Long-term Fiscal Projections: Reassessing Assumptions, Testing New Perspectives

New Zealand Treasury

BACKGROUND PAPER FOR THE
2013 STATEMENT ON THE LONG-TERM FISCAL POSITION

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Long-term Fiscal Projections: Reassessing Assumptions, Testing New Perspectives

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Abstract

Affording our Future, the 2013 long-term fiscal statement (2013 LTFS), tests fiscal sustainability over the next 40 or so years through a series of projections, capturing trends, risks and uncertainties flowing from population ageing and other drivers. The statement also canvasses a range of policy options to address sustainability, and their possible effects on living standards. Projections by their nature are assumption-driven and so it is important to explain where the assumptions come from. The present paper lays out the modelling approach, the assumptions behind the projections, and the sensitivities around these assumptions. Early versions of this paper and two others on fiscal sustainability and on preliminary versions of the projections were presented at the NZAE Conference in June 2012, were tested before the Long-term Fiscal Panel in August, and were covered in presentations to the Affording our Future Conference in December.

JEL CLASSIFICATION

JEL classification codes:

H00 – Public economics
H50 – National government expenditures and related policies
J00 – Labour and demographic economics

KEYWORDS

Key words: Public economics; government expenditure; labour economics; demographic economics
Executive Summary

For the past 15 years or so, many countries around the world have examined the implications of current spending and revenue programmes on the sustainability of their fiscal position, given the expected demographic changes, likely trends for economic growth, and other drivers. The outcomes of these projections show the potential effects of policy choices made by past and present governments, coupled with other growing pressures such as the ageing population.

To evaluate the sustainability of the fiscal position in New Zealand, we use a few indicators such as the path of core Crown net debt (as defined in the Fiscal Strategy Report) as a ratio of gross domestic product, or of the ratio of debt financing costs to GDP.

The current paper gathers together the key assumptions (and the reasons we have chosen them) behind our base case scenario, “Resume historic cost growth,” referring to the source of many of our assumptions about government spending in the projection period. The 2013 projections build on the 2013 Budget forecasts with the spending projections starting from the beginning of the 2015/16 financial year, when the present Government’s electoral term will have ended. This incorporates the current operating surplus forecast for 2014/14. The base case assumes that projected tax revenue quickly stabilises around the 2001-2012 historical average to GDP.

Both expenses and revenues are affected by the assumptions we make about demography and the economy. In terms of demography, we use Statistics New Zealand’s median projections for our assumptions about fertility and life expectancy. We also use the agency’s assumptions about net migration. Economic assumptions include average hours worked, productivity growth, workforce participation (SNZ’s median assumptions), inflation, and interest rates. We also make growth assumptions about types of government spending. All of these assumptions affect the path of our projections. On the following two pages, we present a summary table of the key assumptions in our base case scenario.

This package of assumptions produces projections of the operating balance remaining in surplus until the mid-to-late 2020s, when cost pressures from the ageing population and rising health-care costs produce growing deficits. This causes debt servicing costs to rise from 1.7% of GDP now to about 12% in 2060. Accelerating debt grows from 27% of GDP now to just under 200% by 2060.

Others have come to essentially the same conclusion as we do: over time we will see a growing gap between government expenses and revenue, if we make no policy changes.

The paper also tests some changes to the assumptions and shows, for example, that having a higher birth rate, or higher productivity (both lifted by around a third, say), or doubling the net migrants move the debt track around a bit but the result is still unsustainable.

Other background papers examine indicators of fiscal sustainability, the results of the projections, implications of fiscal pressures on growth, on equity, and illustrate ways of keeping the fiscal position sustainable largely by looking at the three key areas: tax, retirement income, and health spending.
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1 Introduction

For the past 15 years or so, many countries around the world have examined the implications of current spending and revenue programmes (pensions, health, education spending, personal and corporate taxes) on the sustainability of the fiscal position, given the expected demographic changes, likely trends for economic growth, and other drivers. The outcomes of these projections show the potential effects of policy choices made by past and present governments. To change the possible longer-term fiscal position will require current and future governments to make further policy choices.

In New Zealand, the Treasury has produced long-term (40 or more years) fiscal projections from the mid-1990s for one purpose or another. The Treasury has published formal statements of the possible future fiscal position twice before, in 2006 and 2009, as required by the Public Finance Act (in section 26N of the Act as amended in 2004). The 2006 statement attracted relatively little attention. The second, arriving on the heels of a domestic recession and the 2008 global financial crisis, painted a more dire picture and produced a wider debate about what choices could be made to prevent the projected debt position (New Zealand Treasury, 2006, 2009).

To evaluate the sustainability of the fiscal position, we use a few indicators such as the path of core Crown net debt as a ratio of gross domestic product, or of the ratio of debt financing costs to GDP. The paper on fiscal sustainability by Buckle and Cruickshank (2013) canvasses other indicators such as the fiscal gap derived from the inter-temporal budget constraint. In the present paper, though, we concentrate on the net debt indicator as used in the Fiscal Strategy Report (English, 2009). This excludes the New Zealand Superannuation Fund and advances from the financial assets subtracted from gross debt.

Picking up lessons from the first two statements, and from the 2010 Tax Working Group process, the Treasury embarked on a wider and more open process to prepare the 2013 statement. We commissioned external and internal experts to provide research on the evolution of the welfare state, on various policy settings and choices that could be made to bend the debt curve down relative to GDP. Some considered what could be learned from the past, both from programmes and policy-making processes that have had long-lasting results. Other important topics included fiscal sustainability, likely future growth, the evolution of the New Zealand welfare state from historians’ and philosophers’ perspectives, and approaches to intergenerational equity.
In addition to commissioned research, the Treasury set up an external panel to challenge our work and provide suggestions on how to improve our analysis. A summary of the panel’s deliberations was made public after each of the four sessions between August and November. This was followed in early December by a public conference hosted jointly by the Treasury and the Victoria University Chair in Public Finance. The conference covered our work and that of the external experts. We published the next Long-term Fiscal Statement, entitled *Affording our Future*, on 11 July 2013 (New Zealand Treasury, 2013) and this will lead to a series of public talks, and other publications over the coming year.

Part of our work for the first panel session was this paper. It re-assessed our modelling process and explained the reasons for our choice of assumptions and the sensitivity of the fiscal position to different choices.

The Office of the Auditor-General’s work programme for 2012/13 had a theme, “Our future needs – is the public sector ready?” The Office produced a useful survey of public sector financial sustainability research as a backgrounder for this (OAG, 2013). In addition, the OAG has selected the long-term statement, its production process and modelling for review. The resulting report will be published a month or so after the statement.

This present paper is structured as follows. Section 2 explains at a high level what our projection model, the Long-Term Fiscal Model, does and doesn’t do, dual ways of presenting projections, and how we will reflect uncertainty. Section 3 discusses the base demographic projection assumptions. This is followed by Section 4 explaining the choices behind the economic assumptions. Section 5 examines how base-case tax assumptions were arrived at, while Section 6 lays out the assumptions behind our spending projections for New Zealand Superannuation, welfare benefits, health and long-term care, education, and the rest.

Section 7 deals with assumptions needed to frame fiscal sustainability such as the long-term target debt ratio and how long to use current policy spending forecasts before moving to trend projections based more on historical averages. In Section 8, we discuss the sensitivity of the modelling to changes in the key demographic, economic and fiscal assumptions. Section 9 concludes.

The thinking in this paper draws on the paper on fiscal sustainability (Buckle and Cruickshank, 2013) and is incorporated in the paper on our economic and fiscal projections (Bell, 2013).
2 Long-term Fiscal Model primer and approaches to projections

“The goal of forecasting is not to predict the future but to tell you what you need to know to take meaningful action in the present.” - Paul Saffo, technology forecaster

“I don’t try to describe the future. I try to prevent it.” - Ray Bradbury, science fiction writer

This section provides a broad-brush look at how the Treasury’s spreadsheet-based Long-term Fiscal Model (LTFM) produces projections. Before embarking on that, however, we need to explain the language we use to describe two different approaches to looking at the future. The model is posted on the Treasury website after each statement is released (New Zealand Treasury, 2013a).

We use the term “forecast” for predicting the results of the key interactions of the economy to produce a view of the business cycle over the near-term future. For example, a surge in exports lifts the demand for workers, driving down unemployment, and eventually wages and inflation rise, producing a monetary policy response to slow economic growth. We use the New Zealand Treasury Model (NZTM), a macro econometric model with estimated coefficients capturing such behavioural linkages, to do the Budget Update macro forecasts going out five years (Ryan and Szeto, 2009).

On the other hand, the term “projection” means a prediction of the future involving relatively few interactions, few drivers, and relatively few assumptions; a projection is more likely to follow smooth trends rather than the ebbs and flows of the business cycle. It can be used to show the effects of a change and answer a question: “What if this assumption was higher, or lower?” A projection is not an attempt to forecast the future in the way described above; it is much more of a mechanical exercise. The two comments at the top of this section reflect the view that a projection is successful, if it provokes a discussion leading to changes that avoids the projected outcome.

2.1 How the Long-term Fiscal Model works

The LTFM was developed in the mid-1990s to examine possible longer-term effects of current fiscal policy settings. Today, the general idea is still the same: take the medium-term economic forecasts from the NZTM (covering two to five years, say) as a starting point and then grow out these economic projections for several decades beyond that. Couple these with fiscal projections, using the last year of the fiscal forecasts as the launch point for projections of taxes, spending on government services, transfers, and changes to assets and liabilities.

The long-term fiscal team has weighed up the pros and cons of when it is best to switch from the forecasting methodology to projections: One approach is to go directly from history to projections (so no “forecasting” interval), another to go to projections after the next expected election, and a third to wait the traditional five years before moving to projections. This discussion will be taken up in Section 7.

The model uses a high-level macro background to project the government’s financial accounts - financial performance (flows of revenue, spending including on the costs of servicing the existing debt and on government investment, for the core Crown and wider
total Crown, including SOEs and Crown Entities), and the financial position (the balance sheet, assets and liabilities, including various measures of debt).

The macroeconomic forecasts (of GDP, employment, interest and exchange rates, for example) are produced by the NZTM. The macro modellers put in a set of assumptions describing the long-term trend behaviour of the NZ economy. The model then produces a quarterly track that describes a path from the end of actual outturns until it reaches the medium-term trend. The expenditure forecasts use estimates made by spending departments for the first year, based on budget tax and expenditure decisions, with total spending extended out by the operating allowances (unallocated new programme spending or tax changes) for the following years. Revenue forecasts are derived from the macroeconomic forecasts, micro tax data and aggregate outturns from the Inland Revenue Department.

