents cannot process too many assets at once;
- (ii) a “communications constraint”, i.e. that communication takes place along hierarchical lines; and
- (iii) a “constraint on agents' objectives”, i.e. agents choose their portfolios by solving mean-variance problems but do not take into account interactions with other analysts' portfolios. This leads to different portfolios from the globally optimal portfolio even though the entire entity (sharing the same utility function) also wishes to solve a mean-variance problem.

Vayanos assumes that factor loadings (risk factors) for assets managed by different analysts change (randomly) over time, so making it difficult for a centralised entity to evolve towards an optimal portfolio structure. This assumption could be relevant, in a

modified form, to considering management of assets to meet differing streams of liabilities (subject to different random factors) across decentralised entities. This approach is related to that of Bolton and Dewatripont (1994), who assume that decentralisation is valuable because it allows agents to specialise by processing the same type of items more frequently. It is also related to Radner's (1993) approach favouring parallel processing for information reasons.

In Vayanos's approach, the communications constraint consists of three assumptions. First, the organisation has a hierarchical structure. Second, information flows up the hierarchy. Third, agents transmit to their superiors their portfolio's expected payoff, factor loading, and variance due to idiosyncratic risk. Each agent is assumed to have an objective function similar to the overall organisation's objective function, but the central (or principal) agent's objective concerns the portfolio of all assets, while each other agent's objective concerns only the assets under that agent's control. The agent thus does not take into account the interactions between the assets under his control and those not under his control. These assumptions appear consistent with real world investment company practices and so constitute a reasonable first step in studying the decentralisation of the portfolio problem.

Optimally (with full information, zero transactions costs, etc.), there is an interaction between an overall portfolio's factor loading (risk) and an individual asset's factor loading: As the portfolio becomes riskier, the investment in any risky asset, n , decreases. This interaction term is the reason that an organisation's portfolio is not optimal if each agent chooses investment in asset n without taking into account the interactions with the assets not under his control.

One can then consider that an optimal hierarchical structure is one that produces close to the optimal investment structure *for many sets of factor loadings* – i.e. the structure needs to be robust. This is a very important point, and one that is relevant to the issues at hand. In designing an institutional structure to manage the Crown's assets and liabilities, the structure must be robust across potentially major changes to the environment – whether these stem from economic reasons (e.g. a change in risk, returns, actuarial calculations, etc) or political reasons (e.g. changes to liabilities driven by legislation).

Vayanos notes that if there is a "group" component to factor loadings, it raises the issue of whether organisations should be structured according to functions, products or in a hybrid (matrix) fashion. One reason for agents not communicating portfolio characteristics to one another in practice may be that they use different definitions of factor loadings and so an agent's factor loadings may not be meaningful to other agents. Vayanos gives an example of a manager in charge of a "world" portfolio using, as factors, US output and world output, while the manager in charge of the US portfolio uses US output and US exports. If US exports are a linear combination of US output and world output, both agents are using the same model, but different factor loadings. Once this example is extended to managers dealing in accident insurance liabilities, pension funds and foreign reserves, the potential for different factors becomes very high indeed. In such circumstances, the ability to aggregate information within a centralised body (a centralised asset-liability manager) may become very difficult, and decentralisation of asset allocation becomes an attractive option. (However,

decentralisation of deal execution, back office, etc is not necessarily supported by this argument, especially if different subsidiaries invest in similar types of instrument.)

Froot and Stein (1998) examine another issue of relevance in a financial environment. They look at two key effects on bank behaviour of taking on non-tradable (e.g. credit) risk. First, there is a covariance spillover effect. Holding fixed the bank's risk aversion, investment in any specific product will be less (more) attractive to the extent that there is also a significant investment made in another product with positively (negatively) correlated non-tradable risk. Second, there is a bank-wide cost of capital effect. Even if all the covariances across the new products are zero, investment decisions are in general interdependent because they can all influence the bank's risk profile. For example, if the bank takes a large, very risky position in one product, even if this position has zero covariance with all others, the position might make the bank less willing to take on any other risks.

This implies it is optimal (*ceteris paribus*) to centralise all investment decisions, but in practice centralised decision-making may be difficult. Froot and Stein argue that this is likely to be especially true when decisions are made at very high frequencies. They further contend that a decentralised approach may work well if individual decisions are small and there is reporting from time to time to the centre. In such a situation, the centre can send hurdle rates back to individual managers reflecting institution-wide considerations.²³

In practice, banks and corporations often use "risk-adjusted return on capital" (RAROC), where each investment under consideration is allocated a certain amount of capital. Multiplying the allocated amount of capital by a cost of capital yields a capital charge. Whether this is optimal or not depends on how the capital charge is set. This is, of course, the way that the Crown works now for non-financial assets, presumably because decentralised management of these assets is cheaper than centralised management of those assets. It is also the way that most financial institutions operate. In these cases, asset portfolios can in principle be adjusted quite rapidly, and fully decentralised decision making could become extremely unwieldy.

7. Practical Insights

While Crown asset management has some unique features (the ability to under-write payouts through the power to tax, for one), it also has many features that are akin to asset and financial management across financial conglomerates and multinational enterprises. Practical insights of corporate management practices from a number of sources are summarised below, with contrasts to current financial management within Crown entities.

PricewaterhouseCoopers Study

PricewaterhouseCoopers (PwC, 2000) conducted research for New Zealand Treasury to examine private sector "best practice" in financial asset management, concentrating

²³ With improved technologies, hurdle rates reflecting institution-wide considerations can be computed and relayed back to subsidiaries much faster than previously, reducing potential inefficiencies resulting from use of out-of-date hurdle rates.

in particular on management within international financial services conglomerates. They examined the degree of centralisation versus decentralisation of a number of activities and the rationale for the resulting structures. Activities included:

- governance:
 - objective setting
 - specification of mandate
 - policy setting
 - portfolio design;
- front office:
 - market research
 - strategy determination
 - strategy execution;
- back office (transaction processing):
 - deal capture
 - settlement
 - accounting;
- middle office:
 - risk management (VaR and exposures)
 - performance measurement
 - compliance and performance reporting.

At the governance level, each of the five surveyed conglomerates had a matrix structure, with decision-making and organisational governance converging at the board of directors. Process governance is sometimes initiated at a decentralised (business unit) level but signed off at a higher level. Mandate setting – i.e. the specification of a “default” (or strategic) asset allocation – is normally initiated at the business unit level because of its understanding of the unit’s liabilities. However, the process does not end there: It is usual for the mandate to be signed off by a centralised body. Frequently, the board, or other centralised body, will seek external advice regarding the in-house recommendations coming from business units.

Tactical asset allocation relative to the mandate’s baseline settings is normally conducted in-house at a centralised level. Firms understand that having different subsidiaries taking conflicting asset allocation positions (e.g. one subsidiary going short on domestic equities and the other going long on the same assets) does not add value, but does add costs.

Management of individual portfolios (e.g. “foreign equities”) is normally devolved to specialist managers. This frequently includes out-sourcing, unless specialist in-house staff already exist, and/or the activity is seen to be central to the organisation’s mission.

