Population Ageing and the Efficiency of Fiscal Policy in New Zealand

Nick Davis and Richard Fabling

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AUTHORS

Nick Davis
The Treasury, P.O. Box 3724, Wellington, New Zealand

Email	Nick.Davis@treasury.govt.nz
Telephone	64-4-471-5924
Fax	64-4-472-3791

Richard Fabling
The Treasury, P.O. Box 3724, Wellington, New Zealand

Email	Richard.Fabling@treasury.govt.nz
Telephone	64-4-471-5054
Fax	64-4-472-3791

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NZ TREASURY

New Zealand Treasury
PO Box 3724
Wellington 6008
NEW ZEALAND

Email	information@treasury.govt.nz
Telephone	64-4-472 2733
Website	www.treasury.govt.nz

Abstract

New Zealand's ageing population is expected to have a significant impact on long-term government expenditure, particularly in the areas of health and superannuation. Recent projections from Treasury's Long-Term Fiscal Model suggest that, under current policy settings, government expenditure (excluding financing costs) will increase by approximately seven percentage points of GDP by 2050. From the perspective of economic efficiency, we consider several methods for financing that expenditure.

We find that tax smoothing is significantly more efficient, from a welfare perspective, than balancing the budget. This result is primarily due to our assumption that the assets accumulated under tax smoothing earn an average return over the government's cost of borrowing. This excess return is not without risk. By modelling asset returns and economic growth in a stochastic manner we find that tax smoothing with a diversified portfolio of financial instruments may also reduce year-on-year tax rate volatility.

Introducing practical considerations, in particular expenditure creep (where additional government spending is triggered by an improving balance sheet position), tips the scales in favour of a balanced budget approach. Hence, strong fiscal institutions are a prerequisite for achieving the welfare gains from tax smoothing.

JEL CLASSIFICATION H30 – Fiscal Policies and Behaviour of Economic Agents: General
H60 – National Budget, Deficit, and Debt: General

KEYWORDS Public Finance; Tax Smoothing; Balanced Budget; Demographics; and Deadweight Loss

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1 Introduction

New Zealand, like most developed countries, faces the prospect of an ageing population. During the next century, the old age dependency ratio is expected to more than double (from 19% to 49%).[1] This dramatic demographic shift reflects the progression of the large cohort of baby boomers into their retirement years, rising life expectancies and declining fertility.[2]

Studies of the fiscal implications of population ageing consistently show that, in the absence of policy change, a significant deterioration in the fiscal position is inevitable.[3] In particular, the Treasury's Long-Term Fiscal Model (LTFM) projects government expenditure (excluding financing costs) increasing by approximately seven percentage points of Gross Domestic Product (GDP) over the next half century (see Figure 1). Two key arguments underpin this projected fiscal deterioration. First, a slower growing and eventually declining labour force is expected to lead to lower economic growth and tax revenue since unemployment and labour productivity are not projected to change significantly from historical norms. Second, increases in the average age of the population are expected to raise per capita health and superannuation expenditure.

Some political and economic commentators point towards the rising share of public expenditure to GDP, and the diminishing share of working age people in the population, and conclude that tax rates should increase now (or at least not decrease). Such arguments are usually based on a view that waiting till later to raise taxes is inefficient, unsustainable and/or unfair. On the other side of the debate, there is a strong lobby for deferring tax increases and maintaining a rough balance between taxation and expenditure. Proponents of this view emphasise the adverse effects of taxes on growth and the potential for less restrained fiscal management associated with a period of sustained primary surpluses.

In this paper, we compare these strategies by focussing on questions of economic efficiency. While also relevant to the debate, we do not address issues of equity or

1 This ratio has been defined as the population aged 65+ over those aged between 16 and 64.

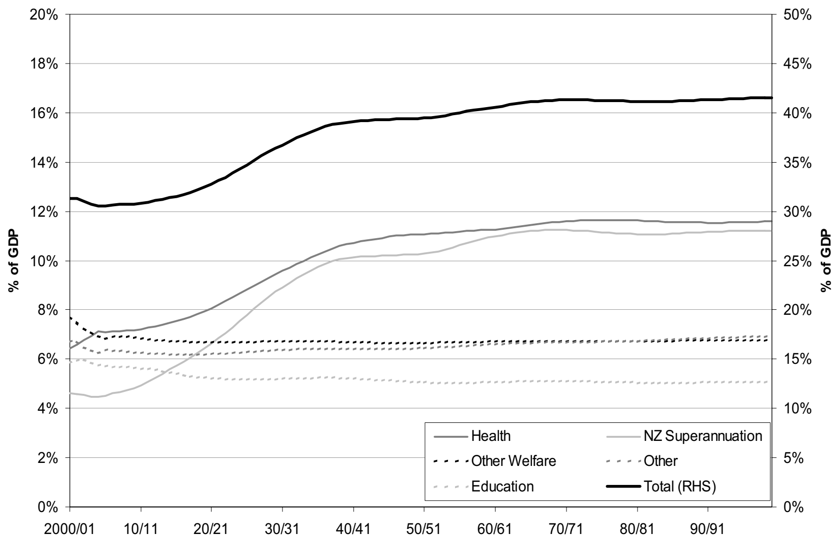
2 The baby boomers are those people born during the high birth rate years following WWII.

3 For example, see OECD (2001) and Visco (2001) for discussions in the international context, and Polackova (1996) and Bagrie (1999) for New Zealand commentaries.

sustainability. At the heart of our analysis is the question of how fiscal policy should accommodate the burgeoning expenditures associated with an ageing population.

In Section 2, we establish the analytical framework for our analysis. From a theoretical viewpoint, tax smoothing minimises the excess burden associated with taxation. To assess the quantitative benefits of this strategy we use the balanced budget approach as our benchmark and develop a stochastic model to estimate the present value of future reductions in deadweight losses.

Figure 1 – Projected expense to GDP ratios



Source: The Treasury

In Section 3, we present the results of our modelling. For a base set of assumptions, we estimate that tax smoothing has significant welfare benefits. This finding is in contrast to previous studies and is primarily due to our assumption that the assets accumulated under tax smoothing earn an average return over the government's cost of borrowing. This excess return is not without risk. Consistent with Bohn (1990), we find that a diversified portfolio of financial instruments reduces the year-on-year volatility in tax rates relative to a balanced budget strategy.

