MODELLING NEW ZEALAND'S LONG-TERM FISCAL POSITION

Matthew Bell, Gary Blick, Oscar Parkyn*, Paul Rodway and Polly Vowles

New Zealand Treasury
** oscar.parkyn@treasury.govt.nz; 04 917 6026*

Abstract

As recent events in Europe make ever clearer, fiscal sustainability matters. This paper explains the modelling behind the Treasury's Long-Term Fiscal Statement, *published in October 2009. We construct two main fiscal scenarios for New Zealand over a 40-year horizon. The historic trends scenario allows historic and current spending and revenue settings to interact with changing demography. A sustainable debt scenario explores the implications of a top-down fiscal constraint on public debt. Alternative policy scenarios are modelled, looking at the implications for both the fiscal position and what people receive from the state.*

JEL Codes: E62; H68; J11

Keywords: Fiscal policy, population, projections, New Zealand

Note: This paper is also available as New Zealand Treasury Working Paper 10/01. The October 2009 *Challenges and Choices: Statement on the Long-Term Fiscal Position* is available at www.treasury.govt.nz/government/longterm/fiscalposition/2009.

Table of Contents

1 **Introduction** **1**

1.1 Outline of this paper 1

2 **Broad approach** **2**

2.1 The Long-term Fiscal Model 2
2.2 Uncertainty 2
2.3 Limitations 2
2.4 Forecasts and projections 3
2.5 Two main scenarios 3
2.6 Reconciling results: 2006 to 2009 8

3 **Demography** **15**

3.1 How population is projected 17
3.2 Setting of assumptions 19
3.3 How much could demography ease fiscal pressures? 24

4 **Economy** **25**

4.1 The three Ps 25
4.2 Population and labour force participation 25
4.3 Economy-wide productivity 28
4.4 Comparing economic assumptions: 2006 and 2009 29

5 **Revenue** **31**

5.1 Which tax types are projected? 31
5.2 Projecting source deductions tax 32
5.3 Projecting corporate tax and other taxes 34
5.4 Modelling alternative tax regimes 35
5.5 The rebalancing scenario 36

6 **Expenditure on public services** **37**

6.1 Modelling approach 37
6.2 Modelling framework for public services expenditure 37
6.3 What the public receives from the government 45
6.4 Spending areas as a proportion of GDP 47

7 **Health care** **49**

7.1 Drivers of health spending 49
7.2 Modelling assumptions 52
7.3 Results 54
7.4 Sustainable debt scenario 58

8 **New Zealand Superannuation** **61**

8.1 Projecting NZS spending 62
8.2 Effect of NZS changes on costs and tradeoffs 64

9 **Working-age benefits** **68**

9.1 Definitions and projection method 68
9.2 Modelling of welfare spending 69
9.3 Alternative scenarios 71

10 **Indicators of fiscal sustainability** **73**

10.1 Debt, net debt and net worth 73

10.2 Primary balance 73
10.3 The inter-temporal fiscal gap 74

11 Conclusion 76

11.1 Modelling refinements 76
11.2 Policy conclusions 77

Annex 1: Changes in demographic projections 79

Annex 2: Deriving model equations 82

References 83

List of Tables

Table 3.1 – Changes in population age structure 16
Table 3.2 — Assumptions for the 2008-base projections 23
Table 3.3 — Projection results 23
Table 3.4 — Effect of demographic projections on the fiscal position (% of GDP) 23
Table 4.1 – The three Ps of GDP 25
Table 6.1 – Modelling frameworks for public services expenditure: 2006 and 2009 38
Table 6.2 – Parameters for public services expenditure 38
Table 6.3 – Demographic modelling by sector 42
Table 8.1 – Effects of potential NZS changes from 2017 in 2050 66
Table 9.1 – Fiscal gap 75
Table A1.1 – Assumptions and outputs – Series 5 79

List of Figures

Figure 2.1 — Net debt 5
Figure 2.2 — What individuals receive from the government – historic trends 6
Figure 2.3 — What individuals receive from the government – sustainable debt 7
Figure 2.4 – Net debt, 2006 and 2009 projections 8
Figure 2.5 – Net debt, 2006 projections and the first four changes 9
Figure 2.6 – Net debt, 2006 projections and the final sets of changes 12
Figure 2.7 – Stepwise changes to 2050 net debt, 2006 to 2009 projections 14
Figure 3.1 – Proportions of population in each 5-year age group 15
Figure 3.2 – The changing shape of New Zealand's population (% of the total) 16
Figure 3.3 – Old age dependency ratios will almost certainly double 19
Figure 3.4 – Total fertility rates 20
Figure 3.5 – Period life expectancy at birth 21
Figure 3.6 — Net migration 22
Figure 3.7 – Effect on net debt of 30,000 migrants, and fertility of 2.5 from 2014 24
Figure 4.1 – Aggregate labour force participation rate (% of those 15-64) 27
Figure 4.2 – Unemployment rate (% of labour force) 28
Figure 4.3 – Economy-wide labour productivity growth (% growth) 29
Figure 4.4 – Key economic variables in 2006 and 2009 projections 29
Figure 5.1 — Source deductions tax revenue 33
Figure 6.1 – Labour cost growth in public and private sectors (%) 40
Figure 6.2 – Non-demographically-driven smoothed volume growth 1972-2008 44
Figure 6.3 – Public services expenditure 45
Figure 6.4 – Volume of public services per capita 46
Figure 6.5 – Public services expenditure per capita (inflation adjusted) 47
Figure 6.6 – Spending shares – sustainable debt and historic trends 48
Figure 7.1 – Health spending and GDP per person – inflation-adjusted 49
Figure 7.2 – Health cost weights, by age group 50
Figure 7.3 – Modelling health spending growth – 2006 versus 2009 54

Figure 7.4 – Health, 1950-2050 – actual and projected (Historic trends) 55
Figure 7.5 – Health spending under various productivity assumptions 57
Figure 7.6 – Health spending under the sustainable debt scenario 59
Figure 7.7 – Annual nominal growth in health spending – sustainable debt 60
Figure 9.1 – Primary balance (% of GDP) 74
Figure A1.1 – Changes in old age dependency ratio for medium projections 80
Figure A1.2 – 2009-base year projection has lower NZS than 2008-base 80
Figure A1.3 – 2009-base year projection has lower net debt than the 2008-base 81

Modelling New Zealand's Long-term Fiscal Position

1 Introduction

The Treasury is required to publish, at least every four years, a Statement on the government's fiscal position looking out at least 40 years. The first *Statement* was published on 22 June 2006, the second on 29 October 2009. This paper is an accompanying document to the 2009 *Statement*, and seeks to outline the modelling approaches used and the assumptions chosen. This paper also describes the changes – in approach, assumptions and results – between the 2006 and 2009 *Statements*.

The *2009 Challenges and Choices – New Zealand's Long-Term Fiscal Statement,* (referred to as the *2009 Statement*) was designed to be a more accessible document than the *2006 Statement*. While the key assumptions were outlined in an appendix in the *2009 Statement*, there was a deliberate choice to avoid including equations and detailed discussions of the judgements around the assumptions. This paper provides these details for those interested in the more technical aspects of long-term fiscal modelling.

1.1 Outline of this paper

Section 2 of this paper summarises our broad approach to modelling the long-term fiscal position, how we deal with uncertainty, and the limitations of the model. It also highlights the changes in approach from the *2006 Statement,* and explains how these affect the projections. Section 3 outlines the demographic assumptions, and provides sensitivity analysis around some key assumptions. Section 4 discusses the assumptions made to project economic growth. Section 5 covers the modelling of government revenue.

Section 6 outlines the general framework for modelling areas of government spending on public service, while Section 7 focuses on the modelling of health care services in more detail. Sections 8 and 9 discuss the modelling of government transfers – New Zealand Superannuation (NZS) and working-age benefits.

Section 10 discusses indicators of fiscal sustainability. Section 11 concludes this paper by highlighting some conclusions and some areas for further work for future *Statements*.

2 Broad approach

2.1 The Long-term Fiscal Model

The basic structure and philosophy of the Long-term Fiscal Model (LTFM) used in our projections have not changed since the *2006 Statement*, although some of the modelling details and assumptions have been refined. The LTFM involves a three-stage approach to projecting the long-term fiscal position:

- first, we use Statistics New Zealand's National Population Projections to project the future structure and size of the population
- these projections of the population, and labour force participation, are then combined with an assumption about economy-wide labour productivity growth to generate projections of gross domestic product (GDP) out to 2050, and
- finally, we add in projections of the government sector, with the primary focus of our analysis being on revenue, spending and the resulting debt track.

Projecting economic and fiscal variables over a 40-year period requires some significant assumptions to be made. There are many variables that can, and will, affect the economy and the future fiscal situation in ways that are impossible to predict. The projections in the *2009 Statement* and this paper are not likely to eventuate. They are projections of outcomes conditional on a set of simplified assumptions. These assumptions are chosen to represent different interpretations of current policy, generally using growth rates based on historic trends, to highlight any long-term lack of sustainability.

2.2 Uncertainty

To capture the considerable uncertainty present in such long-term projections, we have conducted sensitivity analysis around most of our key assumptions in this paper. This analysis uses plausible high and low scenarios to demonstrate a range of outcomes, and their impact on the fiscal position. In the *2009 Statement*, only one set of high and low scenarios was presented. This set of scenarios showed the effect of the aggregation of several favourable (to the fiscal position) assumptions on the one hand, and an aggregation of several unfavourable assumptions on the other. The assumptions related to economy-wide productivity growth, aggregate labour force participation and net migration. This paper disaggregates the effects of each of the individual assumptions in the relevant demographic and economic sections.

2.3 Limitations

The LTFM is a relatively simple model, which has the benefit of being transparent and relatively straightforward to understand. A key limitation of the model is that there is no capital in the GDP production function. Also, it contains no automatic feedbacks from spending and revenue to economic variables. There are many potential feedbacks between the variables used in this model, for example, between tax and labour force participation, between education spending and productivity, and between the parameters around NZS and savings. These feedbacks, and many others, are discussed qualitatively in both the *2009 Statement* and this paper. However, there has generally been no attempt to quantify these in the model. This is because the magnitude of many of these feedbacks has not been determined with any certainty for the New Zealand context.

We have made one exception to the absence of feedbacks. Recently, there has been an increasing amount of empirical evidence published on the effect of taxes on economic growth. For this reason, in the alternative scenarios that involve an increase in tax, we have modelled a consequent negative impact on economic activity. This is discussed in more detail in Section 5.

2.4 Forecasts and projections

In this paper, and the *2009 Statement,* the term forecasts refers to the first five years of the projections, the fiscal years of 2009 to 2013 (ending 30 June). These forecasts of economic and fiscal variables were based on the best data available at the time of *Budget 2009*. The forecasts attempted to factor in the impacts of any policies or events that were planned to occur over the next five years.

Projections refer to extensions of the forecast base into the long term, from 2014 to 2050. These projections apply assumptions to grow forward variables from the forecast base. Generally, assumptions are based on historic averages and current policy settings. As stated above, projections should not be thought of as the best current view of likely future outcomes, rather they represent potential outcomes, which are entirely dependent on the assumptions behind them.

2.5 Two main scenarios

The projection of fiscal variables can generally be grouped into “bottom-up” and “top-down” approaches. Bottom-up approaches model the growth of individual spending areas and the current revenue system, based on a set of drivers – such as demographic growth, inflation, and wage growth. These assumptions create a growth path of the spending or revenue area. In aggregate, these paths show the combined effect on the overall fiscal position – usually illustrated with a projection of government debt. Top-down projections start with a set of objectives for key fiscal indicators such as debt-to-GDP, tax-to-GDP or spending-to-GDP. These projections then determine, for example, the spending and revenue that would be required to meet a certain objective, given likely demographic and economic changes. The *2009 Statement* and this paper use both approaches.

2.5.1 Historic trends and sustainable debt

Our bottom-up scenario is called the *historic trends* scenario, as the growth rates of the drivers of spending are largely based on recent historic growth rates. Our top-down scenario is called the *sustainable debt* scenario, as the key constraint is a debt track based on the Government’s long-term objectives, as laid out in the *Fiscal Strategy Report* in *Budget 2009*. While both bottom-up and top-down approaches were used in the *2006 Statement*, the scenarios presented in the *2009 Statement* are new. These scenarios are discussed in more detail below and in the later Sections 5-9.

The two main scenarios contain the same assumptions for revenue, and for transfer spending, such as New Zealand Superannuation (NZS) and benefits.

Both scenarios assume that government revenue initially follows the track outlined in the *Budget 2009* medium-term projections (covering 15 years, from 2009 to 2023). This track contains the assumptions of the Government's medium-term fiscal strategy. These assumptions lead to the tax-to-GDP ratio rising in the medium term, primarily due to fiscal drag on taxes on wages and salaries.[1] After this initial 15-year period, we assume a gradual fall in the tax-to-GDP ratio to a level similar to that in the 2010 year.

Spending is comprised of two main parts – transfers (such as NZS and benefits) and all other publicly-funded services. Spending on NZS and benefits is determined by the number of recipients and how these payments are linked to wages or inflation. Any increases simply flow through to the baseline spending, lifting government debt if no other changes are made. Sections 8 and 9 provide more detail about how spending on NZS and benefits is modelled.

The modelling of spending on publicly-funded services, such as health care and education, differs between the two main scenarios. In these spending areas, future expenditure levels are determined through the government's annual budget decisions, usually by granting them a certain proportion of the allowance set aside for new spending (ie a certain amount of spending above the level of the previous year). In these areas, it is more difficult to judge what a continuation of current policy would look like. For this reason, spending on these public services is projected in two ways, each of which can be thought of as a different interpretation of current policy. The historic trends scenario models the individual bottom-up drivers of this expenditure, based on recent history. The sustainable debt scenario imposes a top-down debt constraint, based on the Government's long-term fiscal objectives, and revealing the adjustments to expenditure on public services that would be required to meet this constraint (assuming that spending on NZS and benefits grows in accordance with current policy settings).

In the historic trends scenario, the projection methodology for public services expenditure has changed somewhat since the *2006 Statement*. Expenditure is still driven by modelling plausible cost drivers based on inflation, wage growth and demography. However, the *2009 Statement* introduces explicit parameters for public sector productivity and non-demographic volume growth. Non-demographic volume growth is an estimation of the real increases in services people tend to receive over time (which are not demographically-driven), based on historical trends in spending growth. Section 6 provides more detail about these changes.

Combining these expenditure assumptions with the revenue assumptions outlined above leads to a projection of net debt-to-GDP that reaches just under 225% of GDP by 2050. Net debt is the residual in the historic trends scenario.

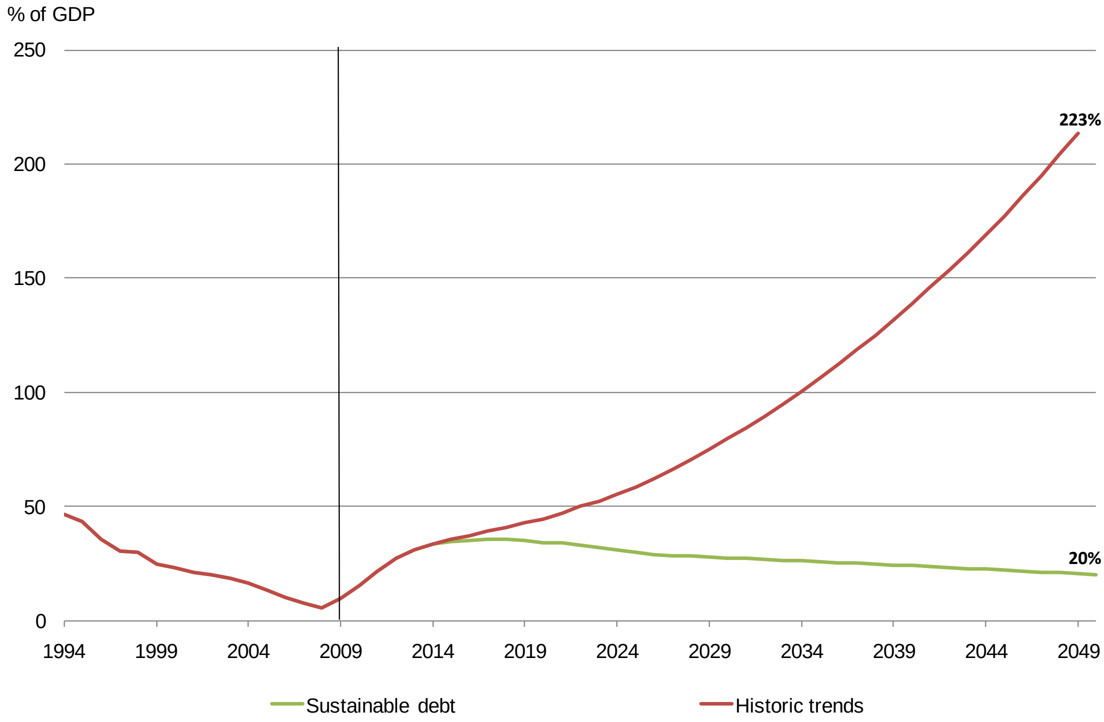
The sustainable debt track is not constant throughout the projection period. From 2009 to 2023, the debt track follows the medium-term projections from *Budget 2009*. It contains the $1.1 billion operating allowance assumption made by the Government for *Budget 2009*, for this 15-year period. Debt rises initially, due to the recession. By 2023. the build up of net debt has been managed back to just over 30% of GDP. After 2023, the debt

[1] Fiscal drag refers to the phenomenon that tax grows faster than the income it is levied on because, as a person's income grows, an increasing proportion of it is taxed at a higher rate. Fiscal drag occurs if the rates and thresholds of a personal income tax system are not adjusted over time.

track is projected to be consistent with the Government's long-term objective of a net debt-to-GDP ratio of 20%, and so gradually adjusts to reach this level in 2050.

The sustainable debt scenario uses an expenditure constraint that ensures that debt remains at sustainable levels. Most of the drivers of expenditure on public services, inflation, wages, demography and public sector productivity, are the same as under the historic trends scenario. The only difference between the two approaches is that, in the sustainable debt scenario, the non-demographic demand growth variable becomes the residual. This factor is made to adjust to ensure that the overall expenditure constraint is met. In the medium-term, from 2009 to 2023, this expenditure constraint is a $1.1 billion new spending allowance (otherwise known as the operating allowance), which grows annually with inflation. After 2023, the operating allowance is adjusted to be consistent with the Government's long-term net debt objective (a net debt-to-GDP ratio of 20%). This works out to be an operating allowance of just over $2 billion in 2024, growing in line with GDP thereafter.

Figure 2.1 — Net debt[2]



Source: The Treasury

2.5.2 Public sector productivity and the basket of services

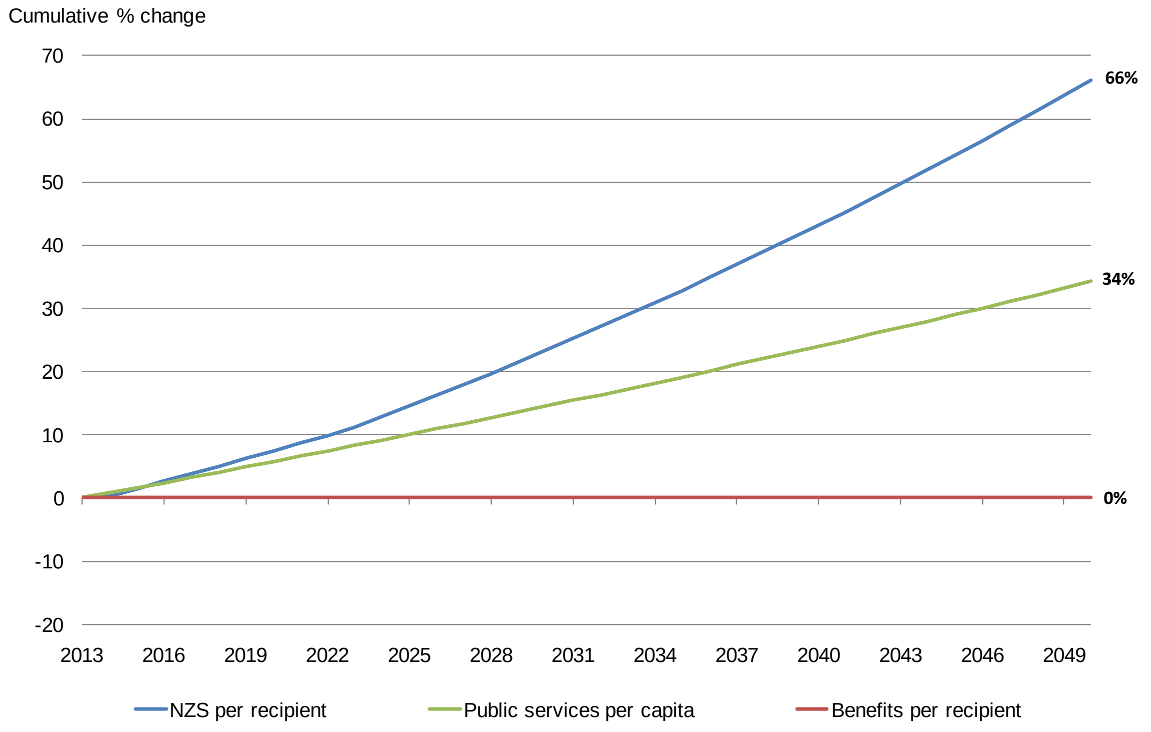
The estimate for public sector productivity growth is based on available empirical evidence. It is important to note that we have assumed that public sector productivity growth is substantially lower than economy-wide productivity growth. The implications of this assumption are discussed in more detail in Section 6. A key reason for introducing

2 Net debt refers to core Crown net, which is a broader measure than gross debt because it nets off some financial assets, which could be used to offset debt. See Section 10 for more detail.

public sector productivity was that it allows us to decompose expenditure into price and quantity components, and to equate a level of spending with a level of service provision.

This ability to decompose the quantity of services led us to create a measure we call the basket of publicly-funded goods and services. This represents the quantity of real (inflation-adjusted) public services per person, and includes a wide range of goods and services such as health, justice, education, defence and core administration. Figure 2.2 compares the long-term cumulative growth of this basket of public services with the real payments per recipient for NZS and other benefits. Section 6.3 outlines the calculation of this basket in more detail.

Figure 2.2 — What individuals receive from the government – historic trends



Source: The Treasury

NZS payments are projected to broadly increase in line with the average wage, which we assume grows by 1.5% above inflation, so the real purchasing power of a superannuitant's payment grows by a cumulative 66% from 2013 to 2050.[3]

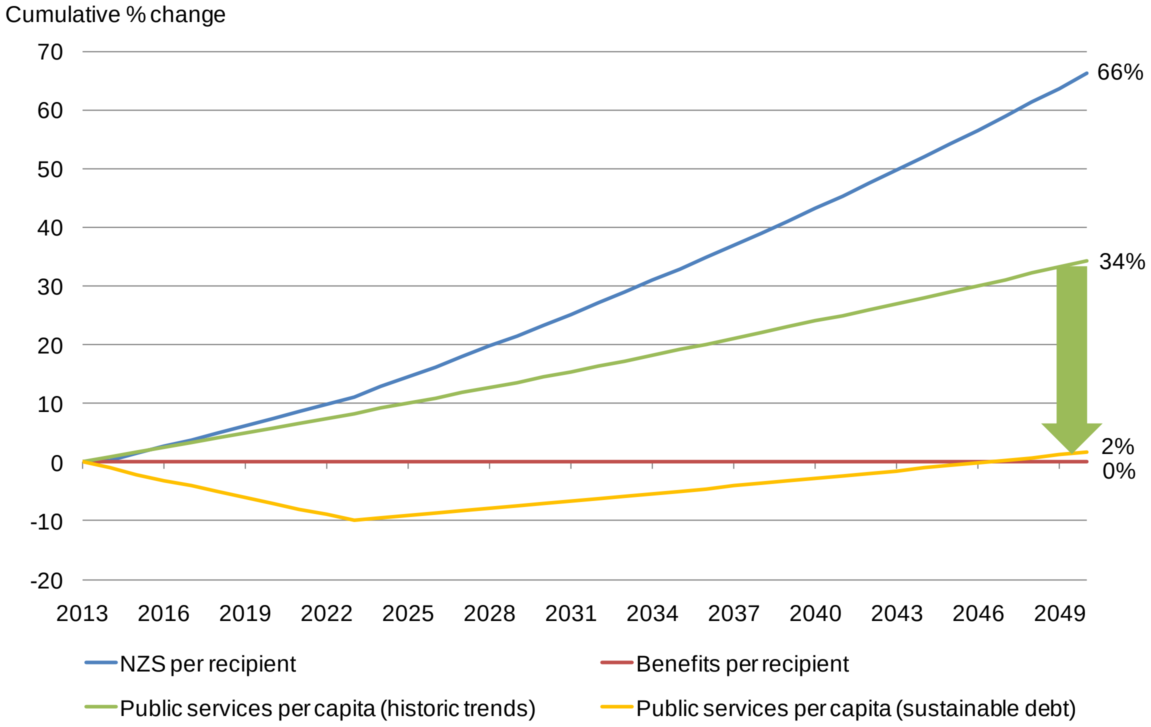
Benefit payments are generally indexed to the CPI, and so do not grow in real terms. This allows beneficiaries to buy the same bundle of goods and services through time – whereas wage earners (or NZS recipients can afford an increasing bundle through time.

Public services per capita grow cumulatively by 34% (0.8% a year) under the historic trends scenario. Total spending on public services is larger than spending on NZS, but is shared among more people, including superannuitants, than superannuation spending.

[3] This figure reflects the fact that NZS payments do not necessarily grow by 1.5% above inflation in every year. They grow by inflation only until they hit the 'wage floor' of 66% of the average after-tax weekly wage. Section 8 (p.65) explains this policy setting in more detail. Furthermore, fiscal drag changes the relationship between the gross wage and the net wage and lowers annual real NZS payment growth below 1.5% over the first decade of the projection.

Under the sustainable debt scenario, public services bear all of the adjustment required to reach a sustainable level of net debt. Figure 2.3 shows the effect on the basket of this adjustment. NZS and benefits are unaffected, because they sit outside the annual budget allocation process, so are modelled the same way as under the historic trends scenario. As a result of the constraint, real public services per capita are lower than in the historic trends scenario. These public services fall by around 10% by 2023, in real terms, compared to 2013 levels. Once the constrained period to 2023 has passed, public services per capita begin to increase, but reach only 2% above 2013 levels by 2050.

Figure 2.3 — What individuals receive from the government – sustainable debt



Source: The Treasury

Figure 2.3 shows that the $1.1 billion operating allowance in the medium term is not enough to cover increased public service costs and increased demand from the larger and older population. The quantity of publicly-provided services to the average New Zealander would initially have to decline if no other changes were made. The *2009 Statement* goes on to discuss how this constrained path of spending on public services could be achieved, and how other policy choices could affect the basket in the long term.

The next part of this paper shows how these modelling changes, along with changes in the underlying data, affected the projections between the *2006* and *2009 Statements*.

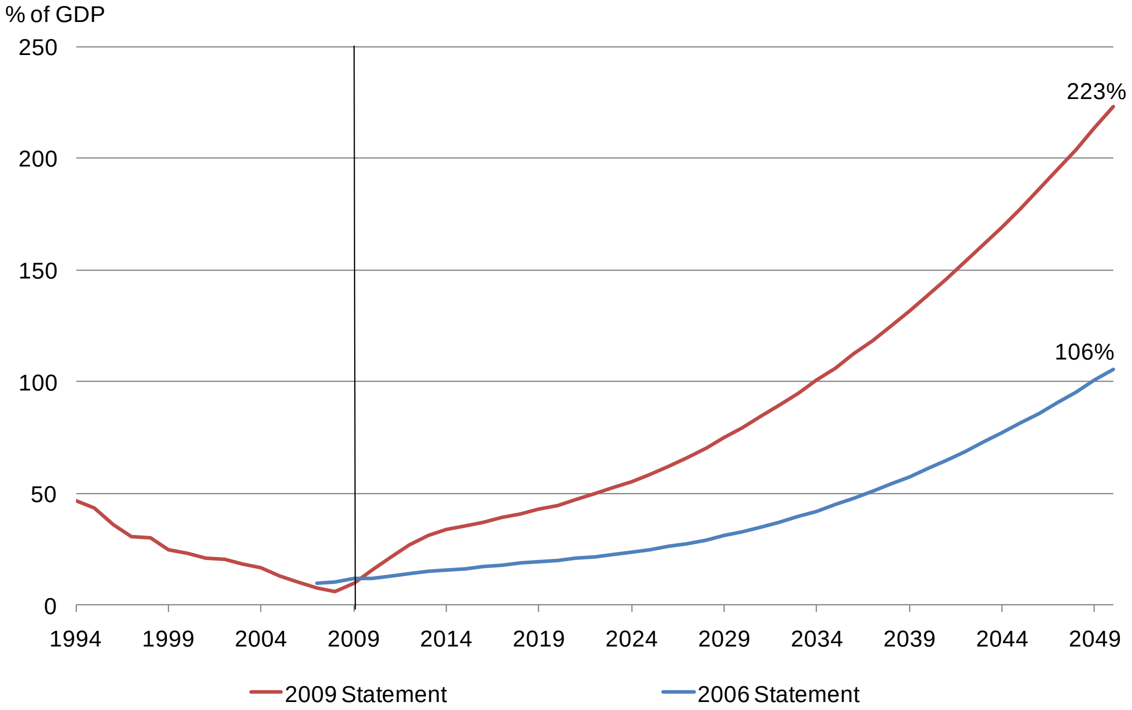
2.6 Reconciling results: 2006 to 2009

Much has changed in the economic and fiscal environment since the *2006 Statement* was published, and there have been improvements to the modelling approach. This section decomposes the differences between the 2006 and 2009 projections into some of these major causes of change, using the historic trends projection of core Crown net debt as the fiscal indicator. Specific changes addressed, in incremental fashion, are:

- the change to International Financial Reporting Standards (IFRS) data in 2007 and the simplification of the model that accompanied that change
- modelling changes, other than those related to tax
- tax revenue modelling changes
- updated demographic projections
- new economic base, and
- new fiscal base.