Back and middle office operations, which historically have tended to be decentralised, are increasingly becoming centralised to take advantage of economies of scale and consistent risk management, resulting in reduced costs and increased efficiency.

Improved technology is increasingly enabling centralisation of back office functions to occur even across geographically disbursed operations.

Technological considerations have also opened up the possibility of outsourcing back and middle office functions. To date, little such outsourcing has occurred, but it is increasingly being considered, especially as sunk costs involved in such activities depreciate (e.g. as computing systems have to be replaced). Providers, based around custodial companies, are now available to undertake outsourced back and middle office functions.

Overall, the study found that the key drivers towards increased centralisation of financial management functions are:

- improved governance (especially better compliance and reporting);
- increased skills (especially in risk management); and
- economies of scale (especially pertaining to back office).

The second of these points (centralised risk management) is increasingly a key driver for centralisation of governance and related functions. It is up to the centre to decide whether to embark on “risk mitigation” (i.e. undoing risks arising from decentralised decisions) or “risk leverage” (taking on risks relative to a base mandate). Combined with technological improvements, the overall trend in financial management of conglomerates is increasingly towards centralisation of functions, with the exception of mandate preparation which, in the main, remains decentralised.²⁴

Corporate Treasury Survey

The 1999 Corporate Treasury Survey conducted by KPMG and the New Zealand Society of Corporate Treasurers reports information pertaining to outsourcing of financial management functions amongst New Zealand corporates. Apart from treasury advice and policy setting, and superannuation and insurance, no other category of middle/back office had been out-sourced by over 7% of treasury operations. For instance, accounting had only been outsourced by 3% and virtually no firms had outsourced settlements.

However, 20% had considered outsourcing settlements, and 10% had considered outsourcing accounting; just over 25% had considered outsourcing accounts payable and systems administration. The survey reports that the major drivers of outsourcing are:

- Cost efficiency (38%);
- Limited staff resources (31%);
- Non-core function (28%).

The major reasons given against outsourcing are:

- Loss of control (86%);
- Savings not achievable (71%);

²⁴ Recalling that mandate sign-off tends to be centralised.

- Not satisfied with level of security (37%).

The increased consideration of outsourcing may indicate that changing technologies are leading firms to examine the possibilities in this direction where previously these functions had to be conducted in-house. In this light, the reasons against out-sourcing (particularly lack of savings, and even dissatisfaction with level of security) may become less relevant over time.

Multinational Company Practice

Wallace (2000) reports results of a Greenwich Treasury Advisors survey of the management of foreign exchange risk across 31 major multinational companies based in Europe and the United States. As well as an overall trend towards adopting more concrete foreign exchange management practices, there were trends towards transactions cost reduction and centralisation of activities.

Nearly all the 31 firms surveyed had centralised their trading and back office functions, and most had centralised risk management. These developments were in spite (or possibly because) of their having subsidiaries and branches across many separate countries and regions. They had been facilitated by improved technology that enabled centralisation and had been driven by cost and risk management considerations.

A similar perspective comes from a description of the New Zealand Dairy Board (NZDB) approach to financial management (Taylor, 2000). The NZDB has centralised its treasury function into a Global Treasury Centre. This acts as a shared services centre with functions that include:

- Setting global treasury policies;
- Auditing subsidiary financial and treasury practices;
- Managing a centralised pool of foreign exchange assets;
- Executing all foreign exchange transactions;
- Forecasting and managing group-wide liquidity;
- Controlling global short- and medium-term financing;
- Managing group-wide collections and disbursements;
- Managing bank relationships.

Taylor summarises key advantages and disadvantages of centralising treasury activities as:

Advantages

- Optimisation of group assets and/or liabilities;
- More effective foreign exchange management;
- Lower cost of funding and improved foreign exchange pricing;
- Lower personnel costs and lower cash usage;
- Specialist expertise available at one site;
- More sophisticated risk management techniques are available;
- Less operational risk;
- Better informed senior management.

Disadvantages

- Inability to be aware of all relevant regional (subsidiary) issues;
- Slower response to local issues;
- Resentment from subsidiaries.

Overall, the advantages of centralisation are seen to outweigh the disadvantages, leading Taylor to conclude that there is “now overwhelming support for the centralisation of treasury – and indeed the onus is on those who have not centralised to justify the reason why.” Further, “automation of business processes and globalisation of business units means that global treasury centres will become more common” in recognition of the modern approach that capital optimisation is a centralised function.

These cost-driven conclusions are supported by risk-driven factors: “As multinational corporations adopt more enterprise wide risk management practices and pursue the aggregation of risk into common risk measures, the rationale for Treasury centralisation will be clear for all to see.” At the Crown level, these risk management factors (which are magnified by the presence of political risk) point to particular benefits of centralised risk-management practices.

Crown Entity Practices²⁵

As a contrast to corporate “best practice” approaches discussed above, Crown entities (CEs) generally manage financial risks according to a decentralised approach. The assumption is that CEs are accountable for managing their own financial (and other) risks, are in the best position to do so, and face the right incentives to manage these risks appropriately. Each entity manages its own foreign exchange risks, but if this risk is material, then the existence and management of foreign exchange risk should be covered in its Statement of Intent.

Credit risk is one area which the Crown has sought to control centrally because of the accumulation of such risk across the Crown, but this is done only for entities which do not have a specific investment regime in their enabling legislation. The large Crown entity investors have specified investment regimes and so are not covered by these credit directives. However, because these are the large investors, they are the very entities which should be subject to centralised directives on credit exposures if the concern is with aggregate Crown exposures to certain credits. A further anomaly in current Crown entity financial management practice is that specific investment regimes embodied in crown entities’ enabling legislation are inconsistent with one another.

Overall financial, including asset, management practiced by entities within the Crown sector is at odds with evolving best practice in the corporate sector. The lack of centralised governance, risk management, and execution, and the duplication of costs is at the opposite end of the spectrum to modern corporate practice (although is not necessarily inconsistent with past corporate practices). The implication, discussed below, is that introduction of tighter asset and financial management practices into the Crown sector could be beneficial in risk management and efficiency terms.

²⁵ This material is derived from “Crown Entity Reform Paper 3: Financial Arrangements” (May 2000) available on the Treasury website at: www.treasury.govt.nz/crownentity/paper3.asp.

8. Criteria for Evaluating Crown Financial Asset Management

The foregoing analysis, drawing on both theoretical and practical insights pertaining to the public and private sectors, suggests a number of criteria for evaluating the Crown's asset management activities. Inevitably, there is personal judgement involved in the choice of these criteria, but for the most part they flow directly from the previous analysis, which consistently points to a range of similar criteria.

An appropriate Crown financial asset management regime should be designed to:

- Be consistent with alternative approaches to defining the Crown's risk tolerance and the Crown's balance sheet, including definitions relating to:
 - comprehensive net worth;
 - reported net worth;
 - intermediate definitions.

Accordingly, it should be able to adapt to changing definitions of the Crown balance sheet, and should be managed in a fashion consistent with management of overall Crown liabilities to enable the Crown to achieve its desired risk profile.