The economic projections use Statistics New Zealand’s population projections and participation rate assumptions to project the labour force (of those employed, or unemployed and actively seeking work). The labour force projection is then combined with assumptions about the unemployment rate, average hours worked and the growth of average output per hour worked to arrive at a projection of real GDP. This is combined with an assumption about trend inflation to produce a projection of nominal GDP. If the gap between the forecast of real GDP growth and potential (or trend) growth has not closed by the end of the forecast period, the first few years of the projection period are used to close the gap.

Projections for taxes on wages (source deductions) assume a gradual rise from the present depressed ratio to GDP to something close to the historical average over about five years into the projection period. After that, this tax grows with nominal GDP (in other words, we assume a fixed tax-to-GDP ratio). Corporate tax grows with GDP generally from the first projection year (although growth could be held back for a year or two, if businesses are still working through accessible losses). All other taxes (GST, excises and so on) grow with GDP in the projection period.

Government spending on services (G, or government consumption, in the standard macro identity, \( Y = C + G + I + X - M \)) is grown for each type of spending using population groupings (weighted by age and gender for the major health groupings) or just age (education) or just GDP (for many of the other spending areas), estimates of wage or other input price growth, public sector productivity growth for the area, and inflation.

As for transfers, spending on New Zealand Superannuation is grown by the projected growth of the average wage (net of taxation) and the numbers of people 65 years and older. Because not everyone 65 and older collects NZS, this implies the proportion of recipients to the total population of people 65 and older remains the same through time.

The main social welfare transfers (now regrouped and renamed under the welfare reforms) are grown by CPI inflation and the proportions of five-year age groups receiving each of the benefits (these proportions of the population remain fixed through the projection period). We assume that all supplementary benefits are grown from the end of the forecast base by inflation or by nominal wage growth and the numbers of people 15 years and older. Past statements have assumed that all supplementary benefit payments grow by inflation, just as the main ones do, but it seems as if growth of some of these benefits is better modelled by a higher value.
Revenue and spending (on goods and services and on transfers) are combined to produce estimates of projected primary balances. In the first projection year, the balance reduces the previous year’s debt (if it’s a surplus) and the finance cost of the resulting mid-year debt is added to current spending. The balance for that year is then added to the previous year’s debt (here we are using an accrual amount to proxy cash), producing a projection for the debt path. They take into account the debt build-up over the fiscal year in which it is incurred.

The new spending on capital is allocated to property, plant and equipment in the forecast period and then the end-of-forecast stock is projected out using the growth of nominal GDP.

In summary, LTFM-based projections are not based on econometric modelling. Rather, they use plausible growth drivers, often drawing on current policy parameters or calibrations from history. We will discuss the plausibility of the assumptions in Sections 3-7.

2.2 Two ways of presenting LTFM projections

For most of the period from the early 1990s to 2008, successive governments made their initial budgetary decisions with an eye on projected longer-term trends towards maintaining prudent debt levels, as formalised in the Fiscal Responsibility Act 1994 (which was absorbed into the Public Finance Act in 2004). The result was that the ratio of debt to GDP fell through this period (Figure 1). So for nearly two decades, spending was generally constrained by governments keeping the debt ratio to “prudent” levels over the long term. What was “prudent” was announced in advance by successive governments.

*Figure 1 – Core Crown debt, since the mid-19th century (% of GDP)*

Source: Statistics New Zealand, NZ Treasury.

Note: This incorporates several different measures of debt. From 1972, this is gross sovereign-issued debt and the former core Crown net debt (this excludes NZ Super Fund). Forecast/projection from 2013 onwards. This is IFRS-GAAP-consistent only from 1997 onwards.
In the first two reports on the long-term fiscal situation, growing fiscal pressures eventually produced a series of primary \(^1\) deficits (it took a decade or two in the 2006 report, but happened immediately in the 2009 report as a result of the Global Financial Crisis). These deficits were the result of weakened tax revenue, growing programme spending compounded by spending to finance the growing debt. So while this was the debt ratio picture in the two statements, long strings of deficits don't reflect the behaviour of governments between 1994 and 2008.

Allowing debt to grow with no corrective policy reaction assumes that future governments will abandon past “prudent” behaviour. As an alternative to this, we assume that future governments will manage their budget decisions so that net debt is maintained in the long run at around 20% of GDP (the current objective and the working assumption for these projections; see Section 7.1). To incorporate this in the modelling, we maintain the demographic and economic assumptions and the current fiscal settings, and use the operating allowances (the budgeted new non-transfers spending) needed to reach and then hold at the debt limit. We shall see that with no changes to spending on NZS and welfare, this requires much lower growth in all other spending than we have seen over the past decade and a half.

So we have two ways of presenting the likely fiscal challenge future governments might face. In the past, New Zealand, and nearly every other country, has concentrated on the debt ratio as an indicator of the sustainability of current fiscal settings. We are calling this presentation the “Resume historic cost growth” scenario where we resume historic cost growth from a certain year onwards (we’ll call this the “historic cost” scenario, for short). This could be criticised as not being historic: As noted above, governments of all stripes have generally kept debt growth under careful control from around 1994 until the onset of the GFC in 2008. They have not let net debt grow faster than GDP.

The outcome of this scenario is very sensitive to the starting position. New Zealand went from a projection of the 2050 (net) debt ratio of over 100% of GDP in the 2006 statement to over 220% three years later. What had changed? There were some spending policy changes and tax cuts, but the main change was the economy contracting in 2008 and the need to support people through the worst of the recession. In 2009, commentators tended to concentrate on the projected level of debt at the end of the projection, rather than on policy choices needed earlier on to stabilise the debt ratio and reduce financing costs (Bell and Rodway, 2013).

For Part 2 of the 2013 statement, the illustrations of policy changes concentrate on what is needed to keep net debt as a more or less constant share of GDP. We work out what operating allowances are needed to keep net debt at around 20% of GDP as an alternative scenario. The focus is then more directly on a stream of decisions around spending and taxation and these seem more real and amenable to change than frighteningly large piles of debt, although they in fact complement each other.

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\(^1\) A primary balance (surplus or deficit) is the government’s fiscal balance (revenue less spending) excluding payments to finance debt and excluding interest income from financial assets.
3 Demographic assumptions

We now turn to the assumptions behind the population projections. The population and labour force projections published by Statistics New Zealand in July and late August 2012 are different from past projections. Bascand (2012) presents background material on the approach to population and labour force projections, the assumptions and results, past accuracy, and stochastic methods for quantifying uncertainty around the median.

Population ageing shows up as a rise in the median age. It will also show up as changing proportions of the young and old to the group of people between the old and the young. The division points between these three groups are not entirely arbitrary. Around the world, people often receive a pension starting at age 65. In earlier days of New Zealand, 15 was the age many left school for work, perhaps on the family farm. Many statistics agencies have kept these division points for inter-country comparability, even through in many countries a sizeable proportion of people remain in tertiary education until their early 20s and many continue in the labour force for a few years past 65.

A move for the “end of youth” from age 15 to 19, say, lifts the youth dependency ratio (youth over the middle group starting at 20) but keeps roughly the same shape. Changing the old to age 67 and older, for example, and diving by a smaller middle (20-66) has a lesser effect and a similarly shaped ratio curve.

While these social and economic changes are important, we have decided to keep the 15/65 divisions for comparability internationally and with our earlier work.

3.1 Approach to quantifying demographic uncertainty

In July 2012, Statistics New Zealand released the 2011-base national population projections. They chose their best shot assumptions for the median projection just as they did in the past for the median projections in the past (then called “Series 5”). The new projections have a greater emphasis on quantifying uncertainty. SNZ published percentiles (e.g., 5th, 10th, 25th, 50th, 75th, 90th and 95th) to give an indication of uncertainty around the median, or 50th percentile, projection. These uncertainty fans come from 2,000 stochastic projections, based on randomly sampled values of distributions of the major input assumptions derived from historical observed spreads. The 50th percentile, for example, is an indication of where the actual value has a 50% chance of being higher than the projected value, and a 50% chance of being below the actual value. This 50th percentile population projection is the starting median projection.

The background to this approach is found in Dunstan (2011), building on his earlier work, and in Creedy and Scobie (2002), Leonova and McLellan (2005), Wilson (2005), Ball (2013), and others.

In the 2009-base releases, and earlier, SNZ illustrated demographic uncertainty by producing eight other “official” deterministic projections made up from different combinations high, medium and low assumptions for fertility, mortality and net migration.

In the 2009-base releases, and earlier, SNZ illustrated demographic uncertainty by producing eight other “official” deterministic projections made up from different combinations high, medium and low assumptions for fertility, mortality and net migration.

Figure 2 is an illustration of uncertainty around the median projection of total population. This shows the 50th percentile value is 6 million in 2060 with the interquartile range (25th to 75th percentile) of 5.6 million to 6.3 million. So half the stochastic projections have values for this ratio between these two values and half were outside this band. The 25th percentile means that one quarter of the stochastic projections lie below this line, and three quarters lie above.
In reviewing the population projections behind our economic and fiscal modelling, it is important to be comfortable with the assumptions that determine the mid-range projection. This comfort could come from reviewing historic trends, the social and economic pressures that may be changing those trends and looking at what is happening in comparable countries.

Then, because we live in an uncertain world, we should not rely on a single projection as our only guide to future trends. Before the advent of stochastic projections, we used the official alternative projections for conveying uncertainty. Because we are trying to illustrate the risks to the fiscal position, deciding which alternative projections to use depends on the relative costs of an under-projection and an over-projection. To warn about where growth of public spending, for example, on health or New Zealand Superannuation might go (both areas are affected by ageing), at present we could pick an alternative that has higher gains in life expectancy.

In the new stochastic world, this uncertainty is more quantified. That's a positive step forward. However, each statistic you look at, such as the dependency ratio of 65 and older to 15-64 year olds requires a calculation for each of the 2,000 runs and then a stacking in each year to calculate the percentiles. Working out how demographic uncertainty produces a probability distribution for the primary balance, for example, means running the stochastic projections through the LTFM and then sorting the results. Ball (2013) recently presented this work to the Population Association of New Zealand conference.