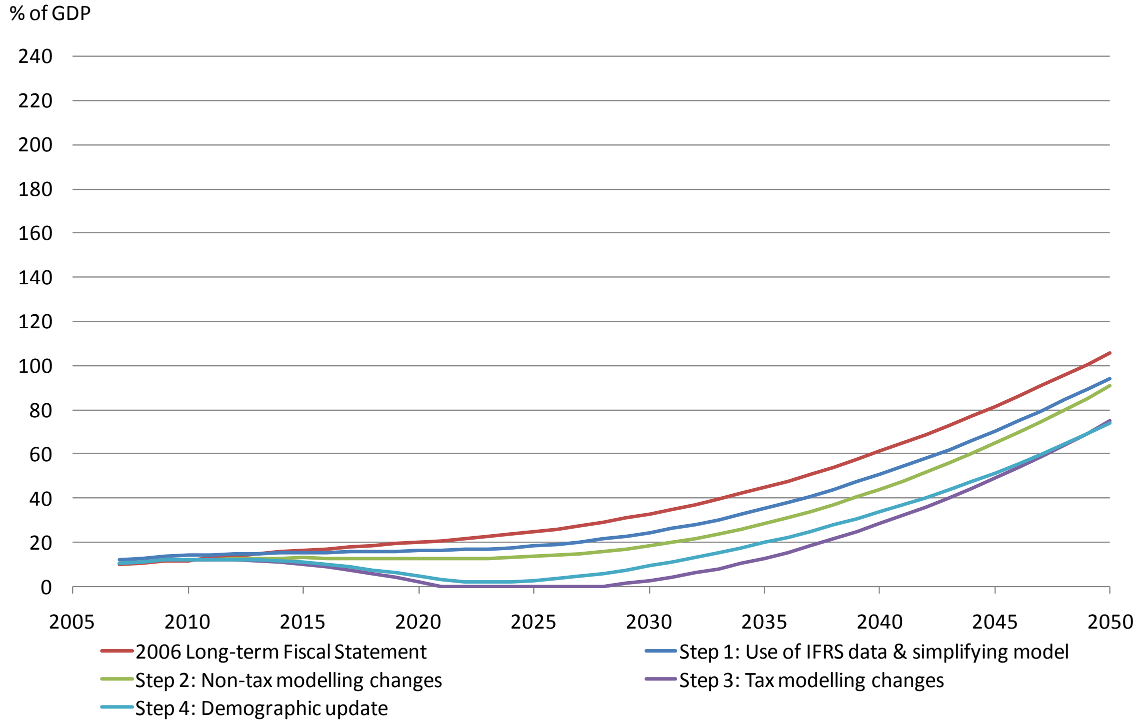
Bridging from the 2006 model to the 2009 version involves applying the changes in a stepwise manner. The impact of each change, shown in Figures 2.5 and 2.6, depends on the order in which the changes are imposed. However, the total difference, as depicted in Figure 2.4, remains the same no matter how the various impacts are calculated.

Figure 2.4 – Net debt, 2006 and 2009 projections



Source: The Treasury

Figure 2.5 – Net debt, 2006 projections and the first four changes



Source: The Treasury

2.6.1 The change to IFRS data and simplification of the LTFM

In 2007, the New Zealand Government changed its set of accounting standards for fiscal reporting. The new standards are New Zealand equivalents of the IFRS. Both the old and new standards conform to Generally Accepted Accounting Principles (GAAP), and, when they were introduced in 2007, they were often differentiated by the terms old GAAP and new GAAP. The *2006 Statement* used modelling from an old GAAP-based model.

The switch to IFRS data affected most fiscal variables used in the model, meaning it had to be rebuilt. The decision was made to take the opportunity, as part of this rebuilding project, to simplify the model. Over the years, the model had been developed and had components added, and so a complete reconstruction gave the opportunity to remove any modelling whose size and complexity did not justify the value it added to the modelling. Most of the simplifications involved non-core Crown material associated with Crown Entities and State-Owned Enterprises.

The change to IFRS data had no impact on the economic data used in the model. Furthermore, simplifying the model did not alter the manner in which any economic variables were projected.

To quantify the impact of these changes, the data used in the original model were converted to IFRS equivalents and run through the new simplified model. The change in the core Crown net debt indicator, from the original 2006 model's projection, produced by these changes is shown in Figure 2.5 as Step 1: Use of IFRS data & simplifying model. This shows that these changes did not substantially change the projections of net debt.

2.6.2 Modelling changes, other than those related to tax

These modelling changes reflect changes in the way key variables were projected relative to how they were modelled in the *2006 Statement*. Because tax revenue is such a vital component of the fiscal projections, changes to tax projections are treated separately.

The most significant-non-tax changes to the modelling were in the way non-social welfare expenditure types, such as health and education, were projected. The details of these changes are covered in Sections 6 and 7. Less significant changes, in terms of their impact on key fiscal indicators such as net debt, occurred in the modelling of some asset classes.

The change in the core Crown net debt indicator produced by these modelling changes, from the projection that resulted from the switch to IFRS data and simplification of the model, is shown in Figure 2.5, as the line labelled Step 2: Non-tax modelling changes.

2.6.3 Tax revenue modelling changes

The *2009 Statement* modelled tax revenue in a number of different ways to the *2006 Statement*. The biggest change occurred in source deductions (largely PAYE tax on wages and salaries), where fiscal drag was modelled for a period. The approach used in the tax projections in the *2009 Statement* is covered in more detail in Section 5. However, two significant points to mention here are:

- the *2006 Statement* simply assumed that all tax types remained at their end-of-forecast ratios to nominal GDP throughout the projection period, and
- a fiscal drag elasticity is applied to source deductions in the *2009 Statement's* modelling for the first decade of projections, after which source deductions are returned to a long-run ratio to GDP and stay at that ratio for the remaining years. This implies that tax thresholds and/or rates are then adjusted regularly to prevent the impact of fiscal drag.

The importance of tax revenue, and in particular how it is projected, is illustrated by the line labelled Step 3: Tax modelling changes in Figure 2.5. Applying the *2009 Statement* tax projection approach to the *2006 Statement* data actually reduces net debt to zero around 2020. It remains there for nearly a decade before lifting again.

However, across the period 2006 to 2050, the average core Crown tax revenue to nominal GDP ratio is actually slightly lower in the 2009 approach (31.1%) than it is in the original 2006 modelling (31.5%).

As with many other factors in the long-term projections, timing matters more than totals. With fiscal drag lifting the overall tax-to-GDP ratio in the early years of projections, more revenue is received in this period than under the 2006 approach. This, in turn, reduces debt in this earlier period and so keeps debt financing costs down. Post-2023, when fiscal drag is removed and the overall tax-to-GDP is reduced below that assumed in the 2006 modelling, debt starts to rise again. However, it rises from a lower base than at the same time in the original 2006 modelling, and so has to cover a smaller expenditure total because debt financing costs are significantly less.

2.6.4 Updated demographic projections

Despite the importance of Statistics New Zealand's demographic projections to the modelling in the *Statements*, updating them made little difference to the projections. The line labelled Step 4: Demographic update in Figure 2.5 applies the demographic projections used in the *2009 Statement* to the other changes introduced so far (IFRS data, simplified model, modelling changes including those to tax).

The *2006 Statement* used Statistics New Zealand's official National Population Projections published in December 2004. These were an update based on Census 2001 data. For the majority of the modelling the Series 5 projections were used, which assume medium fertility, medium mortality and medium net migration (10,000 each year is the long-term annual value used).

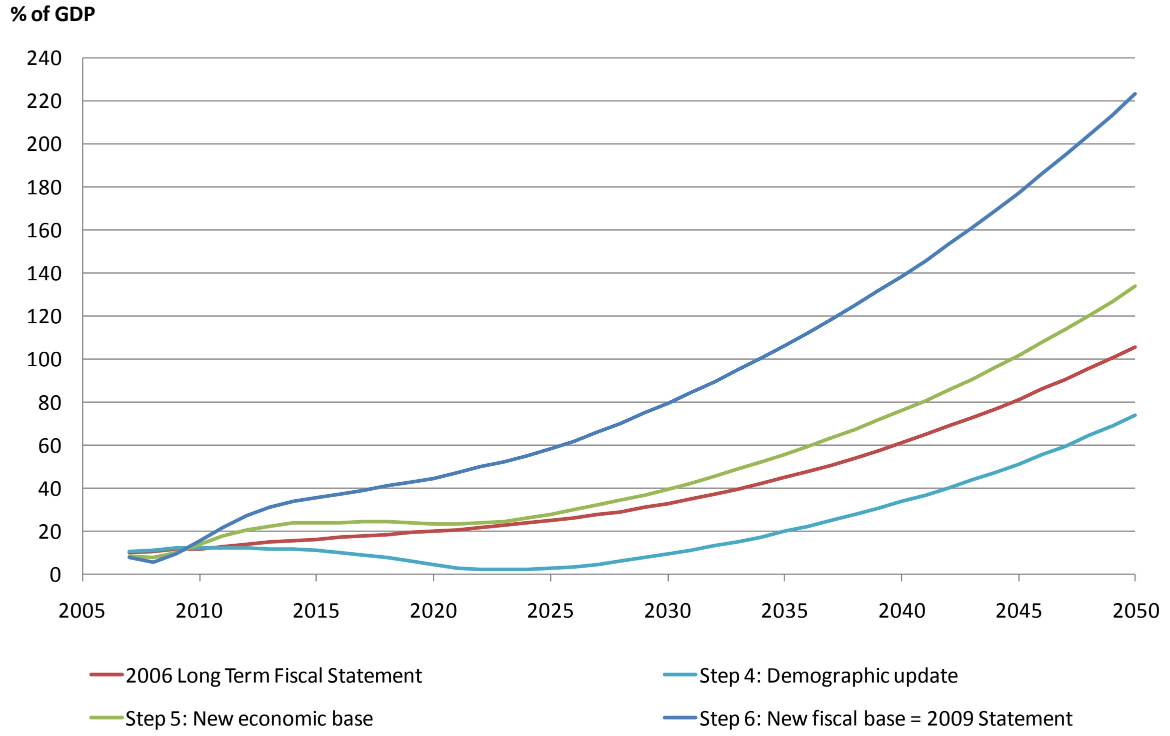
The *2009 Statement* used 2008-base demographic projections provided to the Treasury by Statistics New Zealand. These were based on 2006 Census data, updated to reflect changes observed in births, deaths and migration at 30 June 2008. These were not official projections, but an interim set produced by Statistics New Zealand before official projections were available on 27 October 2009 (too late to be used in the *2009 Statement* modelling). For the majority of the *2009 Statement* modelling, including the projections depicted in Figure 2.5, Series 5 assumptions were used.

The updated demographic projections did not make a great deal of difference to the net debt track because the changes to the demographic variables tended to be greatest in the early years. It is in these initial projected years that net migration figures are most volatile and, to a lesser extent, temporary lifts or falls in birth rates have an impact. While these are important, they are generally not long-lasting and consequently their impact on the net debt projection is not as great as if they were permanent shifts. Rather, as the demographic projections progress out into future years, more standard long-term assumptions around net migration, fertility and mortality dominate, and these generally do not change too much from update to update.

2.6.5 New economic base

All of the modelling changes introduced so far have led to a lower net debt projection than that of the *2006 Statement*. Of these changes, the tax revenue projection has made the biggest impact on the path of net debt. In terms of the 2050 level reached, the sum total of the four steps examined have reduced net debt, as a ratio of nominal GDP, from 106% in the original *2006 Statement* to 74%. While this shift of around 30% seems significant, it needs to be viewed in the context of how quickly debt rises once finance costs start to impact. To illustrate, only seven years earlier (2043) in the *2006 Statement* the net debt to GDP ratio was 73%.

Figure 2.6 – Net debt, 2006 projections and the final sets of changes



Source: The Treasury

The next change, incorporating the *2009 Statement* economic base, does have a significant effect on the net debt track. This impact is shown in Figure 2.6 as the line labelled Step 5: New economic base. It results from applying the 2009 economic base to the set of changes introduced up to the fourth step of applying updated demographic projections.

It is worth noting a caveat at this point, which is that it is not possible to separate completely the impacts of an updated economic base from those of an updated fiscal base. For example, if unemployment (an economic variable) had not risen owing to the recession, unemployment benefit expenditure (a fiscal variable) would not be so high. Even more significantly, if GDP growth were stronger (an economic variable), this would flow through to higher tax revenues (a fiscal variable).

In modelling an updated economic base, elasticities and assumptions are applied to flow the impacts of the economic changes through to fiscal variables. However, these are not going to match exactly the actual impacts that occurred. Furthermore, with a gap of three years between the *Statements*, updated fiscal data will incorporate changes that are due to more than just changed economic conditions. With a new policy, such as KiwiSaver, which was not in place at the time of the *2006 Statement*, it is relatively simple to ascribe its impacts totally to updated fiscal data. However, with something like expenditure on the Domestic Purposes Benefit, some of the change will be due to policy decisions taken in the intervening years, some to average rates paid not turning out exactly as forecast in 2006, some due to demographic changes such as rises in fertility, some due to the impacts of the general economy (CPI indexation of rates, higher unemployment, etc), and likely some further causes not mentioned here.

The main point is that, if this analysis were to be done in a different order, the proportions of change attributed to the economic update and the fiscal update respectively would likely be different (but the total would not change). We have chosen to put the economic update impact first, mainly because we do have elasticities and assumptions that we can apply to flow these changes through to fiscal data. Moving in the opposite direction is even harder to assess in terms of causation.

The economic base used for the *2009 Statement* was that from *Budget 2009*. This was a forecast done as the impacts of the recession unfolded on the New Zealand economy. At that time, owing to the projected persistent effects of the recession, several key economic variables were forecast not to have returned to their long-term or equilibrium levels or rates of growth by 2013. The following variables were adjusted in the first few years of the projections, to return to their long-term levels or rates of growth: age-and-gender group labour force participation rates; Consumers Price Index (CPI) inflation; unemployment rate; and average hours worked. All variables return to their trend rates or levels by 2016.

Despite this, the impact of a far weaker economy over the next few years than was forecast for the same period in the *2006 Statement* has a marked effect on the net debt projection. For example, the *2006 Statement* assumed nominal GDP would grow by 34% between 2007 and 2013 (from $160 billion to $214 billion). Despite starting from a higher 2007 base of $169 billion in the *2009 Statement*, growth to the 2013 level of $203 billion is only 20%.

2.6.6 New fiscal base

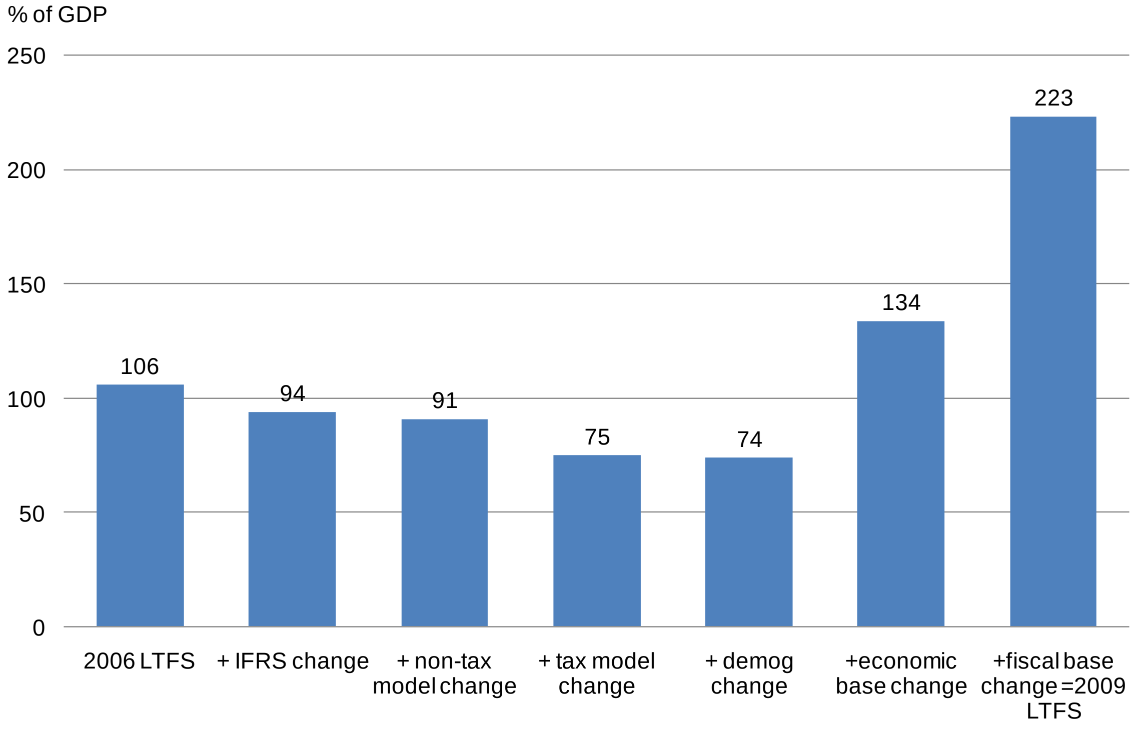
The final step is to introduce the fiscal base from *Budget 2009*, which takes the projection to that of the *2009 Statement*. This is depicted in Figure 2.6 as the line labelled Step 6: New fiscal base = *2009 Statement*. As has been discussed, had the economic and fiscal base update steps been reversed, then the attribution of their individual impacts would likely be somewhat different. Despite this, it is clear that the impact of the recession on the fiscal base is quite marked.

The other big contributor to the fiscal impact has been new policies and programs introduced since the *2006 Statement*. The most significant of these, in terms of the impact on net debt projections, are the personal tax cuts that have occurred. Another notable addition to expenditure is KiwiSaver subsidies.

The combined changes result, for net debt as a percentage of nominal GDP by the final projected year of 2050, in an increase from 106% in the *2006 Statement* to 223% in the *2009 Statement*. The transitional steps for this particular year are depicted below in Figure 2.7.

This illustrates that the big changes come from the updated economic and fiscal bases, rather than the modelling and demographic changes. Changing the way tax revenue is projected, for example, reduces net debt by 16 percentage points of GDP in 2050, while updating the economic base boosts net debt by 60 percentage points of GDP and the new fiscal base lifts net debt by a further 89 points.

Figure 2.7 – Stepwise changes to 2050 net debt, 2006 to 2009 projections



Source: The Treasury

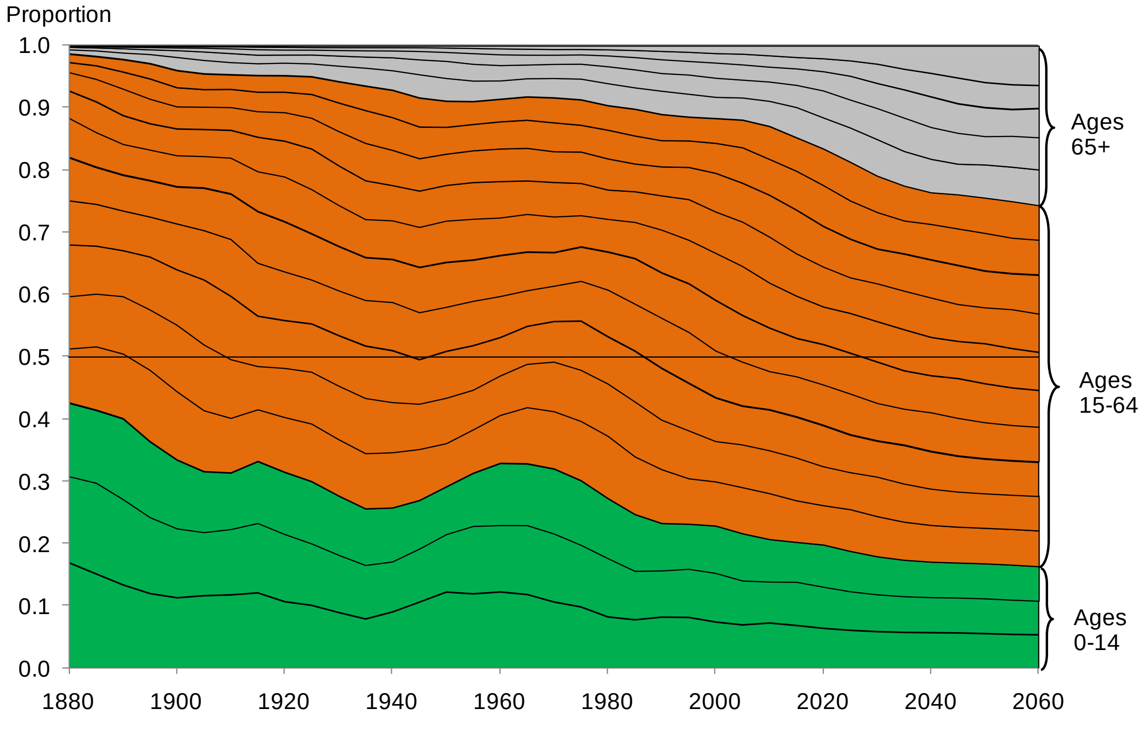
3 Demography

Population ageing refers to a fall in the proportion of children in the population and a rise in the proportion of older people. It reflects the transition from relatively high fertility and mortality rates to relatively low fertility and mortality rates. These changes lead to a rise in the median age of the population – the age which splits the population into equal numbers of people younger and older.

Population ageing is likely to accelerate after 2011 as the large numbers of people born during the two decades after the Second World War turn 65 (which is a standard defining point for the older population). In 1950, the median age was 30 years. In 2009, the median age had climbed to 37 years. Statistics New Zealand medium population projection (2008-base) has a median age of 44 years in 2060.

In Figure 3.1, the bulge of the post-World War II baby boom can be seen moving up through the age groups. The role of the baby boom in reducing the median age (the age at the 0.5 proportion in the figure) can be clearly seen from 1945 (or a few years earlier) to 1965 (or a few years later). The generally rising median ages are shown in Table 3.1

Figure 3.1 – Proportions of population in each 5-year age group



Source: Statistics New Zealand

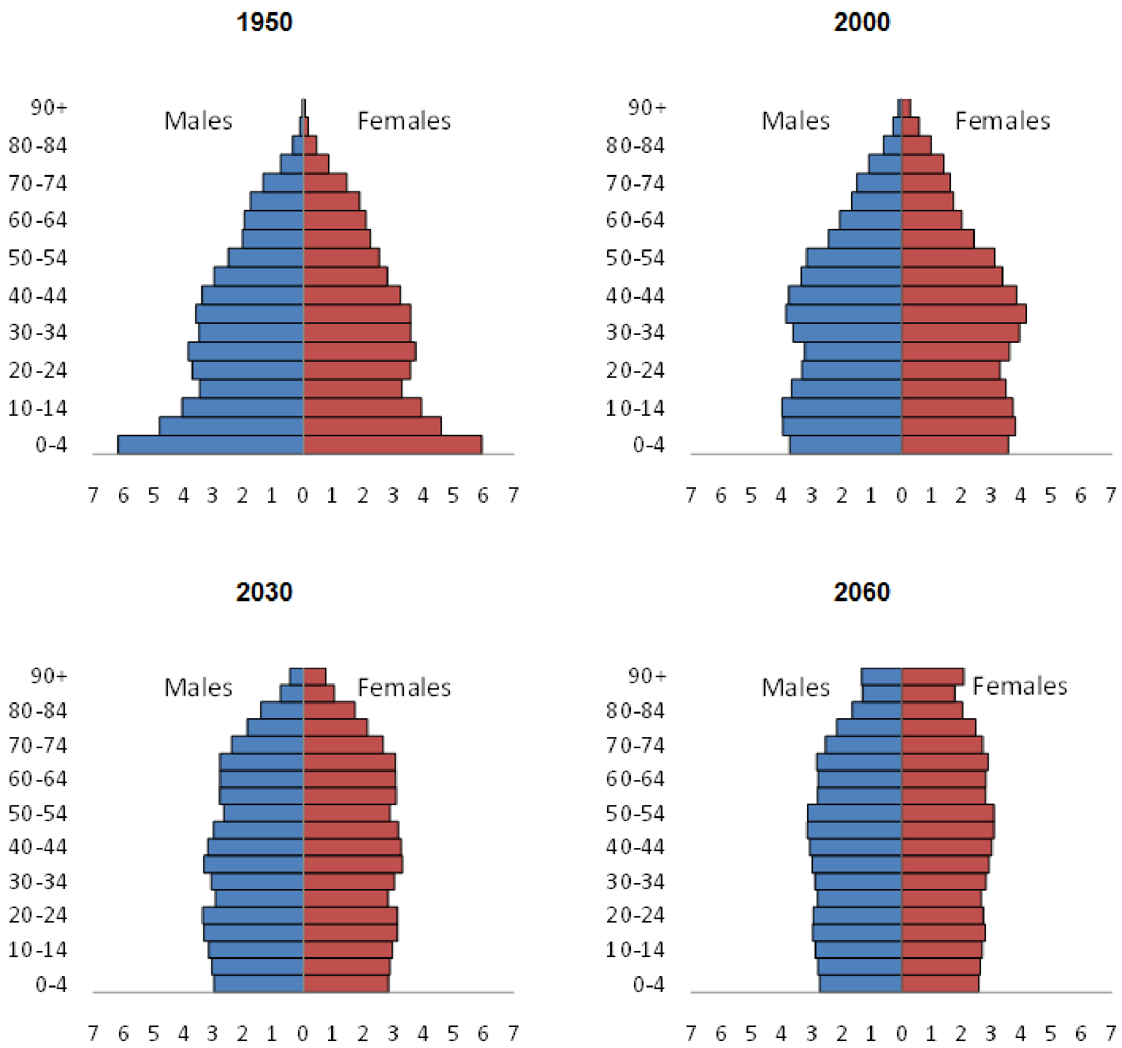
Table 3.1 – Changes in population age structure

Age group	1900	1920	1940	1960	2005	2025	2045	2060
	Percentage distribution							
Under 15	33	30	27	33	21	19	17	16
15-64	63	65	64	59	67	63	59	58
65 and older	4	5	9	8	12	19	24	26
Ratio of under 15 to 65+	8:1	6:1	3:1	4:1	1.7:1	1.0:1	0.7:1	0.6:1
Median age (years)	23	26	30	26	36	42	43	44

Source: Statistics New Zealand, Series 5 projection

Another way to depict population ageing is by using population pyramids (Figure 3.2). Here, the bottom-heavy pyramids show the effect of the post-war baby boom in 1950, giving way to more balance in 2000. The older age groups fill out as we move further into the 21st century.

Figure 3.2 – The changing shape of New Zealand's population (% of the total)



Source: Statistics New Zealand, Series 5 projection

The reason the population is ageing is that families have become smaller and people are living longer. The trend of falling fertility was reversed for two decades or so from the end of World War II. During this baby boom, the total fertility rate peaked at 4.3 births per woman in 1961. This baby boom tended to make the population younger than it would otherwise have been in the latter half of the 20th century. It will also accelerate ageing over the coming two decades of the 21st century. After that, the population is likely to revert to trend ageing. In other words, the baby boomers are not the cause of population ageing (it will continue after they are gone), but they will speed it up over the next two decades. The first of the post-war baby boomers start turning 65 in 2011 and these numbers grow until 2030.

This shift towards relatively more old people and relatively fewer young people has implications for economic growth, for government revenue and spending and the public debt position, for internal migration, housing, family structures and the care of the elderly.

The *2009 Statement* deals with the implications of ageing on tax, spending and net debt. These fiscal indicators depend crucially on Statistics New Zealand's population projections. This part of the paper deals with how these are calculated, how the assumptions are set, and how sensitive the projections are to assumption changes.

