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Objectives, Targets and Instruments for Crown Financial Policy

Eric Hansen

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Objectives, Targets and Instruments for Crown Financial Policy

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This paper was written while the author was on the staff of the New Zealand Treasury. The views expressed in this Working Paper are those of the author and do not necessarily reflect the views of the New Zealand Treasury. The paper is presented not as policy, but with a view to inform and stimulate wider debate.

Abstract

Crown financial policy is concerned with how the government manages the Crown's assets and liabilities. The recently established New Zealand Superannuation Fund, which is projected to grow to around 45% of GDP over the next few decades, highlights that Crown financial policy is likely to become an important economic policy tool with potential to have a significant impact on New Zealand economic welfare.

The policy framework of objectives, targets and instruments is adopted as a basis for organising the theory literature relating to Crown financial policy. Applying this framework, seven distinct policy objectives are identified as potentially relevant to the future development of policy. Applying qualitative assessment criteria, it is concluded that four of the seven objectives should be the main factors that inform the design of alternative policy options. The four objectives relate to minimising distortionary taxation, time-consistency of policy, agency costs of government, and downside efficiency risks. The three objectives considered less relevant relate to policy neutrality, missing markets and risk management services.

The four main objectives imply a range of targets could be adopted for the Crown balance sheet, some of which would be conflicting. The objectives of minimising distortionary taxation suggests targeting the minimum risk portfolio by building up financial assets and net worth whereas the objective of minimising the agency cost of government suggests placing an upper bound on government operating surpluses and limiting the build up of financial assets. Time-consistency and agency cost objectives tend to conflict because the former suggests the level of debt should be kept low whereas the latter suggests high debt levels.

JEL CLASSIFICATION H11
 H63

KEYWORDS Agency cost; bounded rationality; Crown balance sheet;
 distortionary taxation; imperfect and incomplete capital markets;
 public debt management; Ricardian equivalence; time-
 inconsistency;

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Objectives, Targets and Instruments for Crown Financial Policy

1 Introduction

Crown financial policy specifies how the government manages the Crown's assets and liabilities.¹ Policy analysis in this area is concerned with how the structure and size of the Crown balance sheet could affect the decisions of citizens in managing their own wealth portfolios and also government decisions on fiscal and other economic policies. Crown financial policy is closely related to corporate financial policy, which is concerned with how a company's balance sheet could affect the decisions of shareholders and managers.

The Treasury has conducted research on Crown financial policy in one form or another since at least the mid-1990s. Skilling (1997) and Davis (2001) summarise and develop the literature relevant to Crown financial policy, while Grimes (2001a) discusses the operational objectives and practices relevant to managing the Crown's balance sheet.² Empirical analyses by Huther (1998), Fabling (2002) and Davis and Fabling (2002) have found tentative evidence that it may be possible to improve the performance of the Crown balance sheet.

At a practical level, changes in the Crown balance sheet impact on the government's fiscal performance. An example is the financial year 2002/03, where a partial revaluation of the Crown balance sheet reduced the government's operating surplus (based on accrual accounting) from \$4 billion to \$1.4 billion. This adjustment amounts to around 6% of Core Crown revenue.³

Crown financial policy is likely to become progressively more important as the recently established New Zealand Superannuation Fund accumulates financial assets over the next few decades equivalent to 45% of GDP or around \$56 billion in current terms.⁴ If these funds accumulate as projected, then a 10 basis point (or 0.1%) improvement

¹ This paper uses the term Crown financial policy to mean government policies relating to the management of the Crown's aggregate balance sheet. The Crown balance sheet includes the Crown's ownership interest in state-owned enterprises and other central government assets and liabilities meeting Generally Accepted Accounting Practice (GAAP) but excludes Local Authority assets and liabilities. A wider definition of Crown financial policy would include measurement issues, financial reporting and performance and accountability issues but these are excluded for the purposes of this paper.

² International contributions include Bohn (1990, 1995), Chari, Christiano and Kehoe (1994), Leong (1999), Lucas and Stokey (1983), and Missale (1997, 1999).

³ See Crown Financial Statements at <http://www.treasury.govt.nz/>.

⁴ McCulloch and Frances (2001) describes the New Zealand Superannuation Fund.

(decline) in annual returns at the same risk level would confer a net present value gain (loss) to New Zealand of around \$1 billion (at 5% discount rate).

Purpose of this paper

A key purpose of this paper is to organise the theoretical literature within a coherent policy framework to provide a basis for comparing policy recommendations. A second key purpose is to select a subset of key concepts that should inform the design of alternative policy options for Crown financial policy.

Organising framework

This paper adopts the framework of objectives, targets, and instruments. Objectives are high-level qualitative statements of intent, targets are quantitative expressions intended to give effect to the qualitative objectives, and instruments are policy levers subject to the control of the authorities. By way of example, in the New Zealand monetary policy regime the overall policy objective (as specified in the Reserve Bank Act 1989) is to “maintain price stability”, the current policy target is medium term inflation in the range of 1-3% p.a. and the policy instrument is the Official Cash Rate.

The Crown balance sheet may be viewed as an instrument, as policy makers ultimately have control over the gross size and structure of the balance sheet. The discussion in this paper shows that the Crown balance sheet potentially could be targeted at a wide range of markedly different policy objectives, each contributing to overall economic welfare.⁵

In the case of some objectives, the literature also suggests that other non-balance sheet instruments may be available to achieve the desired objective. Examples may be found in the form of institutional arrangements such as the Reserve Bank Act 1989 and Fiscal Responsibility Act 1994 and various regulatory and social policies.

The task for policy makers, therefore, is an instrument assignment problem. Policy makers need to identify the various potential objectives, identify the balance sheet and other possible instruments, and determine the best mapping of instruments to objectives. The optimal assignment is that which would maximise New Zealand economic welfare. Policy targets are specified as part of the implementation regime for guiding the adjustment of instruments to achieve objectives.

Structure of paper

The paper has the following structure. The next section (Section 2) provides a brief overview of seven policy objectives identified in the literature. Sections 3 – 9 discuss in turn the motivation for each objective and summarise the implications for setting of policy targets and instruments. Section 10 summarises the policy targets associated with each objective.

Up to this point I avoid, as far as possible, assessing empirically or judgementally the significance and relative importance of the objectives. I depart from this approach in the

⁵ The list of objectives could include political objectives where a current government may act strategically to constrain the political choices of a future government, e.g. cutting taxes to run large budget deficits specifically for the purpose of inhibiting other political parties from campaigning on policies favouring higher government expenditure. Political objectives of this nature are excluded in this paper, which instead focuses on economic efficiency objectives as the basis for maximising economic welfare. For discussion of the political economy of fiscal policy, see Alesina and Perotti (1994) and Milesi-Ferretti (1995).

penultimate section. In Section 11 a set of criteria are developed and applied to assess *a priori* whether any of the seven objectives identified earlier should be omitted from further consideration in the development of policy options. This section also discusses at a high level the conflicts between the selected policy objectives. Conclusions are discussed in Section 12.

2 Overview of potential objectives

The Ricardian equivalence theorem suggests that Crown financial policy may have no impact on economic welfare.⁶ However, as noted above, previous analysis conducted within and outside the Treasury has identified wide-ranging situations where Crown financial policy would matter for economic welfare.

The potential for real effects raises the obvious question as to how policy should be set to maximise economic welfare. Skilling (1997) argued that the Crown should only manage risk to the extent that it is efficient to do so. He developed a high-level framework based on efficient management and efficient provision. The efficient management argument is that the Crown balance sheet should be managed in a manner that imposes the least cost on the economy as a whole. The efficient provision argument is that the Crown should manage risk because citizens are risk averse and are constrained from diversifying their Crown exposure. Skilling considered that comparative institutional analysis leads to rejection of the efficient provision argument.

This section drills down below Skilling's high-level framework to develop a more detailed framework for organising the literature relevant to Crown financial policy. A review of the theoretical literatures on capital markets, optimal public debt management, time-consistency of fiscal and monetary policy, the principal-agent approach to public sector management identifies a minimum of seven potential objectives may be identified. These are:

1. maximise the potential for the gross size and composition of the Crown balance sheet to be neutral for economic welfare (relates to Ricardian equivalence literature);
2. minimise the expected economic value of deadweight losses (relates to tax-smoothing literature);
3. minimise the risk of unstable fiscal and monetary policies (relates to time-consistency literature);
4. minimise the agency cost of government (relates to principal-agent literature);
5. maximise opportunities for efficient risk sharing through provision of market-maker services (relates to incomplete capital markets literature);

⁶ The Ricardian Equivalence theorem (Barro 1974) states the conditions under which the choice between financing government expenditure by taxes or by issuing debt has no impact on the real economy. The equivalence result holds only under restrictive assumptions about citizens' altruism and rationality, completeness and efficiency of financial markets, and lump-sum taxes. Closely related to Ricardian Equivalence is the Neutrality Theorem of Debt Management (Missale 1999) which states under similar conditions that "public debt management" has no impact on the real economy. Public debt management includes the choice of denomination and maturity of the securities to issue, indexation features, changes in the relative supply of existing securities, and innovations in the menu of public assets.

6. achieve citizens' desired wealth portfolio and risk tolerance through provision of risk management services (relates to literatures on bounded rationality, moral hazard, and capital market imperfections); and
7. minimise downside efficiency risk, particularly the risk of exacerbating existing inefficiencies or creating new sources of inefficiency in the private sector (relates to wide range of literatures noted above).

The above ordering does not imply relative importance. The objectives have been grouped consistently with Skilling's (1997) high-level framework:

- *Policy neutrality:* Objective 1 concerns the base case where Crown financial policy would be irrelevant for economic welfare.
- *Efficient management:* Objectives 2 - 4 concern how Crown financial policy may affect economic welfare through the management of government affairs.
- *Efficient provision:* Objectives 5 - 7 concern how Crown financial policy may affect economic welfare through the provision of services to the public, such as market making and risk management services.

Sections 3 – 9 discuss each objective in turn. Each section discusses the factors motivating the objective and presents key insights in terms of policy targets that may be appropriate and possible instruments.

Taking forward all seven objectives to inform the design of alternative policy options would be undesirable. For this reason, Section 11 develops and applies a set of criteria to assess whether any objectives should be rejected from further consideration. The analysis concludes that four of the objectives relating to distortionary taxation, time-consistency of policy, agency costs of government, and downside efficiency risks should be the main factors that inform the design of alternative policy options.