3.2 Fertility assumptions

One of the drivers of population ageing is a secular decline in average family size. The crude birth rate is the number of births per 1,000 people. Apart from a few wobbles now and then, the birth rate has generally fallen from around 40 births per 1,000 people 150 years ago to 15 per 1,000 now (put another way, from families averaging five to six children to families with two children). One of the largest of these wobbles was the rise in the birth rate after the Depression and the Second World War through to the late 1960s (the baby boom). Statistics New Zealand dates the baby boom from 1946 to 1965,
although the birth rate was climbing from the mid-1930s and remained above the long secular decline until the 1970s.

Figure 3 – Birth rates have been generally falling through time

Source: Statistics New Zealand

Another measure of fertility is the sum of the age-specific fertility rates in a particular year. This summary measure is the “total fertility rate” (the period measure for that year) and can be interpreted as the average number of live births that a woman would have during her life, if she experienced the same age-specific fertility rates from that point onwards. It is a measure used by SNZ in making fertility assumptions in its projections.

We are not expecting that New Zealand will see another large baby boom in the future, because social and economic conditions have changed from those prevailing in the two decades after the Second World War. Contraception is more reliable, women are participating more in tertiary education and in the labour market, and are having their children later in life than they did a decade or two ago. All these factors have led to a lower fertility rate.

At this stage, it is not clear whether the higher fertility rates of Māori and Pasifika groups are converging towards Pākehā rates. From 2002 to 2009, Māori births were a growing percentage of the total and the average age for Māori childbirth could be rising.2

SNZ’s medium assumption in the August 2012 population projection update is that the fertility rate will gradually settle back a little from where we are now (at around 2 babies per woman) and then stay at the long-term assumption rate of 1.9 from 2032 onwards. This assumption is based on an analysis of the NZ period and cohort fertility rates, rates of childlessness, and ethnic fertility patterns, as well as international comparisons. It is also close to the fertility rates we have seen since 1977 (between 1.9 and 2.2). The New Zealand fertility rate and the long-term assumption were both near the top of the OECD in 2010.

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2 In 2006, fertility rate for the total population was 2.05 babies per woman (2.14 in 2009). For Māori, it was 2.7 (2.8 in 2009); Pasifika, 2.95; Asian, 1.52 and European, 1.92. A rising average age for Māori births could indicate greater participation in the labour market or tertiary education and could signal a fall in the fertility rate and birth numbers (Te Puni Kōkiri, 2011). Cunningham (2012) discusses Māori life paths and outcomes.
The long-term rate of 1.9 babies per woman has been our assumption since the 2009 statement. At this point, it seems a plausible central assumption. Upside risk occurs if non-European groups do not converge as fast as it is assumed in the background (but this has some advantages for the fiscal position). Downside risk occurs if Māori and Pasifika converge quickly to European and Asian fertility rates. This would have the opposite effects on public spending.

Figure 4 – New Zealand’s period total fertility rate, 1921-2060

![Babies per woman vs. Year](image)

Source: Statistics New Zealand, history and median assumption (red)

The figure below shows the probability distribution around the median assumption for fertility in the 2011-base population projection. This uses random sampling from a normal distribution with a standard deviation derived from the history of fertility between 1977 and 2009 and shifted so that the 1.9 fertility case is at the 50th percentile.

Figure 5 – Uncertainty around the median assumption for period total fertility rate

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3 Although there are many more factors that could affect future fertility rates other than ethnic composition. Moreover, convergence of ethnic fertility patterns is not a necessary requirement for the mid-range assumption.
3.3 Mortality (life expectancy) assumptions

Life expectancy is an area we should test carefully in setting assumptions for our long-term fiscal projections. Life expectancy assumptions have generally been progressively lifted internationally as recorded increases have been sustained.

Another tendency in setting these assumptions has been to slow down gains in life expectancy when looking ahead.⁴

The IMF (2012) has warned that governments and managers of private funds are likely to be underestimating the life expectancy of ageing populations, a risk that could further threaten their fiscal positions and increase risks to financial and fiscal stability.⁵ The IMF analysis showed that if individuals lived three years longer than expected, which was in line with under-estimations in the past, the already large costs of ageing to governments could increase by another 50%. Longevity risk affects financial stability by threatening fiscal sustainability and weakening private sector balance sheets, adding to existing vulnerabilities in the current environment.

The crude death rate in New Zealand (deaths per 1,000 mean population) has been trending downwards for the past 150 years, apart from wars and epidemics (e.g., the Spanish influenza epidemic shows up as the sharp spike in 1918).

Figure 6 – Death rates have been generally falling through time

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⁴ Oeppen and Vaupel (2002) found a linear relationship through time for the growth in the highest life expectancy around the world. Despite this pattern, demographers continued to announce limits to life expectancy which would then be surpassed within a few years. US demographer Tuljapurkar (2005, 2005a) has analysed the burden of disease and potential health innovations from nanotechnology and believes that average life expectancy in the US in 2050 could reach 100 years.

⁵ These messages were repeated by the Financial Services Council in June 2012: the FSC says Statistics New Zealand’s medium life expectancy assumptions are too low and that taxes will need to go up to cover NZS costs (Financial Services Council, 2012).
Age-specific mortality rates in a particular year are converted into a summary measure called life expectancy at birth for that period via life table calculations. Life expectancy at birth can be interpreted as the average number of years that a person born in that year could expect to live if she experienced the age-specific mortality rates prevailing in her year of birth (period measure) throughout her life. It does not, therefore, include the effect of any future decline in age-specific mortality rates. If rates continue to fall through life, as we have generally seen since the mid-1940s, that person is likely to live longer (this is captured by the cohort measure of life expectancy which uses the mortality rate a year later at each subsequent year of age).

A person wanting to get an idea of how long she might live on average (perhaps for planning how much to save for retirement) should look at the cohort measure of life expectancy, rather than the snapshot, period measure. The table below shows that a girl born in 2000 could live 10½ years longer than if death rates remained the same as in her birth year (period measure).

**Table 1 – How long might I live?**

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Life expectancy at birth, period and cohort measures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1900</td>
</tr>
<tr>
<td>Males</td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>57.4</td>
</tr>
<tr>
<td>Cohort</td>
<td>58.2</td>
</tr>
<tr>
<td>Females</td>
<td></td>
</tr>
<tr>
<td>Period</td>
<td>59.9</td>
</tr>
<tr>
<td>Cohort</td>
<td>63.1</td>
</tr>
</tbody>
</table>

Source: Statistics New Zealand (2012). Both measures are based on historic death rates to 2011 and then on the median mortality assumptions from 2012 onwards.

Note: “Period” refers to the year in which the mortality rates are converted into life expectancy. “Cohort” refers to the year of birth and the calculation takes changes in age-specific mortality rates from year to year into account. The period values for 1900 are non-Maori.
Compared with New Zealanders born in 1900 (non-Maori), those born in 2000 can expect on average to live an additional 30 or so years (cohort measure). Since 1950, life expectancy at birth (period measure) has risen by about 23 months (1.95 years, averaging males and females) each decade. There is uncertainty about how far and fast mortality rates will continue to fall.

These trends toward longer lives on average are a result of drier and warmer homes, cities without horse manure dust in the air, clean water and communal sewage disposal, public health campaigns for immunisation and against smoking, healthier lifestyles and food, and better medical care and technology. Improvements in life expectancy resulted first from reductions in infant mortality and maternal deaths and later from people living to older ages. What has not changed much over this period is the age of the oldest people. What we are seeing are more people surviving to older ages.

In the median 2011-base projection, SNZ assumes mortality rates will continue falling and so life expectancy (the period measure) will continue rising, but at a slower growth rate (1.6 years or 19 months per decade) to reach 88.1 years for men and 90.5 years for females in 2061. These are higher than in the 2009 medium assumptions (closer to the old high life expectancy - or low mortality - scenario) and seem more in line with life expectancy assumed in comparable countries.

Figure 7 – Rising life expectancy at birth

SNZ’s very high life expectancy projection assumes life expectancy at birth increases at a similar annual rate as between the 1975–77 and 2005–07 complete period life tables (by 0.31 and 0.23 years of life for males and females, respectively), reaching 95 years for both males and females in 2061. This is an average growth of 2.7 years per decade from 6

6 The oldest “verified” people live to around 115. New Zealand’s oldest person was Florence Finch, who died in Hastings aged 113 in 2007.

7 This reflects the non-linear relationship between age-specific death rates and life expectancy, combined with the fact that death rates are relatively low at younger ages so that further reductions cannot generate the same life expectancy gains as we’ve had in the past. These 2061 assumptions contrast with the 2009-base projections where the two medium assumptions for 2061 were 85.6 and 88.7 years.
2012 onwards. This is useful for conservative funds managers when looking at “worse-case” scenarios for their retirement income funds.

Māori life expectancy has increased substantially from 1950 to 2007: for males it rose by 30% and for females by 34% (the New Zealand total changes were 16% for males and 15% for females over this period). However, Māori life expectancy in 2005-07 stayed lower than the total by 7.6 years for males and by 7.1 for females). More are surviving to older ages (TPK, 2011, p28). Only 52% of Māori males born in 1950 could expect to reach 60; by 2005-07, this proportion had reached almost 80%. For Māori females, the proportions were 53% in 1950 and 87% in 2005-07. The proportions for the total population in 2005-07 were 90% for males and 93% for females.

The OECD’s estimate of life expectancy for New Zealand females was 82.7 years in 2009 putting the country about half way down the OECD. For males, life expectancy was 78.8 years in 2009, ranked 8th in the OECD.

Risks on the downside are no further convergence in average life expectancy between Māori-Pasifika and Europeans (genetics, socioeconomic backgrounds and health access could be drivers of this), and a faster-than-expected rise in obesity and diabetes, or similar health conditions, across all population groups.

3.4 Net migration assumptions

The other key variable used in producing population projections is net migration. This has moved erratically up and down over the past half century, because of policy changes, the relative economic growth differences between New Zealand and the source and destination countries, and on the numbers of Kiwis leaving for their “overseas experience,” returning Kiwis and the reunification of families of former migrants.

Assumptions about levels of net migration do not have a major bearing on the ageing of the New Zealand population, as they are relatively small proportions of the total and have few older people migrating. Higher net migration tends to reduce slightly the effects of ageing over the long term.

