# TREASURY WORKING PAPER 00/2

# Manual for the Long Term Fiscal Model

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**ABSTRACT**

The paper sets out a generic approach to the Long Term Fiscal Model (LTFM). The main purpose of the LTFM is to produce Progress Outlooks for Fiscal Strategy Reports. Progress Outlooks of the fiscal position are required by the Fiscal Responsibility Act 1994. The LTFM uses demographic, economic and policy assumptions to project expenses, revenue, assets and liabilities. The projections start from the end of the three-year forecasts in Economic and Fiscal Updates. Projections are usually presented as scenarios to highlight the uncertainty around the projections. The manual contains a technical description of the model and discusses procedures for using the model. A copy of the model is attached to the paper. It is a large spreadsheet run on Excel 97.

## 1. INTRODUCTION

The Long Term Fiscal Model (LTFM) projects the financial performance and the financial position of the Crown beyond the three year forecast period of Economic and Fiscal Updates.

The principal purpose of the LTFM is to produce the Progress Outlooks for Fiscal Strategy Reports. Progress Outlooks are projections (minimum of ten years) of the fiscal position, and are required by the Fiscal Responsibility Act 1994. The LTFM is also used to provide advice on fiscal policy.

The LTFM uses demographic, economic and policy assumptions to project expense, revenue, assets and liabilities. The projections in the LTFM start from the end of the three-year forecasts in Economic and Fiscal Updates. Due to the high level of uncertainty around these projections, they are usually presented as scenarios.

The basic approach of the LTFM is shown below:

**DIAGRAM 1: Approach of the LTFM**
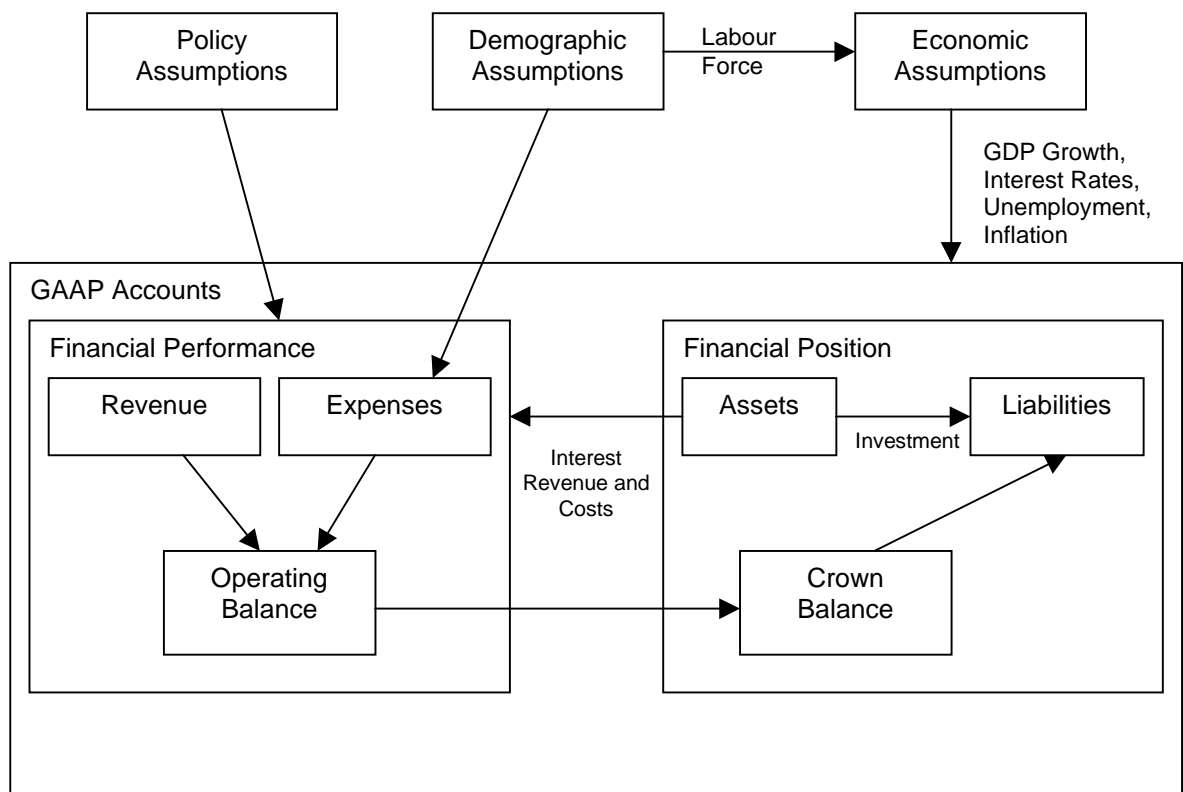
The basic features of the model as shown are:

- The LTFM projects on the basis of assumptions about fiscal policy.

- Demographic projections from the Statistics New Zealand feed into specific expense assumptions and provide labour force projections for GDP projections.

- Economic assumptions regarding GDP growth, interest rates and employment feed into revenue, expense and asset projections.

- Revenue and expense projections feed into the operating balance, which in turn feeds into the projected Crown balance.

- Changes in asset levels determine an investment requirement, which along with the operating balance determines borrowing requirements. At the margin the government finances through debt.

- The financial position feeds back into financial performance through interest costs and revenues.

The approach used to policy assumptions will depend on the purpose of particular projections. There are two basic approaches:

- a top down approach, which projects on the basis of existing expense provisions; and

- a bottom up approach, which projects on the basis of underlying cost drivers.

The LTFM does not include any feedback from expenses, tax or debt on GDP growth, interest rates or other economic variables. In other words, individual behaviour does not respond to fiscal variables. While the LTFM does not model these feedback from the fiscal position to the economy, The Treasury recognises that these effects may be important. However, advice on these effects lies outside the scope of the model.

This manual is intended to:

- ensure a consistent approach to modelling;

- provide a basis for training new Fiscal Analysis and Reporting staff, and improve understanding of the LTFM within the Treasury;

- assist Fiscal Analysis and Reporting in improving external users understanding of the LTFM, and allow for a wider dissemination of the LTFM; and

- establish procedures for satisfactory quality assurance of LTFM output.

## 2. PURPOSE OF THE LONG TERM FISCAL MODEL (LTFM)

### 2.1 Requirements of the Fiscal Responsibility Act (1994)

The principal purpose of the LTFM is to assist the Crown in meeting its obligations under the Fiscal Responsibility Act (1994).  The purpose of the Act is stated as:

> "*to improve the conduct of fiscal policy by specifying principles of responsible fiscal management and by strengthening the reporting requirements of the Crown*"

The focus of the principles of responsible fiscal management is on the Crown achieving and maintaining a strong financial position.  However, the actual requirements of the Act focus on transparency of fiscal policy making.

The Minister (responsible for the Act) is required to regularly report to Parliament and publish certain information.  The reporting is to be in accordance with generally accepted accounting practice (GAAP).  With regard to the medium and long term the Minister is required to:

- publish a Budget Policy Statement  containing the Government's long-term objectives for fiscal strategy (amongst other things); and

- to lay before Parliament a Fiscal Strategy Report assessing the consistency of the budget with the Budget Policy Statement and providing Progress Outlooks for a minimum of ten years (amongst other things).

Progress Outlooks are projections of major fiscal variables.  The projections are to illustrate, for stated assumptions, the likely future progress towards achieving the Government's fiscal strategy objectives.  The Fiscal Strategy Report must explain any differences from previous Progress Outlooks.

In addition to providing the Progress Outlooks, the LTFM is used to inform advice on the Government's fiscal strategy.  This would include its objectives as well as particular policies (e.g. tracking progress towards a debt target and advice on whether fiscal intentions are reasonable).

### 2.2 Fiscal policy advice

While the requirements of the Fiscal Responsibility Act (1994) are central to the purpose of the LTFM, it is also used to provide advice as part of the

Treasury's wider role.[1]   Within this, there are two key areas were we anticipate the model will be used to provide advice outside of the context of the FRA:

- advice on fiscal strategy, particularly in relation to decisions with major fiscal implications (e.g. tax rate changes); and

- advice on issues with long-term fiscal implications (e.g. retirement income policy and health policy).

Advice on such issues needs to recognise the limits of the LTFM.  Output from the LTFM would only form part of the policy story.

## 2.3   External users of the LTFM

We maintain the LTFM and are its most consistent users.  However, it is has been used by a number of external users and is, in general, publicly available. Indeed, we are seeking to promote use of the LTFM to increase understanding of fiscal policy and long term fiscal issues.

We would appreciate being informed of external parties intended use for the model and will naturally be interested in any results.  We will, in most instances, be prepared to provide feedback on work that uses the LTFM.  Where modified versions of the LTFM are distributed beyond initial users, we anticipate that modifications will be clearly identified.   Discussions with political parties regarding the LTFM will be governed by normal protocols for such contacts.

Many of the assumptions in the model require the user to exercise judgement. The assumptions we use often reflect work that has been undertaken by The Treasury and others that is outside the scope of this manual.  External users are urged to exercise caution when changing assumptions and to clearly communicate the assumptions they use.

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[1]   New Zealand Treasury Strategic Plan 1999 - 2000

## 3. MODEL ACCOUNTING

### 3.1 GAAP requirements

Following the requirements of the FRA, LTFM projections are generally prepared on an accounting basis using GAAP.

The GAAP standard applicable to the LTFM is Financial Reporting Standard No 29 "Prospective Financial Information".  While FRS 29 is intended for projected financial statements, it is primarily intended for projections of a shorter term than those of the LTFM.  Given the very extended projection period and the very high level of uncertainty, we take a broad approach to interpreting the requirements of FRS 29.

Following the definitions of FRS 29 the LTFM is used to provide projections rather than forecasts.[2]  Projections are based on "hypothetical but realistic assumptions and reflect possible course of action for the reporting periods concerned".  Projections would normally be presented as ranges.  It is normal practice for projections using the LTFM to contain several scenarios.

While the assumptions in projections need not be supportable, they do need to be reasonable.  Moreover, where assumptions are interdependent, the treatment of the interdependent assumptions should be consistent.

FRS 29 contains a number of disclosure requirements.  The key requirement is that all significant assumptions should be disclosed.  Moreover, where assumptions are subject to a high degree of uncertainty, the uncertainty and the potential effect on the information should be disclosed.  The remaining disclosures relate to informing users about the nature of the information and the caution necessary when using the information.

### 3.2 Mode v mean

Statutory requirements and GAAP mean the LTFM projects on the basis of what is "likely" to occur.  This can be compared to estimating the mode of a distribution.  We note that an economic approach would model the expected value or mean of the distribution.  This difference may be significant where the distribution of outcome is not symmetrical.  This would be the case where an unlikely event would have significant effect in one direction (e.g. a major earthquake).

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2  FRS 29 defines a forecast as: "prospective financial information prepared on the basis of assumptions as to future events that the governing body reasonably expects to occur associated with the actions that the governing body reasonably expects to take".  A projection is defined as: "prospective financial information prepared on the basis of one or more hypothetical but realistic assumptions, (or 'what if' scenarios), that reflect possible courses of action for the reporting periods concerned".

### 3.3 Revaluations

The projections include expected revaluations only where they can be predicted with a reasonable degree of certainty. Physical and transport assets are revalued to allow for the impact of inflation.