The preference for tax smoothing is robust with respect to variations in discount rates, expenditure growth assumptions, labour supply elasticities and asset allocation. However, in Section 4, we introduce practical political economy considerations to our analysis. We show that expenditure creep (where additional government spending is triggered by an improving balance sheet position) tips the scales in favour of a balanced budget approach. Hence, strong fiscal institutions are a prerequisite for achieving the welfare gains of tax smoothing.

2 Analytical framework

2.1 Efficient public finance

Economic efficiency is usually defined in terms of welfare. In the area of public finance, a key source of excess burden is taxation. Due to their involuntary nature, taxes 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. It follows that society would benefit if taxes were levied in a way that minimises the welfare costs of taxation.

Barro (1979) first demonstrated that governments should minimise the excess burden associated with taxation by smoothing tax rates over time. This result arises because welfare costs are thought to increase (decrease) by more than the proportionate rise (fall) in the tax rate. While Barro constructed his argument in a deterministic framework, Lucas and Stokey (1983) and then Bohn (1990) demonstrated that the tax smoothing result generalised in a stochastic environment to smoothing tax rates over time and across states of nature. Bohn (1990) highlighted the role for financial instruments in insuring against state-contingent shocks to the primary balance.

The implication for fiscal policy is that, by smoothing taxes, the government can minimise the present value of deadweight losses. We follow Browning (1987) in approximating the deadweight loss function by:

$$h(\tau_t) = \left[\frac{\varepsilon \tau_t^{\,2}}{2(1-\tau_t)} \right] Y_t \tag{1}$$

τ_t is the marginal rate of labour income tax; Y_t the aggregate labour income at time t; and ε the compensated net-of-tax wage elasticity of labour supply. With a discount rate r, the present value of the excess burden, $H(\tau) = \sum_{t=1}^{\infty} \frac{h(\tau_t)}{(1+r)^t}$, is used to assess the relative efficiency of alternative financing strategies.

Our theoretical approach is to estimate $H(\tau)$ with aggregate data. Browning (1987) notes that, if all households are confronted with the same marginal tax rate and had the same labour supply elasticity, this approach will yield accurate results. However when marginal tax rates and/or elasticities differ, this approach will understate the excess burden. The degree of understatement increases with the dispersion in marginal tax rates and/or elasticities.

Furthermore we treat all income as labour income. This also biases our excess burden estimates downwards because marginal deadweight losses for capital income taxes are thought to be higher than for labour income taxes. We use the ratio of total taxes to GDP (that is, an aggregate average tax rate) as our measure of the marginal tax rate. This too biases down our estimates since the aggregate marginal tax rate is higher than the aggregate average tax rate.

Equation (1) may give estimates that overstate the true welfare cost. First, Browning's partial equilibrium approach assumes that the marginal value product of additional hours worked, and therefore the gross wage rate, is constant. The degree to which this assumption biases the results depends on the elasticity of the marginal product curve relative to the labour supply elasticity. Browning argues that the demand elasticity is high relative to the labour supply elasticity. It follows that the degree of overstatement is small.

Second, if the actual compensated labour supply curve is convex instead of linear, then the excess burden measured using equation (1) overstates the true excess burden. An alternative approach is to use a compensated labour supply function that exhibits constant wage elasticity. Whether a constant elasticity specification over or understates the true welfare cost is unclear. The available evidence provides little basis for determining an appropriate form for compensated labour supply. For this reason, we test the sensitivity of excess burden estimates to changes in the functional form.

2.2 Modelling methodology

While in theory it is efficient to smooth the burden of taxes over time, in practice, and with few exceptions, governments do not tend to follow strategies that resemble tax smoothing (Alesina and Perotti, 1994). One hypothesis that might be formed from this observation is that the quantitative benefits of smoothing taxes are insignificant. Alternatively, one might suppose that there is something in tax smoothing that renders it impractical or economically costly in practice. We consider the former issue in Section 3 and leave the latter to Section 4.

Previous estimates of the welfare costs of alternative financing strategies, in the face of demographic-related expenditure growth, have found the gains of tax smoothing over balanced budget to be insignificant. In a study for the United States, Cutler et al (1990) write, "the change in the present value deadweight loss between 1990 and 2060 is 1% of 1990 GNP" (page 49). In a similar study for Denmark, Jensen and Nielsen (1995) find that the difference in the present value of deadweight losses between the two strategies "accounts for only about 0.03% of GDP in 1993" (page 17). For New Zealand, Dahanayake (1998) estimates that "the maximum gain of tax-smoothing [using a 40-year fixed horizon] over balanced-budget is only about 0.87% of projected [2007/08] GDP".[4]

While our modelling approach is similar to these previous studies there are some important differences:

- Endogenous Labour Supply - we make total hours worked endogenous to account for the substitution effect of taxes on labour supply. This adjustment is implicit in Browning's formulation of the excess burden but is overlooked by other studies.
- Moving Horizon - we employ a moving-horizon (fixed smoothing period length) in our tax-smoothing simulations.[5] This has the effect of generating a rising tax rate over the next fifty years, irrespective of the financing strategy.
- Stochastic Productivity Growth - we model labour productivity growth as a stochastic process. This has the effect of making nominal GDP growth and tax revenue stochastic, while maintaining the LTFM's hypothesised negative relationship between population ageing and economic growth.
- Government Investment in Risky Assets - we assume that the government invests primary surpluses in assets that are expected to earn returns in excess of the government's cost of borrowing. Importantly, this excess return is not without risk since returns are modelled stochastically. The risk/return properties of the financial portfolio are allowed to vary with the government's choice of asset allocation.

Other aspects of our approach are more conventional. For example, we start by assuming that the government's expenditure profile is exogenous. This assumption is partially relaxed later in the paper. The expenditure profile is obtained from Treasury's LTFM (see Woods, 2001, for an overview of that model). Tax rates are determined using deterministic GDP forecasts rather than stochastic ones. This avoids making the unrealistic assumption that the government has perfect foresight. Finally, for the tax smoothing scenarios, the tax rate is determined as the rate that is expected to return net debt to its initial level (relative to GDP) at the end of the smoothing period.[6]

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4 In Dahanayake's analysis, net debt was reduced to zero before commencing the tax-smoothing strategy. Hence, comparisons between balanced budget and tax smoothing take place in 2007/08, the year net debt was projected to reach zero.

5 We also report the fixed-horizon (diminishing smoothing period) results for comparative purposes.

6 Our definition of net debt (gross debt less total financial assets) is not to be confused with that used in the Crown Financial Statements.