Table 2 – Higher net migration lowers the old age dependency ratio and median age

<table>
<thead>
<tr>
<th>Net migration assumptions (long-run)</th>
<th>Old dependency ratio</th>
<th>Median age</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2011</td>
<td>2060</td>
</tr>
<tr>
<td>0</td>
<td>0.20</td>
<td>0.51</td>
</tr>
<tr>
<td>12,000 (50th percentile projection)</td>
<td>0.20</td>
<td>0.44</td>
</tr>
<tr>
<td>25,000</td>
<td>0.20</td>
<td>0.41</td>
</tr>
</tbody>
</table>

Source: Statistics New Zealand, 2011-base projections, median fertility and mortality assumptions

The median assumption of 12,000 net migrants each year is a little higher than the average from 1990 and double the 60-year average. The economic slowdown after the GFC, along with the Christchurch earthquakes, may have changed the near-term flows.

Figure 8 – Net migration, 1950-2060 (median projection, 2011-base)
As more of our traditional source countries face greater pressures from ageing, we are likely to see greater competition for immigrants, and inducements for Kiwis to migrate. Hence, we are likely to find it is harder to attract, or hold onto, 12,000 net migrants. Any lower numbers occurring over a long period means greater pressure on government spending and taxation from a population that is ageing faster than the 2011-base median scenario.

### 3.5 Role of the baby boom

One reason people do not appreciate the permanency of the change in the population structure is that they think it is all a “baby boomers” story and they won’t be around forever. In the two decades after World War II, fertility was high, with a peak at twice the average number of births per woman as is the case now. And life expectancy is much higher today.

Even without the post-WWII baby boom, our population would still be ageing as a result of the fall in the fertility rate and the trends towards lengthening lives over the past century. Over the last 50 years, the baby boom reversed the rise in the median age and in the next three decades or so, the baby boom will lift the proportion of the population over 65. By the mid-century, when most of the post-WWII baby boomers will have died, the population will have an older age structure than at any time in the past.

Figure 11 illustrates this using the ratios of the young (0-14 years) and old (65 years and older) to the core working age population aged from 15 to 64 years. The figure shows the historic and projected ratios and endeavours to illustrate what these ratios would be like if the fertility rate had not increased during the immediate post-war years. This has the effect of smoothing out the number of births between 1945 and 1965. Taking the top off the baby boom shows up as the gap between the red and blue lines (young dependency ratios) and removes some of the 65-year-old survivors from 2012 onwards (gap between the green and purple lines). The important point is that from 2050 or so onwards, when the bulk of the baby boomers have died, the aged dependency ratio is still twice as large as it is now and it’s not turning down!

The biggest contributors to New Zealand’s ageing population are our past low fertility and falling mortality rates which are expected to continue.
3.6 Demographic assumptions: conclusions

Here are high-level comments about the three main assumptions and how they flow through to the median projection:

- The median fertility assumption of 1.9 in the long run seems balanced between risks. SNZ continues to assume this in the 2011-base projections.

- Statistics New Zealand’s 2011-base median mortality assumption is close to the 2009 high life expectancy case. The 2011-base assumptions have lifted life expectancy all the way out to 2061, where the gap with the 2009-base assumption is 2.5 years for males and 1.8 years for females. This better reflects the longer-term fiscal risks we are likely to be facing (IMF, 2012).

- The present median migration assumption of 12,000 is probably fairly balanced, but it does have some risks on the downside from increased competition for people from other countries facing similar ageing pressures. The lift from the 2009-base assumption of 10,000 net migrants reflects the fact that the label “permanent and long-term migrants” was not picking up people who stay here longer than visitors do and could well be counted among the longer-stay residents.

- The resulting demographic projection is the one we feel is the most suitable for the long-term fiscal projections as it balances assumption risks on the upside and downside. It provides a mid-range projection Statistics New Zealand builds its uncertainty fans around.

- As such, it is less likely to be rejected out of hand as unrealistic. We provide later an example of using lower mortality/higher life expectancy as the driver of the fiscal position. It shows a worse debt position by 2060, as you would expect. It doesn’t really matter whether net debt is 200% or 300% of GDP; no government would allow this to occur.  

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Figure 9 – Effect of removing the 1946-1965 baby boom on dependency ratios

![Dependency ratios graph](image)

Source: The Treasury, Statistics New Zealand, median projection (2011-base)
The population in mid-2011 was 4.4 million and the old-age dependency ratio was 0.20 (the ratio of numbers 65 and older to those between 15 and 64). The 2009-base mid-range projection had the population growing to 5.6 million and a dependency ratio reaching 0.44 in 2060, while the 2011-base median projection has a population at 6.0 million with the ratio at 0.44. (Details are available in Bascand, 2012.)
4 Economics

This section outlines the assumptions needed to produce projections of real GDP. These include assumptions about labour participation rates, the unemployment rate, the average of weekly hours worked, and labour productivity growth. It also includes assumptions about the inflation rate (used for general price growth), and the government five-year bond rate (used to calculate debt financing costs). Drawing on work by Gardiner et al. (2012), we also indicate how population ageing might potentially affect these variables through time (although these effects have not been modelled).

4.1 Labour participation assumptions

Significant changes have occurred in labour participation rates over recent years. The rates have typically fallen among the younger age groups, associated with increased participation in tertiary education and the downturn in the business cycle. Male labour participation rates up to age 50 have generally fallen over the past 25 years, while most female rates have been rising (see the age-group graphs in Annex 1).

The 2012 labour force projections use the same approach as the underlying median demographic projection: they have a deterministic median projection based on the central demographic projection with percentiles of various statistics around this to reflect historically-based uncertainty in demographic and participation rate assumptions. The labour force consists of people aged 15 years and over who regularly work for one or more hours per week for financial gain, or work without pay in a family business, or are unemployed and actively seeking part-time or full-time work.

Dividing these numbers by the median population projection gives a measure of “median” participation for each age and gender group.

The 2012 median projection assumes:

- fertility, mortality, and migration – as outlined in the 2011-base national population projections (see above)

- labour force participation – the average working life (to age 80 years) increases to 49.4 years for males and 43.4 years for females. In 2006, the base average working life (to age 80 years) was 45.5 years for males and 37.0 years for females.

The labour force projections are based on census data (the latest published census year is still 2006). Between the 2010 update (Series 5M) and the 2012 median update, SNZ increased the aggregate labour force by 286,000 people in 2061 (Figure 12).

*Figure 10 – Probability distribution of the median labour force projection*
Population ageing will tend to lower aggregate participation through time. This is because participation rates of older groups tend to be lower than those of younger groups. So as people join the older groups in relatively greater numbers, the aggregate rate will tend to fall. This is one factor, among several, likely to slow GDP growth in the future.

In the 2012 projection of the labour force, by 2015, about the time when the LTFM projection begins, SNZ tends to flatten the single-year-of-age participation rates of the workers aged under 50 (see Annex 1). For some age groups, this is justified – they are high and stable anyway - but in other cases, this breaks rising trends in the quarterly HLFS data. For example, without the recent effects of the recession, the participation rates for women aged 25-29 rose strongly through history and then the census-based projected rates rise for a few years and then stop rising.

Changes this time include higher participation by women aged 50 and older (which level out at about 2035), and by men aged 65 and above. In fact, from about 2020, between 25% and 30% of people aged 65 and older are expected to be in the labour force (compared with 20% now).

The 2012 labour force projection has the 2010 aggregate Series 5M (medium) below the 25th percentile from 2020 onwards (Figure 11). The result is that the aggregate labour force projection has lifted by some 290,000 people in 2060. This means that the new projection for GDP (and tax revenue) is higher than under the former projection.

As an example of using this way of displaying uncertainty in fiscal projections, the stochastic population and labour force projections enable us to produce a fan of uncertainties (percentiles around the mid-range projection) for the cost of NZS as a proportion of GDP. This says the median (50th percentile) rises to 7.9% in 2060. It is “most likely” (in the sense of lying in the interquartile range) the value will be between 8.4% and 7.4% in that year. Finally note that that this ratio is more likely to lie above the median than below. (Ball, 2013, deals only with effects of uncertainty in demographics and the labour force on fiscal projections around the median; work on combining this with economic uncertainty is still in progress.)
4.2 Productivity growth assumption

We intend to keep the 1.5% assumption of annual growth in output per hour worked (labour productivity growth) used in both the 2006 and 2009 statements (and in fiscal strategy modelling done for each annual budget). While we look at history as a guide to setting this assumption, it is perhaps better regarded as a view of where growth of the New Zealand economy could be converging with our major trading partners.

Measures of aggregate productivity vary widely with the historical period considered. Here are some guides for thinking the 1.5% assumption is plausible:

- This is broadly in line with (smoothed) productivity growth over the past three decades (of 1.3%) (Figure 13).

- Fiscal sustainability reporting by countries in similar stage of development use similar long-term productivity assumptions: Australia (2010), 1.5; UK – OBR (2010), 2.2%; Canada – PBO, 1.2%.

- The Di Maio and Carroll (2012) papers presented at the first external panel session look back over New Zealand’s growth record of the past 40 years and at what might drive growth over the next 40. They suggest that productivity growth of between 1.5% and 2% on average is possible.

Figure 11 – Probability distribution of NZS spending ratio to GDP

Source: Statistics New Zealand, Ball (2013). The above chart shows the effects of variations in demography and labour force only.
This assumption of 1.5% annual growth has been criticised as unrealistically high (see, for example, Stroombergen, 2013). Weaker growth would lower tax growth, and perhaps add to welfare demand, lower the budget balance and put upward pressure on debt. More growth would do the opposite. Our modelling assumes 80% pass-through of real wage growth for a large part of government expenditure, and wage growth is a major part of GDP growth. The result is that much of the effect of this assumption, but not all, is washed out in the total tax and expenditure ratios to GDP (this is model-dependent, but productivity is likely to affect both expenditure and revenue to some extent under any plausible modelling framework). The sensitivity of the fiscal position to the productivity growth assumption will be tested later in this paper.

If you break out labour productivity by age and gender groups using their wages, Gardiner et al. (2012) show that the assumed labour productivity growth would fall through time to about 1.45% in 2060. They conclude that the relatively small reduction in labour productivity growth reflects that the increase in the proportion of people 65 and older is offset by the decline in youth and a marginal increase in the proportion of prime age adults into the age groups with relatively higher productivity.