- Provide legislative and/or other protections against raiding.
- Enable matching of assets to specific pools of liabilities so as to simplify management of the overall Crown portfolio, consistent with an optimal portfolio approach. As a result, the design should ensure that information about liability pools feeds fully into the initial setting and periodic revision of baseline asset allocation mandates pertaining to those pools.
- Have clear accountabilities (and associated monitoring) for designing asset allocation mandates to achieve desired risk-return profiles.
- Minimise contradictory asset allocation moves relative to baseline mandates across subsidiary entities.
- Employ the best available asset managers, without favouring in-house managers over other available managers.
- Ensure control over individual and aggregate credit risks across the total portfolio.
- Minimise transactions costs arising from the duplication of functions such as:
 - execution of trades;
 - back office processing;
 - middle office monitoring and reporting.

This may be through centralising in-house back/middle office operations, or through out-sourcing these operations to an independent provider, depending on the relative costs and benefits of doing so.

- Ensure that all legal requirements are met and (given the inherently political environment for the Crown) are perceived to be met. This includes ensuring that there is no insider trading and no perception of insider trading arising from receipt of Crown-specific information (e.g. fiscal and monetary policy decisions).

9. Implications for Crown Financial Asset Management

The Crown balance sheet currently lists a number of major liability pools associated with specific entities including ACC, EQC, NPF, GSF, RBNZ and DMO. For the most part, as described in the Appendix, these pools are fully or partly funded by assets. In addition, the Crown has other blocks of liabilities which are implicitly, but not explicitly, on its balance sheet. NZS (currently unfunded), for instance, is conceptually a similar liability to GSF, which is on the Crown balance sheet.

The assets of a number of the entities are managed in similar manners. For instance, each of ACC, NPF, GSF and potentially EQC and NZSF invest in one or more of the conventional asset classes: domestic bonds, foreign bonds, domestic equities, foreign equities, cash and property. The RBNZ is an exception in this respect, with its assets held as short-term liquid foreign fixed interest instruments in order to meet potential exchange rate intervention and other needs.²⁶ Reinsurance activities (e.g. by EQC or DMO) are another separate activity.

The criteria established in section 8 – and the personal judgements that flow therefrom – indicate that certain activities associated with managing the assets should be decentralised and some should be centralised. Particular implications are as follows.

Mandate Setting

In each case, the entity should be responsible for setting the mandate for managing assets within that entity after considering the nature of its liabilities. The primary objective for a fully funded entity should be to structure the assets in such a manner as to minimise the risk to the net value of the portfolio (see below for a part funded entity). Thus a fund that has liabilities which are highly correlated with foreign equities will have a high proportion of its assets in foreign equities. Another fund which has liabilities that are highly correlated with domestic bonds will largely hold domestic bonds.²⁷

²⁶ Archer and Halliday (1998) discuss reasons for holding foreign reserves. The RBNZ's foreign reserves holdings are an example of matching liabilities and assets. The DMO raises funds in offshore markets and transfers these to the RBNZ to manage. The RBNZ is accountable for its asset management relative to the benchmark agreed between the two organisations; the DMO is accountable for management of residual risks if the funds it raises are not identical to benchmark.

²⁷ A variation to this approach is required for the RBNZ's reserve holdings. In this case, it is the structure of the assets (i.e. the foreign reserves) that primarily needs to drive the nature of holdings (since that is the purpose for which they are held) although the cost of raising the

Management of exchange rate exposures becomes an integral part of portfolio management within each entity driven by the influence of exchange rates on liability values.

This approach ensures that there is decentralised analysis of the nature of liabilities within each entity. It is at this level where the greatest information, and the strongest incentives to interpret this information accurately, exists. Thus each entity should establish, and periodically re-evaluate, a baseline asset allocation (including foreign exchange exposures) for the entity's asset portfolio.

The entity would be accountable for its setting of this asset portfolio. It would not be subject to outside direction (Ministerial or official) over its asset allocation policy. To ensure appropriate accountability, the analysis behind the exposure of the liabilities to various factors and the resulting asset allocation choice should be reported comprehensively to a central monitoring unit (most probably within Treasury). This monitoring unit would in turn ensure that this information was available to any centralised Crown Asset-Liability Management Office (ALMO) to assist in its positioning of overall Crown risk (see below).

It should be noted that this approach of matching assets to liabilities within specific entities is not necessarily globally optimal where the "centre" (e.g. Treasury) does not have the instruments to achieve a globally preferred portfolio. In these circumstances (as shown in section 5), the centre may theoretically wish to mandate an unmatched portfolio within a specific entity.

For accountability purposes, however, this latter approach can be problematic. If it were to be pursued, one way to minimise accountability issues is to allow the centre to mandate the portfolio of just a single entity (one large enough to significantly affect the entire portfolio structure). This may be most appropriately done through a fund which is not specifically tied to an explicit pool of balance sheet liabilities.

For the case of an entity with only a partially funded portfolio, the situation is more complex (as shown in section 4). Political considerations suggest that it is inadvisable to require a partially funded entity to structure its assets so as to match the exposures of its liabilities to certain factors. Such a portfolio would be highly leveraged, resulting in asset returns that would be highly volatile. Even though such volatility may be optimal in order to minimise variance to the entity's net worth, it could be judged to be politically unacceptable, especially at times of negative returns.

Accountability and compatibility reasons suggest that partially funded entities should be required to engage in the same mandate-setting process as fully funded entities as if they were fully funded. Their assets could then be invested in a manner that reflects the derived asset allocation. The information regarding the exposures of its liabilities and consequent structure of assets would be reported to the centre, including to a central ALMO, enabling the ALMO to position its assets/liabilities to take account of the funding short-fall of the specific entity.

liabilities (by DMO) also necessarily informs the decision over the structure of both the liabilities and the assets.

Alternatively, if constraints prevent ALMO achieving a globally optimal portfolio, it could make sense (albeit enlarging principal-agent risks) for ALMO to request that the entity just hold certain asset classes that the fund would hold anyway, to assist in achieving the global optimum. For example, assume GSF has liabilities of \$12 billion and assets of \$4 billion, and that analysis of its liabilities yields an optimal asset structure (if fully funded) comprising \$4 billion domestic bonds, \$2 billion offshore bonds, \$1 billion domestic equities and \$5 billion foreign equities. Further assume that at a Crown-wide level, ALMO wishes to enlarge its holdings of foreign equities by more than \$5 billion and wishes to reduce (or at least not increase) its holdings of other asset classes. In such circumstances, if there were no other way of achieving the global optimum, it would be theoretically preferable from a global portfolio management perspective to request GSF to hold its \$4 billion asset portfolio purely in foreign equities.^{28, 29}

The advantage of requiring asset allocation for each entity to be derived at the decentralised level (apart from averting political shocks) is that the decentralised information processing regarding the nature of liabilities and appropriate asset structure is maintained at the entity level, with resulting informational, incentive, accountability and monitoring advantages. At the same time, the ALMO has the information from the specific entity required to match the unfunded part of the entity's portfolio – whether or not it has the power to direct on fund-specific asset allocation according to global portfolio considerations.