2.3 Central assumptions

The modelling of alternative financing strategies and the calculation of welfare costs require a number of parameter assumptions. We define a set of base assumptions below and consider the effect of variations in most of these parameters later in Section 3.

2.3.1 Compensated Labour Supply Elasticity

We follow the approach of Browning (1995) in deriving a calibrated economy-wide estimate based on a recent survey of the empirical literature by Blundell and MaCurdy (1998). Based on this survey, we obtain midpoint estimates of compensated wage elasticities of 0.13 and 0.70 for men and women respectively.[7] A weighted-average of these estimates (with a 35% weight for women, approximately equal to their share of total labour income) yields a figure of 0.33. This is the same figure obtained by Browning (1995) based on earlier surveys by Pencavel (1986) and Killingsworth and Heckman (1986). Based on these estimates, we use 0.3 as our base estimate.

2.3.2 Labour Supply Functional Form

As discussed earlier, the available evidence provides little basis for determining an appropriate form for compensated labour supply. We use a linear specification since that is consistent with Browning's formulation of the excess burden. Later in the paper we test the sensitivity of the results to this assumption.

2.3.3 Demographics

Statistics New Zealand provides The Treasury with a number of different demographic projections. The LTFM uses the medium fertility, medium mortality series with two alternative migration assumptions. We choose the medium migration series for our base case. This series assumes a net inflow of 5,000 people per annum.

2.3.4 Expenditure Growth

We use the LTFM's base assumptions for expenditure growth, namely, 1.5% real growth in welfare, health, education and defence expenditure.

2.3.5 Asset Allocation

The majority of the Crown's marketable securities are currently invested in New Zealand bonds, and some foreign bonds, with little investment in equity markets. The New Zealand Superannuation Fund (NZSF) is anticipated to shift the composition of Crown investment towards offshore equities. These practical considerations aside, it would be prudent for any government accumulating financial assets over the long-term to adopt a diversified financial portfolio. Recent studies have shown that the government can reduce investment volatility by investing in a relatively broad range of asset classes (Huther, 1998, and Fabling, 2002). For these reasons we have chosen a "balanced" asset allocation as our base assumption.[8] Information on asset class returns, including the underlying correlation structure, is included in the Appendix.

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7 In obtaining the mid-point estimates, we drop the single largest and smallest values.

8 The balanced portfolio has equal proportions of New Zealand and foreign bonds and equities.

2.3.6 Discount Rate

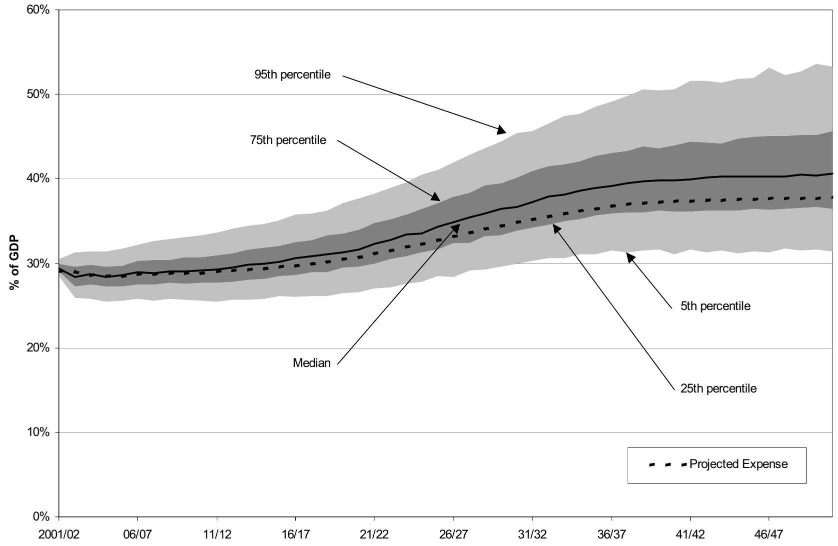
Previous studies of this type use the government's long-term borrowing rate. We follow this approach and use the yield on the 2016 inflation-indexed bond (4.7%) adjusted for expected inflation (1.5%) to give our base discount rate of 6.2%.

3 Results

3.1 Base case

We begin by analysing the balanced budget scenario. The first thing to note about the stochastic modelling is that even in the absence of risky portfolio returns, volatility in the tax base (GDP growth) has a very strong impact on the volatility of tax rates (see Figure 2). This volatility largely results from the decision not to use the balance sheet to absorb short-run volatility in the tax rate. If the gross debt target were relaxed somewhat this volatility would decline substantially (see Davis, 2001, for an example of banded debt targets in a stochastic environment).

Figure 2 – Balanced budget tax rate



Source: Authors' estimates

Due to the initial stock of debt, the government needs to run operating surpluses in order to maintain net debt as a constant share of output. The rising expenditure profile requires the median tax rate to increase from the current tax rate of 32% to 41% of GDP by 2050/51 with a 10% probability of the tax rate exceeding 50% at the end of the projection period.

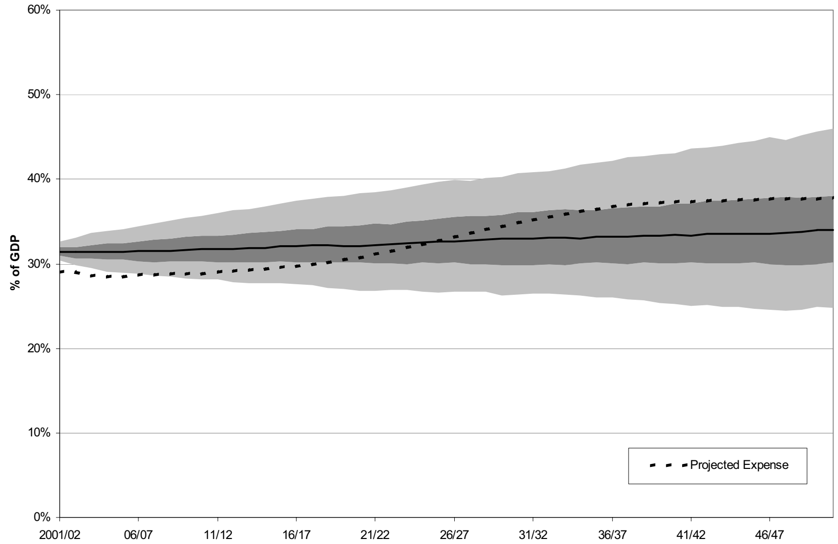
Figure 2 can be compared with the distribution of tax rates under a fifty-year tax smoothing strategy (see Figure 3). The median tax rate is much smoother, only rising slowly through time. The gentle increase reflects the fact that government expenditure is expected to reach and then maintain a higher level for the foreseeable future.[9]

Figure 4 demonstrates the extent of the asset accumulation that occurs under tax smoothing. By assumption, gross liabilities remain at a constant share of GDP implying that the median financial

[9] In a fixed horizon model, the profile of the median tax rate is flat but this strategy is unrealistic since it implies a significant upward adjustment to the tax rate in 2051/52.