Definition of Crown balance sheet

Throughout this paper the terms “Crown balance sheet” and “Crown portfolio” are defined in accordance with Comprehensive Net Worth (CNW) (Bradbury *et al* 1999). This is an economics concept that means the balance sheet includes the present value of future taxation revenue and the present value of the government's social obligations to citizens. CNW is broader than the GAAP-based accounting definition of net worth as published in the Crown Financial Statements.

It is recognised that available information may be insufficient to allow implementation on CNW basis and that actual policy implementations would likely be based on a narrower definition of the Crown balance sheet. However, CNW is useful for analytical purposes.

3 Policy neutrality

Economic objective

The economic objective assumed in this section is to maximise the potential for the gross size and composition of the Crown balance sheet to be neutral for economic welfare.

Two sets of motivations are available in support of this objective. First, if Ricardian equivalence held:

- citizens would achieve their desired wealth portfolio irrespective of the size and structure of the Crown balance sheet; and
- the government could focus on operating policies without having to take into account balance sheet considerations.

Second, two further motivations are available on the basis that Ricardian equivalence is unlikely to hold perfectly:

- since any policy setting inevitably has potential of being in error, the more closely that policy neutrality holds the less detriment to economic welfare arising from errors in Crown financial policy; and
- proposed policies to improve economic welfare may be rejected on the basis of comparative institutional analysis. In this case, Crown financial policy should promote conditions consistent with minimising the adverse real impacts of policy on economic welfare.

Key insights for policy

Ricardian equivalence implies that Crown financial policy is indeterminate in the sense that all policy options achieve the same optimum level of economic welfare. Citizens would rearrange their personal portfolios to undo any changes in the stochastic properties of their exposure to the Crown portfolio. Economic efficiency would require only that citizens' personal portfolios be on the Capital Market Line (CML), as illustrated below.⁷ Notably, however, citizens' sub-portfolios such as the Crown balance sheet do not need to lie on the CML.

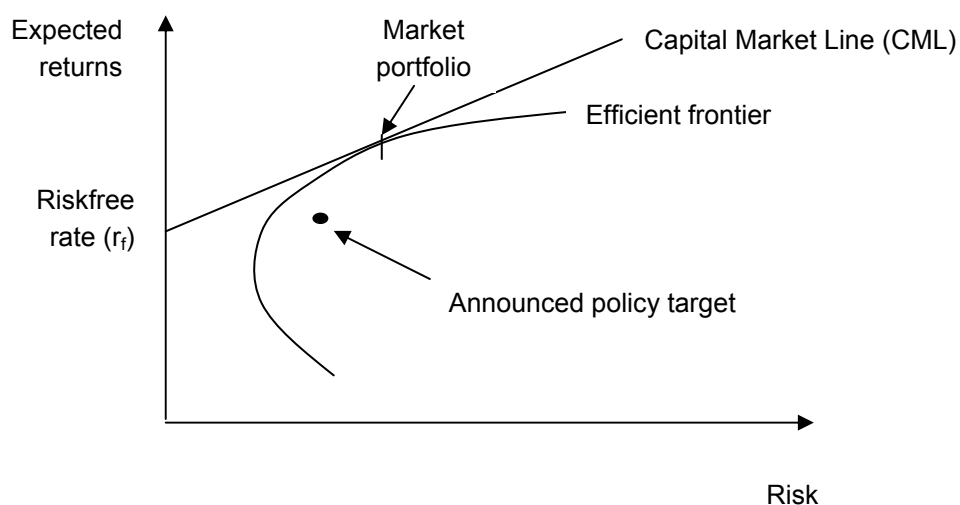
Nevertheless, Ricardian equivalence would not imply that Crown financial policy should be left undetermined. To construct optimal personal portfolios, citizens would need to know the stochastic properties of their exposure to the Crown. This suggests that an objective for Crown financial policy could be to minimise the risk that citizens misperceive the Crown's policy settings, particularly its risk/return targets. On this basis, the government's policy settings should be explicit, transparent (hence, easily communicated) and signalled prior to implementation. This could suggest extra Crown reporting requirements, possibly involving changes to the Fiscal Responsibility Act 1994.

Figure 1 below illustrates the situation in risk/return space. The figure shows the Crown portfolio lying inside the efficient frontier at an announced risk/return point. Under the

⁷ The Capital Market Line is the linear efficient set obtained by taking combinations of the riskfree asset and the market portfolio (Copeland and Weston 1988). An investor may achieve a portfolio with less risk than the market portfolio by investing a portion of his or her available funds in the riskfree asset and the remainder in the market portfolio. A portfolio with risk greater than the market portfolio may be achieved by borrowing the riskfree asset and investing all funds (including borrowings) in the market portfolio.

Ricardian assumptions, citizens' total wealth portfolios would lie on the CML at points reflecting each individual's level of risk aversion.

Figure 1 – Example of Crown portfolio inside efficient frontier



Summary on policy neutrality

Economic objective:

Maximise the potential for gross size and composition of the Crown balance sheet to be neutral for economic welfare

CFP objectives:

Minimise the risk that citizens misperceive policy settings (especially risk/return targets)

Targets:

No specific targets identified as optimal. For purposes of transparency, the government should announce a risk/return target but otherwise may allow the Crown balance sheet to evolve as residual of government operating policies.

Instruments:

Legislative provisions that ensure risk/return and other policies are explicit and transparent, and that changes are signalled in advance of implementation, e.g. Fiscal Responsibility Act 1994

4 Distortionary taxation

Economic objective

The economic objective of tax smoothing is to minimise the economic value of the deadweight losses of taxation.

The motivation for this objective is that taxes, due to their involuntary nature, create incentives for taxpayers to substitute away from taxed activities toward activities that are not taxed, or are taxed at lower marginal rates. If the taxed activities would otherwise be worthwhile, the substitution reduces welfare and creates a deadweight loss. An appropriate policy objective is to minimise the deadweight losses of taxation subject to satisfying the Crown's inter-temporal budget constraint (IBC).⁸

Key insights for policy

The literature shows that detailed conclusions about alternative policies depend on the assumptions made regarding departures from the other Ricardian conditions, e.g. whether capital markets are imperfect and/or incomplete and whether citizens alter their other wealth portfolios response to changes in the Crown balance sheet. These are discussed below.

Though not analysed specifically in the literature, the shape of the deadweight loss function also has important implications for Crown financial policy. The standard case assumed in the literature is that the deadweight loss function is convex in the tax rate, with the result that minimising the variability of the tax rate would maximise economic welfare. However, it is an open empirical question as to whether the losses due to variability in the tax rate are economically significant to the extent that a policy response would be warranted. It is therefore of interest to consider implications for policy in the case where the deadweight loss function is linear in the tax rate. The discussion below analyses the cases for both linear and convex deadweight loss functions.

The results reported in this section (and throughout the paper) were derived from models where distortionary taxation affects the level of economic activity but not the growth rate. The omission of policy conclusions relating specifically to economic growth reflects the absence of suitable models in the literature, which thus far has focused on how taxes impact on long-run equilibrium growth but not the impacts of alternative time profiles of the tax rate or uncertainty about the tax rate.⁹ This is an area where further development could produce important insights for policy.

The cases discussed in following subsections are:

- linear loss function;
- convex loss function;
- incomplete capital markets;

⁸ The inter-temporal budget constraint requires that at any date the sum of net worth as at that date plus net present value of future tax revenue be greater than or equal to the net present value of future government spending.

⁹ See, for example, Barro and Sala-i-Martin (1992) and Gemmell and Kneller (2003).

- misperceptions of default risk; and
- non-responsive citizens.

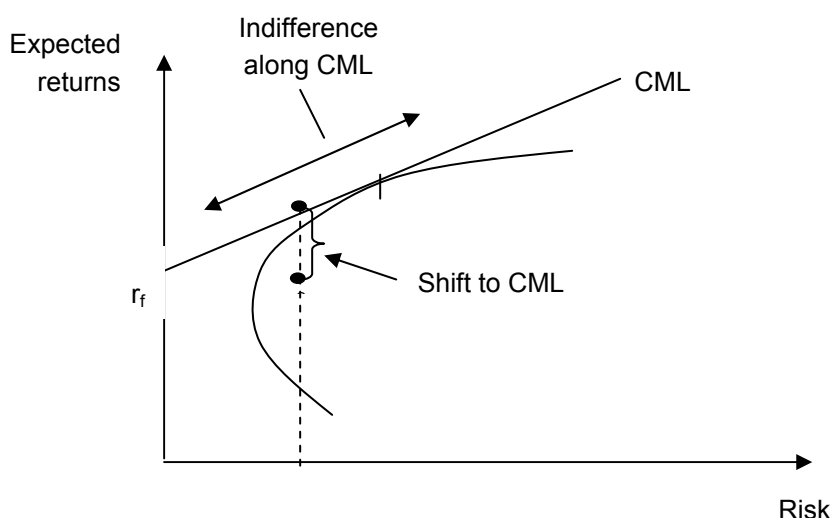
4.1 Linear loss function

Assume all other non-tax related conditions for Ricardian equivalence hold. If the economic loss or “excess burden” were linear in the tax rate, economic welfare may be affected by the long-run average tax rate but not by the time profile or variability of the tax rate. Tax smoothing is irrelevant. Under linearity, the appropriate tax policy objective would be to minimise the long-run average tax rate so as to minimise deadweight losses on average over time.

Government spending policy is a key determinant of the long run tax rate. Another determinant is the composition of the Crown balance sheet, since net returns on the Crown portfolio flow into the government’s Operating Balance. An immediate implication, in contrast to Section 3, is that all diversifiable risks should be hedged so that the Crown portfolio lies on the CML. This would ensure maximum expected portfolio returns for any given level of portfolio risk, as illustrated in Figure 2 below.

Less obvious is that Crown financial policy should be indifferent to positions along the CML.¹⁰ Intuition suggests that the tax policy objective of minimising the average tax rate, combined with the irrelevance of tax smoothing under linearity, would imply the Crown should leverage to the maximum extent possible to generate expected portfolio returns at the highest possible level, i.e. move up and rightward along the CML. The higher expected returns would reduce the expected tax rate, thereby reducing deadweight losses.

Figure 2 – Portfolio target under linear loss function



¹⁰ This result assumes that citizens would be able to engage in short-selling to maintain their desired overall risk profile if were to adopt high risk positions along the CML. As discussed in Section 4.5, if citizens cannot engage in short-selling then government should adopt a low risk portfolio.