ALMO

Because the Crown is concerned with its overall risk profile, it needs a centralised asset/liability manager (ALMO) to consolidate all the Crown's risks pertaining to whatever balance sheet definition it chooses to manage and to manage residual assets and liabilities accordingly.

To preserve a policy-operations split, the ALMO should not be responsible for advising on the actual definition to be adopted for the Crown balance sheet. That recommendation should be made independently, most likely by (another section of) Treasury, albeit after consulting with, and utilising the expertise in, ALMO. It is important that this recommendation be made explicitly and transparently since without it all other risk management operations by subsidiary entities are greatly diminished in usefulness.³⁰

²⁸ Another option is for the centre to lend the unfunded portion to the entity or for the Crown to choose to fully fund the entity. The entity can then invest as if it were fully funded. This has relevance to the choice of whether to establish an NZSF while other Crown entities have large unfunded liabilities (especially GSF). For accountability reasons, it may be preferable to use fiscal surpluses to “top up” these other funds prior to establishing an NZSF.

²⁹ ALMO may also wish to direct an entity on its foreign exchange exposures in order to achieve an appropriate Crown-wide exposure to foreign exchange risks. Alternatively, ALMO may unwind exposures taken by specific entities (but via the ALMO book) to arrive at the desired global exposure.

³⁰ The theoretical preference, as discussed in section 2, is to adopt as wide a definition of the Crown balance sheet as possible, while putting in place mechanisms to minimise various forms of raiding. Risk minimisation in this context essentially corresponds to minimising shocks to future tax rates.

The approach whereby fully funded entities match assets to liabilities to the greatest extent possible simplifies ALMO's task, as does the reporting by partially funded entities of the required asset holdings to offset the unfunded portions of their liabilities.

The ALMO would incorporate (or be an expanded version of) the DMO. To enable it to undertake its task appropriately, it may also require a pool of assets to manage, or at least direct. The largest such pool, and one which is not directly linked to a specific legal entity with its own liabilities, is the proposed NZSF. The possibility of influencing the asset structure of such a pool raises a number of considerations:

- There is a case – given by overall Crown risk management reasons – to enable the ALMO to determine the asset allocation of an NZSF to enable management of overall Crown risk.
- The opposing case, discussed in section 2, is that such discretion could result in various forms of politically determined “raiding” to the detriment of the overall Crown position. (However, suitable legislative and institutional structures could lessen this risk as, for instance, the RBNZ Act and Fiscal Responsibility Act did for monetary policy and fiscal policy.)
- A compromise position is to enable ALMO to over-ride an NZSF's board's preferred asset allocation explicitly and transparently solely for Crown-wide risk management purposes.

The optimal choice out of these three options is clouded by political economy perspectives. However, if appropriately structured, the third of these options (power to exercise an explicit, transparent over-ride but solely for Crown-wide risk management reasons) is arguably a reasonable compromise that enables both optimal Crown-wide risk management while minimising potential raiding.

Another role for an ALMO, which cannot be undertaken in a decentralised fashion, is overall management of Crown credit risk. It is logical for the Crown, through ALMO, to establish and impose consistent credit-risk criteria across all its operations.

Further, aggregation of the Crown's credit exposures to specific counter-parties, and possibly also on a sectoral and country-basis, needs to be monitored centrally, implying that ALMO must have the ability to gain the relevant information from subsidiary entities. Where the resulting aggregated credit exposures are deemed inappropriate, the ALMO must have the ability to use credit-risk derivatives (or other instruments) to manage down the exposures and/or have the ability to limit credit exposures of specific Crown entities. The latter implies that the ALMO must have the power to direct individual entities on credit risk matters where Crown-wide risk limits may potentially be breached.

Tactical Asset Allocation and Portfolio Management

Once individual mandates have been set for each entity, with their embodied baseline asset allocations, there are a number of portfolio management aspects to consider. These include:

- The degree of tactical asset allocation changes relative to the baseline (e.g. increase foreign equities by 5 percentage points and reduce domestic cash and domestic bonds each by 2.5 percentage points).
- Management of assets within each asset class (e.g. how to structure the domestic equities portfolio). Included in this decision is whether to adopt active or passive management within each portfolio.
- Whether to conduct either or both of the above functions internally or to out-source them – and, if the latter, to choose the out-sourced managers.

In order to minimise any actual or perceived insider-trading, a central ALMO cannot engage in tactical asset allocation moves. Subsidiary entities could (and do) undertake such moves. However, there is a major question as to whether it is sensible for them to do so. This is for two reasons.

- Firstly, evidence³¹ suggests that tactical asset allocation does not add value on average.
- Secondly, uncoordinated shifts in asset allocations across a number of subsidiaries may be entirely offsetting, so engendering costs without any potential benefits (hence the move to centralise tactical asset allocation in private sector conglomerates).

Given these reasons, it is prudent to require that neither the ALMO nor the individual entities undertake tactical asset allocation switches. Asset allocation changes should be purely at the strategic level involving changes to mandates consequent on revised estimates of liability exposures.

Asset management within individual asset classes is a large international (and domestic) business with specialist providers of both active and passive management.³² There is no reason to expect that Crown subsidiaries have any advantage over private providers in this field. In addition, this is a field in which there are economies of scale in terms of management costs (including IT costs, information gathering costs, risk management costs, etc). It is also a case where deficient (or unlucky) in-house management could raise unnecessary political risks. Hence unless there is strong evidence to the contrary (e.g. of a highly successful domestic equities unit in a particular entity), the presumption should be that stock selection be out-sourced.

In order to manage out-sourcing of this and other activities (especially back/middle office functions, as discussed below), it is efficient to garner economies of scale by establishing a central body to under-take these functions on an agency basis for Crown

³¹ The classic reference is Brinson *et al* (1986).

³² Again, Brinson *et al* (1986) produce evidence that active stock selection adds little or no value, but this may change depending on circumstances, and the ability to choose active or passive managers should probably be best left to those accountable for choosing relevant managers. Baierl and Chen (2000) note that the proportion of a portfolio devoted to active management should be positively related to the investor's risk tolerance.

bodies. The current NPF formula, with an independent Board, works well in this respect and could be an appropriate starting point. Their ability to use specialist advice across a number of funds and to contract on a large scale with specialist fund managers enables costs to be reduced on a per-fund basis.³³

Centralisation of back and middle office functions across Crown agencies is likely to be an efficient development. Not only are there administrative savings possible, but centralised credit risk management should enhance risk management practice and skills across the entire Crown portfolio (and potentially also to other Crown entities and departments). Centralisation of these functions is consistent with private sector conglomerate practice. If selection of stock selection managers were centralised as discussed above, it would be straight-forward to centralise back/middle office (including reporting, etc) through the same relationship.

There is no reason for these centralised activities to be undertaken by a state sector organisation. Specialist services are available to undertake these functions (selection of stock selection managers, back and middle office). However, as a first step, existing state-related infrastructure (e.g. NPF) could be adopted with little difficulty. Over time, the issue of whether to retain this role in state hands or to out-source it to the private sector is essentially an empirical matter of who is likely to do it best.