The population projections used in the *2009 Statement*, as in the *2006 Statement*, are in aggregate form and do not break out various ethnic groups. Ethnic projections do exist (albeit over a shorter horizon), but were not used in the *2009 Statement*. The latest period life tables have a Māori/non-Māori difference of life expectancy at birth of 8.6 years for males and 7.9 years for females.[4] Māori life expectancy has been lower than European life expectancy since our statistics agency has been collecting the numbers. Māori have been catching up in terms of longevity and the gap between death rates over most of the life span is no longer widening. Poverty, unemployment, and lifestyle choices all play a part in maintaining the gap. A steadily growing economy and low unemployment will help to close this gap.[5]

3.1 How population is projected

Population projections are calculated using the cohort component method.[6] This requires estimates in a base year of the number of people, male and female, at each age from birth to 100+. This also contains the history of past fertility, mortality and net migration. The projection method also requires the single-year fertility rate for women of child-bearing age (12 to 49) for each of the projection years, projected central mortality rates (or the associated survival rates), for each year of age, for males and females, for each of the projected years. Inward and outward migration also affects the size and composition of the population. So another input is the number of people entering, less those leaving the country, for each year of age, for males and females, for each year of the projection. Finally, the calculation requires an assumption about the ratio of males to females at birth (set at 105.5 males for every 100 females).

[4] www.stats.govt.nz/publications/populationstatistics/new-zealand-life-Tables-2005-07.aspx.

[5] Morgan and Simmons, Chapter 3 and pp. 110-113.

[6] For more on the cohort component method, see www.stats.govt.nz, or Preston *et al*, Chapter 6.

The cohort component method projects the base population forward by calculating the effect of deaths and migration within each age-sex group according to specified mortality and migration assumptions. New birth cohorts are generated by applying specified fertility assumptions to the female population of child-bearing age.

Work on the *2009 Statement* began by using the official Statistics New Zealand 2006-base national population projections (released October 2007). Since 2006, fertility has been higher than the medium fertility assumption and this has an effect on the demand for schooling and eventually on the size of the labour force. So the Treasury commissioned Statistics New Zealand to review its assumptions and produce a set of projections based on estimated population at 30 June 2008. These were made available in March 2009.

On 27 October 2009, Statistics New Zealand published its 2009-based projections. This was too late to incorporate into the *2009 Statement*, but Annex 1 of this paper shows how the 2009-based population projections affect the fiscal projections.

3.1.1 Uncertainty in population projections

The *2009 Statement* uses the Statistics New Zealand's Series 5 population projection (2008-base) as its central case. This uses the long-term medium fertility, medium mortality and medium net migration assumptions. Uncertainty is illustrated by constructing "alternative central" projections around the central one, using symmetric settings around the central assumptions. An objection to this approach is that there is no quantification of the likelihood that any of these projections, central or alternative, will happen.

One way of addressing this is to construct stochastic population projections centred on a deterministic medium projection. Some experiments along these lines were done for the *2006 Statement*.[7] There it was shown that, conditional on the Series 5 (mid-range) projection, the old age dependency ratio of people aged 65 years and older to those between 15 and 64 from 2040 onwards would be more than double the value in 2006, 95 times out of 100.

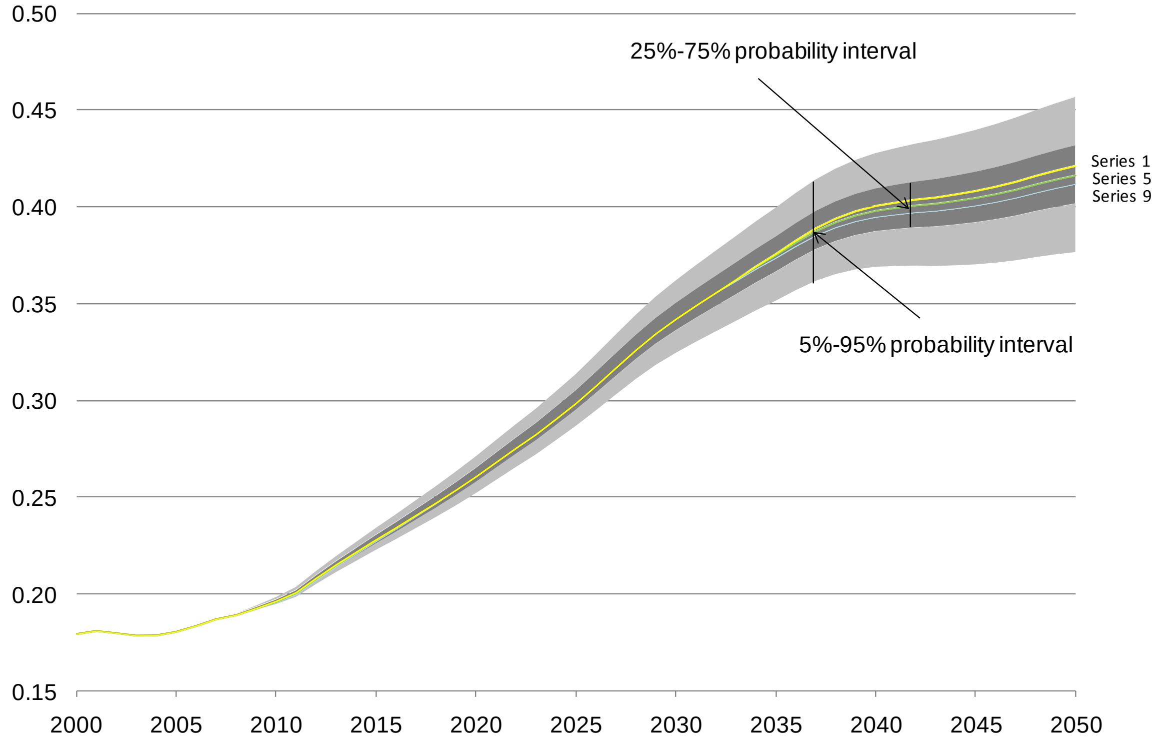
Figure 3.3 uses the distributions from the *2006 Statement* to illustrate the uncertainty around the old age dependency ratio for central 2008-base Series 5 projection. The figure also has the two alternative central projections (Series 1 and Series 9) and shows that they lie well within the 25% to 75% probability interval. (By many other measures, these alternatives are more divergent from Series 5 than the old age dependency ratio indicates.)

For the *2009 Statement*, we decided not to pursue the stochastic approach, preferring to look more closely into the supply and demand variables driving spending growth and be more concrete about what various policy options might mean for the average New Zealander. We use the alternative central projections to give an unquantified bracketing around the central scenario.

---

[7] *New Zealand's Long-term Fiscal Position, 2006*, p45.

Figure 3.3 – Old age dependency ratios will almost certainly double



Source: Statistics New Zealand, the Treasury

3.2 Setting of assumptions

This subsection runs through how the assumptions behind the population projections used here were set by Statistics New Zealand.

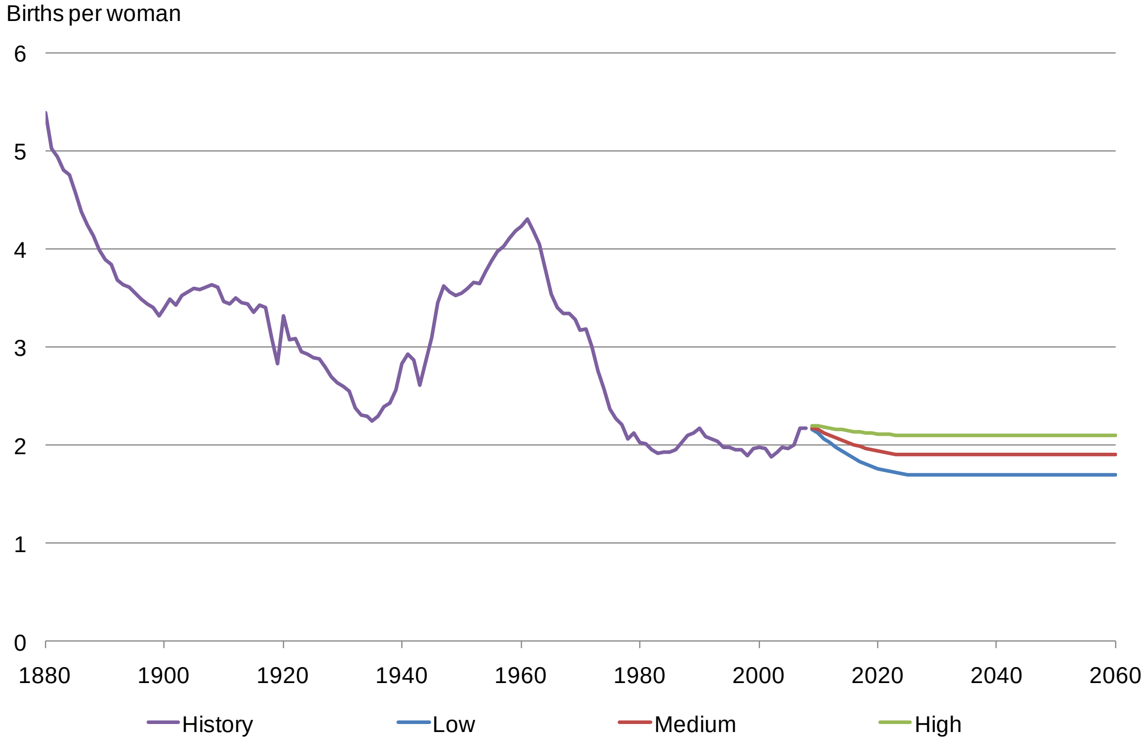
3.2.1 Fertility assumptions

Long-run fertility assumptions are set by considering short-run and long-run trends in age-specific and the aggregate total fertility rates (TFR), both cohort and period, in New Zealand and other countries.

Over the period to 2026, fertility rates are gradually reduced from the recent high values above 2.1 to their long-term levels. The TFR is the sum of all the single-year fertility rates. This is the average number of children a woman would have during her lifetime if she continued to experience the age-specific fertility rates of that year. Note that unlike many economic assumptions, the key demographic assumptions of fertility and mortality are not necessarily the averages of past settings. We are dealing here with structural changes from past patterns.

Once the aggregate fertility tracks are decided on, the breakdown into single year-of-age fertility rates is based on recent patterns. The long-term medium assumption is 1.9 children per woman. The low and high brackets around this are 1.7 and 2.1 births per woman in the long run.

Figure 3.4 – Total fertility rates



Source: Statistics New Zealand (1921-2060), 1920 and earlier years are Treasury estimates.

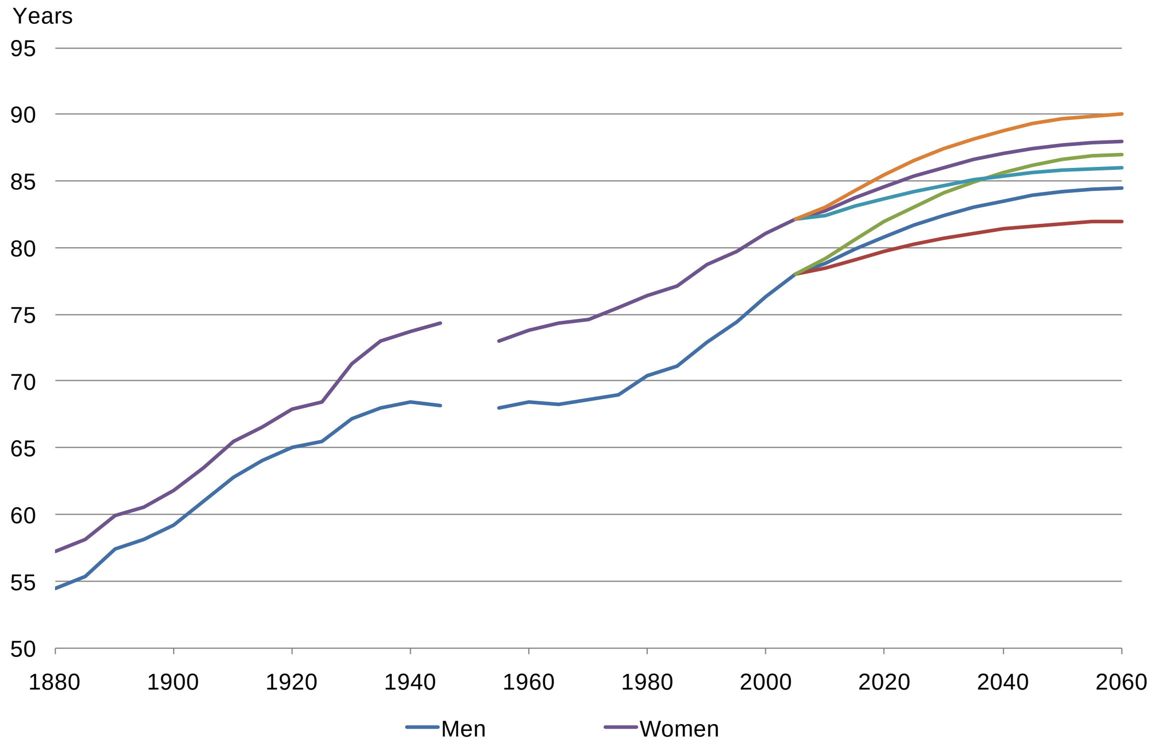
3.2.2 Mortality assumptions

For the 2008-base population projections, Statistics New Zealand sets its mortality assumptions by looking at the aggregate measures of *period* life expectancy at birth and at 65. In history, these are derived for each period for both sexes from single-years-of-age average death rates via life-table calculations. Life expectancy assumptions are set out to the end of the projection horizon (2061) by looking at historical trends and comparisons with other countries having similar populations. They are then broken out into death rate projections and survivorship projections for each single year of age, and sex for each year to 2061.

Period life expectancy is based on mortality rates in a particular period. This is the life expectancy if mortality rates did not change from that period onwards. Cohort life expectancy, in contrast, is based on mortality rates experienced by a birth cohort (people born in the same year) over their lifetime. Cohort life expectancy therefore gives the most authoritative measure of how long people have actually lived. If mortality rates are falling from year to year, cohort life expectancy will be higher than period life expectancy.

For example, the New Zealand period life expectancy in 2005-07 of males aged 65 is 18 years. By comparison, and partly based on medium projections of remaining mortality, the cohort life expectancy of (non-Māori) males born in the early 1940s and reaching age 65 in 2005-07 is 20 years, while the projected cohort life expectancy of males born in 2005-07 and reaching age 65 in the early 2070s is 23 years.

Figure 3.5 – Period life expectancy at birth



Source: Statistics New Zealand. Note: The data break occurs in 1950-52. Before that, Non-Māori data; afterwards, total population. The fans at the end of each line depict the high, medium and low assumptions.

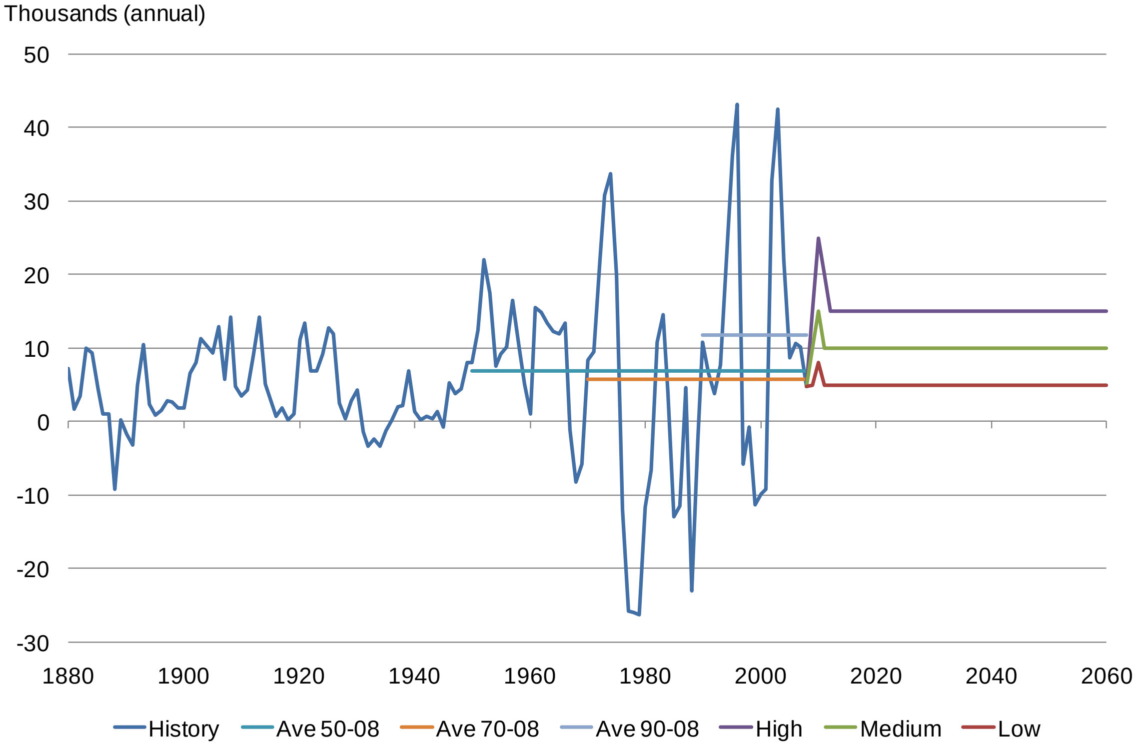
As noted above, life expectancy at birth has risen over the past 100 and more years. At first, the change came from lower mortality in early childhood. In recent decades, the greatest gains in life expectancy have come from reduced death rates among late working and retirement ages (50-79 years). Figure 3.5 shows the gains in life expectancy at birth from 1880 onwards and includes Statistics New Zealand's assumptions to 2060. The medium period life expectancy for females reaches 88 years and for males 84.5 in that year, while the high and low brackets around these mediums is ±2.5 years for males in 2060 and ±2.0 years for females. The rate of growth of longevity is assumed to tail off through time.

3.2.3 Net migration assumptions

Migration in and out of the country has varied widely through time. As a settler society, New Zealand has had periods of large inflows: from Europe after the Second World War, from the Pacific in the 1970s and later. More recently, New Zealand has had large inflows from Asia and South Africa. The outflows incorporate the desire for young Kiwis to have an overseas experience during their 20s.

New Zealand has a higher percentage of its skilled workforce living overseas than any other country in the OECD – nearly one in four highly skilled Kiwis is offshore (Dumont and Lemaître, 2005). This means that we have one of the highest proportions of skilled labour no longer working here. Clearly migration has been an important factor on the shape of our population (and labour force) and is likely to continue to be so in the future.

Figure 3.6 — Net migration



Source: Statistics New Zealand

Statistics New Zealand has set its assumptions of future net migration based on averages over the recent past. The long-term medium assumption is 10,000 people a year. The medium assumption is bracketed by 5,000 for the low case and 15,000 for the high. This is one example where future trend assumptions are based on historical averages. The past has been affected by policy changes and picking where these might go over 40 years is difficult. The medium assumption is based on a two-decade average.

3.2.4 Sensitivity of projections to assumption changes

This section examines two alternative central population projections around the Series 5 projection. It also looks at the extent to which more extreme demographic scenarios affect the fiscal position.

"Alternative central" demographic projections

The Treasury commissioned several updated population projections from Statistics New Zealand for the *2009 Statement* with the estimated resident population at 30 June 2008 as the base. The assumptions for these are summarised in the Table 3.2.

Table 3.2 — Assumptions for the 2008-base projections

Series	Fertility from 2026	Period life expectancy at birth	Migration from 2012
	Births per woman	Males: Females, years, in 2061	Inwards less outwards
1	Low (1.7)	Low (82.0: 86.0)	Low (5,000)
5	Medium (1.9)	Medium (84.5: 88.0)	Medium (10,000)
9	High (2.1)	High (87.0: 90.0)	High (15,000)

Source: Statistics New Zealand

In 2050, the Series 1 total population is 654,000 smaller than Series 5, while the Series 9 case is nearly 700,000 higher (see Table 3.3 below). The low case has the population peaking in 2043 before deaths overwhelm births and net migrants and the total falls (the situation of shrinking population that several fast-ageing countries are facing now). For the low case, the youth dependency ratio (under 15s as a ratio of 15-64s) is much lower than the base case. This ratio is a strong driver of public schooling costs as a proportion of GDP. In the high case (Series 9), the youth ratio remains largely constant.

Table 3.3 — Projection results

Series	Population size, millions				Youth dependency ratio				Old age dependency ratio			
	2008	2030	2050	2060	2008	2030	2050	2060	2008	2030	2050	2060
1 Low	4.27	4.80	4.85	4.74	31.3	26.5	25.5	24.6	18.9	34.2	42.1	45.4
5 Mid	4.27	5.09	5.50	5.60	31.3	29.3	28.4	28.0	18.9	34.3	41.7	44.3
9 High	4.27	5.39	6.20	6.53	31.3	31.8	31.3	31.3	18.9	34.3	41.2	43.4

Source: Statistics New Zealand

The old age dependency ratio is the key driver of the costs of NZS. All three cases see this ratio more than doubling, with the low case having slightly more ageing than the medium which has a slightly older population than the high case.

The next step is to see how these different population scenarios flow through to changes in the fiscal position. Here we assume the same participation and unemployment rates for all three population scenarios. Primary spending (which excludes finance costs) rises with increased age dependency, producing higher debt.

Table 3.4 — Effect of demographic projections on the fiscal position (% of GDP)

Series	Primary expenditure			Operating balance			Net debt		
	2008	2030	2050	2008	2030	2050	2008	2030	2050
1	30.4%	33.8%	36.1%	2.2%	-5.0%	-15.1%	5.7%	81.1%	224.8%
5	30.4%	34.3%	36.6%	2.2%	-5.3%	-15.8%	5.7%	79.5%	223.4%
9	30.4%	34.4%	36.9%	2.2%	-5.5%	-16.1%	5.7%	76.6%	218.3%

Note: This assumes the historic trends fiscal scenario and the core Crown fiscal position

Source: The Treasury

3.3 How much could demography ease fiscal pressures?

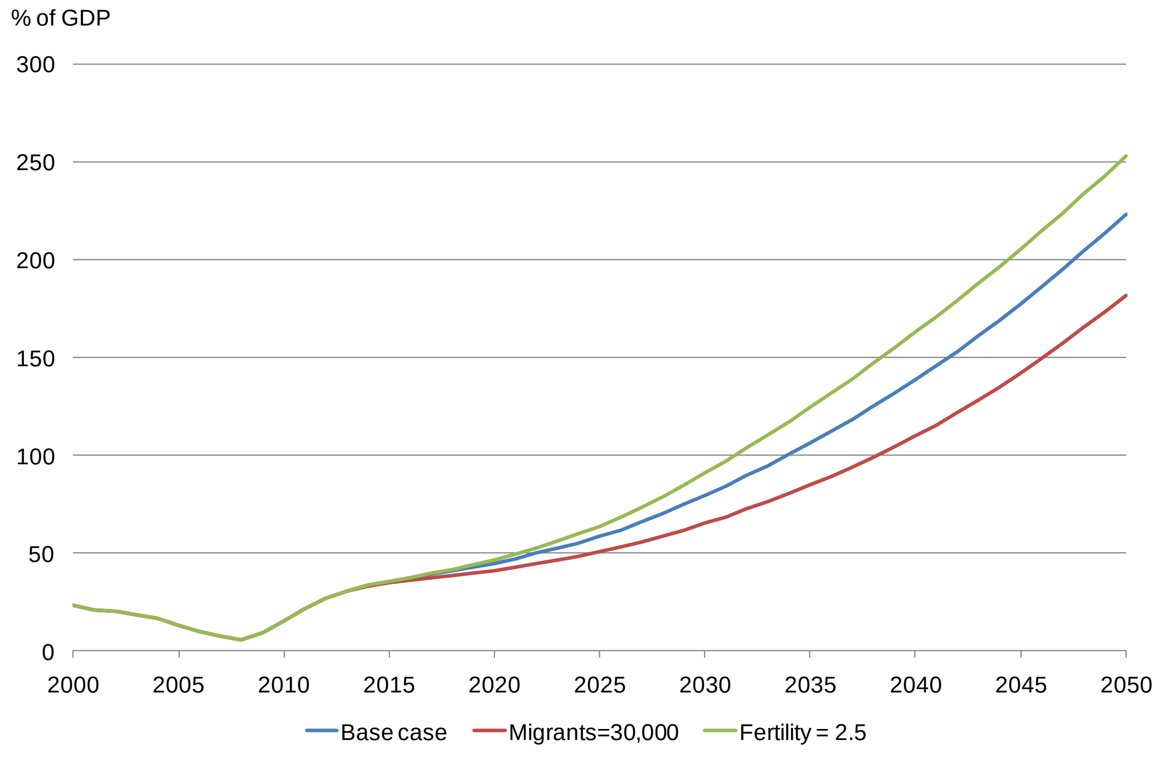
One response, often heard when population ageing and the fiscal position are discussed, is that perhaps the projected gap between revenue and spending could be closed with increases in immigration, or fertility. This section examines the fiscal impact of these sorts of changes.

If the net inflow of migrants were to be increased from 10,000 a year to 30,000 for each year from 2014 onwards, using the current proportions of each age and gender, and if other demographic assumptions stayed the same as in the base case, the old age dependency ratio would be lower by about 2 percentage points in 2030. Eventually, the earlier migrants become old and add to the rise in the old age dependency ratio, which would increase by about 0.9 percentage points in 2050. The overall effect is that net debt in 2050 would move from 223% to around 180% of GDP, as figure 3.7 shows.

If annual fertility were to increase from 1.9 to 2.5 babies per woman by 2014, then the old age dependency ratio would be lower by 4 percentage points in 2050. Yet over the next 40 years, this would lead to a deterioration of the fiscal position with net debt climbing to 251% of GDP in 2050. This is because the additional children require higher health and education spending early in their lives. Although this additional expenditure is followed by tax payments as these additional children move into the workforce, the initial increases in expenditure are not balanced out by the end of the projection period (2050).

These examples show that although changes in assumptions about demography can assist the fiscal position, the general story of increasing net debt remains the same.

Figure 3.7 – Effect on net debt of 30,000 migrants, and fertility of 2.5 from 2014



Source: The Treasury

4 Economy

4.1 The three Ps

The initial five years of the projections, from 2009 to 2013, are taken from the forecasts prepared for the *Budget 2009 Economic and Fiscal Update*.[8] Over the projection period, from 2014 to 2050, real GDP is determined by a simple production function with three drivers: population, participation and productivity (the three Ps), as shown in Table 4.1.

Table 4.1 – The three Ps of GDP

Population: The total number of people available for work.	**working-age population (15 and older)**
multiplied by	
Participation: The number actually working and how much they work.	**participation rates x (1 – unemployment rate) x average hours worked**
multiplied by	
Productivity (economy-wide): How much each person produces each hour that he or she works.	**GDP per hour worked**

4.2 Population and labour force participation

Total population is discussed above in Section 3. There are two concepts of the working-age population. One is based on the Household Labour Force Survey sampling of the civilian, non-institutional population aged 15 and older. This number differs from the (census-based) population of people 15 and older because of HLFS sampling error versus census, and that HLFS excludes people in the armed forces and non-private dwellings (eg, retirement homes, hospitals, prisons), while the census includes everyone who is in New Zealand on census night.

The Treasury produces a five-year forecast of an aggregate participation rate, based on the HLFS, using the New Zealand Treasury Model (NZTM), a general equilibrium macroeconomic model (Ryan and Szeto, 2009). This forecast will reflect the effects of any business cycle in the NZTM forecast. When multiplied by census-based population projections of people 15 and older, the result does not exactly match the HLFS labour force. In preparing data for the LTFM, we break out this single aggregate time series into a historically consistent series of five-year age and gender group participation rates.

[8] Further detail of the methodology used for these forecasts can be found at http://www.treasury.govt.nz/budget/forecasts/befu2009.

The working age population (defined as people aged between 15 and 64) declines from 66% of the total population in 2009 to 58% in 2060. Growth of this group falls from around 1% in 2009 to under 0.5% in 2012 as the baby boomers start turning 65. By 2050, working age population growth stalls.

A person is recorded as participating in the labour force if he or she works at least one hour a week, or is unemployed but "actively" searching for work. Contributions to real output come from hours worked per week, and the amount of output done per hour on average. As the population ages, people will live longer, will likely be healthier, and be working longer in their lives. Offsetting this increased participation by older people will perhaps be more part-time work, and possibly in jobs where output per hour worked (productivity) may not be as high as it was earlier in their lives.[9]

The LTFM uses Statistics New Zealand population projections which, as noted above, are inconsistent with the working-age population derived from the HLFS. The five-year labour force forecast (derived from participation rates and HLFS-consistent working age population) is then blended with a trend projection of participation rates and the census-based population projections to produce a projected labour force in the LTFM.

The trend participation rates are produced using a dynamic cohort method based on historical behaviour by age and gender groups and the latest HLFS participation rates.

4.2.1 Dynamic cohort method of projecting participation rates

This method is based on the observation that the participation of a five-year age group in a particular year will depend on the participation of similar people five years earlier (a synthetic cohort), modified by the probability of their entry into and exit from the labour force. So this method shifts a cohort's past patterns through time as the cohort ages and dampens these effects through time. This projection method has been documented, and used, by the Australian Productivity Commission, OECD, and the United Kingdom's long-term public finance projections.[10]

As a result, the trend towards increasing female labour force participation continues – for those older than 25, who are less influenced by tertiary education participation trends. It requires taking a position on how the 15-19-year-olds are likely to behave through time (these are treated as exogenous). Here it is assumed that their labour force participation will rise only slightly as they are judged to have almost reached peak participation in tertiary education and training.