### 3.4 Materiality

Given the high level of uncertainty, extended time frame and use of assumptions, the model has a high materiality constraint. In considering whether an item is material, consideration is given to:

- the size of the item;

- whether separating out the item significantly alters the expense or revenue track, and

- whether the item is of particular interest to the Government in setting fiscal strategy.

### 3.5 Consolidation

The LTFM consolidates on the same basis as the Crown accounts. SOEs and CEs are, therefore, accounted on an equity basis. The main implications are:

- tax paid by SOEs and CEs is not eliminated, implying that SOE and CE returns are after tax returns; and,

- SOE debt is not included in Crown debt. This is important mainly in the context of the EQC, which may accumulate significant holdings of Crown debt over the projected period.

It is likely that the Crown will move to fully consolidating its accounts in the future. This change will significantly increase the level of expenses, revenue, assets and liabilities shown in the Crown's accounts. The LTFM would need to be put on a fully consolidated basis at the same time.

## 4.  MODEL LAYOUT

The two main sheets of the LTFM are usually labelled "base" and "scenarios". The "Scenarios" sheet contains the main assumptions used by the LTFM.  The "base" sheet is the engine of the LTFM and calculates the projections based on the assumptions from the "Scenarios" sheet.

The "Scenario" sheet contains the main assumptions (the data in H-Ass and D-Ass sheets are also assumptions) used by the LTFM.  There are two tables in the "Scenario" sheet:

- Table 1: Assumptions for Scenarios: contains the key assumptions used for each scenario (discussed in sections 5 to 10 below).

- Table 2: Technical Assumptions:  contains assumptions that are of a technical nature, which typically remain constant regardless of the scenario (discussed in section 12 below).

The "base" sheet contains, in order, the following tables:

- Table 1: Summary: which contains projections for key variables and ratios;

- Table 2: Statement of Financial Performance: Projected Statement of Financial Performance.  Below the statement are notes which show the calculations used to derive individual lines and detail on the components of major expense items.

- Table 3: Statement of Financial Position: Projected Statement of Financial Position.  Below this statement are also notes which show the calculations used to derive the individual lines and detail on the components of some major asset and liability items.

- Table 4: Economic Assumptions: Projections of economic variables.

- Table 5: Cost Drivers:  a summary of the cost drivers for each of the main expense areas.

The "base" sheet is discussed in section 12 below.

In addition to the base sheet, the LTFM contains a number of subsidiary sheets, which contain information or analysis.

- Describe: brief description of the assumptions used in each scenario;

- H-Ass: historical data and data from the three year projections from the most recent Budget Economic and Fiscal Update or December Economic and Fiscal Update;

- <u>D-Ass</u>: contains demographic projections from Statistics New Zealand that are used in the LTFM;

- <u>results$ and results%</u>:  compares summary statistics for the "base" sheet and sheets containing alternative scenarios; and,

The model may also contain sheets with alternative scenarios.  These sheets will be copies off the "base" sheet, but will use a different scenario.

The model may also contain charts set up on different sheets.

## 5. ECONOMIC ASSUMPTIONS

### 5.1 Business cycles

Economic projections are based on long run averages. Business cycles would be expected to occur, but consideration of business cycles is outside the purpose for which the Treasury uses the LTFM.

### 5.2 Feedback from the fiscal position to the economy

The LTFM does not model feedback from fiscal policy to the economy. This approach is simple and easy to explain. It allows us to focus on fiscal policy, by abstracting from particular models of the economy. [3]

There is no agreed accepted view on the exact nature of the link between fiscal policy and economic growth. In particular, the scale of impacts is uncertain. While we are happy to discuss the link between fiscal policy and economic growth, we consider that attempting to explicitly model these effects is not a productive undertaking. It is, therefore, not a high priority on our work program.

A model of economic growth could only partially model endogenous effects, which could misrepresent the effects of fiscal policy on the economy and our actual level of understanding. The Excel platform limits the extent to which we can model simultaneous effects.

While we do not attempt to model the effect of fiscal policy on the economy it is important to keep possible effects in mind. Table 1 below lists some key feedback effects that may need to be considered.

**Table 1: Economic response to fiscal variables**

| Policy variable | Possible economic impact |
| --- | --- |
| Taxation | • May impact on the efficiency of resource allocation and, therefore, productivity.<br>• It may effect labour force participation and saving, with consequent effects on growth. |
| Operating Balance | • May impact on the extent of inflationary pressure. |
| Net Debt | • Public debt levels may effect New Zealand's country risk premium and, therefore, interest rates.<br>• Changes in public debt may change in saving, with consequent effects on growth. |
| Community Wage Rate | • May impact on unemployment. |

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[3] Grimmond D. (1998) "Development of Economic Growth Equations for the LTFM" internal Infometrics paper, presents a possible set of equations for endogenous economic variables. The paper while "reasonably pleased" with its growth functions, notes that "… we recognise that it is impossible derive a simple model that will satisfy all views of what determines productivity growth". Economic literature (e.g. Romer D. (1996) "Advanced Macroeconomics") indicates that there is no agreed orthodox approach to growth theory. For a discussion of feedback from the fiscal policy to the economic growth see: Tanzi, V. and Howell, Z. "Fiscal Policy and Long-Run Growth" IMF Staff papers, Vol 44, No 2 (June 1997).

| NZ Super | • May effect saving. |
|---|---|
|  | • The age of eligibility will may effect labour force participation. |
| Investment | • May effect private sector investment and productivity. |

## 5.3  GDP growth

The LTFM projects nominal economic growth, because the Crown's accounts are kept in nominal terms and tax revenues generally grow in line with nominal GDP.

GDP growth is calculated on the basis of a steady state Solow-Swan economic growth model with Harrod-neutral (labour-augmenting) technological progress.[4] Real GDP growth is calculated as:

$$g_Y(t) = lp(t).lf(t)$$

The growth rate in output [$g_y(t)$] is equal to the product of labour productivity growth [$lp(t)$] labour force growth [$lf(t)$].

Capital is assumed to grow at a constant rate consistent with remaining a constant fraction of output.  This method of modelling long run growth is common in longer term fiscal projections.[5]

This means we assume:

- The economy is at long run trend with no business cycle.

- Labour inputs grow with movements in the labour force projections supplied by Statistics New Zealand (Section 6.2) and changes in the unemployment rate (Section 5.7).

- Capital implicitly grows at a constant rate sufficient to cover the increase in the labour force, the loss from depreciation and the increased productivity of labour so that the capital per unit of effective labour remains constant. As a result, capital as a share of output remains constant.

- Technological progress is exogenous (determined outside the model) and grows at a constant rate.  Technological progress is labour augmenting,

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4  For example, see Wells G. (1995) "Macroeconomics".

5  Chand, S.K. and Jaeger,  A. (1996) "Aging Populations and Public Pension Schemes" IMF Occasional Paper.  Rothman G.P. (1998) "Projections of Key Aggregates for Australia's Aged – Government Outlays, Financial Assets and Incomes" Paper for the Sixth Colloquium of Superannuation Researchers, University of Melbourne.  This paper was prepared by the Retirement Income Modelling Unit, which is now part of the Australian Treasury.

but not capital augmenting. The capital-output ratio remains constant and the marginal product of capital (or return on capital) remains constant.

The advantage of assuming this is that its characteristics are consistent with long run trends in economic growth[6], namely:

- per capita output grows over time, and its growth rate does not tend to diminish;

- per worker output grows steadily at the rate of technological progress;

- physical capital per worker grows over time;

- the rate of return to capital is roughly constant;

- the ratio of capital to output is roughly constant;

- the real wage rate grows at the rate of technological progress; and

- the shares of labour and physical capital in national income are roughly.

## 5.4 Labour productivity growth

The LTFM assumes economy-wide labour productivity growth of 1.5% per annum in the projected period. Typically, progress outlooks will show scenarios with alternate labour productivity assumptions of 1% (low growth) and 2% (high growth). Key work supporting this assumption is:

- Diewert and Lawerence (1999), who estimate trend market sector labour productivity growth of 1.7% between 1972 and 1998;[7] and,

- Estimated average labour productivity growth of 1.4% from 1955 to 1997, using data from a variety of sources including Philpott, B (various) and Statistics New Zealand.

- This assumption is consistent with OECD and IMF long run labour productivity growth estimates.[8] However, Australian retirement income modelling has used a labour productivity growth assumption of 1.25%.[9]

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[6] Kaldor, N. (1963) "Capital Accumulation and Economic Growth" in Lutz, F.A. and Hague, D.C., eds, Proceedings of a Conference Held by the International Economics Association, London, Macmillan. Wells (1995)

[7] Lawrence, D and Diewert, E. (1999) "Measuring New Zealand's Productivity" Report for the Department of Labour, reserve Bank and The Treasury.

[8] see for example Chand S and A Jaeger (1996), Ageing Populations and Public Pension Schemes, IMF Occasional Paper 147. Note the Congressional Budget Office model uses 1% Total Factor Productivity for the US (An Economic Model for Long Run Budget

It is possible that other effects will result in higher than expected productivity growth. For example, it is possible that there will be a delayed effect from the economic reforms or some "catch-up" with the rest of the developed world. However, there is insufficient supporting evidence to build effects of this type into the LTFM.

## 5.5 Components of GDP

Components of GDP are used in the tax revenue calculations. The components are projected as constant proportions of nominal GDP. The proportions are determined by the proportion at the end of the budget period.

## 5.6 Interest rates

The LTFM sets interest rates in real terms. Nominal interest rates are calculated as the sum of the real interest rate plus the inflation rate. In other words, we assume that a classical Fisher hypothesis will hold.

The key interest rate is the rate on five year government stock. We set this rate at 6.5% reflecting the current rate on long dated government stock. The Treasury Bill rate is usually set at 0.5% above the government stock rate, reflecting the normal margin between these instruments. The rates on foreign currency investment are set as equal to their domestic currency equivalent.

Interest rates may be above or below their expected long term rates. They will converge at rates set in the model. Interest rates for foreign currency borrowing converges more slowly, reflecting the Crown's current foreign currency portfolio. Convergence rates are generally not considered a material issue.

## 5.7 Unemployment

The LTFM adopts the 6% structural unemployment rate estimated by OECD's 1996 Survey of New Zealand. Informal discussions within Treasury suggest this is within the bounds of a reasonable estimate. Determining structural unemployment is difficult, given the recent structural change in the labour market and highly cyclical economic growth observed recently.

As with interest rates, unemployment may be above or below its long run rate at the end of the forecast period. The model includes a convergence rate for unemployment.

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Simulations, July 1997, CBO Memorandum). The implied labour productivity growth assumption will be close to 1.5%.

9  Rothman (1998), p 12.

## 5.8 Inflation

The LTFM models the Government's financial position and performance on a nominal basis. This is consistent with its three year forecasts. CPI inflation is projected at 1.5%, which is the middle of the Reserve Bank's inflation target band. The GDP deflator is set equal to consumer price inflation.

The cost of living allowance (COLA), used to adjust welfare benefits, is determined by backwards looking estimates of CPI inflation. The result is that COLA estimates in the first couple of years of the forecast period may be below the level of CPI inflation.

## 6. DEMOGRAPHIC ASSUMPTIONS

The demographic projections included in the model are provided by Statistics New Zealand. We do not consider ourselves expert in demographic issues and rely on the expertise of Statistics New Zealand.