Similarly, there is no reason to force existing entities immediately to adopt the approach outlined above. For instance, a certain entity may be operating extremely successfully on its own (possibly with stock selection in one or more sectors being undertaken internally). As a result of history, its resources may be particularly prone to success in a particular market. If this were the case, it would be important to monitor performance externally on an ongoing basis to ascertain if performance were being maintained. If/when performance, or factors leading to performance, were to diminish, work could begin to transfer its stock selection and linked operations to a centralised body. Such a staged approach would also make sense in terms of ensuring that the infrastructure were not overloaded through transitional pressures.

10. Concluding Comments

The approach outlined above, which derives from the theoretical and practical insights earlier in the paper, can be very briefly summarised as:

- Charge individual entities with setting mandates for asset management which reflects the nature of their liabilities, with the entity having an obligation – in the absence of any over-riding centralised decision from ALMO – to match assets and liabilities to minimise risks to their net worth.
- Establish an ALMO to manage Crown-wide risk, taking into account the portfolios adopted by individual entities. The ALMO should structure Crown financial

³³ As noted previously, the RBNZ's foreign reserves do not fit into this model owing to their different nature. They are likely to be best managed either by the RBNZ itself or through an out-sourcing arrangement at the discretion of the RBNZ. Similar caveats attach to reinsurance activities of Crown agencies.

liabilities to shift the global Crown portfolio towards the desired point on the risk-return frontier. The risk-return frontier faced by ALMO should relate to as broad a Crown balance sheet definition as is informationally feasible. In practice, the current RNW definition could be expanded to include, for instance, future NZS liabilities, particularly with the likely build-up of assets within NZSF.

- It is an open question as to whether an ALMO should also have the ability to direct at least one Crown financial entity as to its asset portfolio – after receiving information on optimal asset allocation from that and other entities. It would do so only in order to achieve a globally optimal Crown portfolio in circumstances where liability management alone could not achieve the desired point on the risk-return frontier. (This may be because of the small size of ALMO's liabilities or because of the presence of constraints on instrument choice.) Any such direction should be transparent and must be shielded from short-term political pressures.
- Adopt a centralised body to manage out-sourcing of stock selection to specialist managers (active or passive) and to manage and/or out-source back and middle office functions.

This approach is consistent with modern best-practice private sector management both of financial conglomerates and of multinational enterprises. It ensures that:

- Entity-specific knowledge of liabilities is utilised to the full (in setting asset management mandates);
- A central body charged with Crown-wide risk management is operational and has the ability to undertake its tasks; and
- Economies of scale across the Crown sector are maximised.

There is no imperative to rush into implementing this approach, but it does provide a framework for consistent evolution of the system over time, and is likely to yield cost savings and improved risk management across the Crown-wide portfolio.

Appendix: Crown Financial Institutions: Current Portfolios

*Greg Horman**

1. This appendix describes the portfolios of the Crown's financial institutions and briefly discusses some important aspects of how they are managed. It is not an exhaustive description, but instead highlights key characteristics of those portfolios, such as size, asset class allocations, and the liabilities against which they are held.

Accident Compensation Corporation

2. ACC held financial assets of \$2,623 million as at 31 August 2000 to cover the future costs of accidental personal injury claims. ACC is structured into different funding accounts, which it is required to manage as separate funds, that are responsible for insuring different categories of injury, grouped by where the accident occurs and the employment status of the person suffering the accident.

3. The cash portfolio, with assets of \$464 million, is used to meet liquidity requirements. The three reserve portfolios, with assets of \$2,159 million, hold diversified assets. The following table summarises the holdings of ACC:

Reserve portfolios	Investments	Solvency ⁽¹⁾	Asset allocations ⁽²⁾						
			C	NZB	NZI	OB	P	NZE	OE
Motor Vehicle	356.3	32%	3%	26%	13%	1%	2%	22%	33%
Residual Claims	799.8	34%	3%	36%	17%	2%	2%	17%	25%
Earners	1,002.8	106%	3%	45%	19%	4%	1%	12%	16%
Total	2,158.9								
Cash portfolio	Investments		Asset allocations ⁽²⁾						
			C						
Liquidity	464.0		100%						

¹ Projected as at 30 June 2001

² Cash – NZ conventional bonds – NZ inflation-indexed bonds – overseas bonds – NZ real property – NZ equity – overseas equity

ACC	2,622.9
------------	----------------

4. Each reserve portfolio is associated with a funding account. They maintain their own distinct asset class allocations but invest in individual asset classes by participating in pooled asset class portfolios that are managed as single entities on behalf of all the funding accounts. The Motor Vehicle reserve portfolio, currently \$356 million and growing in value, adopts benchmark asset allocations of 3% cash, 26% New Zealand conventional bonds, 13% New Zealand inflation-indexed bonds, 1% overseas bonds, 2% real property, 22% New Zealand equity, and 33% overseas equity. The Residual Claims reserve portfolio, currently \$800 million and steadily declining, adopts benchmark asset allocations of 3% cash, 36% New Zealand conventional bonds, 17% New Zealand inflation-indexed bonds, 2%

* Crown Financial Policy, The Treasury

overseas bonds, 2% real property, 17% New Zealand equity, and 25% overseas equity. The Earners reserve portfolio, currently \$1,003 million and rapidly growing, adopts benchmark asset allocations of 3% cash, 45% New Zealand conventional bonds, 19% New Zealand inflation-indexed bonds, 4% overseas bonds, 1% real property, 12% New Zealand equity, and 16% overseas equity. The allocation to New Zealand conventional bonds further distinguishes between long-dated issues and the broader bond market. The allocation to overseas equity is further broken down into hedged and unhedged Australian equity, hedged and unhedged overseas equity, and emerging markets equity.

5. The Motor Vehicle and Residual Claims reserve portfolios represent under-funded accounts. They are only 32% and 34% funded, respectively. The Earners reserve portfolio represents an account in surplus of 6%.

6. New benchmark asset allocations will be adopted from 30 November 2000. The Motor Vehicle reserve portfolio will be invested as 3% cash, 32% New Zealand conventional bonds, 8% New Zealand inflation-indexed bonds, 1% overseas bonds, 2% real property, 22% New Zealand equity, and 33% overseas equity. The Residual Claims reserve portfolio will be invested as 3% cash, 47% New Zealand conventional bonds, 11% New Zealand inflation-indexed bonds, 2% overseas bonds, 3% real property, 14% New Zealand equity, and 22% overseas equity. The Earners reserve portfolio will be invested as 3% cash, 51% New Zealand conventional bonds, 12% New Zealand inflation-indexed bonds, 1% overseas bonds, 2% real property, 13% New Zealand equity, and 19% overseas equity.

7. The key difference between ACC and a general insurer is the duration of its future commitments. The accounts have a long tail and, consequently, the value of the actuarial liability is sensitive to changes in interest rates. Benchmark setting for fully funded accounts aims to eliminate interest rate mismatches between assets and liabilities and balances the expected reward from investment in equity against the objective of reducing risk. Benchmark setting for under-funded accounts involves trying to cover as much interest rate risk as is reasonably possible. The sizeable weighting given to equity is based on the logic of diversifying over time the exposure to the equity market and represents only a small percentage of the actuarial liability; the equity weighting will decline as the accounts move closer to being fully funded.