However, this is a fallacy where citizens are risk averse. The problem is that moving the portfolio up and rightward along the CML incurs systematic risk.¹¹ In equilibrium, the assets offering high expected returns are precisely those assets which offer high payoffs in states where marginal utility is low, and low payoffs in states where marginal utility is high. The high expected return is compensation for this unfortunate distribution of payoffs (relative to the distribution of marginal utility). As a result, Crown investments in high return assets tends to achieve low taxes (and low deadweight losses) in periods where citizens are doing well, and high taxes (and high deadweight losses) in periods where citizens are doing badly. Overall, after taking into account that citizens can achieve their desired risk/return position on their total wealth portfolio, a Crown strategy of investing in high return assets would be neutral for economic welfare.¹²

Summary for linear loss function

Economic objective:

Minimise the expected economic value of deadweight losses of taxation

CFP objectives:

Tax policy: Minimise the long-run average tax rate subject to IBC

Portfolio policy: Ensure Crown portfolio lies on CML

Target:

Zero diversifiable risk

Instruments:

Portfolio weights as appropriate

4.2 Convex loss function¹³

A convex deadweight loss function is the standard assumption in the literature. In this case, Bohn (1990, 1995) shows that Crown financial policy should minimise the variability of the tax rate. This conclusion is due to two factors:

- a convex deadweight loss function places the Crown sub-portfolio at a comparative disadvantage by increasing the spread of returns (net of tax): Bad returns on the Crown portfolio are very bad because they induce higher tax rates (and therefore higher deadweight losses) while good returns are very good because they induce lower taxes (though convexity means the reduction in deadweight losses is proportionately smaller than the increase in bad states). An identical portfolio held directly by an individual would have lower variance of returns; and
- assets offering high expected returns have an unfortunate distribution of payoffs, in the sense that their payoffs tend to be high in states when consumption is high (low

¹¹ The systematic risk of a portfolio is the risk that cannot be avoided by diversifying the portfolio across the risky assets available in the (global) economy, so that returns on the portfolio will vary with the economy (Copeland and Weston 1988). The systematic risk of a portfolio can be altered by increasing or decreasing the proportion of the portfolio invested in the safe asset (proxied by government bonds).

¹² This is discussed further in Section 4.2.

¹³ The analysis in this section assumes the deadweight loss function is not state-contingent. If the deadweight loss function is state-contingent then a tax policy objective of minimising the variance of the tax rate is not optimal. For example, if the labour supply elasticity varies with the state of the economy, then minimising the excess burden requires the labour income tax rate to vary with the state of the economy (see Scott, 1999). The results apply to both linear and convex deadweight loss functions. However, the policy implications are not considered further in this paper on the basis that implementation would require a capability for "fine tuning" that is not available to policy makers.

marginal utility) and low when consumption is low (high marginal utility). The high expected return is compensation for this unfortunate distribution of payoffs (relative to the distribution of marginal utility). Citizens wish to invest in such assets only up to the point where the marginal utility of higher average consumption equals the marginal disutility of higher variability of consumption.

The Crown's comparative disadvantage exacerbates the unfortunate distribution of payoffs from "high return" assets. Thus, citizens would prefer to use one or more of their own sub-portfolios other than the Crown sub-portfolio to optimise their holdings of risky assets. For these reasons, the Crown is best assigned the task of immunising its portfolio to eliminate citizens exposure to the Crown. This means that the Crown should target the zero-variance portfolio,¹⁴ i.e. zero diversifiable and systematic risk. The Appendix provides a more detailed intuitive explanation of Bohn's result.

Instruments to achieve zero-variance portfolio

Consistent with the assumption of complete capital markets, most theoretical contributions favouring the zero-variance portfolio assume the government can issue and purchase state-contingent securities as desired to hedge all risks.¹⁵

An exception is Angeletos (2002), who shows in the context of a closed-economy equilibrium business cycle model that almost every risk can be hedged with non-contingent debt of different maturities. Angeletos presents a stylised example where a government implements the optimal portfolio policy by selling perpetuities and investing in short-term assets. Critical to his result is that shocks to government expenditure and/or the tax base affect the equilibrium interest rate, causing movements in the market value of long term debt greater than movements in the market value of short-term assets.

Summary for convex losses (with complete and perfect markets)

Economic objective:

Minimise the expected economic value of the deadweight loss of taxation

CFP objectives:

Tax policy: Minimise variance of the tax rate subject to IBC

Portfolio policy: Minimise variance of the Crown portfolio

Target:

Zero variance Crown portfolio

Instruments:

- (a) contingent securities, e.g. issue contingent debt with returns negatively indexed to public spending and positively indexed to productivity and other shocks to the tax base;
- (b) debt maturity structure, e.g. issue perpetuities and purchase short-term assets; and
- (c) any combination of market securities with appropriate covariances.

¹⁴ As noted in Section 3, all references to Crown balance sheet and Crown portfolio are in terms of Comprehensive Net Worth (CNW).

¹⁵ Lucas & Stokey (1983), Bohn (1990, 1995), King (1990), and Chari *et. al.* (1994).

4.3 Incomplete capital markets

Thus far the analysis has assumed all Ricardian assumptions hold except those relating to tax distortions. This and the following subsections depart from the various Ricardian assumptions, while continuing to assume the deadweight loss function is convex.

The current subsection summarises the case where some fiscal risks cannot be hedged. The absence of hedging opportunities may be due to incomplete capital markets or simply that the Crown is unable to access certain markets or use particular instruments. Lack of access to particular markets or instruments may be due to asymmetric information issues and moral hazard incentives relating to government spending policy. These are discussed further in Sections 5 and 7. For the purposes of this section, the distinction between incompleteness and lack of access is irrelevant. The key underlying assumption is that the Crown faces a comparative disadvantage in managing citizens' risk/return exposure.

Given the Crown's comparative disadvantage, the optimal tax policy is the same policy objective as the previous section, i.e. minimise the variability of tax rates. Similarly, the optimal portfolio policy objective is to minimise the variance of the Crown portfolio.

Although the tax and portfolio objectives are unaltered, the assumption of incomplete markets restricts the instruments the Crown has available to achieve its policy objectives. Bohn (1995) shows that the optimal policy now has two parts:

- hedge to the fullest extent possible using available securities; and
- consider building and maintaining a positive balance of net worth as self-insurance against unhedged risks.¹⁶

Building a precautionary balance would require the tax rate to be held temporarily higher than otherwise. The cost of additional deadweight losses is worthwhile if and only if the unhedged risks would otherwise result in a negative correlation between tax rates and consumption. The rationale is similar to the previous section, and relates to the high cost in terms of forgone utility if tax rates have to be increased in states where consumption is already low (i.e. high marginal utility). Building up a buffer has value to the extent that the unfortunate timing of changes in tax rates can be avoided.

In contrast, if unhedged risks result in tax rates and consumption being positively correlated then tax adjustments facilitate consumption smoothing. Building a precautionary balance would remove this beneficial effect while also imposing deadweight losses due to temporarily higher tax rates. If the correlation between tax rates and consumption is zero or positive, the Crown should target CNW at zero, i.e. just satisfy the government inter-temporal budget constraint.

Whether the Crown should target a positive net worth buffer is an empirical issue. It depends on which risks cannot be hedged and how these shocks impact on tax policy and consumer behaviour.

¹⁶ Bradbury, Brumby and Skilling (1999, p.27-33) argue against building up a precautionary buffer on the basis that it would be more efficient for the Crown to breach the intertemporal budget constraint in response to temporary shocks. However, they offer no formal modelling in support of their argument.

Instruments to achieve minimum-variance portfolio

A substantive literature has developed analysing the hedging properties of marketable assets and observed debt instruments (in the absence of general state-contingent securities). Alternative debt denominations include nominal debt, price-indexed debt, and foreign-currency denominated debt. Short- versus long-term debt maturities have been analysed also. The key conclusion is that the appropriate instrument is an empirical question. The choice of debt denomination and maturity depends on the type of shocks hitting the economy and the serial and cross-correlations in macroeconomic variables within and across countries. The main results, summarised from Missale (1997), are provided in the box below.

Summary for incomplete markets

Economic objective:

Minimise the expected economic value of the deadweight loss of taxation

CFP objectives:

Tax policy: Minimise variance of tax rate

Portfolio policy: Minimise variance of the Crown portfolio

Targets:

(a) minimum-variance portfolio (i.e. zero diversifiable risk and minimum systematic risk consistent with risks that cannot be hedged);

(b) positive CNW buffer (if unhedged risks cause negative correlation between tax and consumption, otherwise target net worth at zero)

Instruments:

(a) buy (short-sell) assets whose returns have positive (negative) correlation to public spending and negative (positive) correlation to tax base;

(b) choice of debt instruments is an empirical issue (see Missale 1997):

- nominal debt for government spending and productivity shocks;
- price-indexed debt for monetary and real demand shocks causing inflation;
- foreign currency debt when output and inflation shocks are correlated internationally;
- maturity structure of debt to match structure of planned fiscal surpluses;
- short maturity debt when positive correlation between output and real interest rates; and

(c) tax rate, as instrument for building net worth buffer (if required)

4.4 Misperceptions of default risk

The risk premium paid by an issuer of debt securities depends on the degree of default risk perceived in the markets. A poor reputation due to past actions, or simply characteristics similar to those of previous defaulters, may undermine the credibility of promises to honour debt obligations. Hence, the potential exists that the financial markets may assess a probability of default on public debt even though the government may not intend to default under any circumstances. The East Asian financial crisis is a recent example where cross-country contagion was a significant risk.

In the event that a government faces an unjustified default premium on its debt, Bohn (1995) shows that the optimal portfolio policy is to reduce the level of debt until the unjustified premium reduces to zero. If the unjustified premium is exogenous with respect to the level of debt, the optimal debt target is zero.

The debt reduction may be achieved by sale of assets where this does not undermine risk diversification or other objectives. In the absence of suitable asset sales, the optimal tax policy is to “tilt” the time profile of optimal taxes towards higher current taxes to pay down

debt to the target level. In terms of deadweight losses, a temporarily high tax rate is worth incurring in return for achieving a permanently lower tax rate by avoiding the unjustified default premium.¹⁷

The above argument may be refined in two ways:

- if the unjustified premium applies only to some types of debt (e.g. unjustified inflation risk on nominal debt), the optimal portfolio policy would place upper bounds on the particular instrument rather than debt reduction as a whole; and
- a risky security issued for hedging purposes to reduce fluctuations in the tax rate may reduce the probability of default. In this case, the optimal portfolio policy would place lower bounds on securities performing this type of role.