4.3 Unemployment rate

The LTFM uses an aggregate unemployment rate to estimate the number of employees each year based on projections of the labour force. Since 2008, the aggregate unemployment rate has remained high (averaging 6.8% in the year to March 2013) and is forecast to fall gradually to 4.5% by 2022. After that, it is assumed to hold at that level through the projection; this is the estimated long-run unemployment rate for which inflation remains steady (taken from the New Zealand Treasury Model).

4.4 Average hours worked

The assumption of average weekly hours paid in the long run is based on an average paid hours paid over the past decade and a half. For the forecast, average hours paid is scaled up to average hours worked by using a recent ratio of the two. This puts the long-run hours worked per week at 33.2 hours. Gardiner et al. have estimated that the ageing population alone could reduce average hours from 33.2 to 32.4 hours by 2060.
4.5 Inflation

For all the longer-term projection work, we have used a CPI inflation assumption of 2%. This was not based on history, but used because the Reserve Bank has a focus of keeping future average inflation near the 2% target mid-point of the 1%-3% price stability band on average over the medium term (as laid out in the September 2012 Policy Targets Agreement between the Reserve Bank and the Minister of Finance.\footnote{For the purposes of this agreement, the policy target shall be to keep future CPI inflation outcomes between 1% and 3% on average over the medium term, with a focus on keeping future average inflation near the 2% target midpoint.” Policy Targets Agreement, September 2012. http://www.rbnz.govt.nz/monetary_policy/policy_targets_agreement/}

4.6 Interest rates

The 5-year government bond rate assumed for NZTM is 4% real (or 6% nominal). This is adopted as the long-term interest rate for calculating the financial costs of borrowing on government bonds. Treasury accountants have come to a different position on interest rates. They believe interest-rate reductions in the international financial markets (now 50-basis points lower than they were before the GFC) are structural (permanent) and are assuming a 5-year-bond rate over the long term of 5.5%. Work on this continues.

For the 2013 LTFM projections, we straddle these two positions. We are assuming the bond rate moves up gradually from the present 2.2% to 5.5% in 2022, remains at this level until 2027 and then climbs to its peak 6% in 2032 and stays there. These numbers are used to calculate projections of the debt-financing costs which are added to expenditure.

4.7 GDP projections

The labour force projection is a key input to our GDP projections. This is the only use the labour force participation rates are put to in the LTFM. So just the aggregate labour force is used and used to grow out the aggregate forecast of the labour force from the New Zealand Treasury Model.

GDP in the projection period comes from the calculation:

\[
Y_t = Y_{t-1} \frac{LF_t(1 - UR_t)}{LF_{t-1}(1 - UR_{t-1})} \left( \frac{HW_t}{HW_{t-1}} \right) \left( \frac{LP_t}{LP_{t-1}} \right)
\]

and

\[
N_t = N_{t-1} \frac{Y_t}{Y_{t-1}} \left( \frac{P_t}{P_{t-1}} \right)
\]

where \(Y_t, N_t\) is real (nominal) GDP in year \(t\), \(LF_t\) the aggregate labour force, \(UR_t\) the unemployment rate, \(HW_t\) average hours worked, \(LP_t\) labour productivity, and \(P_t\) the price level. This means that growth of real GDP equals growth in the number employed \((LF_t(1 - UR_t))\) plus growth in the average hours worked and the growth in average real output produced per hour worked (labour productivity). Then nominal GDP growth is the growth of real GDP plus the growth in prices.
5 Revenue

For this and the following section, we outline the fiscal assumptions for the historic cost scenario, where we try to capture something like current policy or past practice for projected revenue types, and spending on public services and transfers, against a background of relative constraint. The cost pressures all show up in the debt track.

Three bundles of taxation are covered in the model: source deductions (tax on wages withheld at source), corporate taxes (net of refunds), and the rest (dominated by GST). In the longer run, these are targeted at a historically-derived share of GDP (allowing for recent tax rate changes). This requires a rise in core Crown tax from the present 27.3% of GDP to 29% around 2020 and the ratio holds there. 29% is the average ratio of tax to GDP over the period 2001-2012.

Because tax revenue is below historical averages as a result of the GFC, projections for taxes on wages (source deductions) assume a gradual rise from the present depressed ratio to GDP to something close to the historical average (11.2% of GDP) over about five years into the projection period. After that, this tax grows with nominal GDP (in other words, we assume a fixed tax-to-GDP ratio). Corporate tax grows with GDP generally from the first projection year (although growth could be held back for a year or two, if businesses are still working through accessible losses). All other taxes (GST, excises and so on) grow with GDP in the projection period.

For the total Crown basis, corporate taxes net of refunds are adjusted to a historically justified 4.4% of GDP soon into the projection period. The adjustment might be delayed if we believe there is a large stock of accessible tax losses which would delay the growth of corporate tax for a year or two. The rest of taxes (GST, excises, tax on entrepreneurial income, withholding taxes on interest income and dividends and so on) move quickly to 15% of GDP in the projection period, matching an historical average.

The scenarios in Part 2 of the 2013 statement will consider changes to tax revenue as potential solutions to addressing future fiscal pressures.
6 Expenditure

For the 2009 statement (Bell, et al., 2010), we derived a growth formula for spending on public services that drew on inflation, the growth of real input costs, and demographic and non-demographic volume factors, for what we are now calling the “Resume historic cost growth” scenario. The trend growth parameters were derived from history or current policy settings, and from the underlying demographic projections. Many of the spending lines in the Budget core Crown expense tables (for example, New Zealand Treasury, 2013, pp115-120) are modelled separately in the LTFM.

Annual price growth of public services (health, long-term care, education, law and order are examples) is composed of inflation ($\pi_t = 2.0\%$), real input price growth ($w_t = 1.2\%$, or 80% of labour productivity growth 1.5%), and average public sector productivity growth ($a_t = 0.3\%$). Annual growth in the quantity of services is composed of demographically-driven growth ($d_t$, which depends on each spending sector because different age groups are drivers, each with different cost weights) and non-demographic volume growth ($p_t$, again sector-dependent). The non-demographic volume growth parameter is the residual growth in past expenditure that is not attributable to other drivers, and is derived from trends for the particular sector.

The equation below outlines the framework for modelling a single sector of public service expenditure growth in year $t$, $g_t$ (Bell, et al., 2010, p.82):

$$1 + g_t = (1 + \pi_t)(1 + w_t) \left(\frac{1}{1 + a_t}\right)(1 + d_t)(1 + p_t).$$

In other words, expenditure growth equals price growth (the $\pi$, $w$ and $a$ terms) plus quantity growth (the $d$ and $p$ terms). In a simple, first-order, linearised form (with the higher-order terms omitted), this becomes:

$$g_t \approx \pi_t + w_t - a_t + d_t + p_t.$$

In contrast, the expenditure growth of demand-driven transfers (NZS, unemployment benefit, accommodation supplement are examples) is modelled more simply as

$$1 + g_t = (1 + \pi_t)(1 + d_t)$$

where $g_t$ is the growth of expenditure in year $t$, $\pi_t$ is the growth of transfer indexation (typically CPI inflation or nominal wage growth), and $d_t$ is the growth of the recipient population. Linearised, this becomes:

$$g_t \approx \pi_t + d_t.$$

The linearised versions of these equations are used to derive average historical values of various growth parameters.

6.1 Health

Public health is probably one of the most complicated of the public service sectors to model. What we spend as a country for public health is the result of layers of decisions stretching back for decades. As such, it lacks the simple parametric structure of a (near) universal programme like New Zealand Superannuation.
Spending amounted to $14.2 billion in 2011/12 (more than a fifth of all non-interest spending). The Ministry of Health provides us with cost weights which allow us to break health spending into seven functional categories (aggregated below to five groups):

- Personal health (public costs of GP visits, public hospital stays, public funding of drugs), making up 69% of total core Crown spending on public health
- Mental health, 10%
- Health of older people, 10%
- Disability support services for those 64 and younger, 7%, and
- Public health (preventative health services), 4%.

Each of these has its own per capita costs by age group and gender for 2010. These cost weights are multiplied by the appropriate demographic group and then used to calculate category population cost growth $d$, which varies by year, gender and category.

While the evidence for “healthy ageing” (compression of morbidity) is not always unequivocal and may depend on disease types, we have attempted to model this for each health spending category by shifting out the cost weight curves to reflect the rising longevity (which is now largely occurring in the older age groups). So if life expectancy of a 65-year-old increases by four years in 2060 compared with 2010, we would assume the average spending in real terms for a 65-year-old in 2060 is equivalent to that of a 61-year-old now. This aligns with the approach taken by the OECD in its public health modelling (OECD, 2006).

**Figure 13 – Cost weights for personal health spending, by age and sex ($2010)**

![Figure 13 – Cost weights for personal health spending, by age and sex ($2010)](source: Based on Ministry of Health data (2010), smoothed by the Treasury)

The health of older people category is a proxy for long-term care. The cost curve for this in 2010 has ever-rising growth with age.

Parkyn and Ball (2012) revisited the growth assumption of non-demographic volumes, pushing up the cost curves. In 2009, we estimated this growth at 0.8% as an average across all government public services (Bell, et al., 2010). This has been re-estimated just for the public health sector as 1.5%, equal to the Treasury’s assumption for long-term
annual growth in economy-wide labour productivity. This means that the long-term non-demographic cost growth is now 2.4%, which is 0.9% from the relative price effect \((w_t - \alpha_t = 1.2\% - 0.3\% = 0.9\%)\) plus the 1.5%. The relative price effect is an example of Baumol’s cost disease. This contrasts with the assumption of 1.7% in the 2009 report. By decomposing New Zealand’s public health growth rates between 1981 and 2012, the average is 2.5%, close to the new estimate.

6.2 Education

Education expenditure in the LTFM is modelled by four levels: early childhood, primary, secondary, tertiary; and by tertiary student allowances, student-loan write-offs and Ministry of Education expenses and other expenses.

We have taken current participation rates by age for each of these levels. The data for domestic tertiary equivalent full-time (EFT) students is graphed below. The bulk of tertiary EFT students come from the 18-24 group, although older age groups are also keen on tertiary. In 2010 about a third of males aged 18-19 were in tertiary (on an EFT student basis), while almost half of females of those ages were participating. These numbers have risen since 2008 (boosted by a tighter job market since the start of the recession).