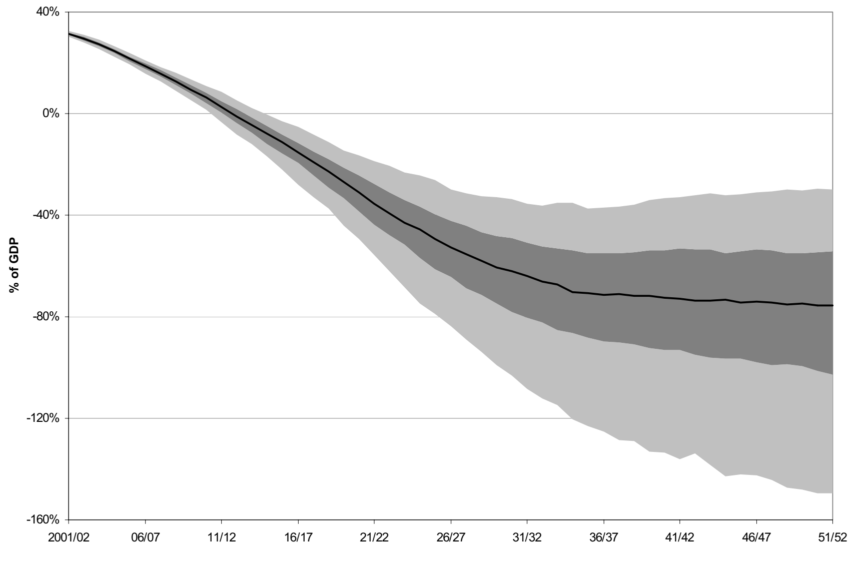
asset portfolio reaches around 107% of GDP in 2051/52. Note also the large variation in net debt levels under different simulations. This volatility is a function of both the size of the asset portfolio and the underlying volatility in returns. Despite this volatility, the two financing strategies generate distributions of tax rates that are quite similar in breadth.

Figure 3 – Tax smoothing (fifty-year moving window) tax rate



Source: Authors' estimates

Figure 4 – Tax smoothing net debt



Source: Authors' estimates

Table 1 compares the present value of deadweight loss associated with the two financing strategies. In each case, the deadweight loss is a large percentage of current GDP. These estimates are broadly in line with previous calculations by Browning (1987) and emphasise that the welfare costs of taxation are significant.

However, our estimates of the welfare savings from tax smoothing are higher than previous studies. Using the fixed horizon approach consistent with previous studies, we estimate that tax smoothing generates present value savings of 5.5% of GDP over a balanced budget strategy. This compares with previous estimates of between 0.03% of GDP and 1.0% of GNP. The main reason for this difference lies in the excess return that we assume over the government's cost of borrowing.

It would not make sense to implement a fixed horizon tax smoothing strategy in practice. Hence the remaining tax smoothing simulations are conducted on a moving horizon basis. Under our base assumptions, we estimate the welfare savings from tax smoothing to be 2.9% of 2000/01 GDP or approximately $3.3 billion. Furthermore since we are applying a 50-year moving window and the expenditure increase is persistent, a substantial pool of assets remains at the end of our assessment period. Thus the benefits of tax smoothing are underestimated substantially since, by construction, those assets would be used to partially fund another fifty years of higher expenditure.

Table 1 – Median deadweight loss for base case

Financing strategy	Loss (% 2000/01 GDP)	Saving over balanced budget (% GDP)
Balanced budget	67	N/A
Tax smoothing (50yr fixed horizon)	61	5.5
Tax smoothing (50yr moving window)	64	2.9

Source: Authors' estimates

To see how significant this underestimate might be, consider the following rough calculation of the deadweight losses outside the projection period (essentially assuming that expenditure has converged to a long-run rate). The median balanced budget tax rate in 2050/51 is 40.6% compared with 33.9% for tax smoothing with assumed future nominal growth in GDP of 2.8% p.a., thus we have:

DWL Savings ≈ DWL difference * discounted annuity increasing at GDP growth rate

$$= \frac{\varepsilon}{2Y_0}\left(\frac{\tau_{50}^{BB\,2}Y_{50}^{BB}}{1-\tau_0+\varepsilon\left(\tau_0-\tau_{50}^{BB}\right)}-\frac{\tau_{50}^{TS\,2}Y_{50}^{TS}}{1-\tau_0+\varepsilon\left(\tau_0-\tau_{50}^{TS}\right)}\right)\frac{1}{(1+r)^{51}}\frac{1}{r-g}$$

$$= \frac{0.3}{228}\left(\frac{0.406^2\times 531}{1-0.321+0.3(0.321-0.406)}-\frac{0.339^2\times 547}{1-0.321+0.3(0.321-0.339)}\right)\frac{1}{1.062^{51}}\frac{1}{0.062-0.028}$$

$$= 7\%$$

While this underestimate is significant, the rest of the paper is restricted to fifty-year simulations. This is due to the availability of forecast demographic and expenditure paths, and to allow easier comparison with earlier studies of deadweight losses.

3.2 Alternative cases

In this section we consider the impact of varying our underlying assumptions. Not surprisingly, the aggregate excess burden is most sensitive to the discount rate.

3.2.1 Compensated Labour Supply Elasticity

We re-estimate the results (reported in Table 2) with a range of elasticities between 0.2 and 0.5.

For higher elasticities, a number of the balanced budget simulations do not have solutions.[10] This is because projected government expenditure exceeds the revenue-maximising tax rate for some

[10] For ε=0.4, seven simulations do not have balanced budget solutions. The number of "failed" simulations rises to 208 when ε=0.5. That is, there is a 21% chance that continuously balancing the budget becomes impossible.

simulations.[11] In comparing the relative efficiency of the financing strategies, it is necessary to exclude the simulations for which there are no balanced budget solutions. This biases the median statistics downwards.[12] Importantly, the extent of the bias will be worse for balanced budget, underestimating the savings from tax smoothing reported in Table 2.