Estimates of entry and exit probabilities are based on age-group behaviour over the past five years (HLFS) and these estimates are cross-checked against the Productivity

---

9 Changes in the mix of employment between the sexes, ages and full-time versus part-time status has meant a fall in the aggregate hours worked over the past few decades. Growing numbers of older people working in part-time jobs could see this aggregate decline continue. See the Productivity Commission (2005), p 62. The effect of ageing on productivity is more vexed. Studies indicate that average productivity levels rise with age before declining after middle age and so changes in the age mix of the labour force may affect aggregate productivity. However, over the 40 or so years of these projections, the gains in productivity of younger workers may roughly balance the productivity decline of older workers, producing a negligible effect on the aggregate. Some research also indicates that the productivity contributions from each group may be complementary. *Op. cit*., p95.

10 See the Productivity Commission (2005, Technical Paper 3: Cohort analysis), Burniaux, *et al*. (2005, Annex 3: Static vs Dynamic Baseline Scenarios), HM Treasury (2005, Annex B: Projecting Employment Trends, p71).

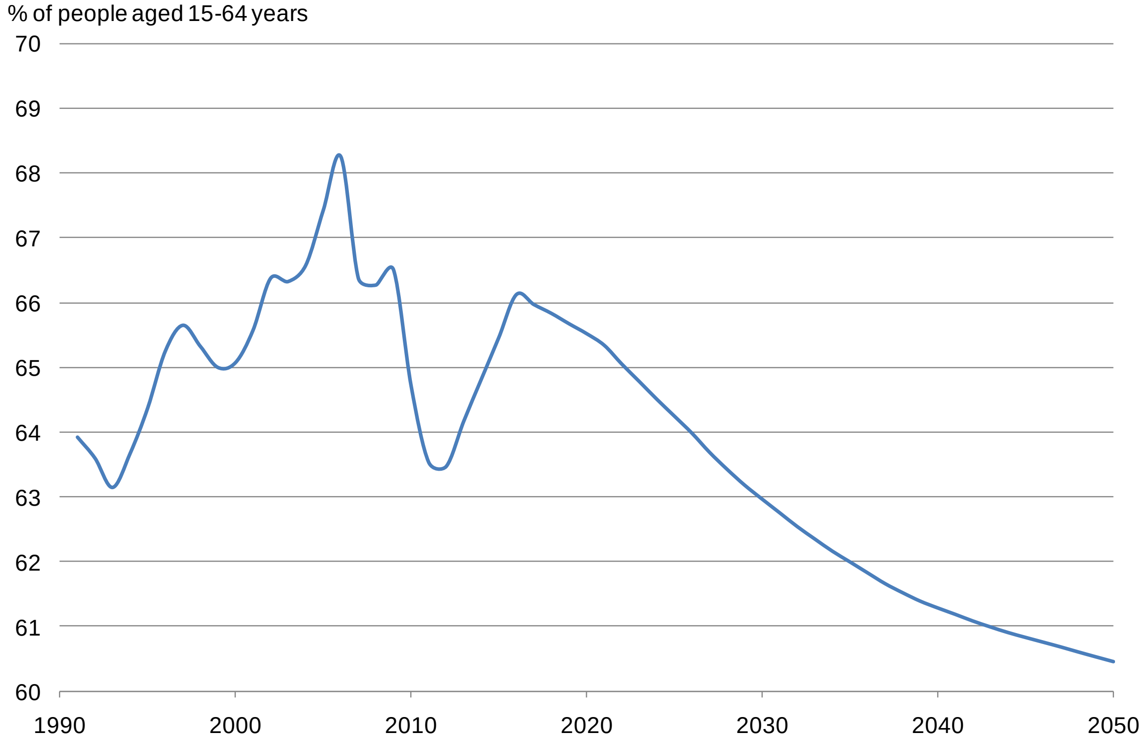
Commission and Statistics New Zealand's short-run participation projections. Selecting these trend probabilities is more of an art than a science. The formulas used to calculate them are then turned around to create the trend participation rates.

There are some clear trends over the longer term; for example, entry probabilities for females fall in the late 20s and early 30s at around the period of prime child-bearing. Males in mid-to-late 40s and older have shown a tendency towards static or falling participation, while female participation for this group has grown strongly. The probability of exit jumps after 65 for both sexes, but falls slightly for those in their 70s.

The near-term forecast age-sex participation rates, produced as part of the economic forecast for *Budget 2009* (including the effect of the recession), are transitioned to long-term trend rates produced by Statistics New Zealand. This transition occurs over the initial three years of the projection.

The proportion of males and females in the labour force is projected to decline despite static or increasing labour force participation rates at most ages. This apparent contradiction is caused by the changing age structure of the population, with an increasing proportion of the population and labour force at older ages.

Figure 4.1 – Aggregate labour force participation rate



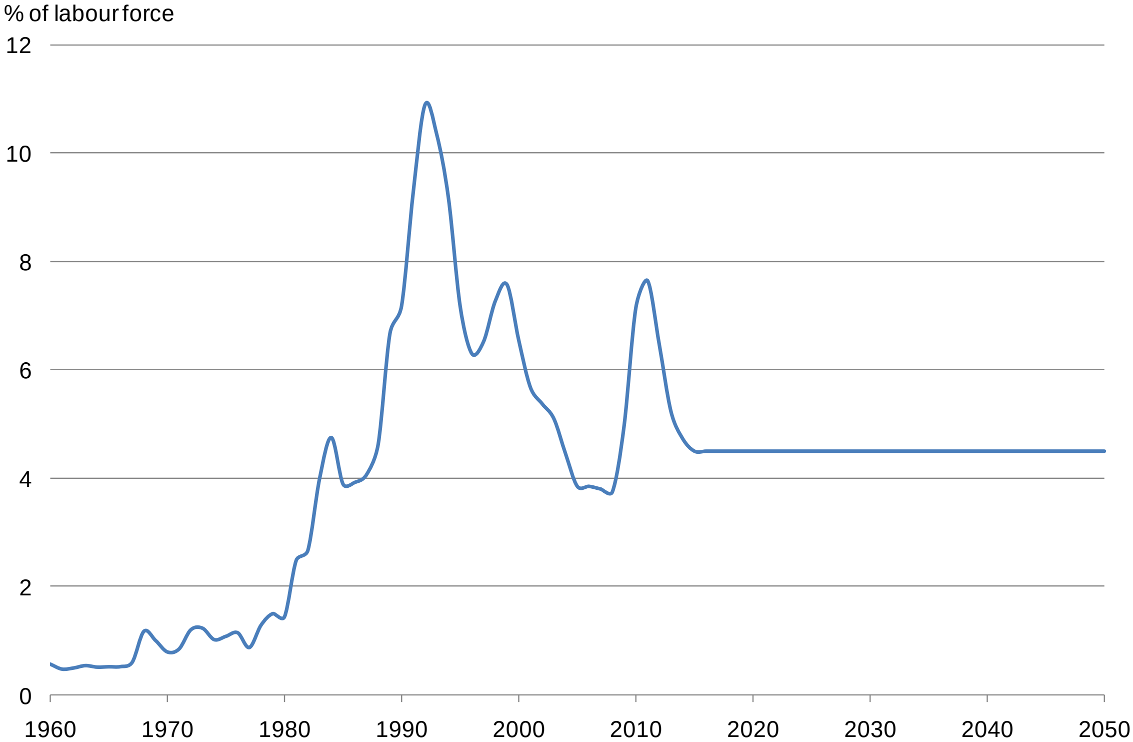
Sources: The Treasury and Statistics New Zealand

4.2.2 Employment and unemployment

The forecast of the unemployment rate comes from the *Budget 2009,* which reflects assumptions about the recession and subsequent recovery. This is then gradually moved to the long-term unemployment rate (4.5%), which is consistent with the estimates of NAIRU in Szeto and Guy (2004) and used as an anchor for the longer-term projections. This is the Treasury's estimate for the unemployment rate where inflation is stable.

Projected employment then is the product of the labour force and 1 minus the assumed unemployment rate (a fixed 95.5% of the labour force).

Figure 4.2 – Unemployment rate



Sources: The Treasury, Statistics New Zealand and Briggs (2003)

4.3 Economy-wide productivity

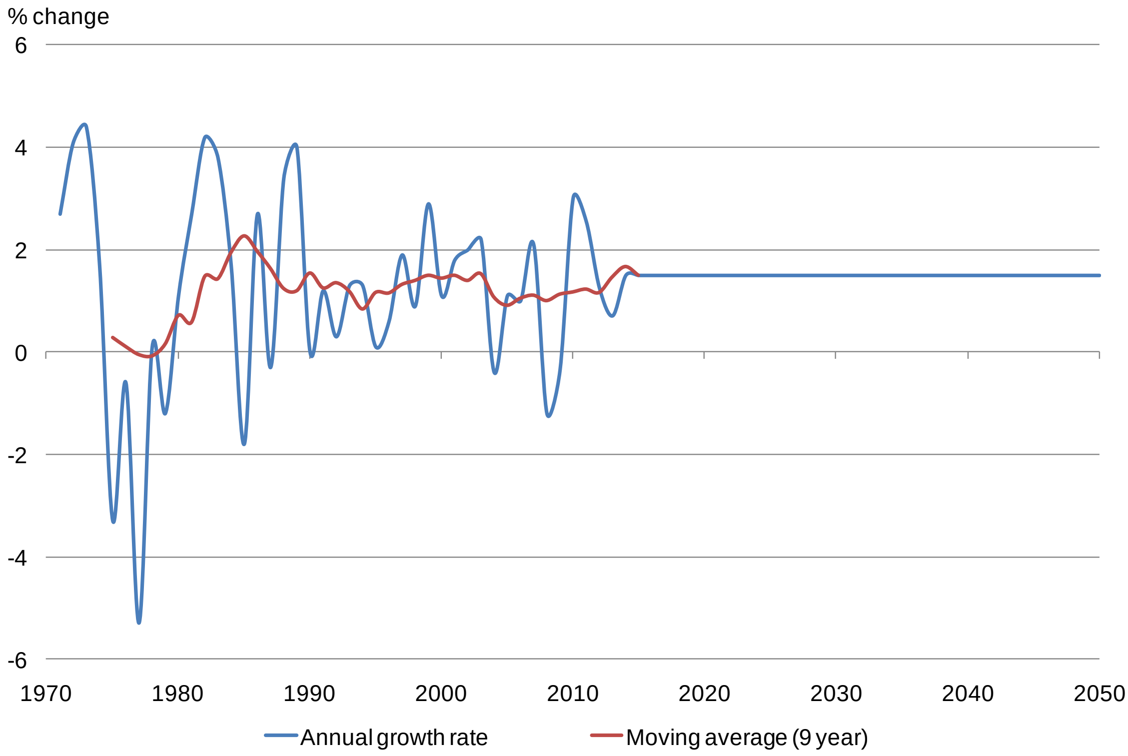
The long-term projections assume economy-wide labour productivity grows at long run trend, assumed to be 1.5% per year in the main scenarios. Figure 4.3 shows how this assumption is based on an historical average. Estimation issues are discussed in New Zealand Treasury (2008) which finds, based on data from 1988 to 2007, that the trend rate has been relatively steady between 1.3% and 1.5% over this period.

An economy's labour productivity is a function of its capital-to-labour ratio and total factor productivity. There is no assumption made in the LTFM about the economy's capital stock and therefore the projections are silent about the sources for the assumed labour productivity growth.

Of course, future productivity growth may differ from that observed in the past. Closing the income gap with Australia by 2025 would likely require labour productivity growth of around 3.3% per year. It is likely that significant structural change in the New Zealand economy would be required to achieve such rates.

There is also some literature on the effects of demographic change on productivity. Empirical evidence suggests that productivity rises with an individual's age before declining after middle age (see Productivity Commission, 2005 and Werding, 2007). However, in the absence of robust estimates for such an effect, this type of effect was not incorporated into the modelling.

Figure 4.3 – Economy-wide labour productivity growth



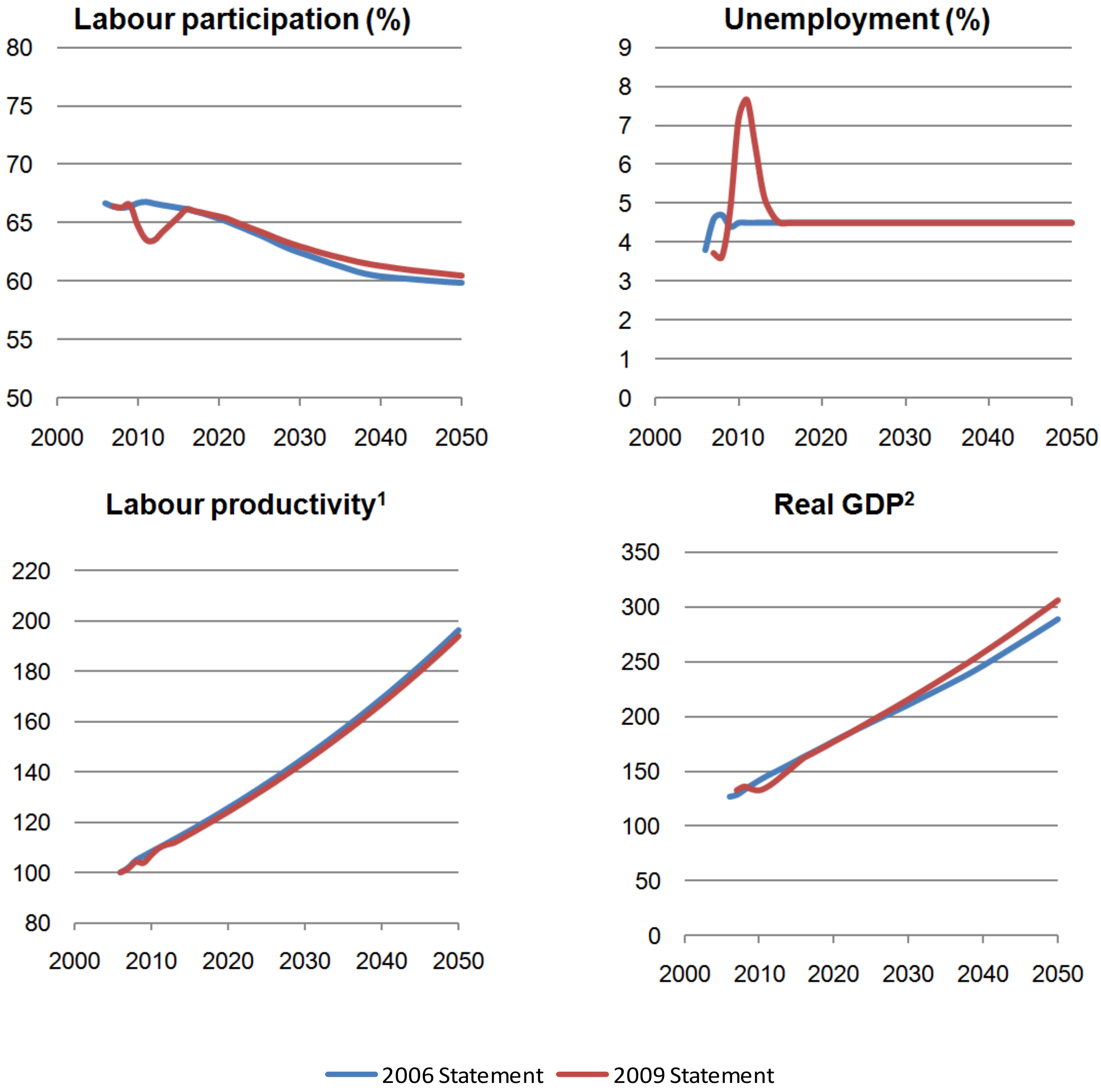
Source: The Treasury and OECD

4.4 Comparing economic assumptions: 2006 and 2009

Figure 4.4 shows the forecast and projections of labour force participation, unemployment and productivity from both the *2006* and *2009 Statements*. Real GDP, a function of these variables, is also plotted.

The key difference between the 2006 and 2009 projections results from the effects of the recession. Output is below potential for a period, with unemployment recovering to its long-term rate of 4.5% by 2015. Longer term, real GDP is slightly higher by 2050 than projected in 2006, primarily reflecting slightly higher projections for the size of the labour force.

Figure 4.4 – Key economic variables in 2006 and 2009 projections



Source: The Treasury

Notes:

(1) Labour productivity is an index constructed using annual growth rates with the base set to 100 in 2006.

(2) Real GDP is measured in $ billions in 1995/96 prices.

5 Revenue

5.1 Which tax types are projected?

The New Zealand tax regime has more than 20 different categories of tax that are reported in the Government accounts.[11] For projection purposes, the various tax types are aggregated into three tax types, as outlined below.

- Source deductions – the tax withheld on wages, salaries, social welfare transfers, bonuses, lump-sum payments and private superannuation fund contributions. The majority comes from pay as you earn (PAYE) on wages and salaries. Source deductions accounts for more than 40% of New Zealand's tax take.

- Corporate tax – the tax types paid by companies in New Zealand on their profits and on the dividends they pay out or receive from overseas entities. Corporate tax comprises net (after refunds) company tax, non-resident withholding tax and foreign dividend withholding payments. Company tax, paid on company profits, accounts for more than 80% of corporate tax.

- Other taxes, including GST – this covers all the remaining tax types, such as goods and services tax (GST), fringe benefit tax (FBT), other persons tax (generally tax on self-employed individuals operating unincorporated businesses), resident withholding tax on interest income, excise duties, customs duty, and several smaller tax types such as gaming duties and road user charges (RUC). GST is by far the largest tax type in this aggregate group, accounting for about half of the dollar value in the "Other" grouping.

There are many ways that the tax types could be grouped for long-term projections. However, with the exception of source deductions, all tax types are projected predominantly by holding them as a constant ratio of nominal GDP, which means the choice of aggregation is not so critical. Our categorisation of tax types for the *2009 Statement* was informed by the following considerations.

- Separating out source deductions, because it is modelled differently from the others tax types, with the ability to incorporate fiscal drag being its main distinguishing feature.

- Projecting corporate tax by itself, because it is dominated by company tax, for which the rate was lowered from 33% to 30% in 2008. Keeping this tax separate allows scenarios to be easily produced, if the company tax rate changes again.

- The majority of the other tax types are not large enough to warrant being projected by themselves and are mainly consumption driven (other persons tax is income-based). Hence they are bundled in with GST, as the components of GDP driving them will mainly be the same as those driving GST.

[11] See note 1 in *Budget 2009* – Notes to the Forecast Financial Statements.

5.2 Projecting source deductions tax

Source deductions tax is grown with drivers related to employment and earned income, because it predominantly stems from tax on wages and salaries. An added complication is the fact that it is levied via progressively higher tax rates on tiered thresholds, making it subject to fiscal drag.

Fiscal drag refers to the phenomenon that tax grows faster than the income it is levied on because, as a person's income grows, an increasing proportion of it is taxed at a higher rate. The term "fiscal drag" comes from this reduction in aggregate demand by a rising average tax rate on personal income.

Other income-driven taxes are not modelled with fiscal drag applied to their drivers, because their annual volatility is much larger than that of GDP. For example, the income stream of a self-employed person such as a farmer or a real estate agent, compared with that of a wage/salary earner such as a teacher or a nurse. The variability in the incomes of the former, from year to year, tends to be much larger than in those of the latter. Finding a long-term ratio of GDP to apply to other persons or FBT is difficult and the volatility in these tax types over history means no significant fiscal drag component can be discerned. For salary and wage earners, on the other hand, it is not difficult to extract a fiscal drag elasticity estimate from historical data, allowing for tax rate and threshold changes.

The modelling of source deductions is as follows:

$$SD_t = SD_{t-1}\,(1 + ELFg_t)(1 + \varepsilon \times lpg_t)(1 + \varepsilon \times \pi_t)$$

where:

t = the fiscal year

SD_t = source deductions tax revenue

$ELFg_t$ = the annual growth in the employed labour force, where the employed labour force is calculated as (aggregate labour force) x (1 – unemployment rate)

ε = the aggregate fiscal drag elasticity estimate for the New Zealand personal tax regime

lpg_t = the annual labour productivity growth, which is the proxy for the annual growth of the average real wage in the economy, and

π_t = inflation, as measured by annual growth in CPI, which turns real wage growth into nominal wage growth.

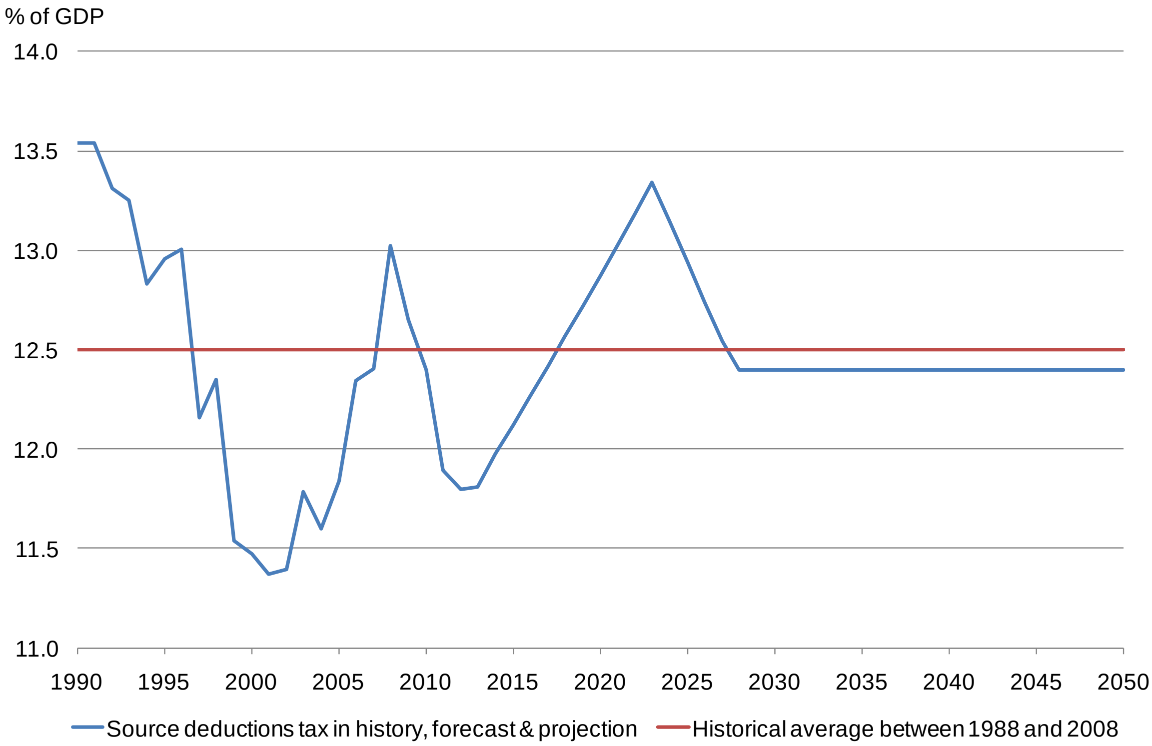
Therefore, the source deductions total in any projected year is derived from its preceding year's value by multiplying it by a demographic driver, which is the growth of the employed labour force, and an indexation driver, which is the growth of nominal wages in the economy. The latter is supplemented by a fiscal drag elasticity, reflecting that as nominal wages grow, a higher percentage becomes subject to higher tax rates.

The *2009 Statement* projections are based on the end-of-forecast values, which are themselves based on the personal tax regime introduced on 1 April 2009. The fiscal drag elasticity used in the modelling relates to that tax regime. It is estimated to be 1.35, as an average value in the first decade of projections. If, for example, nominal wages are assumed to be growing by 3.5% each year, the average tax on the aggregate wages will be growing annually by about 4.7%.

Assuming that fiscal drag will be allowed to go unchecked for a decade is realistic, given the recent history of the New Zealand tax system. However, an assumption that fiscal drag would be allowed to continue for 40 years without change seems fanciful. It effectively means the tax rates and thresholds currently applying would continue to do so, with no allowance for the inflation of incomes. Over a 40-year horizon, even the incomes of those currently on the lowest personal tax rate of 12.5% would grow with inflation to levels that were taxed at 33%.

Consequently, the modelling in the 2009 *Statement* does not assume ongoing fiscal drag lifting source deductions as a ratio of nominal GDP. Rather, we assume that the fiscal drag effect will continue for a decade out to the year ending June 2023, in line with the source deductions tax projection modelling in the *Budget 2009 Fiscal Strategy Report*.

Figure 5.1 — Source deductions tax revenue



Source: The Treasury

After 2023, we assume some form of changes would be applied to the personal tax regime in order to return source deductions, as a ratio of nominal GDP, to a value more in line with its historical average over the last 20 years. The path of source deductions to nominal GDP in history, the *Budget 2009* forecast and the 2009 *Statement* projection, is depicted above in Figure 5.1.

Even the peak of source deductions as a percentage of GDP, reached in 2023, is not out above values reached in the recent past. Following 2023, the long-term projection is reduced at a rate of 0.2% of nominal GDP per year until it attains a level in line with the historical average over the last 20 years.

5.3 Projecting corporate tax and other taxes

Until recently, the method for projecting any taxes other than source deductions was to hold them at their end-of-forecast ratio to nominal GDP throughout projections. This approach rested on an assumption that the economy was back on trend and cycle-free by the final forecast year, and therefore, so too were the various tax revenue types. This method was first changed in the *2008 Pre-election Economic and Fiscal Update* medium-term projections, where the economy was not considered to have recovered from the recession by the final forecast year. The modelling returned some of the key economic variables, such as labour force participation rates, to their long-term averages after a few years into the projection. These are the values they might be expected to attain, based on historical data, in an environment where the economy was on trend and not subject to business cycle fluctuations.

The recovery to a higher ratio of nominal GDP than that observed at the end of the forecast base was done only for corporate tax in the *2008 Pre-Election Update*. By *Budget 2009*, when economic conditions had deteriorated even further, both corporate tax and other taxes were adjusted in this manner. Given fiscal drag modelling was already lifting source deductions relative to GDP, this tax type was not further adjusted.

In *Budget 2009*, which was the forecast base used for the *2009 Statement* projections, the two transitions were:

Corporate tax:

- final forecast year (year ended June 2013), a ratio to nominal GDP of 5.2%
- adjusted at rate of 0.2% of GDP a year to long-term average target of 5.3%, and
- reaches its target by 2014 and then remains at that ratio throughout projection.

Other taxes:

- final forecast year (year ended June 2013), a ratio to nominal GDP of 11.5%
- adjusted at rate of 0.2% of GDP a year to long-term average target of 12.0%, and
- reach their target ratio by 2016 and then remain at that ratio throughout projection.

The targeting of a long-term average ratio to nominal GDP, in projecting the tax types not subjected to fiscal drag, is considered to be an improvement on the old technique of simply holding them at their end-of-forecast ratio. Obviously, the long-term target needs to take into account major policy differences between the historical data used to calculate the average and the future values of the tax type, but this is generally not too hard to adjust for. A good example of this is in corporate tax, where historical figures up to 2008 need to be adjusted for the fact that company tax was levied at 33% then, rather than the 30% rate now in operation and which is projected forwards.

The old method also put too much onus on the tax revenue figures forecast in this last year and did not allow that they might not reflect a “normal” outturn. In the case of corporate taxes, for example, any delayed use of loss build-ups might still be being worked through by the final forecast year, despite the economy being forecast to be back on trend. With no adjustment, this loss use would never be worked out in projections and corporate tax revenue would inherit this weakness throughout the projection horizon.

5.4 Modelling alternative tax regimes

Section 5 of the *2009 Statement* is titled "What role could tax play?" The last part of that section examined the potential increase in tax needed to finance the increased public spending assumed in the historic trends scenario, while still keeping net debt on a projected path that fell to around 20% of GDP by 2050. The modelling focused on the period from the year 2024 onward, when the tax-to-GDP ratio is no longer assumed to rise due to fiscal drag.

The figure quoted for the required lift in tax was "more than 3 percentage points" of nominal GDP. When all the major tax types are returned to their assumed long-term averages in the historic trends scenario, the ratio of core Crown tax revenue to nominal GDP remains at 30.0%.[12] If the same levels of public spending are assumed without an accompanying lift in debt used to finance this, then the tax-to-GDP ratio needs to rise to 33.3%.

The modelling behind this alternative tax scenario assumed very similar expenditure growth out to 2023 as in the sustainable debt scenario. However, beyond this point all non-welfare expenditure types are grown at rates that are higher than those assumed in the historic trends scenario, in order to restore them to the same levels that they reached in this scenario by 2050. Welfare spending is excluded because it is modelled in exactly the same way as it is in the historic trends scenario in all years.

The increases in tax, as ratios to GDP, were modelled evenly between source deductions and other taxes, and half as much was applied to corporate taxes. This was simply based on the sizes of the three major tax types, but it is only one way of many that could have been chosen to model the overall increase in tax revenue required.