8. As at 30 June 2000, the Crown recognised an unfunded liability of \$3,566 million in respect of ACC's accounts. The Motor Vehicle and Residual Claims accounts have a combined net liability of over \$2,500 million. Both accounts are required to be fully funded by 2014, and the deficit is being made up through levies.

The Non-earners and Medical Misadventure accounts, with a combined unfunded liability of \$1,103 million, will continue to be funded on a pay-as-you-go basis through annual appropriations.

9. Investment management and administration activities associated with New Zealand assets are conducted in-house, whilst those associated with foreign investments are contracted out to third parties. ACC controls the risk of underperformance by limiting the scale of active exposures to different investment markets, by limiting the scale of exposures to individual equities and credit risks, and through operational mechanisms designed to ensure that investment staff and external managers comply with those limits.

Earthquake Commission

10. EQC provides natural disaster insurance to New Zealand residential property owners. The financial assets of EQC totalled \$3,530 million as at 15 September 2000. The Minister of Finance has the authority to direct EQC regarding its investment strategy, and its investments are currently restricted to New Zealand bank bills and non-tradable New Zealand government securities. The following table summarises the holdings of EQC:

Portfolio	Investments	Asset allocations ⁽¹⁾		
		C	NZT	NZG
Investments	3,530.0	7%	3%	90%

¹ Bank investments (cash) – NZ treasury bills – NZ government stock

EQC	3,530.0
------------	----------------

11. The portfolio is currently invested 7% in bank bills (which represents the allowable maximum of \$250 million), 3% in treasury bills, and 90% in government stock. In addition, EQC has reinsurance cover of \$1,500 million to call on in the event of a major disaster.

12. If EQC's funds are ever depleted to the point where it could not pay claims, such as following a major earthquake, the Crown guarantees to make up the deficiency by loan or grant to EQC. The guarantee is disclosed in the Crown's financial statements as a non-quantified contingent liability.

13. The Minister has expressed a desire to permit EQC to invest in a more diversified portfolio. EQC is investigating options to pursue an investment strategy incorporating cash, overseas equity, and non-tradable New Zealand government securities. New investment arrangements that are appropriate for a diversified portfolio are being developed.

Government Superannuation Fund

14. The financial assets of GSF totalled \$3,429 million as at 30 June 2000. They are held to meet the pension obligations arising from superannuation schemes, closed to new members since 1992, for past and present public sector employees. Under current policy, the fund is restricted to investing in principally New Zealand dollar denominated fixed interest securities. The following table summarises the holdings of GSF:

Portfolio	Investments	Solvency	Asset allocations ⁽¹⁾				
			C	NZG	SB	LB	XB
Investments	3,429.4	29%	19%	65%	7%	1%	8%

¹ Short-term investments (cash) – NZ government bonds – SOE bonds – local authority bonds – other bonds

GSF	3,429.4
------------	----------------

15. The portfolio is currently invested 65% in New Zealand government stock, 7% in bonds issued by state-owned enterprises, 9% in local authority and other bonds, and 19% in short-term instruments.

16. The GSF schemes are subject to annual actuarial revaluation and had a liability in respect of past service of \$11,775 million as at 30 June 2000, against net assets available to pay benefits of \$3,452 million. The unfunded liability of \$8,323 million is recognised in the Crown's financial statements.

17. The investment arrangements and institutional governance structures surrounding GSF are being changed through new legislation, and the fund will be permitted to adopt a diversified portfolio, including equity assets.

National Provident Fund

18. The financial assets of NPF, totalling \$2,719 million as at 31 March 2000, comprise four categories of superannuation schemes: defined contribution schemes, which may be employer-subsidised; personal, or cash accumulation, schemes with no employer subsidy; defined benefit schemes; and a scheme for consolidating annuitants to avoid having small schemes with insufficient membership. The schemes are authorised to invest in only the Global Asset Trust and bank accounts. GAT has a unitised structure representing various asset classes (cash, fixed interest, real property, New Zealand equity, and overseas equity). Each scheme holds units in the various asset classes depending on the investment strategy adopted in response to the nature of its liabilities—that is, its commitment to pay benefits. The NPF schemes have been closed to new members since 1991. The following table summarises the holdings of NPF:

Defined contribution schemes	Investments	Reserves ⁽¹⁾	Asset allocations ⁽²⁾				
			C	FI	P	NZE	OE
Pension National	565.4	10%	50%	20%	5%	5%	20%
Lump Sum National	320.3	10%	30%	30%	8%	8%	25%
Meat Industry	67.9	14%	30%	30%	8%	8%	25%
Meat Industry Related Trades	0.6	12%	30%	30%	8%	8%	25%
Ships' Officers	8.2	11%	30%	30%	8%	8%	25%
Farm Workers	3.9	10%	50%	20%	5%	5%	20%
Total	966.3						

Personal (cash accumulation) schemes	Investments	Reserves ⁽¹⁾	Asset allocations ⁽²⁾				
			C	FI	P	NZE	OE
Pension Cash Accumulation	22.8	11%	30%	30%	8%	8%	25%
Lump Sum Cash Accumulation	181.7	4%	0%	100%	0%	0%	0%
Total	204.5						

Defined benefit schemes	Investments	Solvency	Asset allocations ⁽²⁾				
			C	FI	P	NZE	OE
DBP Contributors	456.6	100%	35%	25%	5%	8%	28%
DBP Annuitants	652.6	60%	0%	20%	15%	13%	53%
Aircrew	69.5	118%	10%	30%	10%	10%	40%
Annual Single Premium	77.6	116%	35%	25%	5%	10%	25%
Level Premium	16.3	112%	35%	25%	5%	10%	25%
Staff Pension	3.0	113%	35%	25%	5%	10%	25%
Total	1,275.5						

Consolidation scheme	Investments	Solvency	Asset allocations ⁽²⁾				
			C	FI	P	NZE	OE
National Provident Pension	272.8	108%	35%	25%	5%	10%	25%

¹ As a percentage of contributor balances

² Cash – fixed interest – real property – NZ equity – overseas equity

NPF	2,719.1
------------	----------------

19. Whilst they are not part of the Crown estate, the Crown faces risks in respect of the NPF schemes. It guarantees the benefits payable to members, as well as the crediting of a 4% minimum annual return to member accounts in the defined contribution and personal schemes. All the defined benefit schemes, except the DBP Annuitants scheme, are actuarially solvent. The DBP Annuitants scheme had an unfunded liability of \$433 million as at 31 March 2000, which is recognised in the Crown's financial statements. The defined contribution and personal schemes maintain a reserving policy to minimise the likelihood of a call on the Crown guarantee, and all those schemes, save one, are at or above the target of 10% reserves as a percentage of contributor balances.

20. The defined contribution schemes hold financial assets of \$966 million. The Pension National scheme, which constitutes over half that total, adopts the following benchmark asset allocations: 50% cash, 20% fixed interest, 5% real property, 5% New Zealand shares, and 20% overseas shares.