Table 2 – Median deadweight loss for various elasticities

Financing strategy	Loss (% 2000/01 GDP)				Saving over balanced budget (% GDP)			
	0.2	**0.3**	**0.4**	**0.5**	**0.2**	**0.3**	**0.4**	**0.5**
Balanced budget	44	67	90*	110*	N/A			
Tax smoothing	43	64	85	103	1.7	2.9	4.6	6.5

Source: Authors' estimates

3.2.2 Labour Supply Functional Form

If the compensated labour supply is not linear, the welfare cost equation takes a different form. As an alternative, we model a constant elasticity labour supply where the relationship between labour supply and the wage rate is given by $L = L_1 (w / w_1)^{\varepsilon}$. The corresponding deadweight loss function is:

$$h(\tau_t) = \left[\frac{1}{\varepsilon + 1} \left(\frac{1}{(1-\tau_t)^{\varepsilon}} - (1-\tau_t) \right) - \tau_t \right] Y_t \qquad (2)$$

Table 3 – Median deadweight loss for alternative labour supply functional form

Financing strategy	Loss (% 2000/01 GDP)	Saving over balanced budget (% GDP)
Balanced budget	62	N/A
Tax smoothing	58	3.5

Source: Authors' estimates

We can see from these results that the potential overestimate of the excess burden from assuming a linear labour supply curve is minimal (at least at an elasticity of 0.3). In fact, the saving over balanced budget is actually estimated to be larger in the constant elasticity case.

3.2.3 Expenditure profile

In the absence of rapidly increasing per capita health and superannuation costs, the question of how best to finance public expenditure would be much less important. The tax profiles associated with the balanced budget and tax smoothing strategies would be less distinct. For this reason, we consider alternative expenditure paths (low and high growth in health and education) and compare the results with those under the base case.[13] Figure 5 illustrates the sensitivity of the expenditure profile, and the tax smoothing tax rates, to variations in the real per capita expense growth.

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[11] The "failed" simulations do not imply that the balanced budget strategy is unsustainable since we do not account for the countervailing *income effect* of tax changes on the labour supply. In other words, we are capturing welfare effects rather than the total fiscal impact of tax changes.

[12] For example, the present value deadweight loss for tax smoothing, when ε=0.5, is 114% of 2000/01 GDP rather than 103%, as reported in Table 2.

[13] The low (high) growth case assumes real per capita expenditure growth in health and education of 1% (2%) per annum.

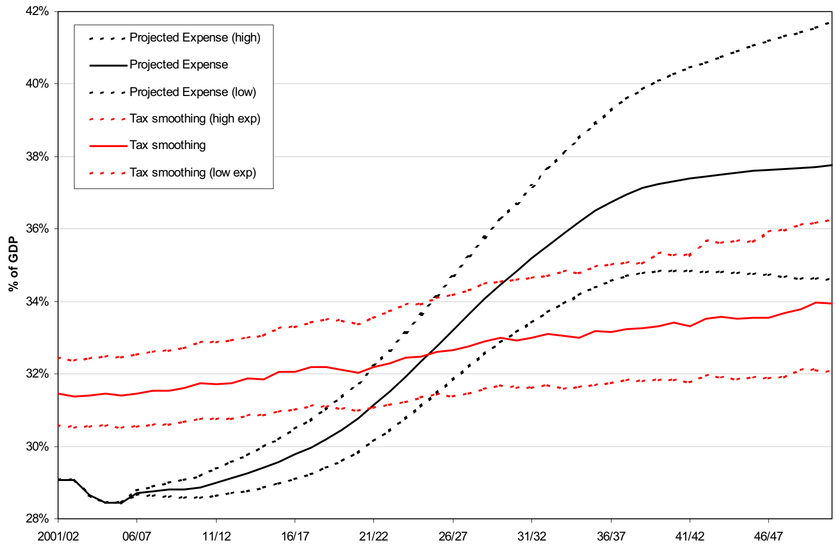
The difference in median tax rates is marked. Under the high growth scenario, expenditure grows throughout the entire projection period to reach 42% of GDP in 2050/51. With low expenditure growth, public spending peaks at just under 35% of GDP before beginning a slow decline around 2040.

Table 4 – Median deadweight loss for alternative expenditure paths

Financing strategy	Loss (% 2000/01 GDP)	Saving over balanced budget (% GDP)
Balanced budget (low expenditure)	61	N/A
Tax smoothing (low expenditure)	59	2.1
Balanced budget	67	N/A
Tax smoothing	64	2.9
Balanced budget (high expenditure)	74	N/A
Tax smoothing (high expenditure)	70	4.0

Source: Authors' estimates

Figure 5 – Median tax smoothing tax rates for various expenditure paths



Source: Authors' estimates

Table 4 demonstrates the effect that these alternative expenditure profiles have on deadweight losses. Under the high growth assumption, the adjustment to taxes under a balanced budget strategy is more severe which tends to favour the tax smoothing strategy. On the other hand, low expenditure growth requires a smaller adjustment to taxes. However, even under the low growth scenario the benefits of tax smoothing remain significant.

3.2.4 Discount Rate

We re-estimate the results (reported in Table 5) with a range of discount rates between 1.5% (that is, 0% real) and 7.2%.

Unsurprisingly, the deadweight loss savings associated with tax smoothing are highly sensitive to the discount rate, and reduce quite sharply as r increases. However, we are sympathetic to the arguments of Caplin and Leahy (2000) and others who maintain that individuals discount the future too much and that governments should employ a lower discount rate for the purposes of welfare analysis than individuals would choose in determining their utility from future consumption. This result is derived from changes in individuals' preferences as they age (changes that individuals do not anticipate). Therefore, for the purposes of policy analysis, we would tend towards applying a lower, rather than higher, discount rate than our base case.

Table 5 – Median deadweight loss for various discount rates

Financing strategy	Loss (% 2000/01 GDP)					Saving over balanced budget (% GDP)				
	1.5%	**3.0%**	**5.0%**	**6.2%**	**7.2%**	**1.5%**	**3.0%**	**5.0%**	**6.2%**	**7.2%**
Balanced budget	233	148	88	67	54			N/A		
Tax smoothing	195	130	81	64	53	37.6	18.9	6.6	2.9	1.0

Source: Authors' estimates

3.2.5 Asset Allocation

The government's choice of asset allocation is interesting for two reasons. First, it determines the expected return from assets set aside to fund future primary deficits. Other things being equal, a higher portfolio return will lower the tax rate required to finance future government expenditure (and decrease the size of the asset pool required).