Evidence suggests that raising taxes, especially over a sustained period, is not costless in terms of economic growth. This is referred to in Section 5 of the *2009 Statement*, which also notes that the impacts for the New Zealand economy are difficult to gauge.

Consequently, when taxes were lifted to cover expenditure growth in this scenario, some ensuing deceleration of GDP growth was built in. A relatively conservative elasticity estimate of -0.25 was applied, meaning that for every 1 percentage point lift in tax to GDP, the level of GDP is retarded by 0.25%.

This means tax-to-GDP ratios needed to be lifted higher, to reach the 2050 net debt target of 20% of GDP, than they would have been if this were not assumed. This occurs for two reasons:

- Tax revenues grow with nominal GDP, so when the latter grows by less, so do the former, and hence even higher tax-to-GDP ratios need to be targeted to offset the same level of expenditure growth, and
- The nominal GDP denominator in the debt-to-GDP ratio is lower, meaning a lower nominal level of net debt has to be attained for the 20% target to be reached, which in turn means tax revenue needs to be higher for the same level of expenditure.

[12] Source deductions stabilises at 12.4%, corporate tax at 5.3% and other taxes at 12.0% of GDP. The remaining 0.3% is due to a small wedge, added back to the total tax revenue figures to give core Crown figures. This relates to eliminations largely from income tax from Crown Entities and State-Owned Enterprises.

Finally, the required increase in tax revenue was expressed in terms of what it could mean, if it were achieved through income tax rises or lifts in the rate of GST. Both calculations were based on current data, as if they were happening now. This was done for practical purposes, because future income distributions or levels of consumption on GST-attracting goods and services are not known. It also served to illustrate what such tax increases would mean in terms of impacts on individuals and households. In regard to personal income tax rates, the increase would be equal to across-the-board tax rate rises of 5.5 percentage points. If the required increase in tax revenue is achieved via raising the GST rate, we estimate that the current rate of 12.5% would need to rise to 20%.[13]

5.5 The rebalancing scenario

Some alternative scenarios, involving various mixtures of policy changes, were examined in Section 8 of the *2009 Statement*. These examined ways of reaching a similar net debt target by 2050 as is attained in the sustainable debt scenario, without putting so much of the weight of the adjustment on non-social welfare spending.

One of these scenarios was called the rebalancing scenario and part of its policy change mix involved raising the long-term tax-to-GDP ratio after 2023. The tax modelling for this scenario was similar to that used in Section 5 of the *2009 Statement* – also outlined above. The main difference was that tax alone was not responsible for offsetting higher expenditure growth. In fact, the tax rise was not specifically targeted to ensure non-welfare spending could match its levels in the historic trends scenario at all, and this spending was still lower than it that scenario. It was, however, significantly higher than in the sustainable debt scenario, and this was achieved in three ways, namely lifting the long-term tax-to-GDP ratio by one percentage point to 31% of GDP, reducing some forms of benefit spending from 2014 onwards, and decreasing the cost pathway of NZS from 2017 onwards. The 1% of GDP lift in the tax ratio was split evenly between source deductions and other taxes and half as much for corporate tax.

---

13 These estimates use data from both the Budget 2009 *Key Facts for Taxpayers* on how much revenue is raised by increases to the various personal tax rates (currently 12.5%, 21%, 33% and 38%) and the Budget 2009 Cumulative Taxable Income Table.

6 Expenditure on public services

6.1 Modelling approach

Modelling government expenditure involves making various judgements. This section discusses the modelling framework and key assumptions for public services. Expenditure on government transfers, including NZS and welfare benefits, is determined by legislated eligibility criteria and index-linked payment adjustments. The modelling approach for transfers is discussed in subsequent sections on NZS and working-age benefits.

Our approach is to base the projections on current policy settings, although these are subject to some interpretation and future uncertainties. Expenditure on public services is subject to greater modelling judgement than the approach used for modelling expenditure on transfers, because future expenditure on public services is determined through the government's annual budget decisions, rather than any legislated formula.

As outlined in Section 2.4, expenditure is projected in two main ways in the *2009 Statement*. Each approach is based on a different interpretation of current policy settings:

- the historic trends scenario, which models the individual bottom-up drivers of expenditure, without regard to the fiscal constraints facing the government, and

- the sustainable debt scenario, which imposes a top-down budget constraint that is consistent with net debt being managed down to 20% of GDP by 2050. This approach is used to determine the sorts of adjustments in expenditure that would be required to meet the budget constraint facing the government.

6.2 Modelling framework for public services expenditure

6.2.1 The drivers of expenditure

The methodology for projecting expenditure on public services (also described as output expenditure, or government consumption expenditure) has changed somewhat since the *2006 Statement*. While we retain the approach of modelling cost drivers based on inflation, wage growth and demography, we also introduce explicit parameters for public sector productivity and non-demographically-driven volume growth. This enables expenditure growth to be explicitly decomposed into price and quantity components. This framework also applies to the modelling of health expenditure, which was treated somewhat differently from other public services in the *2006 Statement*. Health care is discussed in more detail in Section 7.

The 2006 and 2009 modelling frameworks are compared in Table 6.1.

Table 6.1 – Modelling frameworks for public services expenditure: 2006 and 2009

2006 model	2009 model
$\frac{E_t}{E_{t-1}} = (1+\pi_t)(1+g_t)(1+d_t)$	$\frac{E_t}{E_{t-1}} = \underbrace{(1+\pi_t)(1+w_t)\left(\frac{1}{1+a_t}\right)}_{\text{Price growth}} \underbrace{(1+d_t)(1+p_t)}_{\text{Quantity}}$
	Expenditure growth = Price growth x Quantity
Growth in nominal expenditure	Growth in nominal expenditure
=	=
inflation	inflation
x	x
real growth driver	real input price growth
x	÷
demographic driver	public sector productivity growth
	x
	demographically-driven volume growth
	x
	non-demographically-driven volume growth

Table 6.2 provides a brief description of each parameter and explains their values in the main projections.

Table 6.2 – Parameters for public services expenditure

Parameter	Description	Base case value (annual growth rate)	Explanation
π_t	Inflation	2.0%	Mid-point of RBNZ's policy target agreement.
w_t	Real input price growth	1.2%	Reflects assumption that real wage growth is equal to economy-wide labour productivity growth (1.5%). A scalar is applied because not all inputs are wage-linked. The scalar used is 0.8.
a_t	Public services productivity growth	0.3%	Judgement based on available empirical evidence.
d_t	Demographically-driven volume growth	Varies by year and expenditure area.	Growth in the relevant recipient population, with cost weights applied.
p_t	Non-demographically-driven volume growth	Historic trends scenario: 0.8%.	The historic trends parameter value is based on observed historical spending patterns.

	Sustainable debt scenario: -1.04% between 2014 and 2023; 0.45% between 2024 and 2050.	The sustainable debt parameter values are determined by imposing a spending track which meets the top-down fiscal sustainability criterion.

The rationale for the choice of parameters is a notional production function involving price and quantity drivers. The price is determined by supply-side drivers: the cost of inputs (ie, costs of labour, capital and intermediate inputs) and the productivity of the production process. The demand-side is determined by a demographically-driven volume growth factor (reflecting size and composition of population) and a non-demographically-driven volume growth factor (reflecting policy preferences for the scope, quantity and quality of services). The form of the equation in Table 6.1 is derived in Annex 2.

Next we discuss calibration issues in further detail.

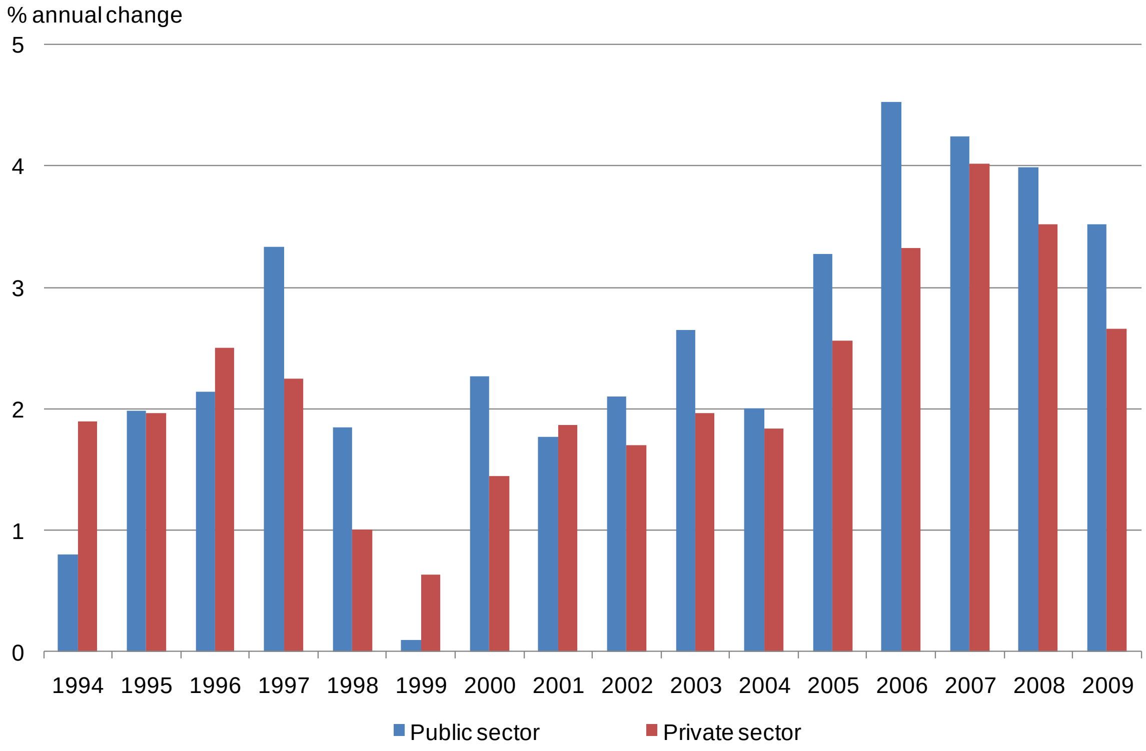
6.2.2 Input price growth

Our modelling framework requires growth rates for input prices to be specified. These growth rates are decomposed into nominal and real components (π_t and w_t).

It is assumed that all input prices rise by at least CPI inflation. It is also assumed that there is some real input price growth, largely associated with the labour cost component. Theory would suggest that wage growth should be in line with labour productivity growth over time, although the relationship may not be strong in the short term. Empirical measurement in New Zealand over the 20th century shows periods of divergence between wage and labour productivity growth which may be partially explained by poor quality data on wages (Briggs, 2003) and also episodes of structural change in the economy (such as those discussed in Parham and Roberts, 2004).

We also assume that wage growth across public services is driven by economy-wide labour productivity. That is, there is equalisation of growth rates across public and private sectors. This relationship is likely to hold broadly because workers are relatively mobile between sectors. Although there could be a wage discount (or premium) for working in the public sector (eg, a discount because of higher job security and/or satisfaction), there is no reason to model a differential in the growth rates. Recent New Zealand data show public sector wages growing slightly faster than the private sector (see Figure 6.1). Also consistent with the theory, no evidence was found for a wage growth differential between high productivity and low productivity sectors in a US study which looked at data from the past 50 years (Nordhaus, 2006).

Figure 6.1 – Labour cost growth in public and private sectors



Source: Statistics New Zealand

Since not all inputs are driven by labour costs, we do not equate the real input price growth factor to be exactly equal to the assumed rate of real wage growth (itself set to economy-wide labour productivity growth). Instead we apply a scalar of 0.8, so that $w_t = 0.8g_t$ where g_t is the rate of economy-wide labour productivity growth. In the two main scenarios, the assumed rate of economy-wide labour productivity growth is 1.5%, applying the scalar gives a real input price growth of 1.2%.

The choice of 0.8 as the scalar is a judgement which reflects the high share of input costs driven by wage growth in public services. A higher scalar means a higher input cost. Labour shares in the production of public services are higher than in many other parts of the economy and likely to be in the range of 60% to 80% (including labour costs incurred outside the formal employment of the State). The scalar applied is at the upper end of plausible values based on labour costs and reflects a judgement that there are likely to be non-labour inputs which exhibit above-inflation price growth, such as costs associated with the introduction of new technologies in the health sector.

6.2.3 Public sector productivity

Public sector productivity is modelled to be an explicit cost driver, with cost and productivity being inversely related (with the parameter a_t). The intuition is that a higher level of public sector productivity means that the government could deliver the same level of public services for a lower cost, holding all else equal (ie, still matching private sector wage growth but using fewer labour inputs).[14] A key purpose for introducing the

[14] The "public sector productivity" parameter is applied across all expenditure on public services. Therefore, it covers private providers, where they are contracted by the government. It is shorthand for the (multifactor) productivity of the production of publicly-funded goods and services.

parameter into the modelling is to decompose expenditure into price and quantity components. It also enables, through sensitivity analysis, the quantification of potential impacts of increases or decreases in the productivity of public services.

Our assumption is that there are small long-run productivity gains in public services, with two main scenarios including an assumption of annual growth of 0.3% (ie, $a_t = 0.3\%$). This is a judgement based on available evidence, as discussed below. A higher value for a_t would mean a lower cost of public services. This is a much lower growth rate than the economy-wide productivity assumption (1.5%). Unbalanced productivity growth can have important dynamic implications, stemming from an increasing relative price of the output produced in the low productivity sector.[15] The effect is known by economists as "Baumol's cost disease." William Baumol's hypothesis was that the service sector (or some parts of the service sector) had less potential for productivity growth because of the high labour content needed in the production of services. Baumol characterised services as the "stagnant" sector compared with the "progressive" manufacturing sector which could make productivity gains through automation (Baumol, 1967). There is continued debate about this hypothesis.

Empirical measurement of productivity in public services is scarce, and New Zealand does not have well-measured productivity statistics for the public sector (Douglas, 2006). However, the available empirical work suggests a plausible range in annual growth of between -0.3% to 0.7%. This is discussed below in more detail.

The United Kingdom's Office of National Statistics (ONS) measures productivity for the majority of the public services, although caveats are placed on the results due to measurement issues. The ONS found that public services productivity averaged -0.3% over 1997 to 2007 (ONS, 2009). This negative result was during a period of significant increases in both inputs and outputs, but with input growth outpacing output growth.

Studies of health care that take a macroeconomic approach to estimating productivity generally find modest gains over the long run. For example, Pomp and Vujic (2008) found that labour productivity gains across the OECD in health care to be approximately one-fifth as high as labour productivity as economy-wide gains, although the extent to which health care is publicly-funded varies across the OECD. Triplett and Bosworth (2003) found that labour productivity in health services in the United States rose by 0.7% per year in the period 1995 to 2000, or at a rate of 0.27 times that of economy-wide labour productivity over that period. The nature of health care partly reflects public services in general, in that it contains a mix of both publicly and privately-provided services, including services with potential for productivity gains (eg, hospitals) and services with apparently low scope for productivity gains (eg, residential care facilities). These issues are discussed in greater depth in Section 7 on modelling health expenditure.

In the private sector, there have been some signs of increasing service sector productivity. Tripplett and Bosworth (2003), for example, found average labour productivity growth in services industries accelerated in line with economy-wide labour productivity growth in the United States over 1995 to 2000. This suggests that significant

---

15 The generic effects can be illustrated by a simple two-sector economic model (van der Plaug, 2006). Suppose there are different productivity growth rates in the two sectors. Suppose also that demand is inelastic for the output of the low productivity sector and factor prices in low productivity sector equal factor prices in the high productivity sector. Then there will be an increasing relative price of the output produced in the low productivity sector. As incomes grow (generated by the high productivity sector), an increasing proportion of that income will be devoted to consuming the output of the low productivity sector.

productivity gains in labour intensive service-based industries are possible where there is scope for introducing new business models or the widespread application of new technologies such as information and communication technology. New Zealand's market sector service industries (eg, retail) showed labour productivity growth from 1995 to 2006 averaging 0.6% per annum – slightly less than half the economy-wide rate of labour productivity growth (OECD, 2008).

Focusing on New Zealand's public services, the main areas of government expenditure are labour-intensive services, many of which are likely to have relatively little scope for significant labour-to-capital substitution in the foreseeable future. Moreover, the public sector is less exposed to competitive market forces which would be expected to spur greater productivity growth, all else equal. These observations support claims that public sector productivity growth is likely to be lower than economy-wide growth rates.

Our judgement is that over the long run there will be the introduction of new technologies and practices which mean that productivity should increase, albeit at a slower rate than in other parts of the economy. The estimate of 0.3% annual growth should be interpreted as a plausible estimate within a wide range of plausible values. It is also not an estimate of historical performance in any particular time period. Indeed, productivity growth in public services may have been negative over the last decade, as found in the United Kingdom. Although we apply a uniform rate across all sectors delivering public services, it should be considered an average – some sectors will perform better than others.

Combining input price and public sector productivity assumptions, we can derive an implicit price deflator for nominal public services expenditure. In the base case, and in steady state, this deflator is equal to CPI + 0.9% (since $w_t - a_t = 1.2\% - 0.3\% = 0.9\%$).

6.2.4 Real volume growth

Real volume growth in the model is decomposed into demographically-driven and non-demographically-driven components (d_t and p_t).

The modelling of demographically-driven volume growth is based on projections of the relevant population of recipients. The health modelling is discussed in more detail in Section 7. The approaches to modelling demographic factors are largely consistent with the modelling approaches used in the 2006 projections for which further detail can be found in Rodway and Wilson (2006).

Table 6.3 – Demographic modelling by sector

Expenditure area	Base for modelling demographically-driven volume growth
Health	Total population with health cost weights by age and sex.
Education	Projected numbers of students by educational subsector (ie, early childhood, primary schooling, secondary schooling and tertiary education).
Other	Working age population.

Other than health and education, demographically-driven volume growth is assumed to be equal to growth in the working-age population. In the case of justice sector, this is because criminal offending is generally by those within the working-age population. Other expenditure on public services, which is a relatively small portion of the total, also tends to grow with the size of the economy, which is driven by the working age population. However, if the modelling was to be further refined, there are likely some areas which may not have any relationship with demographic factors, such as some administration functions.

The non-demographically-driven volume growth parameter is calibrated as the residual growth in expenditure which is not attributable to other drivers. It is a notional construct representing the decisions made through the government's annual budgeting process.

The non-demographically-driven volume is a critical parameter because it separates the historic trends and sustainable debt scenarios; in all other respects these two scenarios rely on the same assumptions. It is also important for determining the basket of publicly services received by people – an innovation given prominence in the *2009 Statement*.

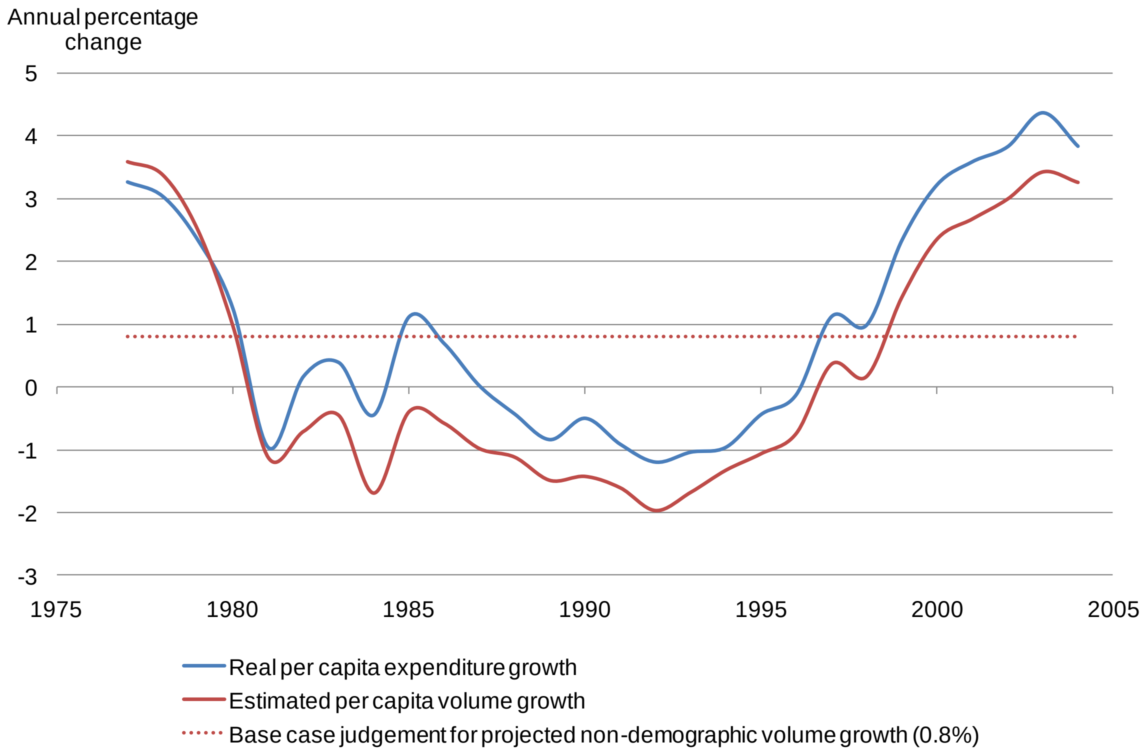
In the historic trends scenario, we set this parameter by looking at trends in government expenditure (excluding transfers and finance costs). Our judgement of a reasonable average value to project forward was 0.8% annually (ie, $p_t = 0.8\%$). Of course, in reality, it would be expected to vary over time and by expenditure area, as it is a function of a wide array of variables, such as society's income, preferences and factors endogenous to the model such as public sector productivity and input prices.

To arrive at this estimate, we looked at historical data for government expenditure, excluding transfers and finance costs. We found the residual growth after deflating for price factors (inflation, labour productivity growth and our assumption for public sector productivity) and population growth. Figure 6.2 plots growth based on data from 1972 to 2008.

This is an imperfect approximation because of measurement issues with the deflator.[16] Nevertheless, we find that growth has varied between -2% to 4% over the past three decades. The general pattern is of relatively strong growth in government spending over the 1970s, followed by a period of restraint in the 1980s and early 1990s, with government spending increasing significantly in the 2000s. This reflects varying economic circumstances and policy regimes over this period. We settled on 0.8%, which is around the average over the past two decades, reflecting an approximate mid-point between periods of restraint and significant growth.

[16] Issues include uncertainty around wage growth (it was assumed to be equal to labour productivity growth), public sector productivity (an assumption of 0.3% per annum was made), and demographically-driven volume growth (general population growth was used, which ignores ageing effects).

Figure 6.2 – Non-demographically-driven smoothed volume growth 1972-2008



Sources: The Treasury, Statistics New Zealand and authors' calculations

Notes:

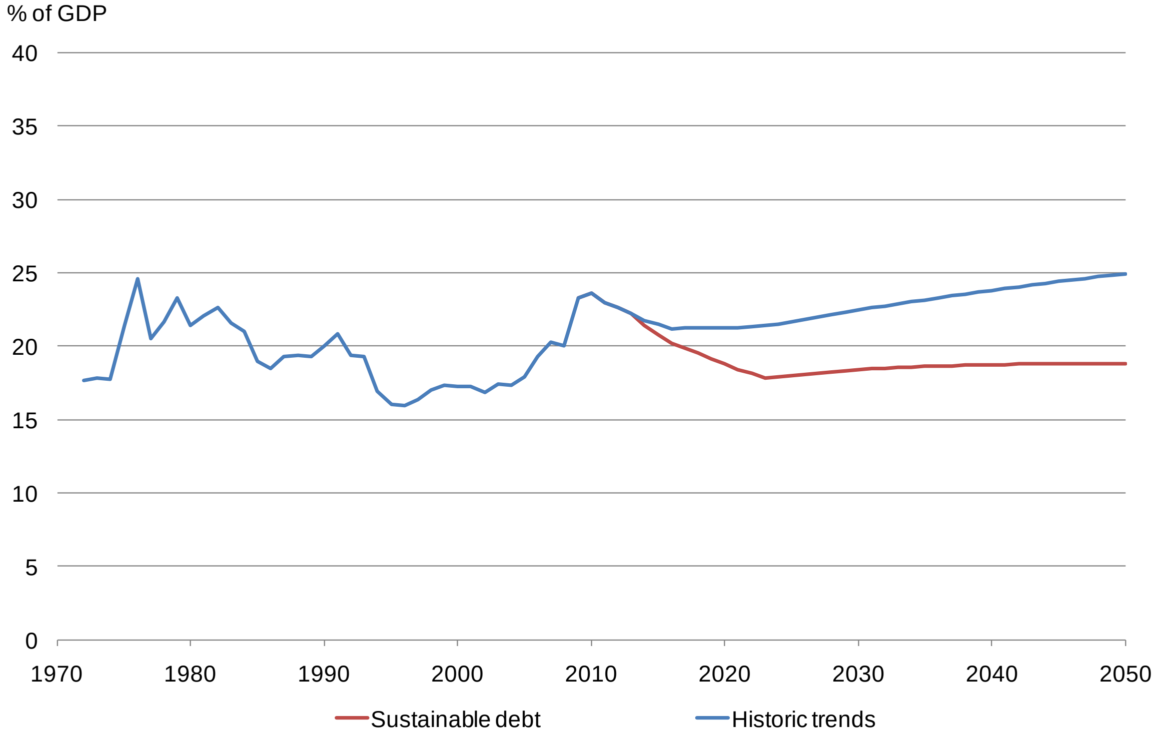
(1) The expenditure base used is core Crown expenses excluding those expenses classified as social security, welfare and finance costs over 1972-2008. Nominal expenditure is deflated using CPI. Per capita rates are computed using New Zealand's total population. Nominal expenditure data is from the Treasury's Fiscal Time Series dataset, updated for *Budget 2009*. CPI and population data are sourced from Statistics New Zealand.

(2) The annual growth rates have been filtered using a 9-year centred moving average in order to smooth out the volatility in the annual data.

(3) Calculated by deflating per capita expenditure growth by an estimate of public sector price growth. This is done by adjusting for inflation, subtracting an estimate of real factor price growth and adding an estimate of public sector productivity growth. Real factor price growth was proxied by the growth rate in economy-wide labour productivity growth, scaled by 0.8, and we used the base case estimate of public sector productivity (0.3% p.a.). This approach was chosen because of data availability and to be consistent with the modelling framework. The economy-wide labour productivity measure used was GDP per hour worked, with data sourced from the OECD.

For the sustainable debt scenario, the expenditure track for public services is chosen to meet a top-down fiscal constraint. The particular fiscal strategy modelled has operating allowances of $1.1 billion (growing by 2% per year – the assumed rate of inflation) to 2023 and then calibrated to reduce net debt gradually to 20% of GDP by 2050. These fiscal strategy objectives are chosen to be consistent with the Government's *2009 Fiscal Strategy Report*. The non-demographically-driven volume parameter is adjusted to these actual operating allowances. The values for p_t were -1.04% from 2014 until 2023 and 0.45% for 2023 to 2050.

Figure 6.3 – Public services expenditure



Source: The Treasury

Note: "Public services expenditure" is defined here as core Crown expenses, excluding social security, welfare and finance costs.

The resulting effects for expenditure under both scenarios are shown in Figure 6.3. The historic trends scenario has expenditure rising to 25% of GDP. For the sustainable debt scenario it is just under 19% of GDP by 2050. Next we look at what this would mean for the actual volume of services delivered to the public.

6.3 What the public receives from the government

The *2009 Statement* includes a projection of the volume of public services delivered to the average New Zealander – in real per capita terms. This is compared with the purchasing power of transfer payments for NZS and other benefits. The rationale for introducing this approach is to look at the long-term fiscal challenges from the perspective of the public, as distinct from the fiscal challenges faced by the government. It is hoped that the projections presented in this way are useful in informing the public debate about the choices and priorities for policy.

For NZS payments and working-age welfare benefits, the growth rate in (nominal) payments to recipients is deflated by CPI growth. The result is a real 66% cumulative increase for NZS payments between 2013 and 2050, while working-age benefit payments stay constant (since these transfers are indexed to inflation, not wages).