In addition to asset sales and temporarily higher tax rates, legislative provisions such as the Reserve Bank Act 1989 and Fiscal Responsibility Act 1994 may help to reduce unjustified default premia. Also important is a regulatory structure that underpins good corporate governance and private sector transparency, especially in the banking sector due to its central role in New Zealand of maintaining a stable financial system.

Summary for unjustified default risk

Economic objective:

Minimise the expected economic value of the deadweight loss of taxation

CFP objectives:

Portfolio policy: Minimise costs arising from unjustified default premia

Targets:

For total debt or any instruments subject to unjustified default premia, set upper bound such that unjustified premium falls to zero

Instruments:

Sale of assets

Tax rate

Institutional arrangements (e.g. RBA 1989 and FRA 1994)

4.5 Non-responsive citizens

Previous subsections have assumed that citizens adjust their total wealth portfolios in response to any change in Crown financial policy. This subsection is concerned with the case where citizens do not respond to changes in Crown financial policy. Possible reasons include bounded rationality, costly information, and capital market imperfections such as liquidity constraints, short-selling restrictions and transaction costs. These are canvassed more fully in Section 8.

Consider a situation where the government's objective is to minimise the expected value of deadweight losses (assumed to be convex in the tax rate).¹⁸ This differs from Bohn

¹⁷ Bohn (1995, pp.69-73) provides several illustrative examples based on data for New Zealand in 1994. In one example, where the unjustified default premium reduces to zero at 30% debt ratio, an initial debt of 55% of GDP would be paid down to 30% over 31 years. Bohn shows that the results are sensitive to the size of the unjustified default premium, share of debt held for foreign investors, and magnitude of tax distortions. They would also be sensitive to any effect of the tax rate on the potential growth rate of the economy.

¹⁸ Huther (1999) presents another approach where citizens also do not respond to changes in Crown financial policy. The model, based on Froot and Stein's (1998) model for private sector entities, assumes some risks are non-tradable (i.e. incomplete markets), the

(1990, 1995), where the government's objective was to maximise the utility of a representative citizen. A possible motivation for the new objective could be that the government does not possess detailed information about citizens' individual utility functions and current wealth portfolios or does not have the ability to construct a social welfare function through interpersonal comparisons. This is consistent with the view that government lacks the information necessary to engage in 'fine tuning' of policy.

In the context where the objective is to minimise deadweight losses, Grimes and Davis (2001) show that perfect tax smoothing is no longer optimal. Optimal Crown financial policy involves a trade-off between the level and variability of tax rates. The Crown would invest a portion of the balance sheet in risky assets with high-expected returns (but possibly with no hedging benefits). This would achieve lower deadweight losses through lower average tax rates.

The intuition for the Grimes/Davis result relative to Bohn (1990, 1995) is straight-forward. First, the assumption that citizens do not respond to changes in Crown financial policy removes the Crown's comparative disadvantage – in effect, the government becomes the only party able to manage the impact of the Crown on citizens' total wealth portfolio. Second, at the same time, the 'no fine tuning' assumption causes the government to adopt a simple expected value criterion that takes no account of the correlation between payoffs on high-return assets and citizens' marginal utility. The combination of these two effects causes the Bohn results to break down.¹⁹

Summary for non-responsive citizens

Economic objective:

Minimise the expected deadweight loss of taxation

CFP objectives:

Tax policy: Minimise the expected value of deadweight losses

Portfolio policy: Achieve risk/return portfolio consistent with tax policy objective

Target:

Specified level of systematic risk (exceeding minimum variance)

Instruments:

No specific information available

deadweight function is convex, and that the risk premium on borrowings is also convex in the level of borrowings. Unfortunately, the government objective function assumed in Huther is *ad hoc* and only loosely related to economic efficiency objectives.

¹⁹ Note that Bohn's results do not require government to possess a capacity for 'fine tuning'. Bohn's core assumption that citizens respond optimally to changes in Crown financial policy allows the government to target the minimum-variance portfolio without requiring any knowledge of citizens' utility functions and wealth portfolios.

5 Time-consistency of policy

Economic objective

In this and following sections we turn away from distortionary taxation as the primary determinant of Crown financial policy. In this section, the objective is to minimise the risk of creating unstable fiscal and monetary policies.

The role of public debt structure in underpinning the time-consistency of fiscal and monetary policies has been recognised since at least Lucas and Stokey (1983). In essence, any government with debt securities outstanding has an incentive to take actions that reduce the real value of debt. Possible mechanisms for reducing the value of debt are outright repudiation, unexpected increases in capital income taxes, or unexpected inflation.

The economic benefit of reducing the risk of time-inconsistency derives in part through stronger financial market credibility leading to lower default risk premia and therefore lower tax rates. However, independent of the tax channel, economic benefits also accrue through avoiding inefficiencies that would arise as the private sector attempts to anticipate and react to an unstable policy.

Key insights for policy

Crown financial policy is determined by weighing the benefits of structuring the balance sheet to eliminate or reduce the incentive on government to act inconsistently over time versus the cost of self-imposed constraints that reduce flexibility to adjust to future shocks. Consistent with the literature on adverse selection and moral hazard, there is a trade-off between incentive and insurance effects: structuring arrangements to provide insurance usually weakens the incentives for consistent behaviour while, conversely, creating strong incentives usually limits the scope for insurance.

The key insights for policy are as follows:

Debt denomination

- price-indexed and foreign-currency denominated debt avoid incentives to reduce the real value of debt through surprise inflation;²⁰
- to the extent that incentive and insurance effects should be balanced, optimal policy implies that a proportion of debt securities should still be denominated in nominal terms;
- to sustain a reputational equilibrium (and therefore time-consistent policy), the incentive to reduce the real debt by unexpected inflation must not exceed the cost of lost reputation. Loss of reputation has the character of a lumpy or fixed cost. The implication for policy is to place upper bounds (as percent of GDP) on accumulation of nominal local currency debt, with the bound set to avoid the temptation for opportunistic behaviour;

²⁰ In New Zealand, the nominal capital gain to preserve the real value of price-indexed debt is taxed. This appears to undermine demand for such securities in New Zealand.

Maturity structure²¹

- confidence crises: Bad equilibria can occur in circumstances where taxes would have to rise substantially if all parties holding maturing debt refused to rollover. For example, in times of fiscal stress the Crown could face substantial risk premia on its borrowings. A “vicious circle” could develop where a confidence crisis results in rising interest rates and depreciating currency. Such speculative attacks can force a country to repudiate its debt. A long and balanced maturity structure avoids the crisis equilibrium by limiting the potential tax increase below the trigger level for repudiation;²² and
- low inflation as reputational equilibrium: The effectiveness of surprise inflation as a method of repudiating debt is enhanced if debt has long maturity, is non-indexed, and denominated in domestic currency. Thus, to sustain a reputation for low inflation as total debt increases the optimal policy is to reduce debt maturity (and increase foreign currency denomination). Due to the ‘fixed cost’ of reputation loss, the reputation constraint binds only at high levels of debt: if debt is below the threshold level there is no constraint on maturity and currency denomination.

The results above place the onus on debt structure for underpinning time-consistent fiscal and monetary policies. In the New Zealand context, institutional arrangements such as the Reserve Bank Act 1989 and Fiscal Responsibility Act 1994 are further instruments to achieve time-consistent policy. An issue is whether the institutional arrangements eliminate entirely the need to structure the Crown portfolio to meet time-consistency objectives or whether they merely relax the level of restraint that should be embodied in portfolio policy targets. This issue is pursued in Section 11.

Summary for time-consistency

Economic objective:

Minimise the risk of creating unstable fiscal and monetary policies

CFP objectives:

Portfolio policy: Minimise the Crown’s incentive to devalue or repudiate debt (and other liabilities)

Targets:

- (a) upper bound on net debt, particularly local currency debt where achieving a low-inflation reputation equilibrium;
- (b) in event that debt exceeds threshold in (a), set lower bounds on average maturity, proportions of price-indexed and foreign-currency denominated debt; and
- (c) upper bound on quantity of debt maturing in any year (or relevant period), consistent with avoiding risk of confidence crises.

Instruments:

Tax rate and/or sale of assets

Re-weighting of liability structure (across denominations and maturities)

Institutional arrangements (e.g. RBA 1989 and FRA 1994)

²¹ Missale (1997) reports that research on maturity structure is at an early stage and that results differ across models. In addition to the two results below, Missale reports conflicting results from Calvo and Guidotti’s (1992) model of short-run opportunistic behaviour. However, their model omits any role for past behaviour to influence investors’ expectations, and the results have been shown to not be robust to allowing the issue of price-indexed or foreign currency debt. Therefore, I omit the results from this paper.

²² In an open economy, government holdings of foreign exchange reserves may also assist in reducing the risk of confidence crises.

6 Agency costs of government

Economic objective

The economic objective in this section is to minimise public sector agency costs.

Pinfield (1998) developed a simple model to demonstrate that the losses from “expenditure creep” – where an improving fiscal position increases the pressure for government spending – may outweigh the gains from tax smoothing. The model reflected that agency costs arise whenever Crown decision makers (politicians and bureaucrats) are imperfect agents of citizens.

In general, delegation of decisions from principal to agent tends to work well when the agent has good information about the principal’s best interests and strong incentives and capability to act accordingly. Conversely, agency costs tend to be high when agents have poor information, weak incentives, and wide opportunity for discretion.

Incentives

Public choice theory assumes that Crown decision-makers act in their self-interest. The theory predicts that:

- politicians (and bureaucrats), due to the need to win votes, have an incentive to promote government spending and investment favouring their special interest group constituents, even if such expenditure is inefficient;²³ and
- politicians and bureaucrats, due to their (non-marketable) human capital exposure and (possibly) asymmetric loss function²⁴, have an incentive to favour lower risk policies than otherwise would be optimal.

Opportunities

The opportunity for Crown decision-makers to act contrary to citizens’ interests may arise in several forms:

- free cash flow: Application of Jensen’s (1986) free cash flow model suggests that Crown decision-makers have greater opportunity to engage in inefficient spending and investments when substantial liquid assets have been accumulated on the Crown balance sheet and/or a “structural” budget surplus occurs;
- monitoring costs: A high risk strategy leading to greater volatility in the Crown’s earnings stream (and components of it) may inhibit effective monitoring. Highly complex strategies can also inhibit monitoring, e.g. Enron’s balance sheet transactions; and
- large player issues: Crown portfolio investments may result in the Crown acquiring dominant shareholding positions in private sector companies, providing opportunity for politicians and bureaucrats to pursue their interests to the detriment of value maximisation.

²³ This does not imply that all government expenditure is inefficient but rather that incentives may result in some inefficiencies.