Second, the asset allocation will affect the stochastic properties of the tax rate since different portfolio compositions imply different volatilities. Importantly, a more volatile portfolio (for example, one heavily weighted in equities) need not necessarily result in a more volatile tax rate because tax rate volatility is dependent on the correlation between portfolio returns and the primary balance. In the spirit of Bohn (1990), there may be efficiency benefits from diversification of the government's portfolio.

We model two alternative portfolios (All New Zealand Bond and All Foreign Equity) and compare the results with those of the base case.[14]

Table 6 – Median deadweight loss for alternative portfolio allocations

Financing strategy	Loss (% 2000/01 GDP)			Saving over balanced budget (% GDP)		
	All NZ Bond	Balanced portfolio	All Foreign Equity	All NZ Bond	Balanced portfolio	All Foreign Equity
Balanced budget	67	67	67		N/A	
Tax smoothing	68	64	59	-1.1	2.9	7.7

Source: Authors' estimates

According to these results, a strategy of tax smoothing that involved debt repayment (and then bond accumulation) would be dominated by a balanced budget strategy. However, this ignores the fact that this strategy generates an asset portfolio of 118% of GDP by 2051/52 that is expected to finance another fifty years of tax smoothing.[15] As discussed earlier, the extent of the understatement of benefits is likely to considerably raise all of the savings figures in Table 6.

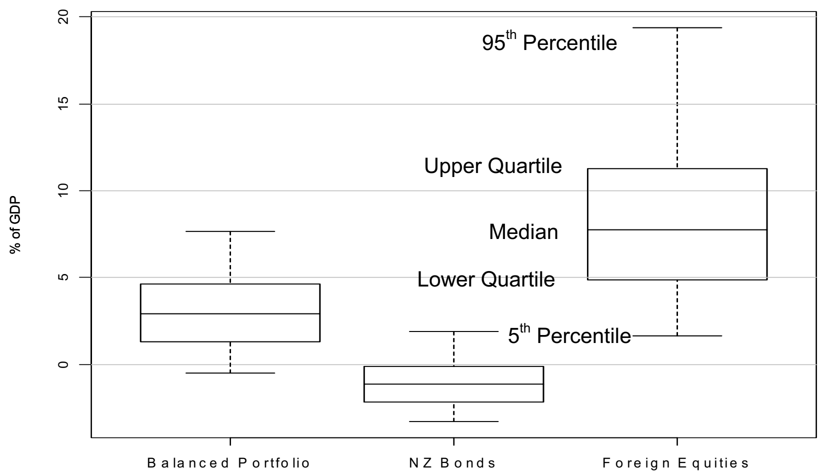
Focussing on the comparative results, note that the deadweight loss savings are quite sensitive to portfolio composition. On the basis of expected savings alone, the modelling suggests that the Crown should follow a particularly aggressive investment strategy. However, the volatility of the investment returns should also be considered.

14 The All New Zealand Bond portfolio eventually exceeds the stock of government debt but this inconsistency has been ignored for illustrative purposes.

15 By contrast, the All Foreign Equity portfolio has only reached 74% of GDP.

Figure 6 compares the distribution of deadweight loss savings for different portfolio allocations. As expected, the width of the distribution for the foreign equities portfolio is considerably wider than the other portfolios. This reflects the volatile nature of equity returns. However, most of the risk appears to be on the upside since the whole distribution sits much higher up the scale than the other portfolios. Table 7 contains the probabilities that the total deadweight loss is lower than balanced budget for each of the portfolios.

Figure 6 – Distribution of deadweight loss savings over balanced budget



Source: Authors' estimates

These probabilities suggest that, given our modelling assumptions, only a government with a very low risk tolerance could justify moving away from a strategy of investing all primary surpluses in foreign equities.[16] However, this result would be sensitive to our assumption about the size of the equity risk premium and the correlation coefficients.

Table 7 – Probability deadweight loss is lower than balanced budget

Portfolio allocation	Probability
All New Zealand Bond	22.5%
Balanced portfolio	91.1%
All Foreign Equity	99.3%

Source: Authors' estimates

Another way of thinking about risk is to consider the volatility of tax rates under various portfolio allocations. Figure 7 shows the year-to-year volatility in tax rates for different portfolio allocations. Throughout the period, the three tax smoothing investment strategies generate significantly lower year-to-year volatility in tax rates compared with the balanced budget strategy.[17] As the stock of assets accumulates under the tax smoothing strategies, return volatility contributes more to volatility in the operating balance, leading to an increase in tax rate volatility over time. This is particularly the case for the All Foreign Equity scenario, where tax rate volatility trends upwards.[18] This upward trend could be stemmed by dynamically adjusting the composition of the portfolio as it increases in size. For example, investing primary surpluses entirely in foreign equities until 2025/26, and then shifting to

16 The probability that the present value deadweight loss for the All Foreign Equity scenario is greater than the Balanced portfolio (All New Zealand Bond) scenario is 1.3% (0.6%).

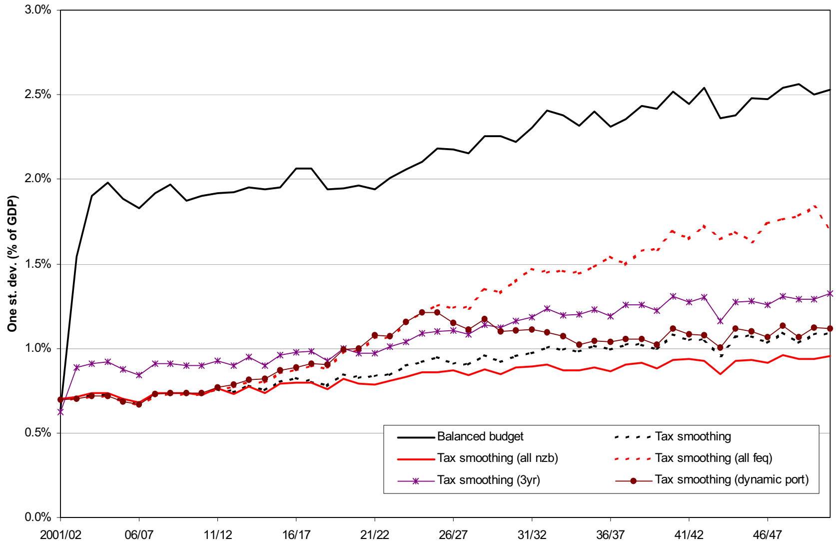
17 Much of the volatility in tax rates under the balanced budget strategy can be eliminated by smoothing over a very short time-frame (see "Tax Smoothing (3 yr)" in Figure 7).