### 6.1 New Zealand resident population projections

The LTFM uses Statistics New Zealand demographic projections. The projections are based on the 1996 Census. We use the medium fertility and medium mortality scenario. The projections are discussed in Annex 1.

We generally use the medium migration assumption of 5000 per annum, which is the long term average level of migration. The LTFM contains two alternative migration settings "High" (meaning 10,000 net migration per annum) and "Low" (meaning no net migration). Table 2 below indicates other demographic variables that may impact on the fiscal position.

**Table 2: Other demographic variables**

| Variable | Implication |
|----------|-------------|
| Fertility | Fertility is an important determinant of population structure for longer term scenarios. Higher fertility will increase the ratio of young to old, initially increasing education costs and weakening the fiscal outlook. However, as they move into the workforce higher numbers of young will improve the fiscal outlook. |
| Mortality | A shorter average life span would reduce the number of aged, and would result in lower expense levels. |

Statistics NZ provides projections by gender and one year age bands. The population is grouped into years before it is copied into the LTFM. Statistics New Zealand also projects by ethnic group, but these projections are not used in the LTFM.

### 6.2 New Zealand labour force projections

The NZ resident labour force projections are produced by Statistics NZ. The projections are derived from the NZ resident population projections by applying a labour force participation rate to each age-sex group. The base labour force is as at the 1996 Census. Trends in participation rates are determined using the 1976 to 1996 Censuses, and more recent trends from the Household Labour Force Survey. The labour force projections will change with the migration assumption. Annex 2 contains Statistics New Zealand's description of the projections.

## 7. POLICY ASSUMPTIONS

### 7.1 Approaches to policy assumptions

Assumptions about Government policy will depend on the purpose of the projections, who "owns" the projections and the time period for the projections. The two main approaches are:

- a top down approach, by consideration of medium term fiscal policy and budget strategy; and,

- a bottom up approach, by consideration of expense drivers.

The relationship between these approaches and different types of advice is shown in Diagram 2.

**DIAGRAM 2: Approach to policy assumptions**
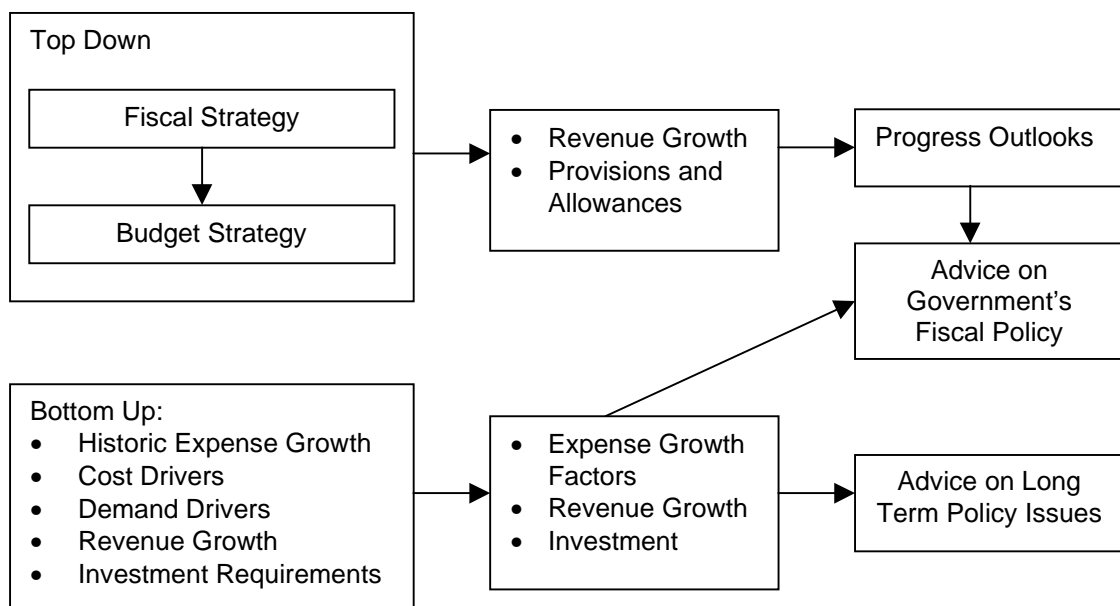


These approaches may be used in combination for the projections used in advice on the Government's fiscal strategy, including:

- the consistency of specific fiscal policies with the Government's objectives;

- the difficulty of maintaining specific policies, including indications of the types of decisions the Government would need to make (e.g. advice on the difficult of remaining within new expense provisions).

NZ Super is set by legislation. The projections follow the legislated rules in both approaches.

## 7.2 Assumptions under a top down approach[10]

A top down approach uses fiscal policy as its starting point. There are three elements of fiscal strategy that may be considered:

- the Government's long term fiscal objectives as stated in Budget Policy Statements;

- budget policies, including baseline policy (e.g. fixed nominal baselines), indexation of benefits (e.g. CPI indexation), allowances for new spending and the counting framework; and

- expense areas outside the general budget process (taxation and NZ Super are the most important of these).

The Government specifies its long-term fiscal policy objectives in the Budget Policy Statement. These objectives are usually established as target ratios (e.g. expenses to GDP and Net Debt to GDP). Progress Outlooks illustrate the Government's progress towards its targets. The projections are, therefore, based on the Government's budget policies rather than on the targets.

Unlike the provisions in the Economic and Fiscal Updates, the LTFM's "provisions" do not represent an explicit Government commitment. Instead they are extensions of the current policy over the medium term. We use the term "allowance" to indicate that the different nature of these extended provisions.

A top down approach requires the specification of the following policy assumptions:

- <u>a tax growth path</u>: the key issue is whether the projection allows for fiscal drag.[11] Revenue assumptions are discussed below in section 8.

- <u>a baseline policy</u>: current policy is for fixed nominal baselines. Health and education baselines are adjusted for demographic change.[12] Expenses are discussed below in section 9.

- <u>allowance for new initiatives</u>: the allowance for new initiatives is set in terms of an level at the end of the forecast period and a growth rate. The

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[10] Much of the discussion in this section relates to fiscal management tools used by the current Government. The specifics of the approach described here may not, therefore, be appropriate under a different Government. However, we anticipate that Government's will retain fiscal management tools of some sort. A top down approach would still be appropriate for Progress Outlooks.

[11] Fiscal drag is discussed below in section 8.3.

[12] There are a few other automatic adjustments to baselines, including to the GSF expense and student loan write-offs.

LTFM includes new initiatives on a GST inclusive bases. Expenses are discussed below in section 9.1.

- <u>benefit indexation</u>:  indexation is defined in terms of main welfare benefits (e.g. community wage) and supplementary benefits (e.g. accommodation supplement). As discussed further in section 9.1, indexation policies have implications for real and relative incomes of beneficiaries.

- <u>allowance for capital spending</u>: as with the allowance for new initiatives, the capital allowance is defined in terms of a level and a growth rate.  The capital allowance is discussed further in section 10.

The purpose of including an allowance for new initiatives is to illustrate the implications of Government policy.  The provisioning lines in the LTFM are not extended beyond the ten year horizon, because Government budget policy does not extend beyond this horizon.  We also have concerns about the reasonableness of extending such allowances beyond ten years.

## 7.3   Process for Progress Outlooks

Progress Outlooks are intended to illustrate the Government's budget strategy. It will normally be appropriate for the Treasury to engage Ministers directly regarding the policy assumptions prior to the publication of the FSR. Communication with Ministers regarding policy assumptions should make the implications of the assumption clear (e.g. not allowing for fiscal drag implies that the Government is making small ongoing tax cuts).

## 7.4   Assumptions under a bottom up approach

Bottom up projections start with consideration of underlying cost and demand drivers for expenses.  Projections using a bottom up approach tend more to being "what if" scenarios and are intended to highlight fiscal pressures that the Government is facing.  Such projections will <u>not</u> usually be based on Government fiscal policy.  These projections may be used to provide advice on fiscal policy settings.

Bottom up projections are also used to provide advice on the implications for the Crown of the expected ageing of New Zealand's population.  Over the long term, there is likely to be a very high degree of uncertainty surrounding any fiscal projections.  However, it is possible to isolate the effect of ageing on key expense areas (e.g. NZ Super and Health).  This allows us to abstract from uncertainty surrounding economic variables.  See section 9.2.3 for a further discussion of this approach.

## 7.5 Financing policy assumptions

The LTFM assumes that changes in the fiscal position are financed through changes in gross debt. This implies that the Government does not respond to changes in its financial position, or to its net investment requirements, by adjusting expense or revenue settings. This approach has the advantage that it:

- is simple (and, therefore, easy to communicate and understand);

- shows the implications of current Government expense and revenue settings (including the risk of debt spirals).

We recognise that Governments are likely to respond to changes in the fiscal position by changing tax rates or expense levels. The model does not, therefore, fully model the Government response.[13] We consider that not modelling such a response, best serves to highlight the possible need for a response.

The alternative would be to allow for some policy response to rising net debt (a debt close off rule). Any such function would be as arbitrary as the current rule. Moreover, by dampening the models response it could lead to an underestimation of the seriousness of potential risks.

At times, especially with longer timeframes, closing the accounts through net debt results in debt spirals. Given the policy regarding economic feedback loops, caution needs to be exercised when considering periods in which a debt spiral is projected. Nevertheless, a projection with a debt spiral does indicate a potential fiscal problem.

A commonly used alternative is to adjust tax revenue to achieve a balanced budget each year.[14] We will be looking at including an option for users to switch between alternative financing policy assumptions.

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[13] Alternative approaches to resolution of this issue are Grimmond D. (1998) "Development of Economic Growth Equations for the LTFM" internal Infometrics paper, Cook D. (1998) "Fiscal Modelling Scenarios" Report for the State Services Commission.

[14] This all tax financing option could be considered the opposite extreme to our all debt financing option. However, both of these options exclude the possibility of reacting through adjusting the expense track.

## 8. REVENUE ASSUMPTIONS

### 8.1 Approach to tax assumptions

For base purposes the model should assume that the Government maintains the current tax structure and undertakes sufficient maintenance to offset any erosion of the tax base. In general, this will imply that the LTFM projects the tax base to grow broadly in line with nominal GDP. The most notable exception is that fiscal drag may increase the effective tax rate on personnel income over time.

Depending on the use to which a projection is being put, it may be appropriate to include tax cuts or increases in some form (including adjustments to the tax scale). Documentation associated with projections should clearly state the assumptions have been used.

### 8.2 Explicit tax cuts and increases

Explicit tax cuts can either be funded from:

- or directly from the operating balance; or

- within the allowance for new initiatives by allocating a portion of the allowance to tax cuts (this approach is possible only with a top down approach).

Tax cuts funded from within the allocation for new initiatives are funded by reducing the allocation available for expense initiatives.

In the same way, tax increases can be used to bolster the operating balance or applied to increasing the provisions. In this case the allocation of the provision to tax will need to be negative.

### 8.3 Fiscal drag, and its relation to tax cuts

Fiscal drag is where the average personal income tax rate rises over time, because as wages grow an increasing proportion of taxable income falls into higher income tax bands. Fiscal drag occurs in all progressive income tax systems. Not including fiscal drag implies an ongoing series of tax cuts in the form of increased income tax thresholds.