Figure 14 – Tertiary participation by domestic EFTS by age group and gender

![Graph showing tertiary participation by domestic EFTS by age group and gender.](Source: Ministry of Education)

Note: These are calendar-year averages from 2003 to 2010

These average proportions are applied to the population projections to provide an estimate of the tertiary EFT-student numbers through time. While the bulk of attendees are aged 24 and under, older students also feature on the nation’s campuses. A similar participation rate weighting process is used for the early childhood and the compulsory sectors (primary and secondary).

As with public health, Parkyn and Ball (2012) re-estimated the non-demographic volume growth for the public education system. Over the last 50 years, education spending has
risen at around the same rate as health spending (around 3% annual average real per capita growth). This has outstripped GDP growth, with the result that spending as a share of GDP has increased from around 2% of GDP in 1950 to 6% of GDP by 2013.

The baby boom added to education pressures in the 1950s and 1960s, but this has been in reverse since. After accounting for these purely demographic effects, Parkyn and Ball’s work suggests that non-demographic education costs have increased at the rate of around 3% per annum over history. In 2009, we assumed the growth of the non-demographic volume as 0.8% across the board. This time, looking at education spending on its own, we feel 1% growth is a better estimate, which when coupled with the relative price factor (0.9%) gives the non-demographic part of nominal education growth as 1.9% per annum.

6.3 New Zealand Superannuation

New Zealand Superannuation is a pension scheme paid out of current taxation to people from their 65th birthday, provided they satisfy a residency test. 11 The payment is set at 66% of the average wage after tax for a couple. A person who lives with others (uncoupled) or who lives alone is paid at higher rates than half of the couple rate. On each 1 April, the payment made to a couple is adjusted upwards by the CPI inflation rate for the year from the December quarter to the prior December quarter with the proviso that the result must lie between 65% and 73.5% of the net average wage. Without tax changes and positive real wage growth, this means that before long, Superannuation payments increase with the growth rate of the net wage (this is the assumption prevailing in the projection period).

As outlined at the start of this section, these parameters make modelling NZS aggregate spending relatively simple. From the last year in the forecast, we grow out the amount by the growth rate of the numbers of people 65 and older and by the growth rate of the average wage net of tax. This implicitly assumes that the proportions of people who are paid different amounts depending on living style (coupled, single alone or single in shared accommodation) and the proportion of people 65 and older claiming NZS remain constant. Note that from the first projected year, the net couple rate is assumed to drop from 66% of the net average wage to 65% as the 66% rate is not written into law.

6.4 Welfare

We are in the midst of changes to the welfare system. The old main benefits, unemployment benefit and sickness benefit become jobseeker support, domestic purposes benefit becomes sole parent support, while the invalid's benefit generally becomes supported living payment (with increased work expectations in some areas). The age breakdowns by males and females receiving the supported living payment and sole parent support are combined with the population projection to provide a projection of numbers of people on these benefits. The growth rate of numbers on the jobseeker support is derived from beneficiary proportions by age and sex and by the growth of the numbers of unemployed. This approach assumes that these proportions will continue into the future.

Finny (2012) surveyed New Zealand legislation and historical practice and it seems that the old main benefits have been indexed by CPI inflation from the early 1970s. This

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11 To be eligible for NZS, a person must be a New Zealand citizen or permanent resident, and have been a resident and present in New Zealand for not less than 10 years since the age of 20, of which five years or more must be since the age of 50.
means that relative to the average wage or payments of Superannuation, the amounts paid in these benefits will grow smaller. Finny also found that to address this in some other countries’ long-term projections the indexation assumption for welfare benefits is eventually boosted from inflation to something closer to wage indexation (examples are Canada, UK and some EU member countries).

We continue to assume that the main benefits will be indexed by CPI inflation. This means that these benefits will fall as a proportion of the average wage and that the aggregate spending on these benefits will fall relative to GDP. Through time, the sustainability of this setting is likely to come under increasing political pressure or people will rely more on supplementary benefits top-ups.

Historical growth of the supplementary benefits (such as accommodation assistance, disability allowance, family tax credit, income-related rents, and other minor benefits) appears to be somewhere between CPI inflation and nominal wage growth (for details, see Table 3 below).

The challenge for us is the sustainability of inflation indexing for the main benefits. Some people could remain on the supported living payment (invalid’s benefit) for a large proportion of their lives and this assumption will lead to a rise in their (relative) poverty.

Table 3 – Indexation and beneficiary assumptions for welfare benefits

<table>
<thead>
<tr>
<th>Benefit type</th>
<th>Driver of beneficiary numbers</th>
<th>Indexation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jobseeker support</td>
<td>Past proportions of unemployed by age, sex</td>
<td>CPI</td>
</tr>
<tr>
<td>Sole parent support</td>
<td>Past proportions by age, sex</td>
<td>CPI</td>
</tr>
<tr>
<td>Supported living payment</td>
<td>Past proportions by age, sex</td>
<td>CPI</td>
</tr>
<tr>
<td>Supplementary benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accommodation assistance</td>
<td>Working age population (15+)</td>
<td>Wage</td>
</tr>
<tr>
<td>Income-related rents</td>
<td>Working age population (15+)</td>
<td>Wage</td>
</tr>
<tr>
<td>Family tax credit</td>
<td>Pop 0-18</td>
<td>Wage</td>
</tr>
<tr>
<td>Non-family tax credit</td>
<td>Working age population (15+)</td>
<td>CPI</td>
</tr>
<tr>
<td>Working for families tax credit</td>
<td>Working age population (15+)</td>
<td>CPI</td>
</tr>
<tr>
<td>Disability assistance</td>
<td>Working age population (15+)</td>
<td>CPI</td>
</tr>
</tbody>
</table>

Source: The Treasury

6.5 Law and order

The cost weighting for the corrections part of this area of spending is concentrated on males in their 20s (with rapidly decreasing numbers at older ages): crime is a young man’s game. We assume that 50% of the spending in this area is on imprisonment, while 25% is on home and other detention. The bulk of the “clients” for this sector are in the least costly parts: we assume 15% is spent on those under non-custodial supervision and 10% on administering fines and other lesser penalties.

For the more untargeted parts of the sector, we assume that the population driver is everyone 15 and older. Overall, the other growth parameters follow the generic pattern described at the start of Section 5.
6.6 Other spending

The other non-finance spending – defence, transport and communications, economic and industrial services, primary services, heritage and culture, housing and community development, core government – are assumed to follow the growth patterns outlined above: public services productivity growth 0.3% a year, non-demographic volume growth 0.8% with demographic growth following that of the adult population (15 and older).

6.7 Fiscal assumptions: conclusions

Figure 16 below shows where our base case fiscal (and demographic and economic) assumptions lead us for expenditure. These are the “Resume historic cost growth” projections where no debt constraint is applied.

Under these assumptions, NZ Superannuation grows faster than nominal GDP, driven in the projection period by population ageing and nominal wage growth. On the other hand, spending on welfare transfers shrinks as a proportion of GDP, even with a higher average indexation growth than just CPI. The two added together roughly hold their share of GDP. Health grows faster than GDP, ending up at about 10.8% of GDP, a 4-percentage-point rise from where it is now. Education spending shrinks a little against GDP, as do all the other spending categories as a group.

So allowing the bottom-up drivers free rein results in primary (non-finance cost) spending rising from 29.1% of GDP in 2015/16 (the start of the projections) to 35.2% in 2060. With a constant ratio of revenue to GDP (29%) after the first few years of the projection, the resulting rising deficit leads to rising debt and higher financing costs, which feed back into higher spending and larger deficits.

Bell (2013) covers the detailed results of doing fiscal projections with these assumptions.

**Figure 15 – Resulting spending shares of GDP (% of GDP)**

Source: The Treasury LTFM (based on BEFU 2013)
7 Fiscal-framing assumptions

The fiscal responsibility provisions of the Public Finance Act (PFA) can also be viewed as an explicit contract, both state-to-state and state-to-citizens. It was a response to shocks (such as Britain going into the Common Market and the 1970s’ oil price shocks), unaffordable policies (such as Think Big, or supplementary minimum prices for sheep meat) and the inevitable consequence: huge external indebtedness and lower living standards. These fiscal provisions reflected a resolve never to be so exposed and vulnerable again. That was the reason the focus turned to debt as the fiscal anchor and successive governments concentrated on generating surpluses and paying off debt over the last quarter century.

Why would the next 25 years be any different? By simple extrapolations of existing policy, the Treasury’s past long-term projections implicitly assumed governments would enter a new reckless phase, without recognising the overarching policy constraint of first the Fiscal Responsibility Act and now the Public Finance Act. No modern government would be elected on a platform of running deficits and accumulating more and more debt outside a crisis.

The beauty of the PFA as an explicit contract is the openness and transparency it provides to citizens on the performance of governments against this contract. At the same time, it reflects a liberal democratic approach and provides governments with discretion within this constraint. It doesn’t prescribe (or proscribe) different philosophical approaches to policy – as long as they can be afforded and don’t create unsustainable obligations for the state in the future. All of this supports the use of net debt as our budget constraint in our long-term fiscal modelling (rather than “exploding debt” graphs).

7.1 Level of debt constraint

The definition of net debt varies from country to country and there can also be different cuts of the indicator depending on what it is intended to measure. This makes net debt a less useful indicator for inter-country comparisons. A simple balance sheet definition is gross borrowing (gross sovereign-issued debt or GSID) less all financial assets. This is useful as a fiscal sustainability indicator through time: all financial assets can in theory be used to buffer changes in debt.

Another definition in the New Zealand context is GSID less core Crown financial assets (excluding advances and financial assets held by the New Zealand Superannuation Fund). This measure of net debt is used by the Government as a fiscal indicator to track performance against its fiscal strategy. The basic reasons for these exclusions from the financial assets are that these assets are less liquid and/or they are made for public policy reasons rather than for the purposes associated with government financing.

Some people argue that the exclusion of financial assets in the New Zealand Superfund, designed as a tax-smoothing device to help with fiscal sustainability, from the definition of core Crown net debt doesn’t make much sense when this net debt indicator is used to evaluate fiscal sustainability.

The projections, however, do not ignore the potential to use NZSF assets to meet future costs including acting as a buffer against future shocks, because they incorporate receipts to and payments from NZSF, then effectively we are taking into account the current policy to use NZSF as a fiscal buffer.
For the Financial Statements of the Government (actual and forecast), we report several indicators of debt: gross (GSID), and the policy net debt indicator, core and total Crown measures, to provide a richer picture of the Government’s fiscal sustainability (English, 2009).