²⁴ The asymmetry arises because bad outcomes may be “career limiting” whereas good outcomes may confer limited benefits (usually enhanced reputation).

Key insights for policy

The key implications for Crown financial policy are:

- tax policy objective: Rather than tax smoothing, limit free cash flows at source by favouring tax rates closer to balanced budget;
- portfolio policy objective: Use the structure of the Crown balance sheet as a fiscal anchor. For example, set a lower bound on gross debt at a level that limits future borrowing capacity. Another example would be to place an upper bound on the level of fungible assets, so that any substantive build up in Crown net worth would be in the form of non-fungible assets (e.g. investment in roads or other assets with significant political hurdles against sale of the asset). Also, limit the share of any asset held by the Crown to avoid large player issues;
- institutional arrangements: To the extent that diversification implies the Crown should invest in liquid and fungible assets, institutional arrangements may reduce agency costs:
 - improve the incentives on political decision makers through legislative or other requirements to make more transparent both intentions and subsequent performance, e.g. Fiscal Responsibility Act 1994; and/or
 - shift decisions to non-political agents with better information, incentives and capability, and limit discretion remaining with politicians and bureaucracy, e.g. New Zealand Superannuation Act (NZSA) 2001 that establishes arrangements for the New Zealand Superannuation Fund.²⁵

A “pecking order” may be applicable. First, an effective institutional arrangement that protects financial assets from political direction could alleviate the need to introduce balance sheet restrictions. Institutional arrangements such as mandatory requirements on government to pay into a fund (e.g. New Zealand Superannuation Fund) may also reduce the proportion of any budget surplus available as “free cash flow”, thereby reducing the risk of resources being diverted to inefficient government spending.

Second, in the absence of strong institutional arrangements, a portfolio policy that invests surplus cash in non-fungible assets helps to protect against future raiding of accumulated assets. To the extent that both institutional and portfolio policies are ineffective in reducing agency costs, the burden falls on tax policy in the sense of placing greater emphasis on balanced budget tax rates rather than tax smoothing.

A caveat to this analysis (which is also applicable to time-consistency issues) is that restricting opportunities does not remove the underlying incentives. Hence, use of the balance sheet and institutional arrangements as suggested above has the risk of inducing Crown decision makers to seek their desired outcomes through other mechanisms, possibly at greater cost in terms of economic efficiency.

²⁵ McCulloch (2003) describes the institutional arrangements of the New Zealand Superannuation Fund.

Summary for agency costs

Economic objective:

Minimise public sector agency costs

CFP objectives:

Tax policy: Minimise free cash flow

Portfolio policy: Minimise fungible assets and capacity for further borrowing

Institutional policy: Ensure decisions are transparent and made by agents with best information, incentives and capability

Targets:

(a) Upper bound on cyclically-adjusted budget surplus (to trigger reduced tax rates)

(b) Upper bound on fungible assets set at a level to buffer against shocks

(c) Lower bound on gross debt set consistent with limiting borrowing capacity

(d) Upper bound on share of assets held by the Crown

Instruments:

Tax rate

Portfolio weights on fungible versus non-fungible asset classes

Portfolio weights on total debt (gross or net depending on how constraint binds)

Institutional arrangements (e.g. FRA 1994 and NZSA 2001)

7 Provision of market maker services

Economic objective

The economic objective is to maximise the opportunities for New Zealand citizens and entities to engage in efficient risk sharing.

The motivation for this objective relates to ‘missing markets’. Although the potential to construct derivative contracts of almost infinite variation allows a small number of underlying securities to span a large state space, it is generally considered in the literature that capital markets are incomplete in relation to intergenerational risk and country risk (Shiller 1993). If correct, such unexploited insurance opportunities suggest the possibility that Crown financial policy could improve welfare by issuing appropriate securities. In some circumstances, the sovereign power of the state may confer a comparative advantage on the Crown as a provider of market maker services.

Key insights for policy

It has long been argued in the literature that the risk of default on private debt makes it impossible to create a private substitute for government debt (Tobin 1963 and Stiglitz 1983). Formal models deriving particular circumstances where safe debt would improve opportunities for risk sharing between current generations and generations yet unborn are available in Fischer (1983) and Peled (1985). Holmstrom and Tirole (1998) present an alternative rationale where government debt is superior to private sector instruments in the provision of liquidity services.

Research on OLG models also suggests tentatively that there may be scope for the Crown to issue output-indexed securities for managing country risk and very long-term

debt for managing intergenerational risk (Gale 1990 and Shiller 1993).²⁶ However, the literature also cautions that financial innovations could have detrimental impact on risk sharing and economic welfare. In particular, it is important to take into account how the issue of new securities would alter the distribution of government expenditure, transfers and taxes across future states of nature. A redistribution of risk across citizens could be welfare reducing.

Summary for market maker service

Economic objective:

Maximise the opportunities for New Zealand citizens and entities to engage in risk sharing

CFP objectives:

Portfolio policy: Create and maintain markets for securities that improve risk sharing

Targets:

- (a) lower bound on existing securities (e.g. safe debt) identified as important for risk sharing; and
- (b) issue new securities to bridge missing markets where this would be welfare-improving

Instruments:

Long-term debt
Range of indexed securities

8 Provision of risk management services

Economic objective

The economic objective is to achieve citizens' desired wealth portfolio, particularly meeting their desired risk tolerance.

The motivation for this objective rests on the view that citizens may be in a weak position to manage their risk exposures, including their exposure to the Crown. It is useful to think of potential barriers to efficient risk management in terms of information, incentives and capability:

- *Information:* Citizens may lack information about the risk/return properties of their exposure to the Crown (and exposures to other risks). The transactions cost of gathering appropriate information may be too high or the information simply may not be available to citizens irrespective of willingness to pay.
- *Incentives:* In general, citizens may be expected to have strong incentives to identify and manage risk exposures consistent with maximising their own welfare. However, public choice issues in a democratic political system may lead to moral hazard and therefore distorted incentives. For example, citizens might assume rationally that the government of the day will provide retirement income, leading to reduced incentive for private savings. Another example is that taxation of return on capital also distorts incentives, possibly causing citizens to exacerbate their risk exposures (Coleman, 1997b).

²⁶ An output-indexed security would have the feature that the return payable on the security varies inversely with the level of GDP (or other output measure) of the economy.

- **Capability:** Citizens may lack capability to manage their risk exposures, for two reasons:
 - citizens may not possess the capacity to make fully rational decisions consistent with their objectives. Such “bounded rationality” may result in myopic decisions as individuals seek to simplify their decision problem through, for example, the use of finite planning horizons and ignoring readily available information; and
 - capability to manage risks may be constrained by imperfect capital markets, such as liquidity constraints, short-selling restrictions, and trading margins. Missing markets or lack of access to market instruments may also present barriers to efficient risk management.

Faced with these barriers, citizens have an incentive to delegate decisions to agents with better information, incentives and capability. Private sector financial intermediaries such as banks, insurance companies, and mutual funds arise to provide risk management services of various forms.

The motivation for this section is that in some circumstances the Crown may have a comparative advantage over the private sector in the provision of particular risk management services.

Key insights for policy

For the purposes of discussion, the following ignores the conceptual and practical difficulties relating to interpersonal welfare analysis. These are discussed in Section 11.

The general nature of optimal policy may be conjectured without analysing in detail each potential barrier.²⁷ All that is required is recognition that some barriers may result in citizens being exposed to risks that desirably should be hedged, while other barriers may prevent citizens from achieving welfare-enhancing exposures. For example, bounded rationality and missing markets (or lack of access to markets) could result in citizens taking unwarranted risk exposures, while liquidity constraints may prevent citizens from creating appropriate risk exposures (e.g. by borrowing to invest in risky assets).²⁸ Short-selling restrictions could work either way: they may prevent citizens from creating risk exposures and equally they may prevent citizens from unwinding risk exposures in situations where the Crown holds too much of an asset.

Thus the first step to achieve the economic objective would involve identifying two sets of risk exposures: those exposures that should be mitigated and those exposures that should be created or increased. Crown financial policy would aim to structure the Crown portfolio to have negative correlation with exposures to be mitigated and positive correlation with exposures to be created or increased.

The analysis does not imply that the Crown portfolio should lie on the CML. Rather, the objective requires only that citizens’ total wealth portfolios be positioned appropriately on

²⁷ Formal models analysing the policy implications are sparse. All predictions in this section need to be viewed as speculative until verified by further analysis.

²⁸ Coleman (1997a) discusses the effects of differential borrowing margins, whereby the government accesses capital markets at lower borrowing interest rate than available to citizens. This is analytically similar but less extreme than liquidity constraints. As Coleman points out, rather than risk management services, citizens who face either higher borrowing rates or liquidity constraints would prefer the government to borrow and on-lend to them. For the purposes of this paper, it is assumed that government has no comparative advantage in the provision of credit intermediation services.

the CML. The location of the Crown portfolio in risk/return space would be determined by the asset and liability holdings required to ensure citizens' total wealth portfolio achieved the optimal risk/return target. In contrast to Davis (2001) and Grimes (2001a), it is unlikely that this would translate into a generic risk/return specification for the Crown portfolio.

Summary for risk management services

Economic objective:

Achieve citizens' desired risk/return trade-off on their total wealth portfolio

CFP objectives:

Portfolio policy: Crown portfolio has perfect negative correlation with all risks exposures that should be hedged and positive correlation with exposures that should be increased

Targets:

Specified risk exposures for the Crown portfolio (set to mitigate/create identified risks to citizens)

Instruments:

Portfolio weights

9 Downside efficiency risks

Economic objective

The economic objective is to minimise the risk of exacerbating existing inefficiencies or creating new sources of inefficiency in the private sector.

The motivation is that, although a market failure may exist, the limitations of government may mean that policy action would not improve economic welfare. In essence, contrary to Sections 7 and 8, government provision of new or additional market maker and risk management services may not be justified because of the risk of making matters worse. Nevertheless, if Ricardian Equivalence fails, it would remain the case that the size and structure of the Crown balance sheet would impact on economic welfare. Therefore, a relevant economic objective is to avoid exacerbating any existing inefficiencies or creating any new ones.

Key insights for policy²⁹

A number of cases may be identified where Crown financial policy potentially should target the minimum-variance portfolio:

- *Bounded rationality.* Bounded rationality implies that citizens would not take full account of the probability distribution of future tax rates (and government spending and transfers). In the extreme, bounded rationality may lead to naïve forecasting of the tax rate, i.e. citizens assume the future tax rate will be the same as the current rate until the government announces otherwise. A Crown financial policy aimed at minimising the variance of tax rates would validate such forecasts.