LTFM projections have not included the impact of fiscal drag. This reflects a view that an assumption of a constant tax burden best serves to illustrate the direction of fiscal strategy. The implications of this assumption in terms of tax cuts should be clearly highlighted in documentation associated with a projections.

The LTFM contains the option for users to include fiscal drag.  This is carried out through an estimate of the income elasticity of personnel taxation.  This elasticity has been estimated using TAXMOD.  The income elasticity of personnel taxation is likely to fall as incomes become higher.  Since TAXMOD was not developed to forecast over a long period, it does not provide us with estimates of this effect.  Caution should, therefore, be used when applying this elasticity over long period.

## 8.4  Excise duties

The government is in the process of reducing tariffs.  This reduction in tariffs results in a reduction in revenue collected from excise duties.  For scenarios were a user wants to show the implications of holding the tax take as a proportion of the tax base constant, the reduction in tariffs should not be included in the tax revenue projections.

We note that the scale of the tariff reduction effect is significantly smaller than the effect of fiscal drag, and cannot be considered offsetting.

## 9. EXPENSE GROWTH ASSUMPTIONS

As discussed above in section 7, there are two main approaches to projecting expenses:

- a top down approach, which extends budget policy settings over the medium term; and,

- a bottom up approach, which projects by growing the base expense level by CPI inflation, an expense growth factor and an allowance for demographic change. Within the LTFM, the expense growth factors are shown in Note 11 of the LTFM (Expense Growth Factors).

Table 3 summarises the differences between assumptions typically used under a top down and bottom up approach.

**Table 3: Expense assumptions under alternative approaches**

| Top down approach | Bottom up approach |
|---|---|
| • Allowance for New Initiatives set by reference to Government Policy. | • No Allowance for New Initiatives. |
| • Allowance for New Initiatives may be allowed to grow. | • No Allowance for New Initiatives. |
| • Expense growth factors set equal to zero to reflect fixed nominal baselines policy. | • Expense growth factors set to reflect expected cost pressures. |
| • Baselines are fixed in nominal terms and, therefore, are not inflation adjusted. | • Expenses grow with inflation. |
| • Health and Education baselines adjusted for demographic factors. | • Health, Education and some core Government expense levels adjusted for demographic factors |
| • Indexation of welfare benefits follows Government policy. | • Indexation of welfare benefits to maintain relative incomes. |

As noted above, NZ Super expense is not affected by the approach adopted. The expense growth factors implied by using the provisioning approach are shown in Cost Drivers table, which is found at the bottom of the Base sheet.

## 9.1 The top down approach

### 9.1.1 Counting to the Allowance for New Initiatives

Under current fiscal policy increases in expense baselines are divided into two groups: forecasting changes and counting changes. The distinction between the two is determined by the counting framework.[15] The counting framework provides a set of rules for deciding whether additional spending counts as a new initiative. All counting changes come from the allowance for new initiatives. The expense allocations are shown in diagram 3 below.

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[15] See CO (97) 7 "Counting Changes to the Fiscal Position Against the (1996) Coalition Agreement's Fiscal Parameters", which outlines the general approach.

## DIAGRAM 3: Expenses allocations in the budget[16]

| Fixed Nominal Baseline | | Additional Expenses |
|---|---|---|

**Forecasting Changes:**
- Finance Costs
- Health demographic
- Education participation
- Benefit take up
- Benefit indexation
- NZ Super Change

**New Initiatives:**
- Cost of New Initiatives
- Cost increases for existing initiative (not absorbed within baselines)

Revised Baseline   +   Provisions   =   Total Expenses
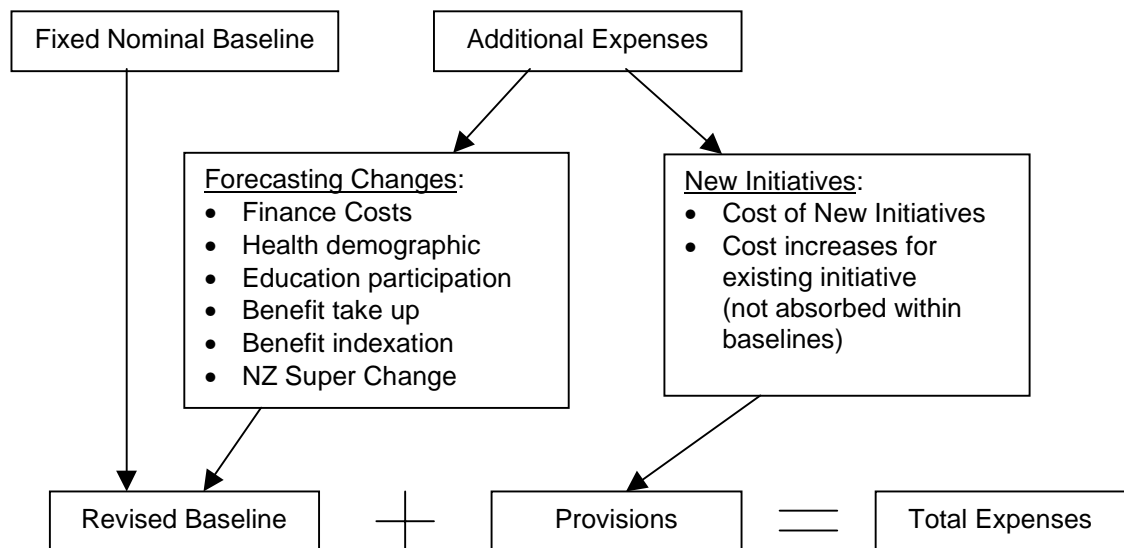
Not all the expenses that count to the allowance for new initiatives are strictly new initiatives.  In particular, expense increases due to cost increases that are not absorbed within baselines count towards the provision.  For example, wage increases for teachers and prison officers have counted as new initiatives.

The Government's commitment to the provision for new initiatives extends only to the three year forecast period.  For the ten year projections we assume that the Government retains the same level of commitment to limiting expense growth.  This has been taken to mean that the level of the provision remains constant as a proportion of GDP and, therefore, grows with GDP.

### 9.1.2  Baseline policy

Government departments have scope to manage expenses within baselines. By making efficiency gains, departments can absorb cost increases, such as wage increases.  With the agreement of their Minister (and Cabinet) departments can undertake new initiatives within baselines, provided that savings are found elsewhere (through efficiencies or reducing other programs).

Fixed nominal baselines requires that cost pressures are either absorbed through efficiency gains or that the cost is met from the allowance for new initiatives.  In terms of model mechanics, a fixed nominal baseline policy requires that the expense growth factors are equal to zero.

Baselines for health and education are adjusted annually for demographic changes.  Other demographic pressures are managed within baselines.  Health

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16 The process of revising the baselines is known as the " budget baselines update", and the process of allocating the provisions is the "budget initiatives process".

spending is also adjusted annually for other pressures, such as inflation. However, these adjustments are counted against the allowance for new initiatives.

Baselines for welfare benefits adjust automatically with projected beneficiary levels. Current baseline policy is to inflation index welfare benefits. Supplementary benefits (e.g. the accommodation supplement) are not indexed. Any increase in benefit levels above this would need to be included within the allowance for new initiatives.

## 9.2   The bottom up approach

Projections using a bottom up approach start with consideration of underlying cost and demand drivers for expenses. Projections using a bottom up approach tend more to being "what if" scenarios and are intended to highlight expense pressures that the Government is facing. Such projections may not be based on Government fiscal policy. Rather, they would be based on judgements about the extent of likely cost pressures. These projections may be used to provide advice on fiscal policy settings.

### 9.2.1   Historic Expense Growth

A first reference point for considering expense growth will be historic expense trends. Table 4 shows historic expense growth trends for by a broad functional classification.

**Table 4: Average real expense growth 1994/95 to 1998/99[17]**

| Real growth per recipient | |
|---|---|
| Health | 3.8% |
| Compulsory Education | 2.8% |
| Tertiary Education | -4.3% |
| Social Welfare (Ex Super) | 1.6% |
| **Real growth** | |
| Defence | -0.2% |
| Other Discretionary | 1.8% |

### 9.2.2   Labour cost growth

The most important input into public sector production is labour. Our expectation is that, in the long run, economy-wide wage growth will increase with economy-wide labour productivity growth and CPI inflation.[18] Moreover, we expect that public sector wages will increase in line with economy-wide wages. Assuming labour productivity growth of 1.5%, therefore, also implies labour cost growth (above CPI inflation) of 1.5%.

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[17] Uses a composite LCI – PPI central Government deflator, except for Social Welfare, which uses CPI as a deflator.

[18] This approach is also used by Chand S.K. and Jaeger A. (1996) "Aging Populations and public Pension Schemes" IMF Occasional Paper.

This can be extended to an assumed expense growth factor of 1.5%, if we make the following assumptions:

- productivity growth has no net effect on expenses;

- the government purchases a constant amounts of outputs;

- the ratio of capital input costs to labour input costs is constant;

- there are no economies of scale, fixed costs or Baumol effects.

### 9.2.3  Expenses as a percentage of GDP

We generally present changes in expenses as a percentage of GDP.  As discussed above in section 5.3, we take the following approach to projecting GDP growth:

(1)
$$\frac{GPD(t)}{GDP(t-1)} - 1 = \frac{lp(t)}{lp(t-1)} \cdot \frac{lf(t)}{lf(t-1)} - 1$$

where:  lp        is labour productivity at time t; and,
          lf        is the labour force at time t.

Following the discussion in section 9.2.2 above, we can formulate expense growth as:

(2)
$$\frac{E(t)}{E(t-1)} - 1 = \frac{y(t)}{y(t-1)} \cdot \frac{p(t)}{P(t-1)} = \frac{w(t)}{w(t-1)} \cdot \frac{p(t)}{p(t-1)} - 1$$

where:  E(t)       is the expense level at time t;
          y(t)       is the amount of output purchased for each recipient in the population group relevant to that expense;
          p(t)       is the population of the relevant group at time t; and,
          w(t)       is the wage rate at time t.

If we assume that lp(t) = w(t), then the ratio of expense growth to the GDP growth can is (by combining (1) and (2)):

(3)
$$\frac{E(t)}{E(t-1)} \bigg/ \frac{GDP(t)}{GDP(t-1)} = \frac{p(t)}{p(t-1)} \cdot \frac{lf(t-1)}{lf(t)}$$

In words, the change in the expense to GDP ratio is determined by the changes in the population and the chance in the labour force.[19]  In other words, the ratio

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[19] For health and some social welfare expense areas the composition of the population will also effect this ratio.

is determined only by changes in demographic factors and invariant to changes in labour productivity and wages rates. An increase in the labour force will decrease the ratio of expenses to GDP. This approach, therefore, allows us to abstract from the uncertainty surrounding labour productivity estimates.

This result provides another reason for assuming that expense growth is equal to labour productivity growth. This assumption isolates changes that resulting from demographic change. Using this assumption is, therefore, useful for illustrating the implications of demographic change.

Strictly following this approach implies that economy-wide labour productivity growth will not lead to an improved fiscal position. If the relation between labour productivity and expense growth does not hold strictly, but rather is only a strong correlation, labour productivity growth will have limited effect on improving the fiscal position. In other words, the ability of the Government to "grow" its way out of demographic expense increases may be limited.