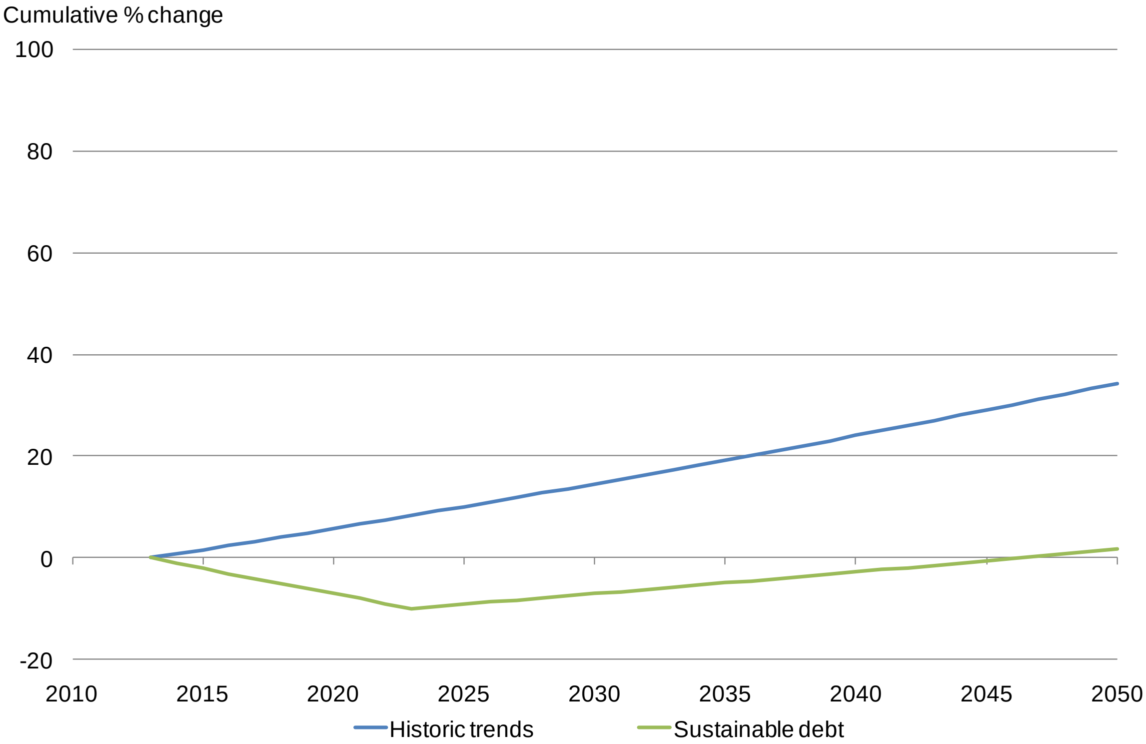
The basket of publicly-funded services is calculated by deflating nominal expenditure by price factors (a function of inflation, wages, and public sector productivity) and removing the volume changes reflecting demographic change. This puts the basket on a quantity per capita basis. Thus the growth of the basket of public services is exactly determined by the non-demographically driven volume growth parameter (p_t).

Figure 6.4 shows the basket of publicly-funded services, comparing the projections for the historic trends and sustainable debt scenarios. The key point is that if the fiscal adjustment falls on public services, as modelled in the sustainable debt scenario, the basket of public services is much reduced relative to the historic trends scenario. Indeed it declines in absolute terms through to 2023, before rising somewhat thereafter so that by 2050 the basket is just 2% above its level in 2013.

The projection for the basket of publicly-funded services crucially depends on assumptions for the price deflator since it is a volume measure. In Figure 6.5 we plot the growth in real expenditure (ie, using CPI as a price deflator instead of CPI + 0.9%).

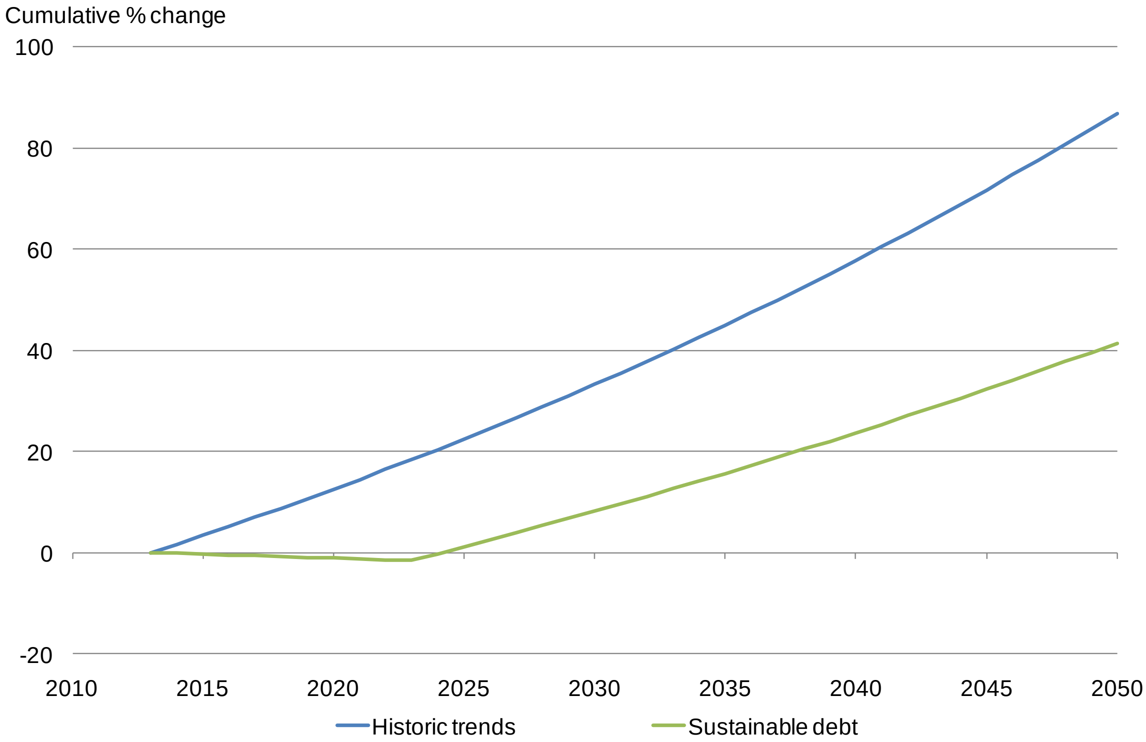
The result is that the expenditure measure (Figure 6.4) is around 40 percentage points higher than for the volume measure (Figure 6.5) by the end of the projection period in 2050. The difference is explained by expenditure increases being absorbed by wage growth – an illustration of Baumol's cost disease.

Figure 6.4 – Volume of public services per capita



Source: The Treasury. Note: "Per capita" refers to the relevant population of recipients for the public goods or services. Health and education recipient populations are adjusted for specific demographic shifts (ie, ageing). For other public services the modelled recipient population is the entire national population.

Figure 6.5 – Public services expenditure per capita (inflation adjusted)



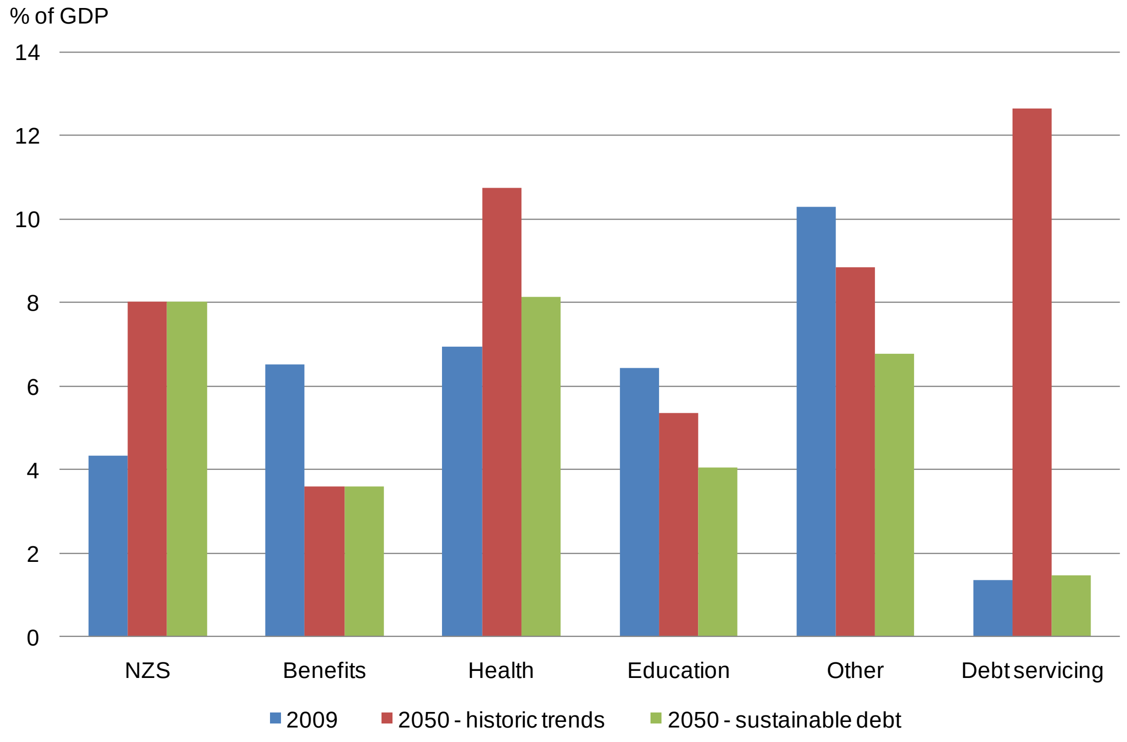
Source: The Treasury

6.4 Spending areas as a proportion of GDP

Figure 6.6 shows how spending across the sectors changes under the two scenarios. Our assumptions about NZS and benefits mean that these components are the same in both scenarios. This means that growth in the other components under the sustainable debt scenario is more constrained than in the historic trends scenario. For illustrative purposes, we continue to let the different demographics affect the various components, but scale back the services per person in each spending area by the same proportion relative to the historic trends scenario. Our assumption is that future governments would apply constraints across spending areas relatively equally, apart from demographic pressures. Future governments may choose to allocate available funds differently due to changes in societal preferences or as-yet unknown factors affecting the cost of services.

Under the sustainable debt scenario, education and other spending decline as shares of GDP, relative to 2009. Health increases as a share of GDP, due to the relatively larger impact of demographic changes on health care, but the growth is much lower than under the historic trends scenario. Debt servicing costs remain stable, reflecting the constraint on debt over the long term. The conclusion is that, given current policy settings, NZS continues to grow at the expense of other public services, such as health and education.

Figure 6.6 – Spending shares – sustainable debt and historic trends



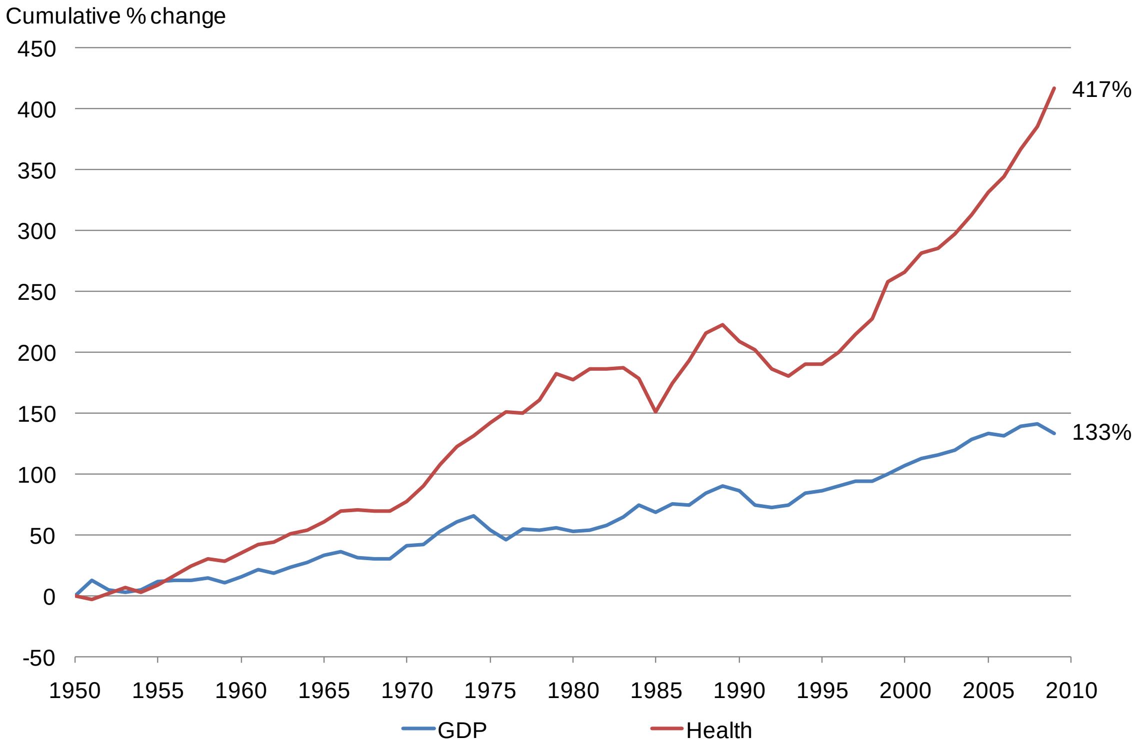
Source: The Treasury

7 Health care

7.1 Drivers of health spending

Publicly-funded spending on health care has more than doubled as a share of GDP over the past 60 years, rising from around 3% in 1950 to 6.9% in 2009. In dollars per person, the amount spent by the government has risen from $550 per person in 1950 to $2,870 per person in 2009 (both in 2009 dollars). Figure 7.1 shows how health spending per person has grown faster than GDP per person, in real terms, over this period. This trend has been particularly marked since the mid-1990s.

Figure 7.1 – Health spending and GDP per person – inflation-adjusted



Source: The Treasury

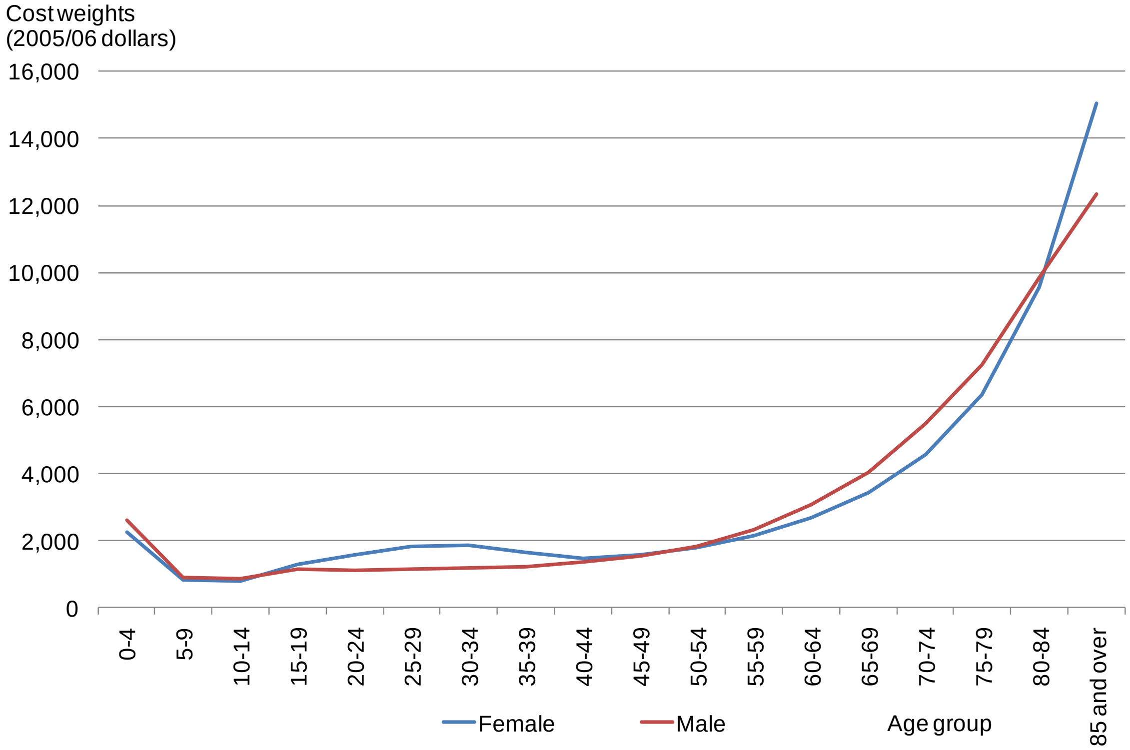
The drivers of this growth in health spending are both demographic and non-demographic in nature. Most research suggests that non-demographic factors, such as income growth and technological change, have historically played a larger role in the growth of health spending than demographic factors, such as an ageing population (Bryant *et al*, 2004; OECD, 2006; Smith *et al*, 2009). These factors are discussed in more detail below.

7.1.1 Demographic factors

Demographic factors that affect health spending include population growth and the age distribution of the population. As discussed Section 3, New Zealand's population is ageing as a greater proportion gradually shifting into the older age groups. Population ageing affects health spending, since older people tend to need more health care – as

Figure 7.2 shows. In reality, age is being used as a convenient and effective proxy for the real drivers of health spending – since “distance to death” and the incidence of disability are more direct drivers of health spending than age per se (“distance from birth”). These issues are discussed more fully, in a New Zealand context, in Bryant *et al* (2004) and in the *2006 Statement*.

Figure 7.2 – Health cost weights, by age group



Source: Ministry of Health

Nevertheless, the effects of population ageing on heath spending have been relatively modest in recent decades – accounting for no more than 10 to 15% of the real increase in spending per person since 1970.[17]

Although this ageing effect will become progressively more important through the 2020s and 2030s, it is not usually projected to become the dominant driver of future spending growth. The main drivers of health spending have been, and will continue to be, income growth and technological change – both of which affect the demand for, and the cost of supplying, health care.

7.1.2 Non-demographic factors

Non-demographic factors, such as income growth and technological change, affect both the supply of, and demand for, health care. Furthermore, health sector institutions and policy settings also affect how these drivers give rise to growth in health spending. These various factors interact with each other in ways that are not fully understood. Consequently, there are different approaches to understanding the drivers of past and future health spending. A typical approach, which we employ here, is to project the future

[17] New Zealand Treasury (2006), OECD (2006).

using assumptions derived from a decomposition of past spending – using the known values of factors such as GDP growth (for example, OECD, 2006; Smith *et al*, 2009).

National income growth matters. Economy-wide productivity growth drives real incomes, and the long-run cost of labour – the major input into health-care services. Since productivity gains tend to be relatively low in labour-intensive service industries, such as health, the real cost of delivering health care has tended to rise over time. Higher incomes also tend to be accompanied by higher public expectations of the range and quality of health services.

Public expectations of the health system also increase as technology progressively extends the range of possible treatment options. For example, treatments for heart disease have evolved from bed rest and aspirin in the 1950s, to a range of treatments that now include coronary bypass surgery and angioplasty. New treatments provide real benefits to patients but tend to involve new spending with relatively high unit costs. Although technological innovation can lead to a decline in the cost of a service, overall spending can rise if the use of the service increases.[18]

As discussed earlier in Section 6, the productivity of publicly-funded services can affect spending growth. But the productivity of health care services is difficult to measure accurately for a number of reasons, such as the lack of comprehensive information about service outputs. Although some macro-economic approaches to productivity measurement suggest there are long-run productivity gains in health care services (eg Tripplett and Bosworth, 2003), health system-level measures of inputs and outputs show declining productivity. Available measures of this type tend to be relatively recent short-run series.

In the case of New Zealand, the productivity measure covers hospital-based services, given data limitations for non-hospital services. System-level examples of a recent decline in health care productivity include measures from New Zealand (Ministry of Health, 2009), the United Kingdom (Office of National Statistics, 2006) and the Netherlands (Chessa and Kleima, 2003). In each case, the measured decline is due to outputs growing more slowly than recent growth in inputs, although as each study notes, there are real difficulties in measuring the changing quality of outputs. These measures also need to be looked at alongside other proxy indicators of system productivity, such as the average length of stay in hospitals. For example, technological developments and administrative practices in hospitals enabled the average length of stay in public hospitals in New Zealand to be halved between 1989 and 2001 – suggesting some productivity gains over this period (Ministry of Health, 2008).

The institutional arrangements within the health system – how services are funded, and how and where they are delivered – also matter for spending growth. In a health system dominated by public funding, as the New Zealand system is, these cost and coverage pressures can lead to government initiatives to expand services and increase existing entitlements. In recent years, discretionary policy choices have been a major driver of the growth in health spending – accounting for at least half of the increase between 2002 and 2008 – in addition to spending increases to manage price and volume pressures.[19] In addition, the government relies on agents at all levels of the health system, including District Health Boards (DHBs), Pharmac, and clinicians, to allocate resources and

---

18 Congressional Budget Office (2008).

19 Calculated from Ministry of Health data on Vote Health initiatives.

manage cost pressures. The way people are organised and motivated affects how efficiently resources are used, and how spending pressures are managed.

7.2 Modelling assumptions

The projection of health care expenditure follows the general LTFM framework for expenditure on public services, outlined in Section 6. Growth in nominal health care expenditure is therefore composed of factors driving growth in the price and the quantity of services, modelled in a way that is consistent with past trends.

The parameter values used for the historic trends scenario also follow the general form for public services expenditure, with annual price growth being composed of inflation (π_t = 2.0%), real input price growth (w_t = 1.2%), and productivity (a_t = 0.3%). Annual growth in the quantity of health care services is composed of demographically-driven growth (d_t = 1.4% on average) and non-demographically-driven growth (p_t = 0.8%). As noted in Section 6, the non-demographically-driven growth parameter is the residual growth in past expenditure that is not attributable to other drivers, and is derived from trends across government services. In a health care context, this parameter represents demand for new services, for example, due to technological changes expanding the scope of treatments.

The equation below outlines the framework for modelling public services expenditure, also explained in detail in Section 6.

$$\frac{E_t}{E_{t-1}} = (1+\pi_t)(1+w_t)\left(\frac{1}{1+a_t}\right)(1+d_t)(1+p_t)$$

The single exception to using the general parameter values for health care is for demographically-driven volume growth, which has health-specific cost weights and assumptions. The approach used to quantify the demographically-driven component of health spending growth is largely unchanged from that used in the *2006 Statement*. This approach captures population growth and the effects of population ageing as a greater share of the population shifts into older age groups, which have historically received higher levels of spending. To capture this ageing effect, population projections are multiplied by age-sex specific cost weights, obtained from historic spending patterns across personal health, disability support, mental health, and public health services.[20] Health spending increases as a greater share of the population moves into older age groups, and into the higher cost weights. We again assume that the projected longevity gains translate into further years of good health, and adjust the cost curve for those aged 60 year and above, so that by 2050, the relative health costs of a person aged 65 years are assumed to be equivalent to a person aged 60 in 2009.

[20] The cost weights for disability support services include cost weights for people aged less than 65 years, and people aged 65 years and over (known as health of older people services).

7.2.1 Changes from 2006

The modelling approach used in the *2009 Statement* includes a number of changes from the approach used to model future health spending in the *2006 Statement*. In 2006, health spending was modelled using the following framework:

- demographically-driven growth, comprising population growth, the effects of an ageing population and changing health status
- nominal GDP growth as a proxy for income growth (implicitly capturing some growth in input prices such as wages)
- income elasticity of demand, capturing the demand for health care services as incomes rise, and
- a residual growth factor, capturing expenditure growth beyond the effects captured by demographic and income-driven changes (eg relative-price changes or increasing service scope due to new technology). This factor was obtained after back-casting known variables, population growth, population ageing, income growth and income elasticity of demand (assumed to be unitary) through history. The base case included an assumption that this residual growth factor would be subject to intensifying long-run cost containment measures, equivalent to the residual abating incrementally from 1.0% to zero over the projection period.

The general modelling form was:

$$E_t = E_{t-1}(1 + cw_t)(1 + g_t)^{\epsilon}(1 + r_t)$$

where:

E_t = health spending

cw_t = growth of Σ cost weights x population group (summing over age and sex)

g_t = nominal GDP growth

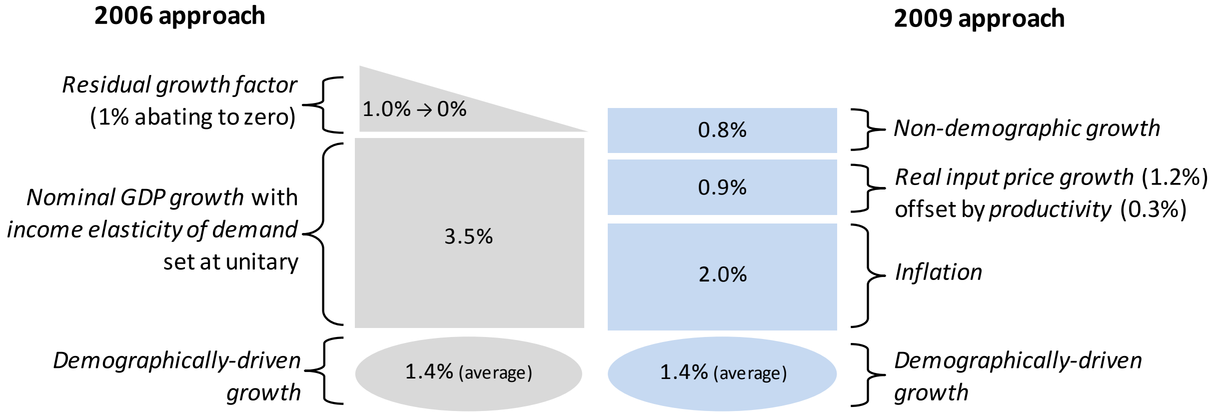
ϵ = income elasticity of demand for health services, and

r_t = a residual growth factor.

The 2006 approach used nominal GDP growth (3.5%), combining assumptions about inflation (2%) and real wage growth (1.5%). The 2006 base case projection set the income elasticity of demand to 1.0. The residual growth factor was set at 1.0%, and incrementally abated to zero over the projection period under the assumption of unspecified cost containment measures.

Figure 7.3 shows how the 2006 approach relates to that used in 2009, using a graphical representation. As noted above, the method for projecting demographically-driven growth is unchanged, with annual increase averaging 1.4% over the projection period (varying from 1.5% per year at the start of the projection to a peak of 1.9% in 2025, before tapering down to 0.7% by 2050). In contrast, the 2009 model rearranges the 2006 non-demographic factors of nominal GDP growth, income elasticity of demand, and the residual growth factor (representing cost and coverage decisions due to technology) into price components (inflation, real input price growth, offset by productivity gains) and a quantity component (non-demographic volume growth). As noted in Section 6, the new method has the advantage of enabling expenditure growth to be decomposed into price and quantity components, and allowing some flexibility to test different assumptions about public sector productivity.

Figure 7.3 – Modelling health spending growth – 2006 versus 2009



7.3 Results

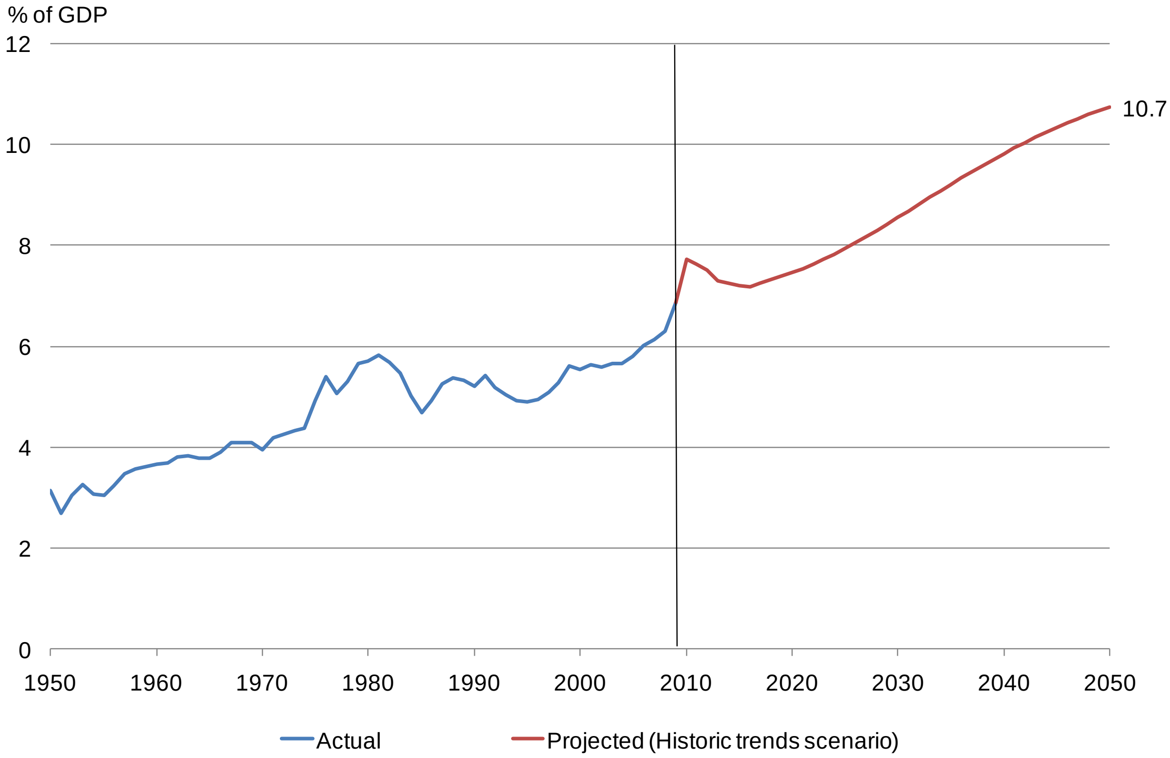
Under the historic trends scenario, health spending continues to grow faster than GDP, increasing from 6.9% of GDP in 2009 to 10.7% in 2050. This increase equates to average nominal growth of 5.0% per year.