More generally, even if citizens' forecasts are somewhat more sophisticated than naïve forecasting, intuition suggests that a minimum-variance policy would help to

²⁹ As with the previous section, formal models analysing the policy implications are sparse and detailed predictions need to be viewed as speculative until verified by further analysis.

minimise citizens' forecast errors, thereby minimising the risk that Crown financial policy exacerbates inefficiencies arising from bounded rationality.

- *Costly information.* To the extent that information is costly to acquire and interpret, the principles of policy transparency discussed in Section 3 would apply. Transparency would at least allow financial intermediaries (as delegated agents) to acquire and interpret information on behalf of citizens.

However, citizens would still be faced with making decisions with inadequate information. If these conditions lead citizens to make naïve forecasts, a Crown financial policy aimed at minimising the variance of tax rates would minimise the risk of citizens making decision errors, thereby minimising the risk of inefficiency.

- *Capital taxation.* Coleman (1997b) shows, in the presence of capital taxation, that a Crown financial policy of investing in risky assets creates an incentive for citizens to exacerbate risk exposures. The incentive arises because good returns on the Crown portfolio lead to reduced tax rate on returns on individual portfolios, while bad returns on the Crown portfolio would lead to higher tax rates on individual portfolios. Citizens' therefore have an incentive to replicate the Crown portfolio so that their individual returns are correlated inversely with the tax rate. A Crown financial policy aimed at minimising the variance of tax rates would minimise the incentive for citizens to exacerbate risk exposures.
- *Liquidity constraints.* In Section 8 it was noted that liquidity constraints prevent some citizens from creating desired exposures by borrowing to invest in risky assets. Binding liquidity constraints would also prevent citizens from smoothing consumption in the face of variability in income and wealth. In this case, the Crown's objective could be to avoid being a cause of variability in citizen's income and wealth. Consistent with Davis (2001) and Grimes (2001a), Crown financial policy would be aimed at minimising the variance of tax rates as a means to avoid exacerbating inefficiencies arising from liquidity constraints.

Conflicting implications arising from short-selling restrictions

In contrast to the arguments above in favour of targeting the minimum variance portfolio, other considerations suggest the Crown should be cautious in accumulating risky assets for tax smoothing purposes. In the case where citizens face short-selling restrictions, a Crown investment strategy that placed too much weight on some assets relative to that desired by citizens would leave those citizens over-exposed to particular risks. An objective of minimising downside risks would suggest placing upper bounds on the accumulation of assets that are not widely held by citizens, to avoid the risk of creating exposures that citizens would be unable to unwind.

"Large player" issues

If the Crown's financial asset portfolio became large relative to the New Zealand capital market the risk would arise that the Crown's investment strategy could substantially alter domestic asset prices. Distorted prices would reduce the allocative efficiency of capital markets. Similarly, the Crown, as a large player, may acquire dominant shareholding positions in listed companies (as noted in Section 6). The Crown could effectively convert a wide range of private sector companies into state-owned entities, with the attendant risk that public choice considerations have an adverse impact on corporate governance. The policy conclusion is that the Crown should be

restricted in its holdings of some asset classes (e.g. local shares) and some particular assets.

Market maker services

The discussion on market maker services in Section 7 concluded that issue of nominal government debt and various indexed securities may enhance economic welfare. The objective in this section (of avoiding exacerbating any existing inefficiencies or creating any new ones) suggests a distinction be made between existing debt securities and financial innovations to issue securities with entirely new characteristics, e.g. country-indexed securities. The objective suggests that policy should ensure that existing benchmark securities continue to be maintained so as to avoid the risk of creating new missing markets that would occur if private sector financial innovation did not replace any government security withdrawn from the market place. This would protect against downside risks relative to the status quo.

A similar argument applies in terms of avoiding the risk of increasing liquidity premia. To the extent that a liquid secondary market has already developed on the basis of the current debt structure, reducing key debt instruments below threshold levels carries the risk of increasing liquidity premia. At a minimum, even if private sector instruments would eventually fill the gap, higher liquidity premia would apply during a transition period during which public debt is being run down but the secondary market in private market instruments had yet to become fully liquid.

Summary for downside efficiency risk

Economic objective:

Minimise the risk of exacerbating existing inefficiencies or creating new sources of inefficiency in the private sector

CFP objectives:

Portfolio policy:

- (a) minimise the risk of materially affecting asset prices;
- (b) minimise the risk of materially affecting corporate governance;
- (c) minimise the risk of creating exposures that citizens cannot unwind (e.g. due to short-selling restrictions);
- (d) minimise the risk of creating new missing markets or causing an increase in liquidity premia; and
- (e) possibly aim for minimum-variance portfolio (depending on source of market imperfection)

Targets:

- (a) upper bound on portfolio weights on assets consistent with (a) – (c) above;
- (b) lower bound on portfolio weights on benchmark debt instruments consistent with (d) above; and
- (c) minimum-variance portfolio (possibly)

Instruments:

Portfolio weights

10 Summary of objectives and targets

This section summarises the results of the previous sections to provide an overview of the policy targets relevant to each objective (refer Table 1 below).

Distortionary taxation

The objective of minimising the deadweight losses of taxation has been analysed across a range of assumptions. A clear conclusion from all models is that all diversifiable risk should be hedged by ensuring the Crown portfolio lies on the Capital Market Line. The distortionary tax objective also supports smoothing of the tax rate over the economic cycle and pre-funding of an anticipated permanent increase in government spending (also referred to as deterministic smoothing).

Other policy targets are conditional on particular assumptions. If citizens are fully rational and not constrained by imperfect capital markets, policy should target the minimum-variance portfolio, i.e. in addition to eliminating diversifiable risk, policy should minimise systematic risk up to the maximum extent permitted by available instruments. If citizens do not alter their portfolios optimally in response to changes in the Crown portfolio, the appropriate policy may involve targeting a level of systematic risk greater than the minimum feasible level.

If markets are incomplete then policy should consider building a positive balance of CNW to protect against unhedged risks. This policy conclusion applies if innovations in consumption and the tax rate are negatively correlated.

An upper bound on gross debt (or on particular debt instruments) should apply in the case where high levels of debt would attract an unjustified premium for default risk.

Time-consistency

The time-consistency objective embodies two main concerns. The first is the incentive for government to reduce the real value of debt outstanding through unexpected inflation, new taxes or outright repudiation. In this case, policy should set an upper bound on net nominal debt so that these incentives are kept in check. Where the main risk is unexpected inflation (rather than new taxes or repudiation) the upper bound would be set on net local currency debt.

If total debt exceeds the upper bound then a portion of the debt should be denominated in foreign currencies and/or indexed to inflation. Shortening the average maturity of debt also helps mitigate incentives for unexpected inflation.

The second main concern is the risk of a refinancing crisis whereby investors collectively refuse to roll over maturing debt at reasonable interest rates. The policy response implied by the literature is to set an upper bound on the volume of debt maturing in any year.

Table 1 – Summary of objectives and targets

Objectives	Targets
Policy neutrality: Maximise the potential for gross size and composition of the Crown balance sheet to be neutral for economic welfare	No specific targets identified as optimal. For purposes of transparency, the government should announce a risk/return target but otherwise may allow the Crown balance sheet to evolve as residual of government operating policies.
Distortionary taxation: Minimise the expected economic value of deadweight losses of taxation: <ol style="list-style-type: none"> 1. Linear DWL function 2. Convex DWL function 3. Incomplete markets 4. Unjustified default risk 5. Non-responsive citizens 	Tax smoothing over economic cycle Tax smoothing over anticipated permanent changes in government expenditure Zero diversifiable risk (i.e. portfolio on CML) Zero-variance portfolio (i.e. zero diversifiable and systematic risk) Minimum-variance portfolio (i.e. zero diversifiable risk and minimum systematic risk) Positive net worth buffer (if & only if negative correlation) Upper bound on total debt and/or particular instruments subject to unjustified premia Specified level of systematic risk (exceeding minimum variance)
Time-consistency: Minimise the risk of creating unstable fiscal and monetary policies	Upper bound on total net debt. If debt exceeds threshold, then lower bounds on average maturity, price-indexed and foreign-currency debt Upper bound on quantity of debt maturing in any year
Agency cost : Minimise public sector agency costs	Upper bound on cyclically-adjusted budget surplus Upper bound on fungible assets Lower bound on gross debt
Market maker services: Maximise the opportunities for New Zealand citizens and entities to engage in risk sharing	Lower bound on existing securities (e.g. safe debt) identified as important for risk sharing Issue new securities to bridge missing markets where this would be welfare-improving
Risk management services: Achieve citizens' desired risk/return trade-off on their total wealth portfolio	Specified risk exposures for the Crown portfolio (set to mitigate/create identified risks to citizens)
Downside efficiency risk: Minimise the risk of exacerbating existing inefficiencies or creating new sources of inefficiency in the private sector	Upper bound on share of any financial asset held by Crown Lower bound on benchmark debt instruments Minimum-variance portfolio (possibly) with returns equal to risk free rate

Agency cost

The agency cost objective recognises that politicians and bureaucrats sometimes face weak or misaligned incentives. Mechanisms that limit the potential for policy makers to act contrary to the interests of citizens include constraining the size of the cyclically-adjusted operating surplus, limiting the build up of fungible assets, and maintaining net debt above a lower bound to put pressure on governments to favour efficient rather than inefficient spending.

Market maker services

Missing markets – particularly in relation to intergenerational and country risk – suggest the possibility that welfare may be improved through the issue of government securities that would enhance risk-sharing opportunities. A corollary is that policy should place a lower bound on the outstanding volume of any existing securities identified as important for risk sharing.

Risk management services

The potential role of government as a provider of risk management services is motivated by the view in some papers that some citizens may be in a weak position to manage their own risk exposures. The models assume implicitly that the government would have a comparative advantage over the private sector in the provision of such services.

Downside efficiency risk

The downside risk objective has three components. The first component relates to the role of tax smoothing as a risk management tool in circumstances where citizens lack the information, incentive, or capability to manage their wealth portfolios optimally. The appropriate policy targets are similar to the case of distortionary taxation.

The second and third components relate to the risks of the Crown being a large player in the local market and the risk sharing and liquidity benefits of benchmark debt securities. The former implies that the Crown's holding of any financial asset should not exceed a threshold share of the asset. The latter implies that the volume of benchmark debt maturities should be maintained above lower bounds. Both policy targets are consistent with the status quo.