### 9.2.4  Productivity in the public sector

It is likely that technological change will increase productivity in at least some areas of the public sector. This productivity growth can only reduce the cost of providing services. However, the reduced cost of services may also result in increased government purchases. Moreover, technological change may open new areas for public spending (e.g. in healthcare).

It is difficult to determine which of these two effects will dominate. For the purposes of the LTFM our base assumption is that these changes will have no net effect on public spending. In policy terms, this implies that savings from productivity gains are ploughed back into the purchase of additional services. This approach is also broadly consistent an assumption that baselines grow with nominal wages.[20]

In some circumstances, it may be possible to provide better estimates of the risks surrounding technological change (e.g. Health). However, given the uncertainty surrounding such estimates they would usually be presented as alternate scenarios.

### 9.2.5  Economies of scale and non-rival goods

The demographic assumptions for administration and some other expense areas imply that there are economies of scale.[21] Expense growth in these areas is not linked to population growth. This implies that they have a fixed cost

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[20] Since a bottom up approach does not allow for increased purchases of public sector outputs except in this narrow situation, we are effectively assuming that the Government is not subject to Baumol's cost disease.

[21] There is no demographic link for administration expenses (including Core Government Services, Health Administration, Education Administration and Social Welfare administration), defence, and economic, primary and cultural services.

nature, which results in economies of scale.  As a percentage of GDP, expense growth in these areas will fall.  Our reason for this approach is that:

- costs in these areas may be fixed.  For example, IRD is unlikely to require significant extra staff to process tax returns.

- the goods may be non-rival, additional people may be able to enjoy the goods without additional purchases by government.  For example, will we need more defence as the population grows?

It is easy enough to see areas where these arguments could be extended.  For example, to the administration of the health system.  However, this could also go the other way.  For example, IRD may need additional auditors as the population grows and we feel obliged to contribute more to international peacekeeping as the population grows.  The approach adopted is intended to provide a balance, without unnecessarily complicating the model.

### 9.2.6  Social welfare

The expense growth factors for social welfare do not reflect increases in underlying cost, since there is no production of services.  Rather the expense growth factors relate to the relative incomes of beneficiaries (compared with the workforce).

The general approach (when using a bottom up approach) followed by the LTFM is to assume that the relative incomes of beneficiaries are maintained.  This implies expense growth factor for social welfare that is equal to labour productivity growth and real wages.  The strength of this approach is that recognises that there is likely to be pressure for additional welfare spending if relative incomes fall.  It is, therefore, appropriate for scenarios that are used to illustrate expense growth.

The alternative would be to assume no expense growth factor, so that benefits would increase only with CPI.  This is consistent with Government policy on benefit indexation (although implying that no part of the provision for new initiatives is allocated to welfare).  This assumption would imply constant real incomes for beneficiaries, but a fall in relative incomes.  The fall in relative incomes over 50 years would be huge.

### 9.2.7  NZ Super

NZ Super is treated differently to other welfare items.  With NZ Super the government has a clear legislated policy of CPI indexing until the level of NZ Super reaches 60% of the average wage and then wage indexing.  The LTFM follows this approach.

## 10. CAPITAL SPENDING, ASSET GROWTH AND BORROWING REQUIREMENTS

The alternative approaches to capital spending are analogous to those for operating expenditure:

- A top down approach requires the specification of a provision for new spending, but holds baselines for physical and transport assets fixed.

- A bottom up approach assets grow in line with anticipated demand for capital spending.

### 10.1 A top down approach to capital spending

Under a top down approach capital spending is broken down into an allocation for new initiatives and a baseline, as with operating expenses.

As with the operating balance limit, the allowance for new capital spending should be set by reference to historic and expected capital spending, and in discussion with Ministers. Baselines for Departments generally allow for no capital injections.[22]

Baselines for SOE and CEs reflect their expected distributions. Only changes to this level of distributions would count against the allowance for new capital spending. Since the LTFM is does not project any change in distribution policy, the no new capital spending is allocated to SOEs and CEs.

The baseline for student loans is set on the basis of expected growth in the scheme.

### 10.2 A bottom up approach to capital spending

Capital spending under a bottom up approach is determined by the level of capital investment required to fund the increase in the Crown's asset base. The level of capital investment will be equal to the sum of:

- the growth in the physical and transport assets, *less* the amount of increase due to inflation;

- the amount of earnings retained by SOEs and CEs;

- additional advances for student loans.

This will differ from the level of capital spending required under a top down approach only by level of investment in physical and transport assets.

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[22] Departments capital spending is, therefore, limited to the extent of depreciation.

## 10.3 Asset accumulation

Investment in a bottom up approach is determined by the rate of asset accumulation. The LTFM assumes that the Crown retains its current ownership arrangements.[23] Table 5 shows the growth assumptions for different asset groups.

Table 5: Growth of assets

| Asset type | Growth assumption |
|---|---|
| SOEs and commercial CEs | Nominal GDP |
| Transport assets | Nominal GDP |
| Non-commercial CEs | Expense area |
| Physical assets | Other expenses |
| Financial assets and working capital | No growth |
| Student loans, EQC and ARCIC | Determined separately |

The overall effect of these asset growth assumptions is that assets grow roughly in line with GDP.

Under a top down approach only the growth of transport and physical assets will differ from that described above.

## 10.4 Capital spending and the borrowing requirement

The Crown's borrowing requirement is calculated by a shorthand version of the reconciliation of the operating balance to the amount available to repay net debt.[24] The borrowing requirement is calculated as:

- Operating deficit (surplus)

- *plus*:
    - ❖   EITHER: the allowance for new capital spending (top down);
    - ❖   OR: the growth in the physical and transport assets, *less* the amount of increase due to inflation;

- *plus*: retained earnings of SOEs and CEs (including EQC and ARCIC);

- *plus* advances for student loans; and

- *less* movements in pension liabilities.

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[23] This implies more than simply not undertaking asset sales. It also implies that it buys rather than leases assets. For SOEs and CEs it implies that they are allowed to retain sufficient funds to grow their operations.

[24] For Economic and Fiscal Updates, this reconciliation is provided as part of the forecast statement of cash flows.

From the reconciliation of the operating balance to cash available to repay debt, we do not include valuation changes, gains on sale, movements in working capital, movements in investments, and the contingency capital provision. There is no movement in any of these items in the projection.

Depreciation would normally be taken from the operating balance to get cash flows from operations. However, we also assume that new assets are purchased to maintain the depreciating assets. The effect is that depreciation nets out of the calculation.

The mechanics of the borrowing requirement calculation are discussed further in section

## 10.5 The operating balance and the financial position

It follows from the borrowing calculation that running a balanced operating position may not be a sufficient requirement for maintaining the Crown's financial position. Given a positive capital spending requirement and the retention of earnings by SOEs and CEs, the Crown will need to run an operating surplus in order to reduce net debt.

# 11. PROCEDURES

## 11.1 Updating for BEFUs, DEFUs and PreFUs

- Update data in "H-Ass" sheet.  For DEFUs and PreFUs this will require adding another year.  A list of data sources for the "H-Ass" sheet is found in section 12.1.

- For DEFUs and PreFUs, extend the history lines in the base sheet to incorporate a new year.

- For BEFUs, update cost weights from H-Mod and population distribution of welfare beneficiaries.   H-Mod is now being maintained by the Ministry of Health.  The Social Policy agency has data on the gender and age profile of beneficiaries.

- Update GSF estimates.  The GSF estimates are available from Crown Financial Policy in the Asset and Liability Management branch.

- Check that the operating balance numbers in the base sheet are consistent with the history sheet.

- Check that the balance sheet consistency check line is equal to zero, or sufficiently close.

- Check charts for expenses, revenue, operating balance, net debt and gross debt.  Make sure that they have moved in the right direction compared to the previous year, given changes made.

## 11.2 New scenarios

- Go to the "Scenarios sheet", "Table 1: Assumptions for Scenarios".  Add a name for the scenario in a new column.  For each row in the table include an assumption.  Table 6 shows examples of typical policy assumptions for alternative policy approaches:

<div align="center">

**Table 6: Typical policy assumptions**

</div>

|  | Top down approach | Bottom up approach |
|---|---|---|
| Top Down Approach | Yes | No |
| Allocation for New Initiatives | Positive Value | 0 |
| Allocation for Cap Ex | Positive Value | 0 |
| Growth in All for NI | GDP | None |
| Growth in All For Cap Ex | GDP | None |
| Indexation of Welfare Benefits | Inflation | Wages |
| Indexation of Supp Benefits | None | Wages |
| Include Fiscal Drag | No | No |
| Include Tariff Reduction | Yes | Yes |
| Expense Growth Factors | 0 | Positive Value |

- Enter the name of the sheet in the "base" sheet or a copy of the "base" sheet.

- Enter a description of the scenario in the "Blurb" sheet.

- Including alternative scenarios on copies of the "base" sheet will allow the scenarios to be compared in charts. When adding a scenario in a copy of the base sheet the operating balance, the Non-Finance Expense, Tax Revenue, Operating Balance, Net Debt and Crown Balance should be added to the results $ and results % sheet.

- Before using the scenarios, check that: (a) the cost drivers in "Table 5: Cost Drivers" are reasonable given the assumptions used; (b) charts of the main fiscal indicators are reasonable, given the assumptions entered; and (c) the balance sheet consistency check is sufficiently close to 0.

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**WARNING!!!**

the LTFM was not designed to carry out scenarios on policy options that have implications in the forecast period. While the LTFM can be used to look at the implications of such options modelling such scenarios will require additional data not contained in the model. It may also require the user to make changes to the "H-Ass" and "base" sheets.

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## 12. TECHNICAL DESCRIPTION

### 12.1 Historic and three year forecast data, ("H-Ass" sheet)

The LTFM projects from the end of the three year forecast period used by the most recent Economic and Fiscal Update. The historic data is obtained from the Financial Statements of the Government of New Zealand. This data is entered directly into the "H-Ass" sheet. Table 7 below shows where the data in the history sheet has been taken from.

**Table 7: Sources for history data**

| Item | Source |
|---|---|
| Financial Performance | EFU Financial Performance |
|     Taxation | EFU Financial Performance + Notes 1 and 2 |
|     Revenue from Operations | EFU Financial Performance + Note 3 |
|     Expenses | EFU Financial Performance + Expense Tables + Community Wage Breakdown |
|     ARCIC – Health Expense | Health Expense Table |
|     Student Loans W/O | Student Loans Journal |
|     Beneficiary Numbers | Social Welfare Expense Table |
|     SOE and Commercial CE Earnings | SOE and CE earnings sheet |
| Financial Position | EFU Financial Performance |
|     Student Loans | EFU Financial Performance, Note 7 |
|     Physical Assets and Inventories | Includes commercial forests and intangibles. |
|     Other Financial Assets | Marketable Securities and Deposits + Advances – Student Loans |
| Crown Balance | EFU Movements in Equity |
| Economic Variables | EFU Macro Forecasts: |
|     GDP, interest rates, labour force and unemployment |     Table 8, June year forecasts |
|     CPI inflation |     Chart attached to table 8 |
|     GDP components |     Household income and outlay accounts. |
|     Foreign interest rates |     International interest rates, nominal |
|     Consumption |     Table 5: nominal GDP – expenditure |
|     Corporate profits |     Table 6: nominal GDP – income |

The following should be noted:

- Foreign short and long term interest rates are from the sheet titled "International Interest Rates". The sheet uses weighted nominal annual averages, using the following weights: US$ = .5, JPY = 0.25, Euro = 0.25 (previously DM).