18 Note that by 2050 the size of the All Foreign Equity portfolio has almost peaked so that this upward trend in volatility would be expected to flatten off after this point.

a balanced portfolio over a ten-year transition period, stifles the growth in year-to-year tax rate volatility in relation to the foreign equity strategy (see "Dynamic Port" scenario in Figure 7).[19]

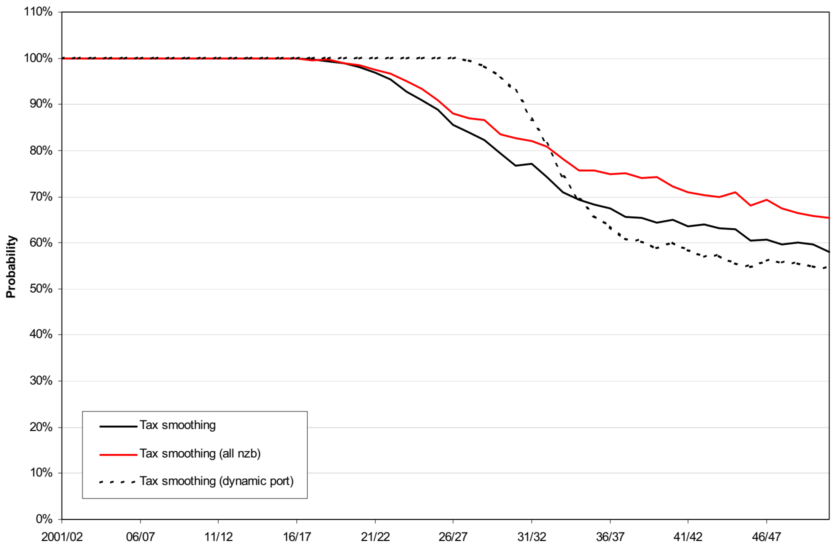
Another consideration is that, by the end of the projection period, the median tax smoothing tax rates are considerably below the balanced budget tax rate, particularly for the foreign equity strategy. This raises the question of whether it is better to have a less volatile but higher tax rate or a more volatile but lower median tax rate. To illuminate this trade-off, we consider the probability that the All Foreign Equity tax rate is lower than the All New Zealand Bond and Balanced portfolio tax rates.

Figure 7 – Volatility of individual tax rate changes for various portfolios



Source: Authors' estimates

Figure 8 – Probability the All Foreign Equity tax rate exceeds that of alternative strategies



Source: Authors' estimates

Figure 8 shows that this outcome is almost certain for the next sixteen years. After that, the volatility of the large and growing foreign equity portfolio leads to some adverse outcomes. Consequently, the probability that the All Foreign Equity tax rate will be lower falls to 65.3% for the All New Zealand Bond portfolio and 58.0% for the Balanced portfolio. Adopting the dynamic allocation strategy lowers

19 This strategy generates present value deadweight loss savings of 6% of GDP over balanced budget.

that probability even further by the end of the period. These results highlight the potential for significant one-off adverse outcomes associated with the All Foreign Equity strategy, and convey the sensitivity of the tax smoothing calculation to initial conditions.

4 Practical limitations of tax smoothing

Having established that the efficiency gains from tax smoothing are potentially significant, we must consider practical obstacles that might prevent its implementation or substantially erode the expected efficiency gains.

One argument employed by critics of tax smoothing is that, given the high frequency of small tax changes, it would be impossible to implement in practice. For example, the lead-time required to change income tax rates extends to some months. There are also administrative costs associated with implementing a change to the tax regime and the additional economic uncertainty to consider. While these are valid criticisms, we have shown that the need to change tax rates frequently is not unique to tax smoothing. Almost by definition, a balanced budget strategy will require frequent changes to tax rates. These considerations suggest placing a limit on the frequency of tax changes.

We implement this approach using a frequency of three years.[20] This has the effect of converting the tax rate into a step-wise function. The results are as follows:

Table 8 – Median deadweight loss with triennial tax changes

Financing strategy	Loss (% 2000/01 GDP)	Saving over balanced budget (% GDP)
Tax smoothing (three-year fixed horizon)[21]	67	N/A
Tax smoothing	64	2.9

Source: Authors' estimates

The savings are basically the same. As expected, the volatility of tax rate changes has increased (due to the lower frequency of changes). However the increased volatility of three-year tax smoothing (over balanced budget) is proportionately lower, since this financing strategy benefits from smoothing short-run shocks to GDP.

Table 9 – Median deadweight loss with delayed implementation

Financing strategy	Loss (% 2000/01 GDP)	Saving over balanced budget (% GDP)
Balanced budget	67	N/A
Tax smoothing (delayed start)	66	1.0

Source: Authors' estimates

Another consideration is that the informational requirements for tax smoothing are huge. There may be an option value in waiting due to the cost of getting it wrong (that is, maintaining taxes now to finance an expected expenditure profile that doesn't grow as expected comes at a high cost). Furthermore, as Jensen and Nielsen (1995) point out, "even if the government's time horizon is long, it might be tempted to enjoy the short-term benefits from the reduced pressure on public expenditures during the 'breathing space' period" (page 10). We model this latter scenario, assuming that the government operates a balanced budget until the baby boomers start to retire in 2010. Table 9 suggests that, while waiting till 2010 before implementing tax smoothing requires a much greater

[20] Three years is chosen to be consistent with the length of the electoral cycle.

[21] It makes sense to use a three-year tax smoothing horizon as the base case (ie, balance the budget across the interval that taxes are fixed). In practice, using a year-on-year balanced budget approach this way is unstable since the expenditure path is not constant.

upwards adjustment in tax rates, the deferred tax smoothing strategy still generates a welfare gain relative to balanced budget.

Another reason that has been put forward against tax smoothing is the negative relationship between tax rates and GDP growth rates. While we have modelled an effect of this sort, through the substitution effect on the labour supply, the possibility remains that we have underestimated the adverse effect of tax rates on growth. A recent OECD study on the relationship between taxation and economic performance concluded that the increase in the weighted-average tax rate of about 10 percentage points over the past 35 years has been accompanied by a 0.5 percentage point reduction in the average annual rate of economic growth (OECD, 1997).