21. The personal schemes hold financial assets of \$205 million. The Lump Sum Cash Accumulation scheme, which constitutes approximately nine-tenths of that total, is invested solely in fixed interest securities.

22. The defined benefit schemes hold financial assets of \$1,276 million. The fully funded schemes, approximately half of that total, adopt benchmark asset allocations of 35% cash, 25% fixed interest, 5% real property, 7.5% New Zealand shares, and 27.5% overseas shares. The under-funded DBP Annuitants scheme holds no cash investments and is invested over 50% in overseas shares. The recently established consolidation scheme, with financial assets of \$273 million, adopts an asset allocation similar to that for the fully funded defined benefit schemes.

23. The investment objective for all the schemes is to maximise the return on assets, subject to an acceptable level of risk as determined by the NPF board in consultation with the Minister of Finance. The liabilities of the schemes are regularly reviewed to ensure that appropriate asset allocations are in place, and investment mandates are reviewed every three to five years. NPF maintains no in-house investment operations. All investment management and custody activities are contracted out to third parties.

Public Trust Office

24. PTO had funds under management of \$981 million as at 10 May 2000, divided among three pools of funds: the Common Fund, the Group Investment Funds, and the Public Trust Investment Funds. PTO has generally been a long-term holder of securities, rather than a trader in its investments. Bonds are typically held to redemption, and shares are held for long periods of time. The following table summarises the holdings of PTO:

Funds under management	Investments	Reserves ⁽¹⁾	Asset allocations ⁽²⁾					
			C	NZB	OB	P	NZE	OE
Common Fund	411.0	78.0	⁽³⁾					
Funds under management	Investments		C	NZB	OB	P	NZE	OE
Group Investment Funds	288.0		51%	15%	5%	2%	10%	17%
Public Trust Investment Funds	282.0		63%	15%	3%	1%	6%	12%
Total	570.0							

¹ As at 30 June 2000

² Cash – NZ bonds – overseas bonds – real property – NZ equity – overseas equity

³ Common Fund adopts a conservative investment strategy, similar to that of the Group and Public Trust Investment Funds

PTO	981.0
------------	--------------

25. The Common Fund, with \$411 million in assets, is a pool of investments on behalf of customers. Whilst the funds are pooled, PTO owns the investments and, consequently, there is no direct linkage between the returns on the investments and the actual returns payable to the trusts, estates, and other clients of the Common Fund. Typically, the investments exceed the liabilities to clients, and the excess represents the investment of PTO's own cash. The current excess of \$78 million as at 30 June 2000, is recognised in the Crown's financial statements. The Crown ultimately carries the risk of making up any shortfall between the Common Fund's investments and liabilities to clients. The Common Fund has always been invested conservatively, with the objective of providing its clients with fair long-term income and a stable capital value.

26. The Group Investment Funds and Public Trust Investment Funds are pooled investment vehicles operated by Public Trust in a manner similar to unit trusts. They are the retail interface with PTO's clients. The former, with \$288 million in assets, are for use with internal clients, whereas the latter, with \$282 million in assets, are for use with the general public. The individual funds are marketed as conservative, balanced, and growth portfolios, whose assets represent investments in separate underlying unitised portfolios of cash, New Zealand bonds, overseas bonds, New Zealand equity, overseas equity, real property, and residential mortgages. The majority of the assets of these funds is invested conservatively, with allocations of 50% to 60% in cash and 15% in New Zealand bonds.

27. Funds management operations for New Zealand assets are conducted in-house. The investment management (front office) and administration (middle and back office) activities are subject to regular internal audit and compliance and performance reporting. Funds management for foreign assets is outsourced to third-party managers or is limited to passive investment in market indices.

Reserve Bank of New Zealand

28. RBNZ held financial assets, in the form of foreign currency assets to support its foreign reserves management function, totalling \$5,812 million as at 30 June 2000. The following table summarises the holdings of RBNZ:

Foreign currency	Assets	Currency of denomination ⁽¹⁾		
		USD	JPY	EUR
Marketable securities	4,226.9	43%	40%	17%
Securities held under reverse repos	1,314.6	85%	3%	12%
Cash balances with other central banks	105.5	98%	0%	2%
Other	164.9	18%	34%	48%
Total	5,811.9			

¹ United States dollar – yen – euro and other

RBNZ	5,811.9
-------------	----------------

29. The financial instruments used in RBNZ's foreign currency activities consist mainly of sovereign securities, securities held under reverse repo transactions, and cash balances with other central banks. In excess of 50% of the funds are held in United States dollar-denominated instruments, with lesser amounts denominated in yen or euros.

30. Unusually for a central bank, RBNZ's foreign reserves are fully funded through foreign currency borrowing by NZDMO. Because the cost of borrowing overseas is higher than the return it realises on those reserves, the Crown incurs a small net cost, although active management of those holdings mitigates that cost. The net income from holding foreign reserves in recent years has ranged from a loss of \$10 million to a profit of \$5 million.

31. RBNZ's domestic currency activities arise from holding assets, totalling \$4,092 million, that represent the investment of its net equity and that support the liability for notes and coins in circulation (the investment portfolio) and from liquidity management operations involving intra-day and inter-day reverse repo assets. The investment portfolio is passively managed; securities are held to redemption. The instruments in which RBNZ invests consist of benchmark or on-the-run New Zealand government securities. In the coming year, RBNZ will begin repoing securities in the investment portfolio to provide greater flexibility in its liquidity management operations.

32. The manner in which RBNZ conducts its foreign reserve and domestic currency operations is subject to comprehensive guidelines designed to minimise operational risk. A risk unit maintains the risk management framework and daily monitors RBNZ's financial risk exposures. A risk assessment and assurance department evaluates key business risks and internal controls and determines the extent and frequency of audits. An audit committee monitors the use of RBNZ's resources, reviews accounting practices and policies, and reviews the internal audit function.

New Zealand Debt Management Office

33. NZDMO is principally responsible for managing financial liabilities, as opposed to assets. It manages the Crown's direct debt and overall net cashflows, as well as some interest-bearing assets. NZDMO borrows externally only to fund RBNZ's foreign reserves and meet refinancing needs. All other borrowing is undertaken in the domestic market.

34. The Crown's foreign currency debt totalled \$7,728 million as at 30 June 2000. Matching that debt is a similar volume of foreign currency assets. RBNZ's foreign reserves were \$5,812 million. The remaining approximate \$1,900 million (\$2,100 million as at 31 January 2000) in foreign currency assets constitutes a hedge for residual foreign currency debt, some of which extends out to 2016. NZDMO has offset the currency risk and interest rate risk on that debt but is left with a requirement to manage a liquidity portfolio. The objective is to generate interest income on investments that matches or exceeds the floating rate interest payments on the restructured portfolio. Over time, as the foreign currency debt matures, NZDMO will use the offsetting investments to finance its repayment.

Crown Financial Asset Portfolio

35. The Crown has an economic interest in the financial assets within the portfolios managed by ACC, EQC, GSF, NPF, and PTO. Those assets total nearly \$13,300 million. The Crown's financial assets also include the foreign reserves of RBNZ, worth in excess of \$5,800 million.