- Entrepreneurial Income is the sum of its farm and non-farm components.

- The components of GDP are entered as March year numbers. The model then converts these to June years on a ¼:¾ basis. The last march year is not forecast. The model calculates this last year by applying the growth rate for nominal GDP.

- Interest and dividends is the sum of "actual interest" and "dividends".

- Corporate profits is equal to total private operating surplus *less* entrepreneurial income *plus* an allowance for SOE operating surpluses. The allowance for SOE operating surpluses is taken as 17% of general government operating surpluses. This is an ad hoc, but immaterial adjustment.

The third year of the forecast period is used as the starting year for the projections. Using this year without adjustments implies that there is no output gap at the end of this year. If there is an output gap at the end of the forecast period, this is closed through higher labour productivity growth. The closure rate is determined by a longer term view of economic growth, but is usually one or two years.

## 12.2 Assumptions for scenarios ("Scenarios", Table 1)

### 12.2.1 Scenario mechanics

To switch between a scenario, a user need to change the scenario identified at the top of the "base" sheet (or any alternative sheet). The name must be from the list of names at the top of the "Scenarios" sheet. The assumptions used in by the "base" sheet will then be automatically updated to those in the column of the "Scenarios" sheet below the scenario named.[25] Each of the key assumptions has been named to allow easy identification in the "base" sheet.

Table 8 below shows where each of the assumptions in the "Scenarios" feeds through into other sheets.

**Table 8: Effect of assumptions for scenarios on other sheet**

| Table 1: "Scenarios" | Feeds into the following | Manual section |
|---|---|---|
| Key economic assumptions | "base" Table 4: Economic Assumptions | 5 |
| Migration assumption | 'D-Ass' sheet | 6 |
| Key fiscal assumptions | | |
|    Top down approach? | • "base", Table 2, Statement of Financial Performance (expense items),<br>• "base", Note 2, Personnel Income Tax<br>• "base", Table 3, Statement of Financial Position (asset items). | 12.4 |
|    Allocation for New Initiatives | "base", Note 1, Allocation for New Initiatives | 12.4.2 |
|    Allocation for New Cap Ex | "base", Note 12, Allocation for New Cap Ex | 12.5.3 |
|    Growth in All for New Initiatives | "base", Note 1, Allocation for New Initiatives | 12.4.2 |
|    Growth in All for New Cap Ex | "base", Note 12, Allocation for New Cap Ex | 12.5.3 |
|    Indexation of Welfare Benefits | "base", Note 5, Welfare Benefits | 12.4.5 |
|    Indexation of Supplementary Benefits | "base", Note 5, Welfare Benefits | 12.4.5 |
|    Include Fiscal Drag | "base", Note 2, Personnel Income Tax | 12.4.3 |
|    Include Tariff Reductions | "base", Note 3, Excise Duties | 12.4.3 |
| Expense growth factors | "base", Note 11, Expense Growth Factors | 12.4.11 |

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[25] To allow for this automatic switching the LTFM uses Excel's OFFSET and MATCH functions. Discussions of these functions can be found using Excel's Help menu.

| Allocation of the Allowance for New Initiatives | "base", Note 1, Allocation for New Initiatives | 12.4.2 |
| Allocation of the Allowance for Cap Ex | "base", Note 12, Allocation for New Cap Ex | 12.5.2 |
| Convergence rates | "base" Table 4, Economic Assumptions | 5 |

## 12.3 Technical assumptions ("Scenarios" sheet, Table 2)

The bottom half of the "Scenarios" sheet contains a number of assumptions of a more technical nature. These assumptions are discussed in the section below where they are used. Table 9 below indicates where these assumptions are used and the relevant section of the manual.

**Table 9: Technical Assumption References**

| Assumption | Feeds into "Base" sheet Where? | Section |
|---|---|---|
| GST Rate for Allowances | Note 1: Allowances for new Initiatives | 12.4.2 |
| Income Tax on NZ Super | Note 2: Personnel Income Tax | 12.4.3 |
| Income Tax on NZ Super | Note 2: Personnel Income Tax | 12.4.3 |
| NZ Super Floor | Note 5: Social Welfare | 12.4.5.2 |
| GSF Pension Expense | Note 5 Social Welfare | 12.4.5.3 |
| GSF Pension Liability | Note 15: Pension Liabilities | 12.5.7 |
| Excise Duties | Note 3: Excise Duties | 12.4.3 |
| Health Cost Weights | Note 6: Health Expenses | 12.4.6 |
| SW Beneficiary Proportions | Note 5: Social Welfare | 12.4.5 |
| Timing Assumptions | Table 2: Revenue calculations | 12.4.3 |
|  | Table 5: COLA calculation | 5 |

## 12.4 Statement of Financial Performance (Base, Table 2)

### 12.4.1 Provision for New Initiatives (Base, Table 2, Note 1)

Not all of the Government's expected expenses have been allocated at the time of a BEFU or DEFU. Economic and Fiscal Updates may contain a provision for new initiatives. The provision is included as an expense, but may be allocated to revenue. The provision is not allocated at in the Economic and Fiscal Update. However, the LTFM allocates the provision, because it projects by functional classification. The basis for the allocation is set in the "Scenarios" sheet.

As a result of this allocation revenue and expense items in the "base" sheet may differ from those in the Economic and Fiscal Update. However, the Operating Balance should remain unchanged.

### 12.4.2 Allowance for New Initiatives (Base, Table 2, Note 1)

The allowance for new initiatives is an extension of the provision for new initiatives to a ten year period. The allowance will only be used if the scenario uses a top down approach. The allowance will be allocated on the same basis as the provision for new initiatives.

The allowance may be set to grow over time. The table at the bottom of Note 1 provides the options for the growth of the allowance.

The allowance is generally set in GST exclusive terms, but is grossed up before it is included in the operating balance.

### 12.4.3 Tax revenue (Table 2 , Revenue, Note 2 and Note 3)

Each component of tax revenue is calculated as:

$$\mathrm{Re}\,venue(t) = \mathrm{Re}\,venue(t-1).[a_t.GrowthTaxbase(t) + a_{t-1}.GrowthTaxbase(t-1)]$$

Revenue grows with a weighted average of the growth in its tax base over the last two periods. This implies a constant average effective average effective tax rate (AETR).

Where the tax base is a component of GDP, the tax base will grow in line with nominal GDP. GDP growth is discussed above in section 5. Where the tax base is a component of Government spending the base grows with that component of spending.

Table 10 below shows tax base, the timing of tax payments, the rate of growth in the tax base and how the average tax rate is calculated for each tax type for each of the tax components.

**Table 10: Tax assumptions**

| Tax | Tax base | Timing t-1 | T | Base Growth Rate | Tax Rate |
|---|---|---|---|---|---|
| Individual Income Tax | Compensation of Employees | 5% | 95% | Nominal GDP | Average from last budget period[26] |
| | Entrepreneurial Income | 5% | 95% | Nominal GDP | Average from last budget period |
| | NZ Super | | 100% | NZ Super Expense Growth | Average NZ Super Rate = 17.1% |
| | Other Welfare | | 100% | Other Welfare Expense Growth | Average Other Welfare Rate = 15.7% |
| Company Tax | Company Profits | 10% | 90% | Nominal GDP | Average from last budget period |
| Other Income Tax | Other Taxable Income | 5% | 90% | Nominal GDP | Average from last budget period |
| Goods and Services Tax | Consumption | 5% | 95% | Nominal GDP | Average from last budget period |
| Excise Duties | Nominal GDP | 5% | 95% | Nominal GDP | Average from last budget period |
| Other Indirect | Nominal GDP | 5% | 95% | Nominal GDP | Average from last |

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[26] The average rate is equal to tax take (excluding tax paid on Vote: Social Welfare payments) / tax base (excluding the gross value of Vote: Social Welfare payments). The tax take from Vote: Social Welfare payments is calculated using the expected average tax rates.

| Taxation | | | | | budget period |
|---|---|---|---|---|---|
| Fines, Fees and Penalties | Nominal GDP | 0% | 100 % | Nominal GDP | Average from last budget period |

Individual income tax may be adjusted for (see note 2):

- to include an additional growth factor to allow for the effect of fiscal drag;

- allocations from the allowance for new initiatives for revenue initiatives;

- tax cuts and increases not included in the allocation for new initiatives.

The level of excise duty may be adjusted for the reduction, and elimination in 2006/07 of tariffs. The value of the adjustment is set out in Note 3.

### 12.4.4 Revenue from Crown operations (Table 2, Note 4)

Revenue from Crown operations is the sum of the following components.

#### 12.4.4.1 SOE and commercial CE distributions:

$$Distribution(t) = ROR_{SOE} \cdot \left[ \frac{Asset(t) + Asset(t-1)}{2} \right] - \left[ Asset(t) - SOE, Asset(t-1) \right]$$

The distribution by an SOE is equal to of its earnings less the portion of those earnings retained by the company.

Earnings are equal to the product of the expected rate of return for SOEs and the average equity investment in the SOE for that period. The return to SOEs is set in the last year of the forecast period. This is then adjusted in line with changes in the Government stock rate.

Retained earnings are equal to the change in the level of equity investment in the SOE. The second component is amount retained by SOEs and CEs for investment in period t. The retained earnings component comes into the operating balance as Net Surplus, less distributions, of SOEs and CEs (which is not included in revenue).

#### 12.4.4.2 Interest on student loans:

Interest on outstanding student loans is calculated as:

$$G.InterstonSL = ROR_{SL} \cdot \left[ \frac{OSL(t) + OSL(t-1)}{2} \right]$$

Gross interest on student loans is equal to the product of the rate of return on student loans and the average level of outstanding student loans (OSL(t)) for the year.

Interest income from student loans is gross, which means that it does not allow for write-offs or administration costs. Write-offs and administration costs are included in other expenses (vote: IRD). The interest rate on student loans is set at a margin of 0.9% on a 30 month average of five year Government stock.

### 12.4.4.3 Other financial assets:

Earnings on financial assets is calculated as:

$$E(t) = ROR_{FA} . \left[ \frac{FAssets(t) + FAssets(t-1)}{2} \right]$$

Earnings on financial assets are equal to the product of the return on financial assets and the average level of financial assets. The interest rate is set at a margin below the rate on five year government stock. The margin is set by the return in the last year of the forecast period.

If gross debt becomes negative, the negative gross debt is accumulated as part of other financial assets. In this case the negative interest on net debt is added to the interest from other financial assets. The rate of interest on these assets (negative debt) will be calculated as per the interest rate on net debt.

### 12.4.4.4 Gains/(Losses) on sale:

Gains or losses on sale come from the history sheet. No gains or losses on sale are projected.

### 12.4.4.5 Other operational revenue:

Other operational revenue is projected to remain a constant fraction of nominal GDP. The fraction of nominal GDP is determined by the level of revenue forecast for the last year of the budget.