11 Selection of objectives for policy design

The analysis above has identified seven potential objectives for Crown financial policy. Ideally, the objectives would be evaluated within a comprehensive empirical framework. However, from a practical perspective, taking forward all objectives to inform the design of alternative policy options would be undesirable. This section assesses whether any objectives should be rejected *a priori* from further consideration. Rejection at this stage would not foreclose the objective being considered further once policy options associated with other objectives have been considered fully. The section also assesses the potential conflicts between the selected objectives.

The conclusion of this section is that the design of policy options should proceed without further consideration of objectives related to policy neutrality and any new market maker and risk management services. Rejection of additional ‘service provider’ motivations is consistent with conclusions reached in Skilling (1997) as discussed in the Introduction. In this formulation, government debt would be retained as an existing market maker service, being incorporated through the objective relating to downside efficiency risk.

11.1 Criteria for rejecting an objective

Subjecting the objectives to *a priori* tests incurs the risk of two types of error:

- *false negative error*: Rejection of an objective that would be accepted by more complete empirical and judgemental analysis; and
- *false positive error*: Acceptance of an objective that would be rejected by more complete empirical and judgement analysis.

The criteria should result in low risk of false negative error but be more forgiving with respect to false positive errors since the later are likely to be picked up during subsequent analysis of policy options. More generally, the criteria should be self-evident, enduring and consistent with the principles of efficient policy design.

The criteria applied below are as follows:

- *infeasible*: Reject an objective if implementation of Crown financial policy to achieve the objective would not be feasible;
- *comparative disadvantage*: Reject an objective if Crown financial policy would be at comparative disadvantage in achieving the objective relative to other instruments;
- *non-binding*: Reject an objective if the policy settings implied by the objective would in practice be non-binding on Crown balance sheet variables; or

11.2 Application of criteria

Table 2 summarises the judgements in relation to each objective. Two of the seven objectives – relating to provision of market maker and risk management services – are judged as failing the criteria.

Market maker services

With the exception of safe debt as discussed above, the role of government as provider of market maker services potentially fails three of the rejection criteria:

- implementation may not be feasible for substantive innovations such as the issue of securities indexed by country output or government spending;
- it is not obvious that the government possesses a comparative advantage over the private sector in the provision of new securities to fill missing markets. Unless specific reasons are identified to the contrary, we should assume the barriers faced by private market makers would apply also to the government; and
- in the event the government did expand its market maker service, it is not known whether the specific new instruments created for this purpose would contravene constraints implied by other objectives. To the extent that such securities would need to be issued only up to the level sufficient to sustain a liquid trading market, it would seem unlikely that such policies would materially constrain the risk/return properties of the overall Crown balance sheet. If this is the case, then the welfare benefits of providing additional market maker services could be investigated independently of the other policy options;

These factors suggest that the design of policy options for managing the Crown balance sheet should proceed without further consideration of ‘market maker services’.

Risk management services

Government provision of risk management services potentially fails two of the criteria. First, implementing a risk management service on behalf of citizens would face formidable information problems and issues associated with interpersonal welfare comparisons.

Second, any Crown financial policy designed for the purpose of providing risk management services would need to demonstrate a net welfare benefit relative to the status quo and other alternative policies. The latter would require comparison with a range of social policies available to protect disadvantaged citizens against risk exposures. These difficulties suggest that it would not be possible to implement a risk management service with high assurance of positive net welfare benefits.

In addition to the two objectives discussed above, four of the five remaining objectives could fail one or more of the criteria. For three of objectives, it is judged that sufficient doubt remains as to warrant including them in the set of objectives to take forward for further analysis.

Table 2 – Application of rejection criteria

Objectives	Infeasible to implement	Comparative disadvantage to other instruments	Non-binding on Crown balance sheet
Policy neutrality	-	-	Yes
Distortionary taxation	Implementation risks to extent that variance-covariance matrix is uncertain ³⁰	-	-
Time-consistency	-	Possibly yes for monetary policy through institutional arrangements such as RBA '89 Fiscal policy: No	Possibly yes for monetary policy if legislative protections are sufficient Fiscal policy: An empirical issue
Agency cost	-	Possibly yes if legislative protections sufficient	Possibly yes if legislative protections sufficient
Market maker services	Yes, to extent that barriers prevent issue of country- and govt spending-indexed securities	Possibly yes, as not clear why govt could avoid the barriers that inhibit private sector filling the missing markets	Possibly yes, if only need to sustain liquid secondary markets
Risk management services	Probably yes, as information requirements very large (govt. lacks capacity for 'fine tuning')	Possibly yes, as social welfare policies likely to target particular risks more directly	-
Downside efficiency risk	-	-	-

Note: Absence of firm view indicated by “-”

³⁰ The variance-covariance matrix is a matrix which has the variances of asset returns in the diagonal and covariances of returns between pairs of assets (or liabilities) in remaining cells (Copeland and Weston 1988).

Distortionary taxation

Tax smoothing involves hedging risks to the Crown balance sheet so that value changes in one part of the portfolio are balanced by changes in other parts, so that there is no need to alter tax rates to make up the difference. Successful hedging requires knowledge of the variance-covariance matrix of returns on assets and liabilities and that these parameters are relatively stable over time. Tax smoothing carries the significant risk of implementation failure due to uncertainties about variance-covariance parameters and their stability over time. The uncertainties are especially large for those Crown assets and liabilities that are non-marketable since, by definition, their returns are not directly observable.

These implementation risks apply mainly to tax smoothing over states of nature. Tax smoothing over time (involving, for example, pre-funding of anticipated future government expenditure) is less vulnerable to these risks. A further mitigating factor is the possibility that substantial hedging may be achieved through debt management structures (Angeletos, 2002).

The overall judgement of this author is that implementation risk may limit the extent of certain forms of tax smoothing but does not render infeasible all forms of smoothing. The distortionary taxation objective should remain as potentially an important determinant of Crown financial policy.

Time-consistency

The Reserve Bank Act 1989 may be viewed as an alternative to Crown financial policy as an instrument to achieve time-consistency in monetary policy. To this extent, the policy conclusions implying upper and lower bounds on various debt securities may be non-binding and irrelevant.

However, since any future Parliament could amend or repeal the Reserve Bank Act there could be circumstances in which the structure of the Crown balance sheet becomes relevant.³¹ Given that Huther (1998), Fabling (2002) and Davis and Fabling (2002) conclude the optimal Crown balance sheet could be several orders of magnitude larger than currently (e.g. financial assets and liabilities over 2500% of GDP) it is quite possible that constraints motivated by time-consistency could be breached.

On this basis, the judgement is that the Reserve Bank Act should be viewed as relaxing but not eliminating a role for Crown financial policy, i.e. constraints motivated by time-consistency of monetary policy should be included as relevant factors in the design of alternative options for Crown financial policy.

Agency costs

Legislative arrangements such as the New Zealand Superannuation Act 2001 provide a level of protection against agency costs in the build up of financial assets. Again, such arrangements would tend to relax rather than eliminate the constraints. The judgement is that the constraints motivated by agency costs are likely to be highly relevant in the design of alternative policy options.

³¹ Even in the absence of legislative changes, the frequent changes to the Policy Targets Agreement since establishment of the Reserve Bank Act indicates the potential for policy to be reinterpreted over time. Another example is the Fiscal Responsibility Act 1994, where the definition of the debt target was changed in 1999 from a net to gross basis.

Policy neutrality

Conclusions regarding policy neutrality emphasise the need for explicit decisions to be made and communicated transparently. These conclusions, which would apply to all policy options including the status quo, have no implications for the tax rate or size or structure of the Crown balance sheet. The conclusions would not affect the design of policy options for managing the Crown balance sheet other than in a very general way.

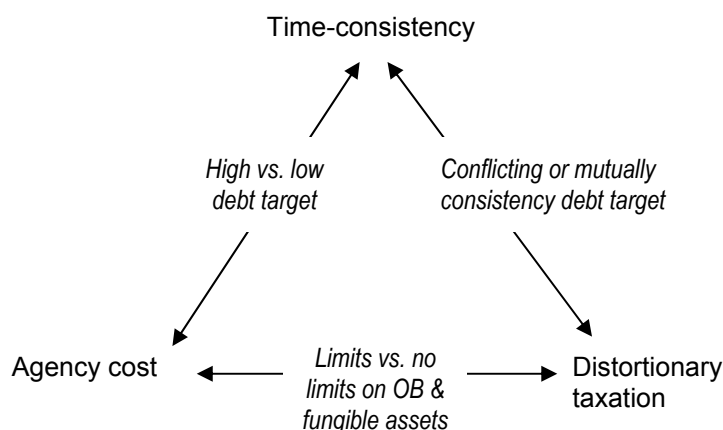
The remaining objective is the downside efficiency risk. This is judged as probably meeting the four criteria.

11.3 Conflicting targets

The four main objectives imply a range of targets could be adopted for the Crown balance sheet, some of which would be conflicting. Three potential conflicts arise from distortionary taxation, time-consistency, and agency cost (see Figure 3 below):

- the distortionary taxation and agency cost objectives tend to conflict over tax rates and hence the Operating Balance (OB) and accumulation of fungible assets. The distortionary tax objective subjugates the level of the Operating Balance and fungible assets to the needs of hedging risk (to smooth tax rates), whereas the agency cost objective implies the tax rate should adjust to limit operating surpluses and prevent any significant build up of fungible assets;
- the time-consistency and agency cost objectives tend to conflict over debt levels. The time-consistency objective implies low debt levels so that the risk premium is low or zero. The agency cost objective implies high debt as a discipline on government spending; and
- the distortionary tax objective may or may not conflict with the time-consistency objective in terms of debt levels. The distortionary tax objective may reinforce the low debt target to the extent that high debt would lead to “unjustified” risk premia on sovereign debt. However, if unjustified risk premia do not occur at any level of debt then a policy aimed at smoothing tax rates may imply aggressive leveraging of the balance sheet to fund the acquisition of financial assets.

Figure 3 – Conflicting targets



12 Conclusions

The potential for Crown financial policy to have real effects on the economy raises the obvious question as to how policy should be set to maximise economic welfare. As a first step to answering this question, this paper organises the literature on Crown financial policy around the policy framework of objectives, targets and instruments.

In this context, the Crown balance sheet may be viewed as an instrument available to target one or more economic policy objectives. Equally, the framework recognises that other instruments unrelated to Crown financial policy may be available to target one or more objectives.

Seven distinct policy objectives have been identified as potentially relevant for ensuring that Crown financial policy contributes to maximising economic welfare. The paper has identified the policy targets and, where possible, specific instruments implied by various economic models.