36. The asset classes identified for the individual portfolios are not uniform and involve differing degrees of specificity, but they can be described in terms of conventional asset classes, such cash, domestic and overseas fixed interest, real property, and domestic and overseas equity. In respect of domestic fixed interest, it is useful to distinguish between bonds issued by the Crown and bonds issued by other parties. Where that distinction is not explicit, it is possible to form a reasonable estimate based on the allocations adopted for similar funds.

37. The following table describes the aggregate composition of the Crown's financial assets. The foreign reserve assets of RBNZ constitute the largest individual portfolio and, because they are held in overseas fixed interest securities, have a material influence on the aggregate composition.

Crown portfolio	Financial assets	Asset allocations ⁽¹⁾						
		C	NZG	NZB	OB	P	NZE	OE
Total financial assets – exclusive of RBNZ	13,282	20%	51%	11%	1%	2%	5%	11%
Total financial assets – inclusive of RBNZ	19,094	14%	35%	7%	31%	1%	3%	7%

¹ Cash – NZ government bonds – other NZ bonds – overseas bonds – real property – NZ equity – overseas equity

38. Excluding RBNZ's foreign reserves, approximately half of the Crown's financial assets are invested in New Zealand government bonds. The second largest allocation is to cash, with 20% of the aggregate portfolio. A further 11% is invested in other New Zealand bonds. Only 16% of the aggregate portfolio is invested in equity.

39. Including the RBNZ portfolio, New Zealand government bonds remain the largest asset class, with over one-third of the aggregate portfolio is invested in them. The second largest allocation is to overseas bonds, which include RBNZ's foreign reserve holdings, with 31% of the aggregate portfolio. Cash represents 14% of the portfolio, whilst only 10% is invested in equity.

References

- Archer, David & Jerse Halliday (1998) 'The Rationale for Holding Foreign Currency Reserves', *Reserve Bank of New Zealand Bulletin*, 61(4), December, 346-354
- Baierl, Gary T. & Peng Chen (2000) 'Choosing Managers and Funds', *Journal of Portfolio Management*, 26(2), Winter, 47-53
- Barro, Robert (1979) 'On the Determination of Public Debt', *Journal of Political Economy*, 940-971
- Bohn, Henning (1990) 'Tax Smoothing with Financial Instruments', *American Economic Review*, 1217-1230
- Bohn, Henning (1998) 'Risk Sharing in a Stochastic Overlapping Generations Economy', Working Paper, Department of Economics, University of California at Santa Barbara, December
- Bolton, Patrick & Mathias Dewatripont (1994) 'The Firm as a Communication Network', *Quarterly Journal of Economics*, 109(4), 809-839
- Bradbury, Simon, Jim Brumby & David Skilling (1999) 'Sovereign Net Worth: An Analytical Framework', Treasury Working Paper 99/3
- Brinson, Gary P., L. Randolph Hood & Gilbert L. Beebower (1986) 'Determinants of Portfolio Performance', *Financial Analysts Journal*, July/August, 39-44
- Chandler, A. (1966) *Strategy and Structure*, New York NY, Doubleday
- Coase, Ronald (1937) 'The Nature of the Firm', *Economica*, N.S.4, 386-405
- Davis, Nick (1998) 'Governance of Crown Financial Assets', Treasury Working Paper 98/2
- Elton, Edwin & Martin Gruber (1992) 'Optimal Investment Strategies with Investor Liabilities', *Journal of Banking & Finance*, 16, 869-890
- Exley, C.J., S.J.B. Mehta and A.D. Smith (1997) 'The Financial Theory of Defined Benefit Pension Schemes', *British Actuaries Journal*, 3, IV, 835-966
- Fowlie, Kerry & Julian Wright (1997) 'Optimal Currency Denomination of Public Debt in New Zealand', *New Zealand Economic Papers*, 31(2), 137-152
- Froot, Kenneth A., David S. Scharfstein & Jeremy C. Stein (1993) 'Risk Management: Coordinating Corporate Investment & Financing Policies', *Journal of Finance*, 48(5), 1629-1658
- Froot, Kenneth A. & Jeremy C. Stein (1998) 'Risk management, capital budgeting, and capital structure policy for financial institutions: an integrated approach', *Journal of Financial Economics*, 47, 55-82

Grimes, Arthur (1992) 'Optimal Public Debt Structure', Pacific Basin Working Paper No. PB93-04, Center for Pacific Basin Monetary and Economic Studies, Federal Reserve Bank of San Francisco. Also available as Discussion Paper G92/15, Reserve Bank of New Zealand, Wellington

Harris, Milton & Artur Raviv (2000) 'Organization Design', University of Chicago Working Paper

Hart, Oliver D. & John Moore (1999) 'On the Design of Hierarchies: Coordination versus Specialization', Working paper, Harvard University

Hawkesby, Christian & Julian Wright (1997), 'The Optimal Public Debt Portfolios for Nine OECD Countries: A Tax-Smoothing Approach', University of Auckland

Huther, Jeff (1998a) 'An Application of Portfolio Theory to New Zealand's Public Sector', Treasury Working Paper 98/4

Huther, Jeff (1998b) 'An Integrated Approach to Government Financial Policy', Treasury Working Paper 99/8

Jensen M.C. & W.H. Meckling (1976) 'Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure', *Journal of Financial Economics* 3, 305-360

KPMG (1999) 1999 Corporate Treasury Survey, Wellington

Lucas, Robert & Nancy Stokey (1983) 'Optimal Fiscal & Monetary Policy in an Economy without Capital', *Journal of Monetary Economics*, 55-93

Mitchell, Olivia (1993) 'Public Pension Governance and Performance: Lessons for Developing Countries', Policy Research Working Paper WPS 1199, Policy Research Department, World Bank, Washington DC

Norges Bank (1997) 'Future Management of the Government Petroleum Fund' (available from website: www.norges-bank.no/english/data/petro_rnb97.html)

Pinfield, Chris (1998) 'Tax-Smoothing and Expenditure Creep', Treasury Working Paper 98/9

PricewaterhouseCoopers (2000) *New Zealand Treasury: Financial Asset Management*, Report to New Zealand Treasury

Radner, Roy (1993) 'The Organization of Decentralized Information Processing', *Econometrica*, 61, 1109-1146

Skilling, David (1996) 'The Crown's Capital Structure: An Efficiency Perspective' (Draft), New Zealand Treasury Policy Development Unit

Skilling, David (1997) 'A Framework for Crown Risk Management' (Draft), New Zealand Treasury Policy Development Unit

Stein, Jeremy (2000) 'Information Production & Capital Allocation: Decentralized vs Hierarchical Firms', NBER Working Paper 7705

Taylor, Geoff (2000) 'Treasury Centralisation Sets Best Practice Standards', *The Treasury Note*, November, 15-17

Vayanos, Dimitri (1999) 'The Decentralization of Information Processing in the Presence of Synergies', Working Paper, MIT

Wallace, Jeff (2000) 'Foreign Exchange Risk Management', *The Treasury Note*, November, 8-11

Williamson, Oliver (1988) 'Corporate Finance & Corporate Governance' *Journal of Finance*, 43(3), 567-591