### 12.4.5 Social welfare spending

Social welfare spending is calculated as the sum of seven individual benefits, other welfare benefits, GSF pension expense and other social welfare spending. The welfare benefits are calculated as:

$$Expense(t) = Expense(t-1).(1+CPI).(1+ExpGrF(t)).(1+\Delta Pop(t))$$

In words, the level of expense is equal to the level of expense in the previous year multiplied by CPI growth, the expense growth factor and the change in the beneficiary population. The expense growth factor represents a real increase in the value of benefits. Expense growth factors for social welfare are discussed above in section 5.2.6.

Population growth is weighted on the basis of the current number of beneficiaries by age and gender. Table 11 shows the distributions population distribution of beneficiaries.

**Table 11: Beneficiary population characteristics**

| Benefit | Gender | Age group | | | | |
|---|---|---|---|---|---|---|
| | | 0-15 | 0-19 | 16-44 | 45-64 | 65+ |
| Domestic Purposes Benefit | Female | | | 81.9% | 9.0% | 0.0% |
| | Male | | | 7.3% | 1.7% | 0.0% |
| Invalids Benefit | Female | | | 21.1% | 21.8% | 0.2% |
| | Male | | | 29.5% | 27.0% | 0.4% |
| Sickness Benefit | Female | | | 25.9% | 15.5% | 0.5% |
| | Male | | | 34.7% | 22.9% | 0.5% |
| Family Support and IFTC | M & F | | 100.0% | | | |

### 12.4.5.1 Unemployment benefit

The Unemployment benefit uses labour force projections supplied by Statistics New Zealand (discussed above) and is calculated as:

$$UB_t = UB_{t-1}.(1+cpi).(1+ExpGrF).(1+\Delta UnBen) \text{, where}$$

$$UBeneficiaries = lf(t).Unemploymentrate$$

Unemployment benefit expenses grow with the rate of inflation, an expense growth factor and the change in the level of unemployment. The number of unemployed depends on the labour force and the unemployment rate. The unemployment rate is discussed above in section 5.7.

The unemployment rate in the economic table is based on the household labour force survey (HLFS). The HLFS defines unemployment as the number of people who answer that they are not currently employed, but are seeking work. This number differs from the number receiving the unemployment benefit. Typically the number receiving the unemployment benefit is higher, presumably because some of those on the unemployment benefit are not actively seeking work (and, therefore, are not part of the labour force). An adjustment is made to the unemployment rate based on the ratio of HLFS unemployed to unemployment beneficiaries at the end of the forecast period. This ratio is assumed to remain constant.

### 12.4.5.2 New Zealand Superannuation

The fiscal model follows the legislation relating to NZ Super. Under the Social Welfare (Transitional Provisions) Act 1990 the net married couple rate is adjusted by the percentage movement in CPI for the previous calendar year. However, if the net married couple rate would fall below 60% of the average ordinary time weekly wage, it is adjusted to equal 60% of the average ordinary time weekly wage.

The net single and net single living alone rates are adjusted to 60% and 65% of the net married couple rate respectively.

The model only projects beyond the forecast period. External users of the model should note that modelling changes to NZ Super that take effect before the end of the forecast period will require a separate estimate of the effect prior to the end of the forecast period.

The age of eligibility for NZ Super hits 65 in April 2000. Therefore, no adjustment is required for movements in the age of eligibility.

### 12.4.5.3   Government Superannuation Fund (GSF)

Pension expenses are projected using adjusted actuarial estimates. The adjustments are made on the basis of expected variations to the expense level in each year, due to different wage, inflation and interest rate assumptions. The expense level is most sensitive to interest rate assumptions. The expense levels decline over the projected period, because both NPF and GSF are closed to new members.

### 12.4.5.4   Other

The other social welfare costs are largely administration costs. These are projected as:

$$otherSW_t = otherSW_{t-1} * (1 + cpi) * (1 + realwage)$$

As discussed in section 9.2.5 there is no demographic adjustment for administration expenses.

### 12.4.6 Health spending (Table 2, Note 6)

Health expenses are calculated for four service levels; primary, secondary, disability support and other. For each service level, except other expenses, the Health Expense – Demographic Change is calculated as:

$$DemE(t) = \sum_{g=1}^{G} CW_g Pop_g(t), \text{ for g = 1 to G}$$

The expense level is equal to the sum of the cost weight for each population group and the population of that group.

The cost weights are taken from H-Mod a database of health expenses, which can be asked to allocates health costs to individual output categories. The LTFM uses output categories aggregated by service level. The LTFM assumes that the cost weights remain constant in real terms over time, implying that the Government commits a constant average level of resources to purchases health

per person in a population group. The chart below shows the cost weights by population group.

**Cost Weights by Population Group**
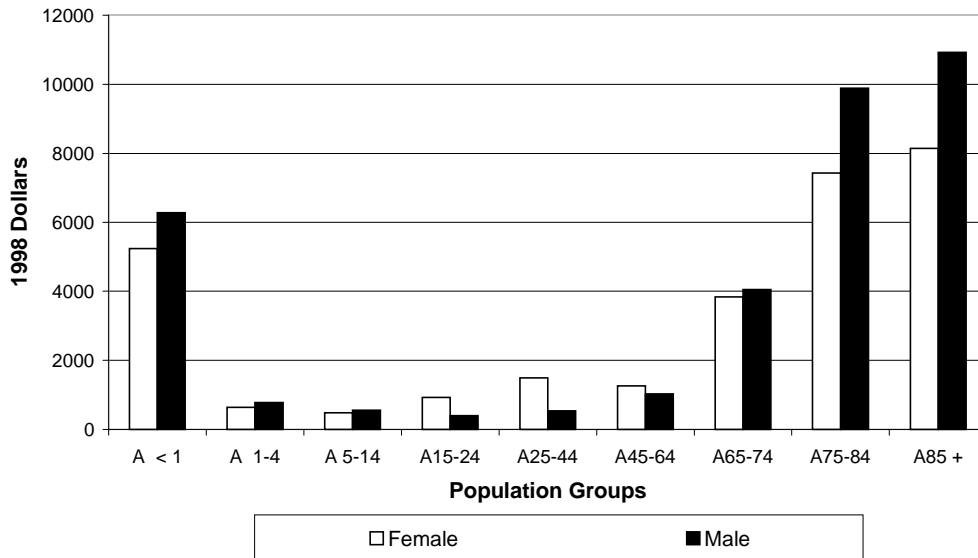


Actual health expenses for each service level is calculated as:

$$ActHE(t) = ActHE(t-1).\frac{DemE(t)}{DemE(t-1)}.[1 + CPI(t)].[1 + ExpGrF(t)]$$

The actual level of health expenses grows with CPI inflation, an expense growth factor and a demographic adjustment. The expense growth factor will vary depending on the scenario being run. Expense growth factors are discussed above in section 5.

Other health expenses are primarily administration expenses. These expenses are treated like other administration expenses in the model, growing with CPI inflation and the health expense growth factor, but with no population adjustment.

Total health expenses also includes ARCIC expenses. These expenses are paid by vote: Labour, but are included in the Health functional classification. These expense relate primarily to payments for non-earners. The LTFM forecasts them to grow with CPI inflation, the health growth factor and the non-earner population (total population – labour force).

### 12.4.7 Education (Table 2, Note 7)

Education expenses is the sum of early childhood education, primary education, secondary education, tertiary education, other education, and student loans

write-offs. Except for write-offs on student loans and other education, these are calculated as:

$$E(t) = E(t-1).\left[1 + CPI(t)\right].\left[1 + ExpGrF\right].\left[\frac{Students(t)}{Students(t-1)}\right]$$

Expenses grow with CPI inflation, an expense growth factor and the number of students. Student numbers are calculated as a fixed percentage of a reference population. The percentage is fixed at the end of the forecast period. Expense growth factors are discussed above in section 9.2.

Other education is primarily administration. Like other administration expenses it grows with CPI inflation and a real growth factor.

Student loan write-offs are due to the difference between gross and net interest (net of write-offs) *plus* the level of death write-offs. Gross interest is taken from Note 4: Revenue from Operations (discussed above in 12.4.4). Net interest and death write-offs are calculated in Note 13: Student Loans (discussed below in 12.5.3).

### 12.4.8 Defence and other expenses (Table 2, Note 8)

Expenses in all these areas are forecast to grow with three components: CPI inflation, an expense growth factor and a population adjustment. However, not all these expense areas have a population adjustment. Expense growth factors are discussed above in section 9.2. Table 13 below shows the expense growth assumptions used for each area.

Table 13: Defence and other expenses

| Expense area | Expense growth factor | Population adjustment |
|---|---|---|
| Defence | Defence | None |
| Core Government Services | Other Expenses | None |
| Law and Order | Other Expenses | Total Population |
| Transport | Other Expenses | Labour Force |
| Economic, Primary and Cultural | Other Expenses | None |

The population growth for transport keeps the level of transport spending consistent with the approach to transport assets.

### 12.4.9 Finance costs (Table 2, Note 9)

Finance costs consist of the sum of three components: interest on domestic debt, interest on foreign debt and other finance costs. Debt levels are discussed in section 12.5.8 below.

The interest on domestic debt is the product of the average closing domestic debt for the last two periods and the average interest rate for long term debt is the average over the last eight periods. Interest on foreign debt is calculated in

the same way.  The interest on foreign debt is the average of interest rates over the last eight periods.

Other finance costs are treated as an administration cost.  They are assumed to grow with CPI inflation and the other expenses growth factor.

### 12.4.10 SOE and CE surpluses (Table 2, Note 10)

SOE and CE surpluses are calculated separately for: SOEs and Commercial CEs Surpluses *less* Distributions, the Earthquake Commission, ARCIC and Other CEs.

The calculation of SOE and CE earnings is discussed in section 12.4.4 above. This section picks up that part of SOE and CE earnings that is not distributed. This amount is the retained earnings of SOEs and commercial CEs and will be equal to the change in the asset value.

As discussed in section 12.5.5 below EQC retains all its earnings.  EQC is assumed to earn the current interest rate on five year government stock.

The ARCIC expense is a payment for non-earners.  The expense is projected to grow with inflation, the health expense growth factor and the population of non-earners.
Non-commercial CEs are not expected to make a return.  Historically they have been loss makers.  We assume that the government's reform programs are successful to the extent that these entities stop making losses over a five year period.

### 12.4.11 Expense growth factors (Table 2, Note 11)

Projected expense growth factors are determined by expense assumptions in the "Scenarios" sheet.  The expense growth factors then feed into other expense areas.  Table 14 shows where the expense growth factors feed through to:

**Table 14: Expense growth factors**

| Expense growth factor | Feeds through to |
|---|---|
| Defence | Defence Expense Line |
| Other Expenses | Note 8: Other Expenses |
| Welfare Benefits | Note 5: Social Welfare |
| Supplementary Benefits | Note 5: Social Welfare |
| Other Social Welfare | Note 5: Social Welfare |
| Health | Note 6: Health |
| Tertiary Education | Note 7: Education |
| Other Education | Note 7: Education |

It should be noted that if benefits are not indexed the expense growth factor will be negative and equal to the rate of inflation.

## 12.5 The Statement of Financial Position (Table 3)

The Statement of Financial Position projects the Crown's Assets and Liabilities. The projections are primarily used to provide an estimate of the level of investment required by the Crown, which is crucial for projecting net debt. The general approach to assets is discussed above in section 6. The projections are also used to provide a base for interest expenses and revenue.