Another point to note on the feasibility of tax smoothing is the issue of time-inconsistency. Realising the efficiency gains from tax smoothing relies on future governments' commitment to the strategy. However, in a political environment where support for a tax smoothing strategy is divided, a change in government can lead to a costly change in strategy. This problem is likely to be particularly acute in the first few years, especially if the financial asset portfolio performs poorly.

Even after a few years, the policy will remain vulnerable if political decision-makers abandon the pre-funding strategy to pursue some other objective (for example, tax cuts). However, the welfare costs of abandonment are likely to increase through time and an electorate cognisant of that fact may constrain the options of political decision-makers. In this sense, tax smoothing might become more entrenched as time goes on, assuming it gets over the hurdle of the first few years.

There is a final practical consideration that deserves more serious consideration: the critical assumption of exogenous government expenditure. Pinfield (1998) argues that tax smoothing would be undermined "if the period of operating surpluses were to trigger higher expenditure than would otherwise be the case – 'expenditure creep' in other words" (page 1). Historical evidence suggests that the level of inefficient public spending and investment rises when public finances are healthy (see Bohn, 1991, and Alesina and Perotti, 1995).

Since tax smoothing involves the accumulation of financial assets, it is possible that future governments might increase expenditure simply because they feel wealthier. Similarly, a future government may alter its investment strategy to pursue welfare objectives (Davis, 1998). The extent to which this sort of behaviour will occur depends on the time-consistency of the government's financing strategy and the strength of its governing institutions. Even with strong institutions, however, some form of expenditure creep is likely.

To demonstrate the effect of expenditure creep we introduce a simple linear rule that ties government expenditure to the level of financial assets held by the government. Endogenous government expenditure is modelled by:

$$G_t^{adj} = e_t G_{t-1}^{adj} + \delta \max(P_{t-1}, 0) \tag{3}$$

G_t^{adj} is adjusted government expenditure; P_t is the operating balance excluding portfolio returns; e_t is the (deterministic) forecast growth rate in government expenditure; and δ is the responsiveness of government spending to changes in net wealth.

Table 10 – Median deadweight loss with expenditure creep

Financing strategy	Loss (% 2000/01 GDP)	Saving over balanced budget (% GDP)
Balanced budget	67	N/A
Tax smoothing	81	-13.7

Source: Authors' estimates

Under this formulation, expenditure creep represents a permanent shift in the level of government expenditure. Furthermore, expenditure creep ceases to be an issue beyond the point at which the portfolio peaks (because it is increasing in wealth but always non-negative). Somewhat arbitrarily, we set δ equal to 10%.[22] The results of modelling are presented in Table 10. The main result is that expenditure creep is sufficient to completely erode the efficiency gains of the tax smoothing strategy.

5 Conclusions

New Zealand potentially faces a large, demographic-driven, increase in public expenditure. We have addressed the question, from the perspective of economic efficiency, of whether to smooth tax rates or run a balanced budget in the face of that eventuality. Compared with previous studies, we have found significantly higher welfare benefits from tax smoothing (around 3% of 2000/01 GDP in present value terms for a balanced financial portfolio). Furthermore, our results understate the potential benefits considerably (by a factor of three) since we have ignored the effect of a much stronger balance sheet position relative to balanced budget moving forward from 2050.

However, realisation of the welfare benefit relies heavily on achieving a credible long-term commitment to the tax smoothing strategy, particularly to maintaining tight budgetary control in the presence of a very strong balance sheet. The efficiency gains of tax smoothing are completely eroded when we relax the assumption of exogenous government expenditure and assume that political decision-makers spend a proportion of the financial assets required to smooth taxes. Hence, strong fiscal institutions are a prerequisite for achieving the welfare gains from tax smoothing.

22 Whether δ=10% is a reasonable assumption is, in our view, a completely open question. Intuitively, it would depend on the quality of both the fiscal and political institutions. To our knowledge, little empirical or quantitative work has been done in this area.

Appendix: Assumptions for Stochastic Simulations

The stochastic simulations were based on 1000 fifty-year scenarios for each of: labour productivity growth; New Zealand bond returns; New Zealand equity returns; foreign bond returns; and foreign equity returns. All series were modelled in nominal terms but, since the inflation rate is deterministic in our fiscal model, the implicit assumption is that the real series are stochastic. The series were modelled as jointly-dependent normally-distributed variables with the following population parameters:

Variables	Mean	Standard Deviation
Labour Productivity Growth (LPG)	3.0%	1.9%
New Zealand Bond Returns (NZB)	7.0%	4.6%
New Zealand Equity Returns (NZE)	8.6%	17.1%
Foreign Bond Returns (FBD)	6.7%	10.4%
Foreign Equity Returns (FEQ)	12.5%	14.9%

Sources: Statistics New Zealand, MSCI and authors' estimates

Correlation Coefficients[23]	LPG	NZB	NZE	FBD	FEQ
LPG (GDP)[24]	1.00	0.22	0.32	-0.16	0.03
NZB	0.22	1.00	0.11	0.34	0.06
NZE	0.32	0.11	1.00	-0.24	0.41
FBD	-0.16	0.34	-0.24	1.00	0.18
FEQ	0.03	0.06	0.41	0.18	1.00

Sources: Statistics New Zealand, MSCI and authors' estimates

The parameters represent the sample means, standard deviations and correlation coefficients for representative series over the period 1991:Q1 to 2001:Q3.[25] There is one exception: the calculated return on foreign bonds was adjusted downwards by two percentage points to be lower than the return on New Zealand bonds.

23 The balanced portfolio has a correlation of 0.17 with LPG and has a mean return of 8.7% and standard deviation of 7.5%.

24 Since LPG is the only stochastic input that affects GDP growth, the volatility of LPG (and the correlations with other series) represents the volatility of GDP growth. For this reason, we used a nominal GDP series to derive the volatility and correlations of the LPG series. Hence, the volatility and correlation parameters should be interpreted as relating to GDP rather than LPG.

25 All series means were measured in real terms and increased by 1.5% to obtain nominal values. The representative series are Statistics New Zealand nominal GDP and the MSCI gross return indices for New Zealand (3-5 yr) bonds, New Zealand equities, World Sovereign bonds (3-5 yr), and World equities.

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