For the LTFS, we have decided to use the (fiscal strategy policy) measure for comparability with past use in the statements and with the current Government’s fiscal strategy.

We have set a net debt constraint of 20% of GDP as our working assumption for our sustainable debt scenario. Successive governments have managed debt down to this level in either gross or net terms for most of the past decade and a half. The current Government has set a target of returning the level of net debt to no higher than 20% of GDP by 2020.\(^{12}\)

**Figure 16 – Government debt ratios and debt objectives, 1986-2011**

Our continued use of 20% as the long-run sustainable level of debt has provoked spirited debates. One camp argues that given New Zealand’s susceptibility to economic and natural shocks through its history, a lower level of perhaps 15% or 10% would provide more of a buffer to ride through these shocks. Moreover, some argue that these levels should be seen as a ceiling, rather than an average so that the level could be a band of 10%-20% with a 15% average through the business cycle. In Section 7 covering sensitivity testing, we consider tighter and looser net debt constraints of 0%, 10% and 30% of GDP to illustrate what is needed to reach each of these rather than 20%.

Besides being where setting “prudent” debt levels as ratios of GDP has reached after two decades of following the Public Finance Act principles, the 20% level covers about half of the physical capital on the current balance sheet and so could be interpreted as sharing the cost of these assets between the current generation and future generations (a version of the golden rule where you borrow only to pay for long-lived assets).
7.2 Forecast-projection transition timing

In past statements, we have used the full five years of the forecast (plus some occasional extensions, for example, to close the output gap between actual and potential GDP) before starting the projections – amounting to more than one term of government. For the 2013 statement, we have considered three options as starting points for the projections:

- **Cold start from the end of history**

  This involves starting the projections from the last official macro and fiscal outturns and meshing the fiscal projections in as best we can. This tells us something about the sustainability of the current fiscal position and of the demographic, economic and fiscal growth assumptions. It has the advantage of not relying on the fiscal plans of any current or future government. With no forecast at the front, we would avoid the confusion that arises about the difference between forecasts and projections and would considerably simplify the modelling. Current policy and assumptions also become clearer to state (macro projection parameters become single, fixed numbers for all future years, for example).

- **Start from the end of the latest five-year forecast.**

  This is what we have done in the past. It has the advantage of having more time to close any output or fiscal gap. On the other hand, it depends on what could be a government’s optimistic fiscal forecasts at improving the fiscal position early on without any committed and detailed policy programme for actually doing this.

- **Start from around the end of the current parliamentary term**

  This represents a position between above two options. This is the end of the current government’s electoral mandate for its fiscal strategy.

We have decided on the third option and the projections will start at the end of the current term (or at least of the end of its final Budget year), making the year to 30 June 2016 the first year of projections of public services expenditure. Projections in the other areas of spending and revenue begin after the five forecast years.
8 Projection sensitivity to assumption change

This section deals with how a variation in an assumption might change the projections from where they are heading with the base-case assumptions outlined above. These alternative scenarios provide no indication of how likely these changes might be vis-à-vis the base-case assumptions (unlike the stochastic projections for population and the labour force that Statistics New Zealand introduced in 2012). They give, however, an idea of the size and direction of change reflecting the long-term fiscal modelling assumptions. Here we compare the effects of assumption changes on the base-case “Resume historic cost growth” scenario (apart from sensitivity testing of the target net debt assumption which uses the sustainable debt scenario).

8.1 Sensitivity to demographic assumptions

In addition to the various fans around the median population projection, Statistics NZ has produced a set of alternative (deterministic) scenarios. These usefully illustrate the directional effects of changes from the median assumptions.

**Higher fertility** A population with a higher fertility rate of 2.5 compared with 1.9 (both attained in the early 2030s) will produce a younger population and a larger labour force. This is unlikely to happen as it is above the 95th percentile until about 2045 (see Figure 6). Something like this might happen, for example, if Māori and Pasifika birth rates do not converge to European levels. The median age in 2061 is 37.7 years compared with the base population projection’s 44 years. In this scenario, higher fertility is not a good shorter-term solution (driven by rising education costs, and health costs), but is a longer-term solution (mid-century and beyond, when additional people born early in the fertility surge join the labour force). This leads to rising expenditure over the horizon to the mid-century resulting in lower primary balances and a rise in net debt of about 30 percentage points of GDP by 2060.

**Longer lives** Higher life expectancy at birth (in 2061, it is 95 years rather than the 89 years of the median scenario) produces higher expenditure, a larger primary deficit and 25% more net debt in the last decade. About half of the rise in total expenditure to GDP over the base-case ratio comes from increases in health and NZS spending.

**Fewer or more migrants** The base-case assumes 12,000 net migrants from 2015. If instead we assume a balance between in- and out-migration (zero net migration), then we have an older population that is 900,000 smaller in 2060, higher spending producing a larger primary deficit and a higher level of net debt. A future where net migration is lower into New Zealand is possible if ageing populations around the world produce fierce competition for migrants.

Finally, assuming twice as many migrants each year (who are younger on average than the resident population) helps the fiscal position over the next few decades, with many jumping straight into the labour force, but is not so good over the longer term, when the earlier migrants become recipients of government services as older members of society. Over a couple of decades, higher migration lowers the median age, lowers the ratio of expenditure to GDP, and boosts the primary deficit, reducing net debt a little. Bear in mind we have only occasionally seen more than 20,000 net migrants a year over the past half century (Figure 9).
Table 4 – Effects of demographic assumption changes on core Crown aggregates

<table>
<thead>
<tr>
<th>Alternative less base-case projection (pp of GDP)</th>
<th>2025</th>
<th>2035</th>
<th>2045</th>
<th>2060</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher fertility (rising to 2.5 by the early 2030s)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>0.5</td>
<td>1.5</td>
<td>2.1</td>
<td>2.0</td>
</tr>
<tr>
<td>Revenue</td>
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<td>0.0</td>
<td>-0.1</td>
<td>-0.2</td>
</tr>
<tr>
<td>Primary balance</td>
<td>-0.4</td>
<td>-1.0</td>
<td>-0.9</td>
<td>-0.4</td>
</tr>
<tr>
<td>Net debt</td>
<td>2.0</td>
<td>10.3</td>
<td>21.4</td>
<td>30.4</td>
</tr>
<tr>
<td>Higher life expectancy (MF 95 years in 2061)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>0.2</td>
<td>0.7</td>
<td>1.9</td>
<td>5.5</td>
</tr>
<tr>
<td>Revenue</td>
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<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Primary balance</td>
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<td>-0.5</td>
<td>-1.1</td>
<td>-2.6</td>
</tr>
<tr>
<td>Net debt</td>
<td>0.6</td>
<td>4.0</td>
<td>14.0</td>
<td>51.8</td>
</tr>
<tr>
<td>Zero net migration (from 2016)</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>0.1</td>
<td>0.6</td>
<td>2.0</td>
<td>5.3</td>
</tr>
<tr>
<td>Revenue</td>
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<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Primary balance</td>
<td>0.0</td>
<td>-0.4</td>
<td>-1.1</td>
<td>-1.8</td>
</tr>
<tr>
<td>Net debt</td>
<td>-0.2</td>
<td>2.7</td>
<td>14.4</td>
<td>58.2</td>
</tr>
<tr>
<td>Higher net migration (25,000 from 2016)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>0.0</td>
<td>-0.4</td>
<td>-1.0</td>
<td>-1.9</td>
</tr>
<tr>
<td>Revenue</td>
<td>0.0</td>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.2</td>
</tr>
<tr>
<td>Primary balance</td>
<td>0.0</td>
<td>0.3</td>
<td>0.5</td>
<td>0.4</td>
</tr>
<tr>
<td>Net debt</td>
<td>0.2</td>
<td>-2.0</td>
<td>-8.1</td>
<td>-24.0</td>
</tr>
</tbody>
</table>

Source: The Treasury, Long-term Fiscal Model (BEFU 2013). These are differences in percentage points (pp) of nominal GDP.

Figure 17 – Effects of demographic assumption changes on primary balance

8.2 Sensitivity to economic assumptions

Next, we look at changes in two key economic drivers in the model: economy-wide labour productivity growth, and labour participation rates.
**Changes in labour productivity growth** The long-run productivity growth rate affects the cost side of the production of public services through wage growth (we assume Baumol cost-disease, and pressures in some sectors from international labour markets). If economy-wide productivity growth is only 1%, rather than the base-case assumption of 1.5%, then with other things unchanged, GDP will be smaller, as will revenue. Expenditure as a share of GDP is higher, producing a higher primary deficit and a higher level of net debt as a share of GDP (higher by 54 percentage points of GDP in 2060). On the other hand, higher overall productivity growth of 2% a year produces a similar effect, but with roughly opposite signs.

**Table 5 – Effects of changes to productivity and participation (core Crown)**

<table>
<thead>
<tr>
<th>Alternative less base-case projection (pp of GDP)</th>
<th>2025</th>
<th>2035</th>
<th>2045</th>
<th>2060</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lower productivity growth (1% a year)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>0.3</td>
<td>1.0</td>
<td>1.9</td>
<td>4.5</td>
</tr>
<tr>
<td>Revenue</td>
<td>0.1</td>
<td>0.2</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Primary balance</td>
<td>-0.2</td>
<td>-0.5</td>
<td>-0.8</td>
<td>-1.2</td>
</tr>
<tr>
<td>Net debt</td>
<td>1.3</td>
<td>6.7</td>
<td>18.0</td>
<td>54.0</td>
</tr>
<tr>
<td><strong>Higher productivity growth (2% a year)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>-0.3</td>
<td>-0.9</td>
<td>-1.8</td>
<td>-3.9</td>
</tr>
<tr>
<td>Revenue</td>
<td>-0.1</td>
<td>-0.2</td>
<td>-0.2</td>
<td>-0.3</td>
</tr>
<tr>
<td>Primary balance</td>
<td>0.2</td>
<td>0.5</td>
<td>0.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Net debt</td>
<td>-1.3</td>
<td>-6.2</td>
<td>-15.9</td>
<td>-45.0</td>
</tr>
<tr>
<td><strong>Lower labour participation rates (2010 low case)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>1.4</td>
<td>2.2</td>
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<tr>
<td>Revenue</td>
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<td>0.0</td>
</tr>
<tr>
<td>Primary balance</td>
<td>-1.0</td>
<td>-1.1</td>
<td>-1.2</td>
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<tr>
<td>Net debt</td>
<td>6.8</td>
<td>19.8</td>
<td>37.0</td>
<td>72.6</td>
</tr>
<tr>
<td><strong>Higher labour participation rates (2010 high case)</strong></td>
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</tr>
<tr>
<td>Expenditure</td>
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</tr>
<tr>
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</tr>
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<td>Primary balance</td>
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<tr>
<td>Net debt</td>
<td>-6.0</td>
<td>-18.0</td>
<td>-33.6</td>
<td>-66.3</td>
</tr>
</tbody>
</table>

Source: The Treasury, Long-term Fiscal Model (BEFU 2013). These are differences in percentage points of nominal GDP.