The main conclusion of the paper is that four objectives should be the main factors that inform the design of alternative policy options for Crown financial policy. The four objectives relate to minimising distortionary taxation, time-consistency of policy, agency costs of government, and downside efficiency risk. Three of these objectives imply targets that are potentially mutually conflicting.

These results will serve as inputs to a future paper that takes into account these conflicts to fashion 2-3 alternative policy options for further analysis.

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Appendix: The trade-off between the level and variability of the tax rate

Introduction

This Appendix is concerned with the standard tax-smoothing model where the excess burden of taxation is convex in the tax rate but the other Ricardian assumptions hold. In particular, it is assumed that capital markets are perfect and complete and individuals and benevolent governments are rational decision makers. In this context, Bohn (1990, 1995) shows in a world of uncertainty that government policy should focus on managing the Crown's aggregate balance sheet so as to minimise the variance of the tax rate. Bohn's results are counter-intuitive, as at face value it would seem the government could choose a high return/high risk portfolio that reduces the expected tax level at the expense of higher variability of tax rates. The tax-smoothing literature appears to be at variance with standard financial theory.

This apparent contradiction has been something of a puzzle. Skilling (1997, p.14) suggested that it is "misleading to examine one of these factors [level and variability of the tax rate] in isolation, as it is the combination of these factors which generate the total deadweight loss." Grimes (2001b) verifies Bohn's conclusions by numerical simulation but does not explain why they hold. He also questioned their robustness to cases where the Ricardian assumptions have been relaxed.

The purpose of this Appendix is to explain the result in Bohn (1990, 1995). The analysis is not intended to imply that a trade-off could not exist in other models with different assumptions.

The Appendix is divided into four sections:

- a brief review of two special cases where the absence of a risk/return trade-off is clear;
- intuition for Bohn's results with consumption-CAPM model;
- intuition for Bohn's results with exogenous asset prices; and
- a comment on potential weaknesses in Bohn's model.

Two special cases

Bohn has presented several special cases where it is intuitively clear that policy should focus on minimising the variability of the tax rate. Two particular cases occur where:

- citizens and/or investors are risk neutral (refer Bohn 1990); and
- fiscal risks are diversifiable (refer Bohn, 1995, p.35).³²

In the first case, where parties are risk neutral, the price of systematic risk would be zero.³³ In this case, all securities would have equal expected returns. Thus, there would

³² Fiscal risks comprise shocks to government expenditure, the tax base, and the market value of existing assets and liabilities on the Crown balance sheet.

be no risk/return trade-off on portfolio returns and therefore no exploitable opportunity available to policy makers. Convexity of the deadweight loss function therefore implies that policy should focus on minimising the variability of the tax rate.

In the second case, where fiscal risks are diversifiable, all fiscal risks may be hedged without cost in terms of forgoing portfolio expected returns. This result occurs because the price of diversifiable risk is zero. The result applies irrespective of the risk tolerance of citizens and/or investors.

The general case with consumption-CAPM model

Bohn (1995) shows the policy conclusion in favour of minimising the variability of tax rates continues to hold in the general case where:

- citizens and investors may be risk averse or risk neutral;
- fiscal risks may include a systematic component; and
- asset prices may be determined in accord with an equilibrium pricing model or exogenously.

Under these conditions, Bohn's result appears counter-intuitive since financial theory implies that hedging the systematic component would incur a cost in terms of lower portfolio expected return. It would appear that the risk/return trade-off applicable to portfolio returns should carry over to a trade-off between the level and variability of the tax rate.

To understand the fallacy of this intuition it is useful for the purposes of this Appendix to assume that asset prices are determined according to the consumption-CAPM model.³⁴ This could be relevant to a closed economy where optimality would imply citizens' consumption choices and asset prices are jointly determined.

Two key factors are important for understanding the policy conclusion in favour of minimising the variability of tax rates:

- first, from the perspective of citizens, the Crown portfolio is one of several sub-portfolios making up their total portfolio. Frictions can place the managers of a sub-portfolio at a comparative disadvantage in providing the risk/return trade-off desired on the total portfolio, e.g. tax distortions may place the Crown sub-portfolio at a comparative disadvantage; and
- second, in an equilibrium model, deadweight losses should not be evaluated by applying constant discount rates in an NPV calculation. Instead, in a closed economy the equilibrium discount rate varies with the marginal utility of consumption. This means that any reduction in deadweight losses in states of nature where marginal utility is low (i.e. high consumption) is less valuable than in states where the marginal utility is high (i.e. low consumption). As a result, calculating the net present value (NPV) of losses at constant discount rates would not reflect accurately the economic value to consumers.

³³ Standard financial theory assumes investors are risk averse, so that the price of systematic risk is positive. (This should not be confused with non-systematic or diversifiable risk, which has price of zero irrespective of investors' risk tolerance).

³⁴ This assumption is relaxed in the next section.

These two factors come together to produce the Bohn (1995) result. A convex deadweight loss function places the Crown sub-portfolio at a comparative disadvantage by increasing the spread of returns (net of tax): Bad returns on the Crown portfolio are very bad because they induce higher tax rates and therefore higher deadweight losses as well as lower after-tax returns on citizens' other sub-portfolios; Good returns are very good because they induce lower taxes and therefore lower deadweight losses as well as higher after-tax returns on other sub-portfolios. Hence, except where assets are negatively correlated with the tax rate, this unfortunate distribution of tax rates means that switching an asset from the Crown's portfolio to a portfolio held directly by individuals would reduce the variance of returns on citizens total wealth portfolios.

In addition, an inherent feature of equilibrium in the consumption-CAPM model is that the assets offering high expected returns are precisely those assets that produce high payoffs in states when consumption is high (low marginal utility) and low payoffs when consumption is low (high marginal utility). These assets must offer a higher expected return to compensate for their unfortunate distribution of payoffs (relative to the distribution of marginal utility). Hence, it is clear that an investment by the Crown in "high return" assets to reduce the expected NPV of deadweight losses (at constant discount rates) potentially could have negative economic value to consumers.

The proof that such investments necessarily would confer negative value to consumers derives from the Crown's comparative disadvantage as portfolio manager. The unfortunate distribution of tax rates (as described above) exacerbates the unfortunate distribution of gross payoffs from "high return" assets. Thus, citizens' would prefer to use one or more of their own sub-portfolios rather than the Crown sub-portfolio to optimise their holdings of risky assets. For these reasons, within this model, it is always best to assign the Crown the task of immunising its portfolio so as to eliminate citizens' exposure to the Crown, i.e. policy should minimise the variance of the tax rate.

The general case with exogenous asset prices

The result derived for the consumption-CAPM model applies also when asset prices are determined by other equilibrium models (e.g. APT) or determined exogenously. Bohn (1995, Section 2) adopts the assumption of exogenous asset prices by writing his model in terms of prices for general state-contingent claims. This approach is relevant to a small open economy, such as New Zealand, where asset prices are determined by international capital flows.

Much of the intuition of the previous section still applies. Given asset prices, optimising citizens maximise utility by trading-off the level and variability of consumption, which they implement through their choice of asset holdings. To the extent that citizens' income risks are diversifiable then their asset holdings would achieve smooth consumption at high average levels. However, to the extent that citizens' income risks include a systematic component, then by definition the equilibrium profile of consumption chosen by rational consumers would result in the marginal utility of consumption being low when asset payoffs are high (and *vice versa*). Similarly, the Crown portfolio still faces a comparative disadvantage relative to other sub-portfolios.

An example³⁵

The result above may be illustrated by a simple example involving one riskless asset earning r (assumed equal to zero) and one risky asset earning expected return of R . Suppose that in state s_1 (with probability 0.75) the risky asset has an excess return of 4 percent, and that in state s_2 (with probability 0.25) it has an excess return of -4 percent. The expected excess return is thus 2 percent.

Given this exogenous distribution of asset payoffs, a rational consumer would hold assets such that the distribution of marginal utility is uncorrelated with the distribution of asset returns, i.e. such that $E[u'(c).(R_{t+1}-r_{t+1})]=0$, where $u'(c)$ is the marginal utility of consumption and E is the expectations operator. Further, suppose that $u'(c(s_1)) = 1$ in state s_1 . Then $u'(c(s_2))$ must equal 3 for this expectation to hold.

Now suppose that if the government makes an investment it can either reduce taxes by 1 percent in state 1 or increase them by 1 percent in state 2. Assume a quadratic deadweight loss function, $h(\tau) = \tau^2$. With an initial tax rate of 0.3, the marginal deadweight losses in the two states will be 0.58 and 0.62 respectively. When these are weighted by the respective marginal utility weights, the expected economic value to citizens is -0.03.

Grimes (2001b) obtains similar results in a range of numerical simulations.

Potential weaknesses

As noted above, the purpose of this Appendix is to clarify the rationale for Bohn's theoretical results and why they are consistent with financial theory. No claim is made that the Bohn model is appropriate for analysing policy options for the New Zealand economy.

Bohn (1990, footnote 5) and Bohn (1995, p.28) take comfort that his results are robust to any form of equilibrium asset pricing model and indeed to the case where asset prices are exogenous. Bohn's comments are in reaction to the Equity Risk Premium Puzzle, whereby the main theoretical asset pricing models, such as the consumption-CAPM and APT have received, at best, very limited empirical support.

However, irrespective of how asset prices are determined, Bohn's results rely on citizens making fully rational consumption and investment decisions. In this respect, the empirical failure of the consumption-CAPM model is a failure of joint hypothesis about both consumption behaviour and asset pricing. From this perspective, the empirical failure potentially strikes at the heart of tax smoothing as Bohn's results rely heavily on the relation between consumption and asset prices implied by equilibrium models.

Looking ahead, a crucial issue is to achieve a better theoretical understanding of observed behaviour of consumption and asset prices.

³⁵ This example is from Coleman (1997a).

Glossary

APT	Arbitrage pricing theory
CAPM	Capital asset pricing model
CFP	Crown financial policy
CML	Capital market line
CNW	Comprehensive net worth
DWL	Deadweight loss
FRA	Fiscal Responsibility Act 1994, New Zealand Parliament
GDP	Gross domestic product
IBC	Inter-temporal budget constraint
NPV	Net present value
NZSA	New Zealand Superannuation Act 2001, New Zealand Parliament
NZSF	New Zealand Superannuation Fund
OB	Operating Balance in Crown Financial Statements
RBA	Reserve Bank Act 1989, New Zealand Parliament
r_f	Risk-free rate of return