As Figure 7.4 shows, this projection is a continuation of a long-run trend. The spike in this ratio at the beginning of the projection period represents a continuation of recent spending growth in the context of a flat or declining GDP due to the economic recession. The ratio declines slightly between 2010 and 2016 because of forecasts of relatively slower health spending growth in the short term in the context of GDP growth increasing back to long-run trend.

The model shows that although the ageing of the population becomes increasingly important, it is not projected to be the dominant driver of spending growth. The impact of ageing accounts for around 0.5 percentage points of spending growth per year at the beginning of the projection period, or around 10% of the annual increase in health spending. This ageing effect rises through the projection period, peaking in the late 2020s and early 2030s at around 1.2 percentage points, or 20-22% of the annual increase in health spending.

Setting aside the impact of raw population growth, the main drivers of spending are the decisions around the costs and coverage of the health care system. This finding mirrors the result obtained in the *2006 Statement*, and is also consistent with other New Zealand-specific modelling of future health costs, such as Bryant *et al* (2004), the OECD (2006), and Winton (2009).

Figure 7.4 – Health, 1950-2050 – actual and projected (Historic trends)



Source: The Treasury

7.3.1 Sensitivity analysis

Modelling future health spending is an inherently uncertain task. The complex interactions between the drivers of spending, the ambiguous impact of future technological developments, and the fact that service entitlements are generally not specified all mean that projecting future health spending is not straightforward. Given this uncertainty, we apply a number of sensitivity tests to the parameters used in the base case to quantify the potential impacts of different, but plausible, assumptions about real input price growth (*w*), productivity growth (*a*), and non-demographic volume growth (*p*).

This sensitivity analysis, discussed below, produces results that range from health care spending comprising 9.6% to 15.4% of GDP in 2050. This range compares with the base result of 10.7%.

We have not tested changes to demographic parameters, such as the implicit assumptions about longevity, the incidence of disability or future mortality rates. This is partly due to time constraints, and partly due to the fact that sensitivity testing in the *2006 Statement* showed that alternative assumptions about the incidence of disability or reductions in mortality had relatively small impacts on health spending as a share of GDP.

Real input price growth

A higher value for the annual price growth of clinician labour could be considered plausible, given the fact that New Zealand competes internationally for increasingly specialised clinician skills (see Medical Training Board, 2009). Our base case assumes real wage growth in the health sector follows economy-wide wage growth over the long run – set at 1.5% per year in the model. We also model an illustrative scenario where real wages for hospital-based clinicians grow at the higher rate of 2.5% per year – equivalent to additional wage growth of 1.0 percentage point per year.

In estimating the effect on health spending, we assume that clinician labour costs are around 10% of health spending – an assumption based on data from DHB consolidated accounts.[21] This assumption leads to overall real wage growth in health care being 1.6% per year – ie (0.1 x 2.5%) + (0.9 x 1.5%). Real input price growth (w) is therefore 1.28% per year, after the labour share scalar of 0.8 is applied (as explained in Section 6). Under this scenario, health spending increases to 11.1% of GDP in 2050 – slightly higher than the base result of 10.7% of GDP.

The assumption of a 1.0 percentage point real wage premium can be extended to hospital-based nursing costs, which comprise around 12.5% of health spending. Using this higher real growth rate for both clinicians and nursing wages gives a real input price growth rate (w) of 1.38% per year. Under this scenario, health spending increases to 11.5% of GDP in 2050.

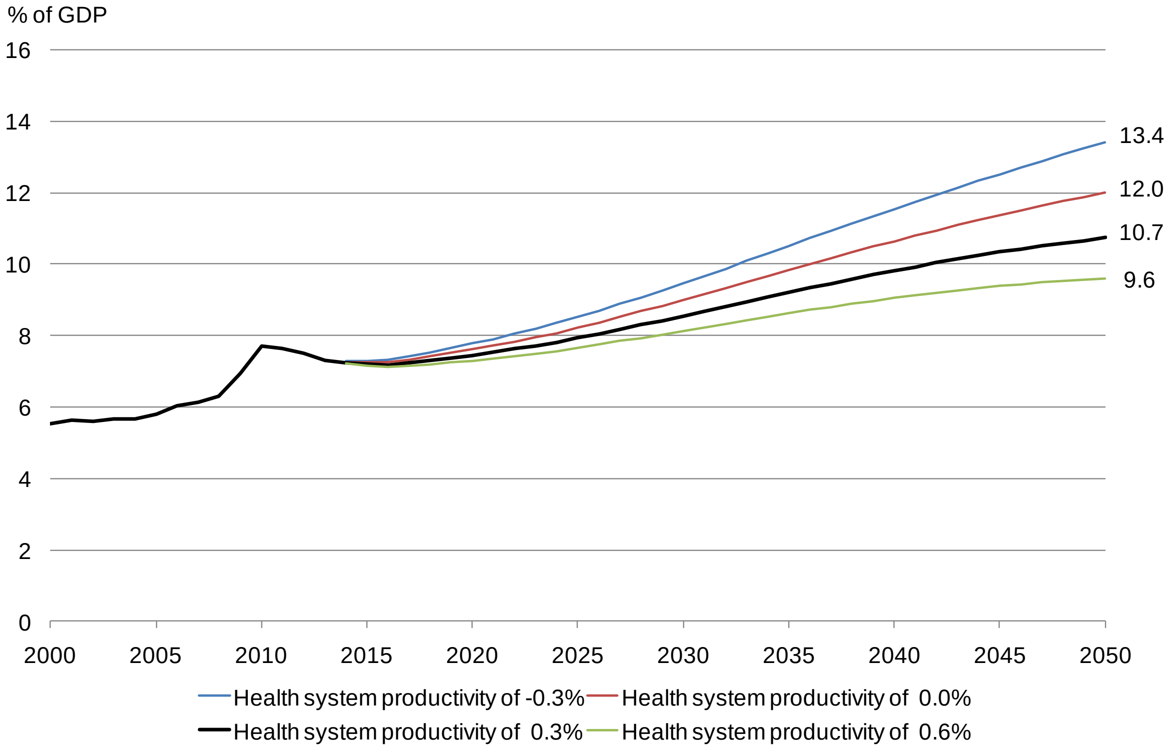
Productivity growth

The result is sensitive to assumptions about the productivity of health care services, as Figure 7.5 shows. A lower productivity assumption than the base case assumption of 0.3% sees health spending grow more rapidly, since fewer services are obtained for a given level of spending. For example, the model shows that if zero productivity gains are assumed, health spending grows more quickly, reaching 12.0% of GDP in 2050. An assumption of productivity declining by -0.3% per year sees health spending reach 13.4% of GDP by 2050.

Conversely, an assumption of higher productivity leads to slower growth in health spending, since more services are provided each year for a given amount of spending. An assumption of productivity gains of 0.6% per year leads to health spending reaching 9.6% of GDP in 2050. These results suggest, unsurprisingly, that productivity gains can make a difference to the rate of spending growth over the long run.

[21] Consolidated accounts for District Health Board annual plans show clinician personnel costs comprise around 20% of DHB provider arm expenditure, which itself accounts for around half of publicly-funded health expenditure.

Figure 7.5 – Health spending under a range of productivity assumptions



Source: The Treasury

Non-demographic volume growth

As discussed earlier in Section 6, the assumption of 0.8% per year for non-demographic volume growth is a judgement, based on aggregate expenditure trends across all public services funded by the government. A slightly higher value of 1.0% per year could be considered appropriate for health care, depending on the period of history being examined. This higher value would fit with an assumption that health care is an area where technological developments are likely to play a relatively strong role in driving future demand for services – beyond that driven by demographic changes. Using an assumption of 1.0% growth in non-demographic growth per year produces a result where health spending reaches 11.6% of GDP in 2050 – higher than the base case by nearly 1 percentage point of GDP.

Combined effect of high cost growth assumptions

The assumptions informing the sensitivity tests that give rise to a faster rate of spending growth can be combined to produce a high cost growth scenario; low productivity (-0.3%), high non-demographic demand growth (1.0%) and high input price growth (1.38%) due to a wage premium for hospital-based clinicians and nurses. The combined effect of these assumptions produces a result where health spending reaches 15.4% of GDP in 2050.

7.3.2 Comparison with previous projections

The base case within the *2006 Statement* projected health spending to reach 12.4% of GDP in 2050 – 1.7 percentage points higher than the historic trends base case in the *2009 Statement*. Similarly, the average nominal growth rate of health spending in the *2006 Statement* was 5.8% per year, compared with 5.0% in the *2009 Statement*.

As discussed in section 2.5, there are a range of factors that account for the differences between the projections in 2009 versus 2006. The relatively slower path of projected health spending growth in the *2009 Statement* is largely due to the change in the non-demographic components of the modelling approach – such as the use of non-demographic demand growth and constant productivity gains in place of the abating residual growth factor. In the *2006 Statement*, the annual increase in non-demographic factors begins at 4.5%, declining to 3.5% in 2050, as the residual growth factor abates from 1.0% to zero due to assumed cost containment measures. This rate of growth is initially higher than the constant rate of 3.7% used in 2009, creating a higher spending base to which other drivers are subsequently applied over the projection period.

Both *Statements* project a range of results for health spending as a share of GDP. The *2006 Statement* produced a low cost growth scenario of 9.7% and a "high elasticity" scenario of 15.7% of GDP in 2050. These scenarios were based on varying the base case assumptions, such as the income elasticity of demand for health care and cost containment measures. This range is similar to that obtained in the *2009 Statement*, where health spending is projected to reach between 9.6% and 15.4% of GDP in 2050.

The OECD (2006) has also projected a range of future spending levels for publicly-funded health spending in New Zealand. Under a cost pressure scenario, where the effect of technology and higher prices continue to rise at the historical rate, health spending was projected to reach 12.6% in 2050. Under a cost containment scenario, where governments pursue policies to manage spending growth, health spending was projected to reach 10.0% in 2050.

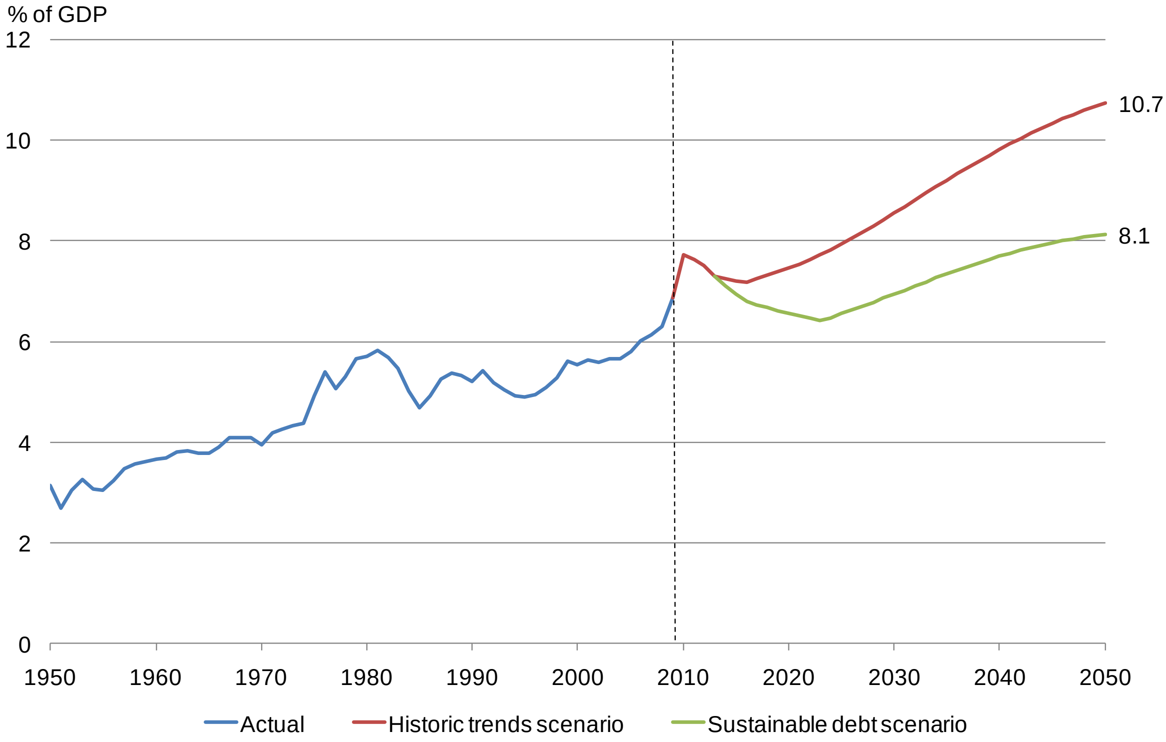
The range of published results indicates that there is no single, or correct, projection of health spending growth. Much depends on the choice of modelling approach, the period of history used for estimating the strength of different drivers, and the assumptions about future technological changes. But the common feature of the projections discussed above is that health spending is expected to continue to increase faster than national income, and therefore rise significantly as a proportion as GDP – anywhere from 50% more, to a doubling as a proportion of GDP over the next 40 years.

7.4 Sustainable debt scenario

The historic trends scenario provides a sense of long-run spending pressures within health care, but is somewhat removed from the fiscal constraints facing the government. The sustainable debt scenario, as outlined in Section 2.4.2, imposes a constraint on government spending that is consistent with net government debt trending back to 20% of GDP in 2050 (and assumes no increases in tax rates, and no changes to major policy settings, such as NZS). The sustainable debt scenario allocates available spending to meet projected demographic pressures in areas such as health care and superannuation. The remaining portion of available spending is then allocated proportionally across spending areas according to the share of existing expenditure base.

Under the sustainable debt scenario, spending on health care grows at an average of 4.3% per year, reaching 8.1% of GDP in 2050. As Figure 7.6 shows, this level of spending is well below the result obtained in the historic trends scenario (10.7%). This result also represents a lower level of spending than that obtained under the most favourable productivity assumption in the historic trends scenario, where health spending reached 9.6% of GDP in 2050. The magnitude of the fiscal constraint suggests that substantial productivity gains alone would not be enough to allow the health system to match the quantity of services modelled under the historic trends approach.

Figure 7.6 – Health spending under the sustainable debt scenario

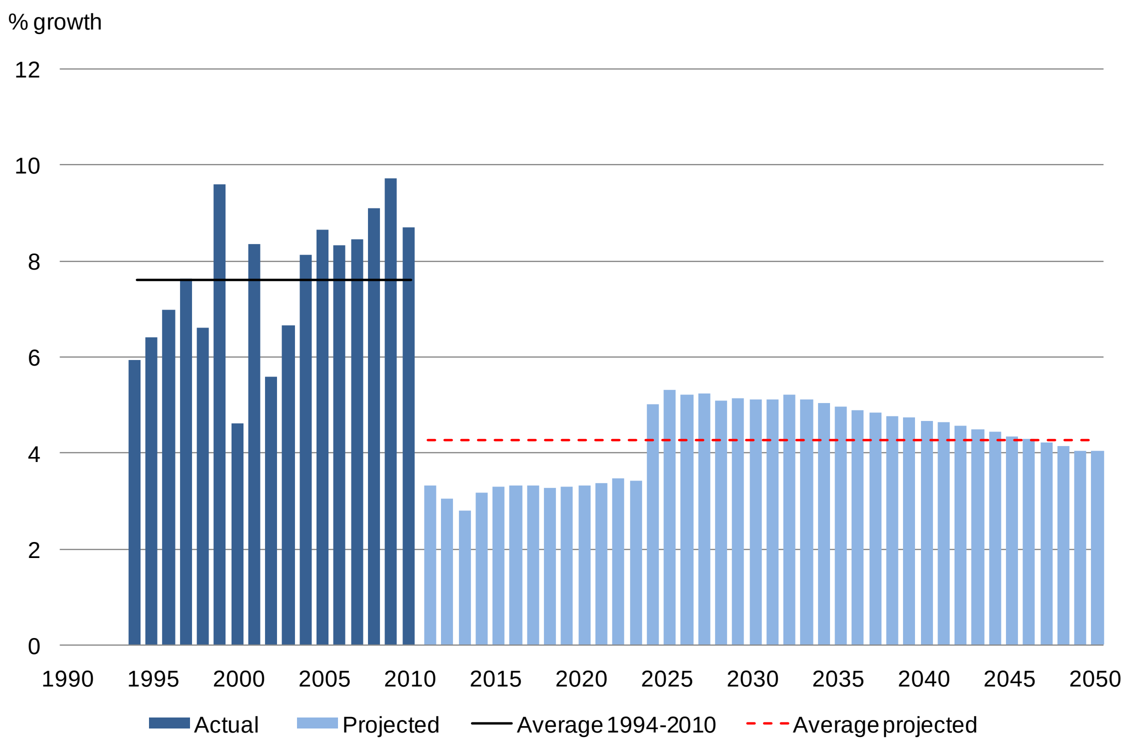


Source: The Treasury

Under the sustainable debt scenario, the annual increase in spending averages 4.3% – lower than the average of 7.6% per year since 1994, as Figure 7.7 shows. The rate of annual increase is lower during the initial period, at 3.3% per year until 2023, as the government limits spending increases in order to manage rising net debt. After net debt is reduced to around 30% in 2023, the operating allowance of new spending is adjusted so as be consistent with net debt gradually being reduced down to 20% of GDP in 2050 –the Government's long-term net debt objective. This allows some room for the rate of health spending to increase after 2023. The annual increases in spending are projected to reduce gradually after the mid-2030s, as the effect of population ageing slowly subsides.

The sustainable debt scenario implies a level of spending that would allow inflation (2%) and average annual real input price growth (0.9%) pressures to be met in the medium term. Demographic and non-demographic demand pressures would be only partially met – implying a reduction in health services per capita of around 10% by 2023, similar to that illustrated with the basket of public services in Figure 2.3. After 2023, higher spending growth allows population growth pressures to be met, and some scope to increase the bundle of services per capita. In 2050, service levels approximate those reached in 2013.

Figure 7.7 – Annual nominal growth in health spending – sustainable debt



Source: The Treasury

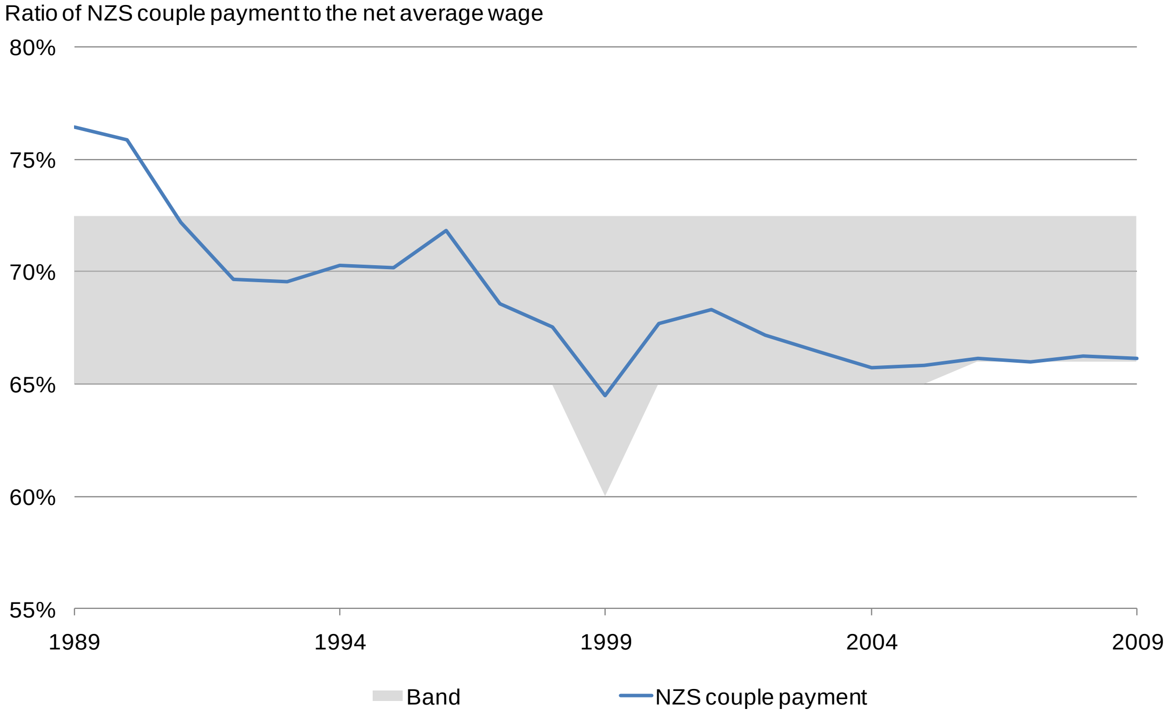
8 New Zealand Superannuation

New Zealand Superannuation (NZS) is a publicly-funded universal pension. Spending on NZS is determined by several parameters relating to the age of eligibility and the payment amounts. Current policy settings are that people are eligible from the age of 65 years, and that a couple receives a combined pension of at least 66%, and not more than 72.5%, of the net (after tax) average wage.[22]

Figure 8.1 shows that the lower limit or "floor" of this band has been adjusted several times over the past two decades – from 65% in 1989, to 60% in 1999, and to 66% in 2006. Figure 8.1 also shows that the ratio of NZS to the net average wage has been moving towards the floor. This is because NZS payments are adjusted with CPI inflation as long as the NZS-wage ratio is within the band, whereas the net average wage tends to grow faster than inflation over the long run. Despite this trend, the annual CPI adjustments mean that the NZS payments have maintained their purchasing power.

In 2009, the ratio is just above 66% of the net average wage, but is forecast to reach 66% in 2010. After the NZS-wage ratio reaches this floor, NZS payments grow with the net average wage, which means increases in purchasing power. Changes to tax rates can affect the average wage and NZS payments differently, and can account for upward movement of the NZS-wage ratio.

Figure 8.1 – Ratio of the NZS couple payment to the net average wage



Source: The Treasury.

[22] People in other living arrangements, such as a single person living alone, are paid set proportions of the "couple" rate.

8.1 Projecting NZS spending

Using current parameters for eligibility and the payment amount, it is possible to project the level of expenditure on this programme.

8.1.1 Modelling NZS

NZS is modelled in the LTFM as follows:

$$B_t = B_{t-1}(1 + n_t)$$

where:

B_t = the average NZS payment in year *t,* and

n_t = nominal (net) wage growth (3.53% per annum after 2013, assuming that tax rates do not change).

If personal tax rates change, then the growth of the net wage will change its relationship with growth of the gross wage and the model takes this into account in calculating n_t.

If E_t is spending on public pensions, then:

$$E_t = E_{t-1}(1 + b_t)(1 + r_t)$$

where:

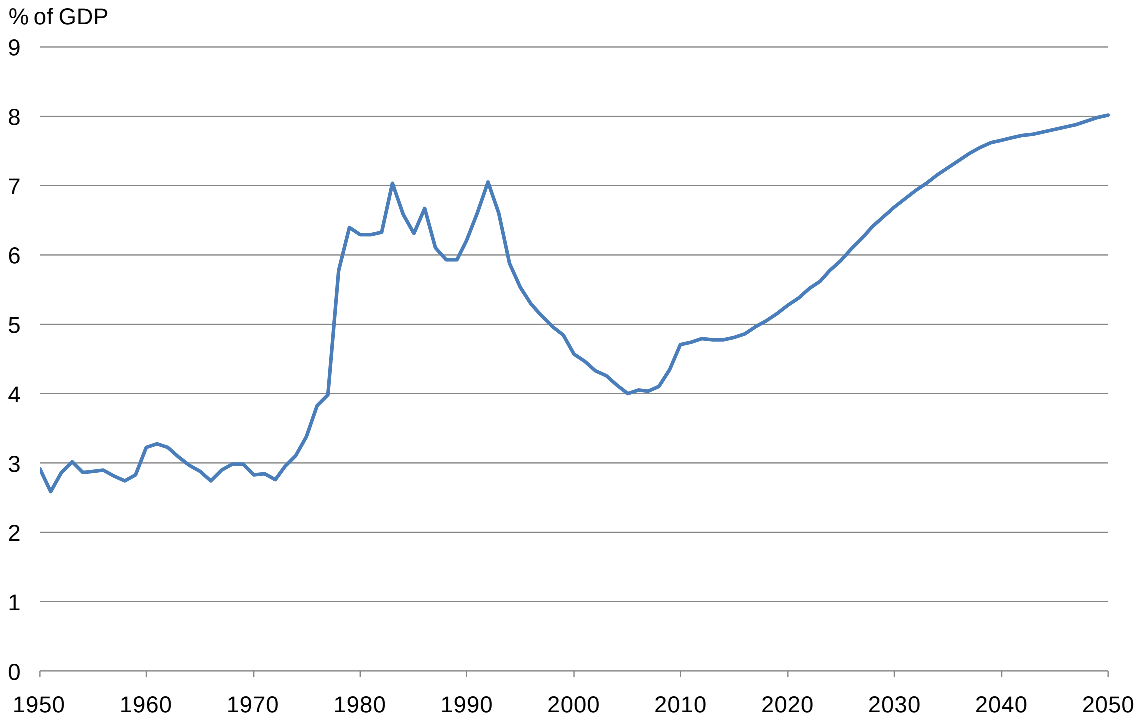
b_t = the growth of B (equal to n_t), and

r_t = the growth of population aged 65 and over.

Spending on public pensions in the last forecast year of the *2009 Budget,* E_{2013}, contains information about the mix of different levels of payment according to living arrangements of people aged 65 and older. This method of projection implicitly assumes that the mix does not change through time (which it would if the rate of partnership formation, for example, changed).

As the number of people aged 65 and older in the population more than doubles between 2009 and 2050, it is not surprising that spending on NZS relative to GDP grows by 2¼ times. Figure 8.2 shows how expenditure on public pensions would grow, as a percentage of GDP, if current policy settings were to be retained. This figure also shows the large rise in 1977 and the following years when the age of eligibility was moved from 65 down to 60 and the size of the married payment moved to about 80% of the net average wage. Low birth rates in the 1930s, the raising of the age of eligibility from 60 to 65 between 1992 and 2001 and changes to the relationship of pension payments with the net wage caused the cost of NZS to move down from 6%-7% of GDP to around 4% recently.

Figure 8.2 – NZS spending under current policy



Source: The Treasury.

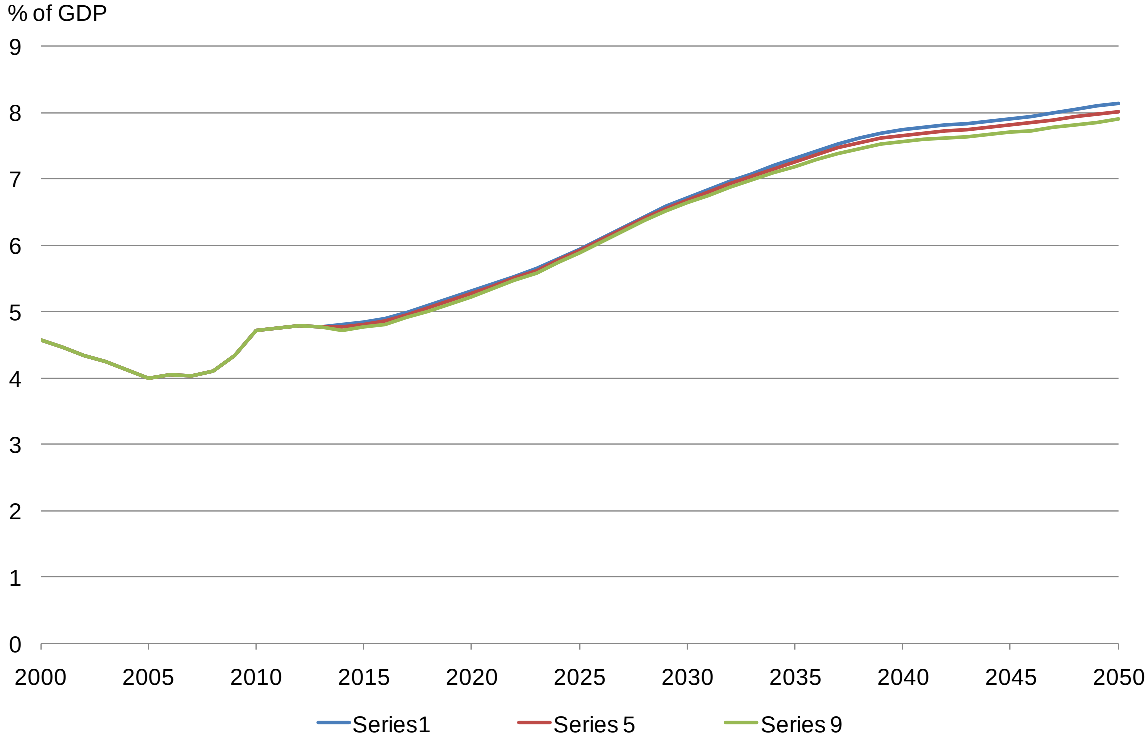
Note: Before 1999, the name and structure of the public pension were different. This figure uses NZS as a convenient name for all public pensions over this period.

8.1.2 Sensitivity of NZS costs to demographic changes

The demography section outlines the assumptions behind the central population scenario (Series 5) and two “central alternative” population projections: Series 1 with low growth and Series 9, the high growth scenario.