The broad approach taken implies that the Crown maintains an asset base as an approximately constant proportion of GDP. It varies from this path due to some specific programs (EQC is the main cause of this variance).

Table 15 below, sets out the main components of the balance sheet and the assumptions used in the projections.

**TABLE 15: Statement of Financial Position: assumptions**

| Asset or liability | Assumption | Analysis |
|---|---|---|
| Student Loans | Special treatment (12.5.3) | Note 13 |
| Other Financial Assets | Gross Debt (12.5.8) | Note 16 |
| Receivables and Investments | Constant in Nominal Value[27] | |
| SOEs and CEs | | Note 14 |
|    SOEs, HNZ, H. Corp, Airways | Nominal GDP Growth | |
|    ARCIC | Separate treatment, (12.5.6) | |
|    Health CEs | Secondary Health Spending | |
|    Education CEs | Weighted Education Spending[28] | |
|    Earthquake Commission | Separate treatment, (12.5.5) | |
|    Other Non-Profit CEs | Nominal GDP | |
| Physical Assets and Inventories | Defence and Other Expenses | |
| State highways | Nominal GDP | |
| Payables and Provisions | Constant Nominal Value | |
| Currency Issued | Constant Nominal Value | |
| Borrowings | Gross Debt | Note 16 |
| Pension Liabilities | Special treatment (12.5.7) | Note 15 |
| Net Revaluations | Zero | |

In general, the effect of these assumptions is that Crown assets remain a relatively constant proportion of GDP over time.

### 12.5.1 Provision for New Capital Expenses (Table 3, Note 12)

The Government makes provisions for new capital initiates. These provisions need to be allocated to other asset lines for the purposes of the projection. The provisions are allocated to physical assets and state highways on the basis of the assumptions from the "Scenarios" sheet.

Allocating the provisions in this way will result in the values for physical assets and state highways being higher than is shown in the Crown accounts.

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[27] The Crown's net working capital consists of receivables, payables and provisions. We would expect the growth drivers of these items to be similar.

[28] Weights determined by the asset base as at the end of the budget period.

### 12.5.2 Allowance for New Capital Expense (Table 3, Note 12)

As discussed above in section 10, under a top down approach new capital expenses will be determined by an allocation. Note 12 allocates the provision to physical and transport assets on the basis of the same allocations as for the provision for new initiatives.

### 12.5.3 Student loans (Table 3, Note 13)

Student loan projected on the basis of the following components:

$$OSL(t) = OSL(t-1) + SB(t).AvgB(t) + NIR(t).OSL(t-1) - R(t).OSL(t-1) - WO_D(t).OSL(t-1)$$

where:  
OSL(t)   is outstanding student loans at time t;  
SB(t)   is the number of students borrowing at time t;  
AvgB(t)   is the average level of borrowing per student at time t;  
NIR(t)   is the interest rate, net of interest write-offs at time t;  
R(t)   is repayments at time t; and,  
$WO_D(t)$   is write-offs due to death at time t.

The level of new borrowing, gross and net interest rates (net of interest write-offs), repayment rate and write-offs due to death are calibrated using TELSAF. TELSAF is a microsimulation model built by the Ministry of Education to project outstanding student loans.[29]

Gross interest on student loans is included as part of interest income (see 12.4.4). Student loan expenses are included in education expenses.

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**WARNING!!!!**

Student loans are an important, but not key item for the LTFM. The calculation in the LTFM is approximate. While we believe that the projections are suitable for discussions about overall fiscal policy, users whose interest is only in student loan expenses are advised to model student loans separately.

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### 12.5.4 SOEs and CEs (Table 3, Note 14)

SOEs and commercial CEs are projected to grow in line with nominal GDP. Equity invested in health CEs grows with the health expense level. Equity invested in education CEs grows with education expenses.

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[29] TELSAF assumes that the thresholds above which the borrowers are required to pay are fixed in nominal terms. The result is that as general incomes rise, students repay sooner. To be consistent with a no fiscal drag tax assumption, these thresholds would need to be adjusted outwards. We will be endeavouring to allow for this in the future. However, we doubt that it is a material issue in terms of the LTFM.

### 12.5.5 Earthquake Commission (EQC) (Table 3, Note 14)

EQC is assumed to build up assets consistent with the Government's policy of allowing EQC to retain all of its operating surpluses. The model makes no allowance for the cost of a major earthquake. The result is an asset growing at a strong compounding rate.

The policy of making no allowance for a major earthquake will result in an overstatement of the expected strength of the Crown's balance sheet. However, the central forecast does not make any allowance for other events beyond the Crown's control. For example, the risk of a major economic collapse in the USA economy or massive losses on derivatives by some branch of the Crown. Instead, this risk should be disclosed and, where appropriate the effect shown through scenario analysis.

### 12.5.6 ARCIC (Table 3, Note 14)

The ARCIC unfunded liability is projected to be paid down evenly over a 15 year period. We recognise that this is a simplification, but consider it sufficient for the purposes of the LTFM.

### 12.5.7 Government Pension Liabilities (Table 3, Note 15)

The projections for Government pension liabilities are obtained from Crown Financial Policy (Asset and Liability Management Branch). The projections are based on expected claims on the funds, payments into the funds from Government and individuals and earnings of the funds.

The projections are sensitive to movements in either interest rates or average real wage, but not strongly (generally we would not consider the level of change significant).

### 12.5.8 Gross debt calculation (Table 3, Note 16)

The borrowing requirement calculation is discussed above in section 10.4. It remains only to note that gross debt in a period is equal to gross debt in the previous period plus the borrowing requirement.

It is possible that the model may show that the Crown has repaid all its domestic debt. If this occurs the model assumes that the Crown starts to accumulate additional financial assets.

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**WARNING!!!**

If the Crown accumulates large amounts of financial assets, the model will become sensitive to the interest rate on financial assets. This interest rate will depend on the investment policy adopted by the Crown and the institution within which the funds are held. Users examining such scenarios are urged to consider these issues further.

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## 12.6 Use of iterative calculation option

The LTFM contains a circular reference: finance costs depend on gross debt, which depends on the operating balance, which depends on finance costs. To resolve this circularity the LTFM uses Excel's iterative calculation option. The LTFM has been set up to turn this option on when it opens and off when it closes.

**Annex 1**

# TECHNICAL NOTES

### New Zealand Resident Population Projections, 1997-2051 (1996-Base)

## 1. General Comment

In October 1997, Statistics New Zealand released the latest series of New Zealand population projections. These projections have as their base the estimated resident population at 30 June 1996. The projections are for every year out to the year 2051, are by single year of age, and by sex.

## 2. Method

A "Cohort-Component" method was used to derive the population projections. In this method, the base population is projected forward by calculating the effects of births, deaths and migration within each age and sex group according to the specified fertility, mortality and net migration assumptions.

## 3. Base Population

The projections have as their base the estimated New Zealand resident population at 30 June 1996. This population was calculated by adjusting the 1996 Census population for undercount and for New Zealand residents temporarily overseas at that date. The population was then updated for births, deaths, and permanent and long-term migration between 6 March 1996 and 30 June 1996.

## 4. Projected Births

The number of births is projected by multiplying the female population aged 12 to 49 years by assumed age-specific fertility rates. Summing the births by age of mother gives the projected total number of births annually.

The medium fertility variant for New Zealand assumes that fertility rates will continue to decrease and that the long-term level (from the year 2010) will reach 1.85 children per woman.

## 5. Projected Deaths

Deaths are not calculated directly but instead are derived as a residual at the end of the projection process. In mathematical form the calculation is:
$$D = P_y - P_{y+1} + B + M$$
where D=Deaths, P=Population, y=Year, B=Births, M=Migration.

The projection process ages the population by applying survivorship rates to the population to determine how many people will still be alive 1 year later. For example, the population aged 25 years in 2001 is derived by multiplying the population aged 24 years at 2000 by an assumed survivorship rate. This process is repeated for all ages. The number of deaths is simply the number of people who do not survive for another year.

The medium mortality variant assumes that life expectancy will continue to increase. For New Zealand, life expectancy in the year 2051 is assumed to be 81.0 years for males and 85.5 years for females (compared with 74.3 years and 79.5 years, respectively, in 1996).

## 6. Projected Migration

An assumed total net migration level is set for each year of the projection period. An associated age and sex distribution is derived based on historical permanent and long-term net migration data.

The assumed medium variant long-term net migration level for New Zealand is 5,000 persons annually. For the year ended 30 June 1997 the actual level was approximately 17,000. That is the level adopted for that year. For the years through to 2002 we have assumed decreasing net migration levels (from 10,000 for 1998 to 5,000 in 2002).

## 7. Projection Process

The order of events in the population projection process is:
- Survive the base population from 1996 to 1997
- Add in the migrants
- Derive the number of births
- Repeat the above steps for each year to the year 2051.

## 8. Nature of Projections

Although the assumptions used to prepare population projections are carefully formulaed to represent future trends, they are subject to uncertainty. Therefore, the resulting projections should be used as guidelines rather than exact forecasts. They provide an indication of the overall trend but do not attempt to project specific annual variation. The projections do not take into account non-demographic factors (eg war, catastrophes, etc.) which may invalidate the projections.

**ANNEX 2**

# TECHNICAL NOTES

## New Zealand Resident Labour Force Projections, 1997-2100 (1996-Base)

### 1. General Comment

The specifications for this job were to produce New Zealand labour force projections based on specified scenarios. Various combinations of four alternative population projections series and three alternative labour force participation rate series were produced. There are six alternative series of projections, and cover the period 1997 to 2100.

### 2. Method

The labour force projections were derived from the complementary 1996-base New Zealand Resident Population Projections by multiplying the projected population by the assumed labour force participation rates in each age-sex group.

### 3. Base Labour Force

These projections have as their base the estimated resident labour force at 30 June 1996. The definition of who is in the labour force is the same as that used at the 1996 Census of Population and Dwellings. The labour force comprises those persons aged 15 years of age and over who regularly work for one hour or more per week for financial gain, or work without pay in a family business, as well as those persons who are unemployed and actively seeking work.

### 4. Projection Assumptions

The labour force participation rates used for these projections are formulated based on historical census data (1976-1996) as well as recent trends indicated by the Household Labour Force Survey. Generally, participation rates for males are assumed to continue to decrease slightly for most ages 20-54 years. For ages 55 years and over the rates are assumed to increase as a result of the increase in the age of eligibility for superannuation. For females, rates are assumed to continue increasing for most age groups. However, the pace of change during the period 1996-2011 is assumed to slow down, and after 2011 the rates are assumed to remain stable at the 2011 level.

The average working life for males is assumed to change from 43.4 years in 1996 to 43.3, 44.2 and 45.1 years, respectively for the low, medium and

high assumptions. The corresponding figures for females are an increase from 34.2 years to 35.5, 36.2 and 37.0 years, respectively.

## 5. Nature of Projections

These labour force projections are based on assumptions made about future fertility, mortality, net migration and labour force participation. Although the assumptions are carefully formulated to represent future trends, they are subject to uncertainty. These projections should therefore be used as guidelines rather than exact forecasts. They measure the changes in the total labour force size and age composition which would occur if the stated assumptions were to apply over the projection period. These projections ignore non-demographic factors (eg catastrophes, war, etc) which may invalidate the projections.