**Changes in labour participation rates** We have used the 2010 high and low bracketing around the medium labour force projection in the 2010 projections to look at the effects of high and low participation around the 2012 median projection. The LTFM translates this census-based projection into an HLFS-based projection. Starting in 2017, the gap between the low scenario and the medium grows to about 4% by 2021 and holds there from then onwards. This means the high and low versions differ from the median projection by 84,000 people in 2020, growing to 130,000 people in 2060.

Lower participation potentially means more people require support and this shows up as higher expenditure. This has no effect on the ratio of tax to GDP as that is largely held as a constant ratio. The result is a larger deficit and significantly higher debt (about 73% larger than the base-case in 2060). The higher participation case is more or less a mirror image of this.
8.3 Sensitivity to fiscal assumptions

This section looks at the effects on fiscal aggregates of a reduction in the public health non-demographic volume growth parameter (the $p$ factor), changes in the productivity growth of public services, a lower level of the operating balance at the start of the projections, and the long-term target net debt level.

**Lower health non-demo volume growth factor** As mentioned in Section 6.1 on health modelling, we have revisited some of the growth parameters in that sector. In the 2009 statement, we assumed a non-demographic volume growth of 0.8% a year across all public services (non-transfer) spending. This time we have reconsidered this and have set the health parameter at 1.5% which is closer to the history of public health spending. Here we show the effect in maintaining the 2009 0.8% setting.

The lower-growth setting means health is cheaper to produce than in history and this reduces the ratio of health spending in 2060 by almost 3 percentage points. This feeds through to higher primary balances and nearly a halving of net debt to GDP (see Table 6). This is clearly a key assumption in setting out the historic cost scenario.

**Changes in public services productivity growth** The next pair of alternative scenarios shows the effects of lower (0%) and higher (0.6%) productivity growth of public services; 0.3% remains the base setting. Lower productivity growth means the costs of producing the desired quantity of services are greater, leading to a growing primary deficit and a larger wedge of net debt (as a ratio of GDP). The higher productivity case mirrors this on the other side.

**Effect of a lower starting operating balance** The next pair shows the sensitivity on long-term fiscal aggregates of the starting point of the projection. This is modelled by adjusting expenditure up by 1 percentage point of GDP in the starting year of the projection. If the 2015 operating balance were 1pp of GDP lower, then net debt in 2060 would be around 70pp of GDP higher than in the base-case, illustrating the compounding effects of interest on rising debt. The lower starting point has the opposite effect. The long-term projections are sensitive to the starting point.

**Higher and lower net debt target ratios** The final examples show the effect of managing net debt to different ratios of GDP in the long term. The base-case sustainable debt scenario has a long-term net debt target of 20% of GDP (that’s the current fiscal strategy setting). Tighter (looser) debt targets of 0%, 10% (or 30%) of GDP are modelled here as reductions (increases) in spending. These results are not symmetric around the 20% case: For a 30% target, only a small amount of fiscal consolidation is required to reach the target, while it takes a couple of decades of hard slog to reach the 10% (or the 0%) target.
### Table 6 – Effects of changes to fiscal settings (core Crown)

<table>
<thead>
<tr>
<th>Alternative less base-case projection</th>
<th>2025</th>
<th>2035</th>
<th>2045</th>
<th>2060</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lower non-demographic volume growth for health spending (0.8% pa)</strong></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>-0.7</td>
<td>-1.9</td>
<td>-3.7</td>
<td>-7.9</td>
</tr>
<tr>
<td>Revenue</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Primary balance</td>
<td>0.6</td>
<td>1.2</td>
<td>1.9</td>
<td>3.1</td>
</tr>
<tr>
<td>Net debt</td>
<td>-3.4</td>
<td>-13.6</td>
<td>-33.3</td>
<td>-87.9</td>
</tr>
<tr>
<td><strong>Lower public services productivity growth (0.0%)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>0.8</td>
<td>2.0</td>
<td>4.0</td>
<td>8.6</td>
</tr>
<tr>
<td>Revenue</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Primary balance</td>
<td>-0.6</td>
<td>-1.3</td>
<td>-2.0</td>
<td>-3.4</td>
</tr>
<tr>
<td>Net debt</td>
<td>3.7</td>
<td>14.6</td>
<td>35.8</td>
<td>95.2</td>
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<tr>
<td><strong>Higher public services productivity growth (0.6%)</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>-0.2</td>
<td>-0.9</td>
<td>-1.7</td>
<td>-3.4</td>
</tr>
<tr>
<td>Revenue</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Primary balance</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Net debt</td>
<td>-4.5</td>
<td>-16.4</td>
<td>-31.0</td>
<td>-59.9</td>
</tr>
<tr>
<td><strong>Lower starting operating balance (down 1pp of GDP in 2015)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>1.5</td>
<td>2.2</td>
<td>3.1</td>
<td>4.8</td>
</tr>
<tr>
<td>Revenue</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Primary balance</td>
<td>-0.9</td>
<td>-1.0</td>
<td>-1.0</td>
<td>-1.0</td>
</tr>
<tr>
<td>Net debt</td>
<td>11.1</td>
<td>23.4</td>
<td>38.6</td>
<td>69.0</td>
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<tr>
<td><strong>Lower long-term net debt target (10% of GDP) - sustainable debt scenario</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>-1.0</td>
<td>-0.4</td>
<td>-0.4</td>
<td>-0.4</td>
</tr>
<tr>
<td>Revenue</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Primary balance</td>
<td>1.0</td>
<td>-0.2</td>
<td>-0.2</td>
<td>-0.2</td>
</tr>
<tr>
<td>Net debt</td>
<td>-1.6</td>
<td>-10.0</td>
<td>10.0</td>
<td>-10.0</td>
</tr>
<tr>
<td><strong>Even lower long-term net debt target (0% of GDP) - sustainable debt scenario</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>-0.9</td>
<td>-1.2</td>
<td>-1.6</td>
<td>-0.7</td>
</tr>
<tr>
<td>Revenue</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Primary balance</td>
<td>1.1</td>
<td>0.8</td>
<td>0.7</td>
<td>-0.5</td>
</tr>
<tr>
<td>Net debt</td>
<td>2.2</td>
<td>-7.8</td>
<td>-17.8</td>
<td>-20.0</td>
</tr>
<tr>
<td><strong>Higher long-term net debt target (30% of GDP) - sustainable debt scenario</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expenditure</td>
<td>-0.1</td>
<td>0.4</td>
<td>0.4</td>
<td>0.4</td>
</tr>
<tr>
<td>Revenue</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Primary balance</td>
<td>0.7</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Net debt</td>
<td>10.6</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Source: The Treasury, Long-term Fiscal Model (BEFU 2013). These are differences in percentage points of nominal GDP.
8.4 Sensitivity to assumptions: Conclusions

These sensitivity tests also provide some guidance about where policy solutions to our long-term fiscal challenge might not lie (at least for the degree of changes and the horizon considered here). Higher fertility and more migrants produce relatively small changes in the fiscal aggregates (although they may have benefits or costs to the macro-economy not captured in this fiscal modelling). Similarly, if more of us worked, or worked longer hours, or we worked more productively, that would help, but wouldn’t solve the fiscal challenge.

Finally, the modelling shows that the lower the net debt target, the longer it takes to get there (no great surprise there, given we have assumed a constant rate of consolidation for each). These results just reflect what the balances have to be to achieve the long-term...
debt target. Under these assumptions, to reduce net debt to 0% of GDP requires an extended period of operating surpluses in excess of 2%. To put this in context, in the largely buoyant years of 1994-2008, various measures of operating surplus (largely at the total crown level) averaged about 2.5% of GDP.
9 Conclusion

The Public Finance Act requires the Treasury to be transparent about the assumptions behind its long-term fiscal projections. This paper summarises our demographic, economic, revenue, expenditure and framing assumptions for the 2013 long-term fiscal statement.

We use Statistics New Zealand’s demographic and labour force projections and these have been recast as stochastic projections around a deterministic median. The assumptions for these have changed – chiefly in lower mortality (longer lives) and higher labour participation than in the previous releases.

We have revisited our economic and fiscal modelling and the assumptions behind the longer-term projections. We now acknowledge more explicitly the policy decision-making over the past 20 years have generally been taken to constrain debt and that looking ahead some kind of constraint should also apply even in the “Resume historic cost growth” scenario. We also acknowledge that the current path for fiscal strategy of getting net debt to around 20% of GDP by 2020, if achieved, is a help in setting up the path for the following decade.

Key to our fiscal projections is how we treat the historic cost projection of health spending. Most major spending areas outside health and NZ Superannuation grow by less than GDP. So the main drivers of the long-term fiscal projections come down to Super, health and taxes. The others admittedly play a role in the sustainability of the fiscal position, but most of the action is with the big three. We have allowed for healthy ageing, resulting in lower public health costs for older people in future.

The final set of assumptions has to do with the role of debt constraint, where to shift to projections. We have stayed with the definition of net debt used by the government for its fiscal strategy as our primary sustainability indicator to allow for comparability with current fiscal strategy and with our previous long-term fiscal statements.
Annex 1

*Participation rates: 5-year age groups, HLFS (to 2012), NLFP (August 2012)*

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Source: Statistics New Zealand

Notes:
1) Red triangles: males; Purple squares: females (HLFS)
2) Blue line: males; Green lines: females (National Labour Force Projections, Based on the 2006 Census, August 2012)
3) For PR6500 and the 65 and older five-year age groups, the HLFS triangles and squares refer to the open-ended, 65 and older group.
References