These population projections produce only small changes to the old dependency ratio in 2050. Figure 8.3 shows that these flow through to only small changes in the NZS costs as a share of national income

Figure 8.3 – Effects of changes to population scenarios on NZS cost



Source: The Treasury

8.2 Effect of NZS changes on costs and tradeoffs

This section examines the effects of four illustrative parameter changes to the existing settings for NZS:

1. raising the NZS eligibility age, roughly in line with increases in longevity
2. indexing NZS payments to a lower growth rate
3. targeting NZS payments, according to the income of the recipient, and
4. lowering the ratio of NZS payments to the average net wage.

Each change is modelled from 2017 onwards. When the NZS policy settings change and, for example, reduce the cost of NZS, then contributions to the NZSF will be less, and vice versa. The effects of these NZS changes are measured by:

- total NZS payments as a ratio to nominal GDP (macro cost effects)
- the effect of these changes on net Crown debt as a proportion of GDP under the historic trends scenario (macro debt effects with no other programme spending and tax changes)
- a measure of the replacement rate: the ratio of the "couple" NZS payment (before tax) to the average ordinary time wage (again, before tax), and

- changes to growth in the basket of public services per capita. This assumes under the sustainable debt scenario that savings made by changing NZS parameters would be used to bolster spending on services other than interest costs and benefits (spending trade-off effects).

What is not modelled is the effect of NZS changes on individuals' behaviour and hence on GDP. The size and perhaps even the direction of these are uncertain, but could affect output, national saving, and hence interest and exchange rates. A qualitative discussion along these lines follows a description of each of the changes.

Raising the eligibility age

To illustrate the size of the effects of raising the age at which someone is eligible to receive NZS, this subsection models an increase to 65.5 years in 2017, and thereafter by a further six months every two years and until it reaches 67 in 2023. Thereafter, it follows the projected six-monthly rises in the life expectancy of a person aged 65, and reaches 69 years in 2050. There are many ways this adjustment could be done. We have modelled a simple approach. The year 2017 was chosen as picked the starting point of the increase because we viewed it as sufficiently far in the future to allow people time to plan for the signalled changes (an important principle in pension reform). It is also the year that Australia has announced as the start of its pension-age changes.

A policy to lift the age of eligibility for NZS would need to be backed by an extension of unemployment, sickness and disability benefits to the age groups affected by this change. Therefore, the fiscal savings from adjusting the eligibility age would be partially offset by the cost of additional payments of benefits to some older workers or of a transitional benefit, as occurred with the changes to the age of eligibility between 1992 and 2001. Yet, even if all affected older workers were to receive these benefits, the increase in the eligibility age would still represent a fiscal gain, since these benefits are paid at a lower rate than NZS.

The modelled rise in pension age to 69 by 2050 produces a ratio of NZS to GDP that is 1.5 percentage points lower than would otherwise be the case. These scenarios reduce the potential numbers of NZS recipients but not the payment amounts. Hence, NZS payments to people do not change, but the affordability of the programme is improved.

With the historic trends scenario assumptions unchanged, except for the eligibility age moving up with rising longevity, the ratio of net debt to GDP moves down from 223% of GDP in 2050 to 201%.

Under the sustainable debt scenario, if we assume that savings from changing the age of eligibility from 2017 are shifted into other spending areas, then in real per capita terms the basket of public services eventually grows by 11% between 2013 and 2050 rather than by 2%. This change would not ameliorate the projected reduction in the size of the basket out to 2023, required to moderate the rise in debt seen in the historic trends scenario.

Table 8.1 – Effects of potential NZS changes from 2017 in 2050

Changes	NZS (% of GDP)[1]	Net debt (% of GDP)[2]	Replacement rate[3]	Growth of basket[4]	How make affordable?
Current NZS policy	8.0%	223%	33%	2%	(Current policy)
Eligibility age rises	6.5%	201%	33%	11%	Reduces recipients and
Change from current	-1.5%	-22%	0%	9%	keeps replacement rate
Indexation (CPI + 1)	6.9%	211%	28%	20%	Keeps recipients and
Change from current	-1.1%	-12%	-5%	18%	reduces replacement rate
Indexation (CPI)	5.0%	166%	20%	8%	Keeps recipients and
Change from current	-3.1%	-57%	-13%	6%	reduces replacement rate
Targeting (½ NZS, top ¼)	7.0%	185%	33% or 17%	8%	Keeps recipients and
Change from current	-1.0%	-38%	0% or -17%	6%	reduces replacement rate
Targeting (0 NZS, top ¼)	6.0%	147%	33% or 0%	15%	Reduces recipients and
Change from current	-2.0%	-76%	0% or -33%	13%	reduces replacement rate
Lower wage floor to 60%	7.4%	201%	30%		Keeps recipients and
Change from current	-0.6%	-22%	-3%		reduces replacement rate

Notes:

[1] Current policy: a couple 65 and older receives after-tax payments at least equal to 66% of the after-tax average wage.

[2] This has the historic trends fiscal scenario with only NZS changing.

[3] This is the ratio of the before-tax (couple) NZS payment to the before-tax average wage.

[4] Real growth of the basket of services (other than benefits and NZS) delivered to the average New Zealander 2013-50, under the sustainable debt scenario.

Indexing NZS payments to a lower growth rate

This section looks at two alternatives to the indexation of payments to net wage growth. Current policy indexes NZS payments to CPI, but with the additional requirement that the payments, net of tax, made to a couple must be between 66% and 72.5% of the average net weekly wage. This means that in a growing economy and with no tax-rate changes, NZS payments grow with wage growth, assuming that the payments follow the 66% floor. The LTFM assumes that wages grow by 3.5% annually, comprising price inflation of 2% per year, and 1.5% real growth.

If NZS payments are indexed to with price inflation alone, from 2017, then superannuitants would still be able to buy the same bundle of goods from year to year, but not a growing one. CPI indexation lowers the cost of NZS from around 8% to around 5% of GDP in 2050.

The modelling also considers a more generous indexation of CPI plus one percentage point (ie, 3% per year). This regime would lower the cost of NZS by 1 percentage point of GDP in 2050.

In each case, the ratio of a couple's single NZS payment to the average wage (both before tax) would be lower in 2050 than the present 33.2% – falling to around 20% for CPI indexation and to 28% for CPI + 1 indexation.

Under the historic trends scenario assumptions, with the only changes being the alternative NZS indexation regimes, the ratio of net debt to GDP drops by 12 percentage points for the CPI + 1 regime and by nearly 60 percentage points for the CPI indexation.

Under the sustainable debt scenario, if we assume that savings from changing indexation from 2017 are allocated to other spending areas, then in real per capita terms the basket of public services eventually grows by 20% between 2013 and 2050 for CPI indexation or by 8% for CPI + 1, rather than 2% in the wage-indexed case.

Targeting NZS payments

Targeting NZS towards those most in need is another way of reducing the cost of the programme, and potentially freeing up resources for public services. Universality is a strong feature of NZS, but it is costly. Targeting income support for the elderly is common around the world, and the challenge is designing a system that makes it difficult for people to prevent income from being included in the pension calculation and in doing it in a way that is administratively efficient. This section illustrates a simple targeting regime (which is assumed to be 100% effective in preventing the sheltering of income). The Statistics New Zealand Household Economic Survey 2006/07 indicates that for about 75% of people 65 and older, NZS makes up more than 80% of their income. For the rest, NZS makes up only about 20% of their income.

We model two scenarios of the effects of targeting where people 65 and older in the top income quartile have half (or all) the NZS removed by an income test. This is phased in over five years starting in 2017.

Under the historic trends scenario assumptions, with the only changes being the targeting regimes, the ratio of net debt to GDP drops by 38 percentage points for the halving NZS for the wealthiest quarter and by nearly 76 percentage points for cutting it completely for the wealthiest quarter.

Under the sustainable debt scenario, if we assume that savings from reducing NZS to the wealthiest quarter of people aged 65 and older are used for other spending, then in real per capita terms the basket of public services eventually grows by 15% between 2013 and 2050 for no NZS or by 8% for halving NZS, rather than 2% in the universal case.

Lowering the ratio of NZS payments to the average net wage

At present, the NZS payment (after tax) to each member of a couple has to be at least 66% of the average net wage. If this payment floor was to be reduced to 60% of the average net wage in 2017, then NZS payments would grow by inflation from 2017 to 2024 when they reach the new 60% floor (based on our assumptions about the relative growth of wages and prices). At that point, the NZS payments would be indexed to wage growth again. This produces a reduction in total NZS costs of 0.6% of national income by 2050 (although most of the gain is secured by the mid-2020s).

Lowering the wage floor from 2017 has the effect of lowering the projected net debt to GDP ratio in 2050 by 22 percentage points.

9 Working-age benefits

9.1 Definitions and projection method

Welfare spending, as discussed in the *2009 Statement* and this paper, refers to all social security and welfare expenditure listed in the government's accounts – with the exception of NZS. NZS is excluded because it is dealt with in its own section of the *2009 Statement*. While welfare spending includes some administration costs, the majority of it relates to benefits, transfers, and tax credits.[23]

Welfare spending is grouped into three different categories for the purposes of projections:

- Unemployment benefit (UB)
- Domestic purposes benefit (DPB), invalid's benefit (IB) and sickness benefit (SB)
- Other welfare assistance and expenses.

In each case, two drivers are applied to project forward the expense figures from their forecast values: projected recipient numbers and an indexation regime.

The different recipient groups are the main reason for differentiating the three categories, because the indexation regime applied (inflation indexation via the CPI) is the same for each category in all the main scenarios in the *2009 Statement*.

Unlike NZS, there is no legal requirement to index the various benefit and transfer rates. Despite this, since the early 1990s, the major benefit types (UB, DPB, IB, SB), as well as a number of smaller ones, have been inflation-indexed each year.

Working for families (WFF) tax credits are not inflation-indexed each year, but rather only when cumulative inflation, as measured by the CPI, related to their last indexation date has surpassed 5%. Not all of the WFF credits are indexed in this way – just the largest component, family tax credit, and the starting income level for abatement. A smaller component, minimum family tax credit, is inflation-indexed annually in a different manner.

A number of smaller benefit types and transfers are not inflation-indexed each year. Accommodation supplement (AS) is the only transfer of significant size that is not indexed. Despite this, and the fact that WFF tax credits are not indexed each year, the modelling here, and in the *2009 Statement*, assumes annual inflation-indexation for all welfare spending. Three reasons for doing this are outlined below.

- Benefit types or transfers that are not annually indexed, such as AS, tend to receive rate increases from time to time on an ad hoc basis.
- While the indexation of WFF tax credits is not annual, in the long-run it achieves similar results and indexing the abatement threshold ultimately results in higher amounts of non-indexed components, like the in-work tax credit, being paid out.

---

23 The major components are shown in the Core Crown Expense tables produced at each Economic and Fiscal Update (EFU). For the 2009 Budget EFU, see Table 4.2 at: http://www.treasury.govt.nz/budget/forecasts/befu2009/082.htm.

- The administration costs included in the category other welfare assistance and expenses are likely to grow with inflation at least, especially as wages are a big component of them.

The recipient numbers used for each major category attempt to reflect the growth of the main demographic groups involved. In the case of other welfare assistance and expenses, this is based on the entire population growth, because benefits such as WFF tax credits and even AS are received by males and females, of a wide range of ages and from various socio-economic groups.

9.2 Modelling of welfare spending

9.2.1 Unemployment benefit

Spending on UB is the largest of the income-tested benefits. In any projected year, the cost is grown from the previous year's value via the formula:

$$UB_t = UB_{t-1} \times (1 + \pi_t) \times \frac{LF_t}{LF_{t-1}} \times \frac{UR_t}{UR_{t-1}}$$

where:

t = the year that the variable refers to

UB_t = UB expenditure

π_t = inflation, as measured by annual growth in CPI

LF_t = size of the total labour force, and

UR_t = the unemployment rate.

The annual CPI-inflation rate represents the indexation regime of UB rates.

Multiplying the labour force by the economy-wide unemployment rate gives the number of people unemployed. The ratio of this calculation between consecutive years gives the annual growth in the number of people seeking work, which is used as a proxy for the growth in the numbers receiving UB.

In recent years in New Zealand until the recent recession, UB recipient numbers continued to fall while the unemployment rate levelled off, admittedly at a low level by historic standards. Despite this, matching the growth of UB recipient numbers to the growth of the unemployed is a logical way of projecting UB. The recession has seen the relationship between UB and the unemployment rate strengthen again.

9.2.2 Domestic purposes, invalid's, and sickness benefits

The remaining three major income-tested benefits are projected together, using an average of their respective demographic drivers. Given SB and IB numbers have grown more quickly than DPB recipients in recent years, it could be argued that these benefit types should be projected individually, and that may be the course followed in future Statements.

Spending on DPB, IB and SB in any projected year is grown from the previous year's value via:

$$E_t = E_{t-1} \times (1 + \pi_t) \times \left[1 + \sum_j (bp_j)(pg_{jt})\right]$$

where:

E_t = combined expenditure on DPB, IB and SB

π_t = inflation, as measured by annual growth in the CPI

Σ_j = summation over *j* groups (*j* refers to each of 22 age and gender groups, comprising the two sexes and 11 age groups: under 20, the nine subsequent 5-year age groups up to 64, and 65 and above)

bp_j = an average, across the three different benefit types, of the historic proportions of the total recipients of each benefit who are in the *j* age and gender group – these proportions are based on recent data from the Ministry of Social Development, and

pg_{jt} = the growth of the *j* age and gender group in year t of demographic projections.

As described above for UB, the inflation rate represents the indexation of the benefit rates.

The weighting of age-and-gender group demographic growth rates by the proportions of benefit recipients in each group achieves two things, namely:

- it concentrates demographic growth in the areas where benefit receipt is largest, eg the majority of DPB spending goes to females aged between 20 and 45, and
- it enables changes in demographics to be reflected in the benefit expenditure projections, eg because most people 65 or over qualify for NZS, benefit receipt is not high in this age group.

As noted in the *2009 Statement*, growth in SB and IB numbers have outstripped population growth over the last decade or more. Even the weighting of population growth into the age and gender groups where benefit receipt is concentrated does not fully address this difference. This suggests that stronger recipient growth could be built into projections, at least for SB and IB, and this might be an approach followed in future Statements. It was not attempted this time, mainly because:

- in the case of SB, in particular, the growth has been erratic – levelling out over some periods in history and accelerating in others – making it difficult to estimate an increment to apply to demographic growth, and
- projecting constant recipient growth above that of normal demographic change over a 40-year projection horizon runs a risk of significantly overstating benefit expenditure – especially given that policy and operational changes to reduce this growth in SB and IB are being developed.

9.2.3 Other welfare assistance and expenses

The rest of core Crown spending on social welfare is encapsulated in this third category. This includes WFF tax credits and significant transfers such as AS.

Spending on other welfare assistance and expenses is grown from the previous year's value via:

$$W_t = W_{t-1} \times (1 + \pi_t) \times \left(1 + \frac{pn_t + yp_t}{2}\right)$$

where:

W_t = expenditure on core Crown welfare except for NZS, UB, DPB, SB and IB

π_t = inflation, as measured by annual growth in the CPI

pn_t = growth of the entire population in year *t*, and

yp_t = growth of the population aged under 20 in year *t*.

Inflation growth in this category not only represents the indexation of benefit rates, but is a proxy for the indexation applied to WFF tax credits and the growth of administration costs.

The averaging of the demographic growth rates between that of the entire population and the under 20 group is an attempt to recognise the significance of WFF tax credits in this group. As these are only paid to families with dependent children, the under 20 demographic driver is a proxy for the growth rate of recipient families, especially as the tax credits are paid largely on a per child basis.

9.3 Alternative scenarios

The *2009 Statement* included an alternative projection of welfare spending, which differed from that used in the two main scenarios of the *2009 Statement* (historic trends and sustainable debt). This alternative scenario for welfare spending involved an assumed reduction in SB and IB recipient numbers, from 140,000 to 100,000 in 2013, and ceasing the inflation-indexation of WFF tax credits. It was outlined in the Benefits section of the *2009 Statement* and incorporated into the rebalancing scenario discussed in the subsequent Combined Scenarios section.

The change in modelling of the WFF tax credits for the alternative projection involves:

- separating WFF historical and forecast data from other welfare assistance and expenses data in the model, and
- growing the new WFF projection in the same way as other welfare assistance and expenses, as described earlier, but removing the annual inflation driver.

Creating the reduced SB and IB recipient number projection was more involved, as outlined in the following four steps.

1. Separate SB and IB historical and forecast expenditure data from that of DPB.

2. Apply the same projection drivers to the two separate lines (SB and IB, and DPB), as described earlier, except for DPB the historic proportion of recipients in each age and gender group is just based on DPB while for SB and IB the average excludes DPB proportions.

3. Reduce the end-of-forecast combined SB and IB expenditure base, used in the first projected year formula, by a ratio of 100/150. This reflects that the Budget 2009 forecast of combined SB and IB numbers was 150,000 in the year ended June 2013, while the scenario assumes this figure is reduced to 100,000 by this time.

4. After the adjustment in step (3), grow SB and IB expenditure by the manner outlined in step (2).

10 Indicators of fiscal sustainability

10.1 Debt, net debt and net worth

The path of the government's balance sheet over time can be analysed to assess fiscal sustainability, defined as the government meeting its inter-temporal budget constraint without policy adjustment.[24] A perpetually increasing debt track, as in the historic trends scenario, is inconsistent with fiscal sustainability. By contrast, a broadly stable debt outlook indicates that revenue and expenses are in balance over time (although not necessarily in any given year). The *2009 Statement* uses net debt as the main fiscal indicator. This differs from the *2006 Statement* which used gross debt.

As discussed in the *2009 Fiscal Strategy Report*, net debt is a broader measure than gross debt because it nets off some financial assets, which can be used to offset debt. Movements in net debt are more consistent with the net flow indicator as measured by the core Crown residual cash balance. Net debt is also less affected by a range of operational decisions, such as those made by the Debt Management Office or the Reserve Bank of New Zealand.

The definition of net debt used does not net off advances (eg, student loans). These advances are substantially less liquid than other financial assets and they are made for public policy reasons rather than for purposes associated with government financing. The financial assets of the NZS Fund are also not netted off. Their inclusion would require the Government's net debt objective to reflect a changing profile through time, as the purpose of the NZSF is to partially prefund future expenses.

Net worth is an even broader measure of the fiscal position, incorporating all assets and liabilities of the Crown. A projection of total Crown net worth is included in the *2009 Statement*.[25] Its path in the projections is dominated by the path of debt. In the historic trends scenario, net worth deteriorates significantly to -146% of GDP by 2050, while in the sustainable debt scenario it is stabilised at 50% of GDP. At 30 June 2009, net worth stood at 55% of GDP.

10.2 Primary balance

The projections for the primary balance are a useful way to indicate the size and time profile of fiscal imbalances. The primary balance is defined as the difference between primary revenue (core Crown tax revenue and non-investment income) and primary expenses (core Crown expenses excluding finance costs).

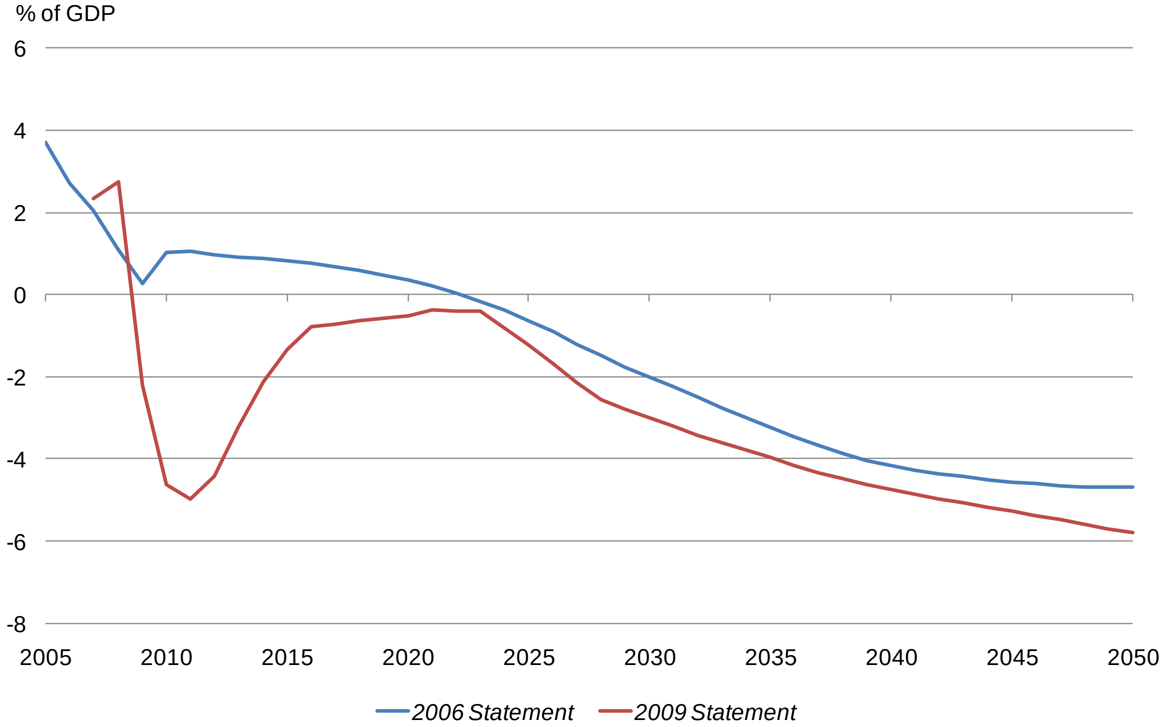
Figure 10.1 plots the primary balance for the base projection in the *2006 Statement* and the historic trends scenario in *2009 Statement*. The key features of the 2009 projection are (i) the move into deficit sooner than projected in 2006 and (ii) the primary deficits are

[24] The inter-temporal budget constraint is based on the notion that all government spending must eventually be financed, either in the current period through taxes, or over time through interest on debt (Janssen, 2002).

[25] Alternative measures of sovereign net worth are discussed in Irwin and Parkyn (2009).

projected to be larger in future years. The primary deficit is 5.8% of GDP by 2050 according to the 2009 historic trends scenario.

Figure 10.1 – Primary balance (% of GDP)



Source: The Treasury

10.3 The inter-temporal fiscal gap

The inter-temporal fiscal gap, or simply the fiscal gap, is another indicator of fiscal sustainability. It is defined as the permanent spending decrease or revenue increase that would be necessary at a point in time to ensure a specified debt-to-GDP constraint is met at the end of the projection horizon. The main benefits in using the fiscal gap are that it communicates the fiscal position in one summary number and indicates the magnitude of the required fiscal adjustment. Janssen (2002) has previously calculated a fiscal gap for New Zealand and it is regularly reported in some other jurisdictions (eg, Congressional Budget Office, 2009).

Results are shown in Table 10.1, where the fiscal gap for the historic trends scenario is used. The specific method used was to determine the change in core Crown revenue or expenses needed in order for net debt to equal 20% of GDP in 2050. No dynamic feedback from fiscal policy to economic growth was modelled. Calculations were done with an initial year of adjustment being 2014, 2024 and 2034.

Table 10.1 – Fiscal gap

	First year of adjustment		
	2014	**2024**	**2034**
Fiscal gap (% of GDP)	3.7	5.7	10.0

Source: The Treasury

The fiscal gap is 3.7% of GDP if fiscal adjustment starts in 2014, and rises if adjustment is delayed. This indicates why early changes are important: it is to ensure that large and sharp adjustments are not imposed on future generations. A 10.0% fiscal gap for 2034 would require a dramatic fiscal adjustment, equivalent to eliminating all expenditure on health care.

The fiscal gap for the sustainable debt scenario is zero. This is because it is a scenario constructed to meet the inter-temporal budget constraint.

11 Conclusion

11.1 Modelling refinements

This working paper has explained the modelling approach and key assumptions in the *2009 Statement* and provided more detail around the results. Changes in the modelling approach from that used in the *2006 Statement* have also been highlighted. In particular, the modelling framework for expenditure on public services has been refined. Parameters for public sector productivity and non-demographically-driven volume growth have been introduced, allowing expenditure on public services to be decomposed into price and quantity components. This innovation ensures our assumptions about service output levels are transparent, and allows some flexibility to test different assumptions about public sector productivity.

The framework for expenditure on public services has also been standardised across spending areas – in contrast to the *2006 Statement*, where health care expenditure was modelled differently from other areas. Using the same framework brings some consistency to the way drivers of government spending are modelled, while still allowing scope for the values of various parameters to be adjusted for individual policy areas.

Future *Statements* are likely to continue to refine the modelling approach and key assumptions. Some further areas to explore are listed below.

- The feasibility of including feedback loops between spending and revenue choices and economic variables could be investigated. Currently, the only feedback lies in the alternative scenarios involving an increase in tax revenue, where we model a consequent negative impact on economic activity. Examples of other potential feedback loops could include the links between tax and labour force participation, education spending and productivity, and NZS and savings levels.

- Assumptions about the economy's capital stock could be developed to accompany assumptions about long-run labour productivity growth.

- The analysis of uncertainty could be further refined. For example, the high and low scenarios around some parameter values could be standardised using percentiles of distributions of past realisations of data series, where these are available. The use of stochastic simulations could also be considered.

- The implications of modelling different productivity assumptions (Baumol's cost disease) between private and public sectors could be explored with. In particular, the implication and increasing relative price for publicly-funded services.

- The base case parameter values used for the non-demographic drivers of expenditure on public services could be varied between different spending areas, where there is a case to depart from the standard public-sector wide assumptions, for example, a higher or lower value for the productivity of services, or non-demographically-driven volume growth.

- Climate change represents an area where further refinement of the model may be needed in future. The economic and fiscal implications of future climate change commitments could be significant for New Zealand, and include the costs of meeting an emission target through mitigating emissions or purchasing carbon credits. As noted in the 2009 Statement, the Emissions Trading Scheme is assumed to be fiscally neutral over time, in line with the Government's indicated intention. Future versions of the model could be updated to reflect unfolding developments in this policy area.

11.2 Policy conclusions

This paper provides some general conclusions that can inform discussions about the challenges and choices, and associated trade-offs, that must be faced to ensure a sustainable fiscal future.

- Make early changes. The longer adjustments are delayed, the larger those adjustments will need to be in future. A number of adjustments, starting early, would be sufficient to maintain the fiscal position. Making early incremental policy change reduces the risk of eleventh-hour decision-making, and gives people time to adjust.

- Keep debt under control. If current policies lead to increasing debt, the resulting financing costs can quickly spiral out of control. Future generations will find it difficult to set their own spending priorities, or meet unforeseen challenges, if a large part of future revenue is required for servicing debt built up by previous generations.

- Encourage workforce participation. Demographic shifts mean all developed countries will be competing for labour and skills. Policies that encourage people to enter work, to stay in New Zealand or to return after their overseas experience, will help grow the economy and the tax base. Particularly important will be tax settings that spur employment, and policies that encourage older people to continue paid work that suits them.

- Focus on growth. Stronger economic growth means the country and individuals will be wealthier, resulting in a larger tax base. Decisions about fiscal settings should consider the impact on growth – this is particularly relevant for the overall level and mix of spending and tax. Many publicly-funded services contribute to economic activity in the private sector, so ensuring the right services are delivered as efficiently as possible can contribute to a more productive economy. However, while stronger growth helps, it will not solve the fiscal problem.

- Keep spending under control and lift public sector productivity. This would involve governments pursuing an ongoing strategy that includes:

  - Reprioritising within existing spending – discontinuing poor value spending and reprioritising the existing $64 billion spending base towards relatively more cost-effective services. All policies should be open for examination, since excluding some areas reduces flexibility and means that larger changes in spending will have to come from other areas, or from higher tax and debt. Reprioritising existing spending can also reduce demand for new spending.

- Setting a high threshold for new spending – any new spending being based on clear evidence of cost-effectiveness. It is easier not to introduce a poor-quality programme than to remove an existing one. Public sector chief executives have an important role in ensuring governments receive robust advice on the cost-effectiveness of policy initiatives.

- Securing a cost-effective mix of price, volume and quality for services – striving to get the same service for a cheaper price, targeting entitlements based on need or ability to pay and ensuring the quality standard is fit for purpose.

- Looking at institutional arrangements – ensuring that institutions, including those that make spending decisions or deliver services for the government, are incentivised to use resources in cost-effective ways and manage spending pressures within current resources.

- Managing public expectations – publicly debating what services the government can reasonably afford to provide, and to whom, given the negative economic consequences of higher taxes or debt.

Fundamentally, a sustainable fiscal position requires that spending and revenue not to deviate from each other for long periods. Returning from our current position of deficits to one of surpluses will require tough decisions about reprioritisation, which will then need to be followed by equally hard decisions further out. The trade-offs become harder and the changes required get more severe as each year of inaction passes.

Annex 1: Changes in demographic projections

The *2006 Statement* used the 2004-base-year official demographic projections for the long-term fiscal position. The *2009 Statement* uses specially commissioned projections from Statistics New Zealand to bring the projection base up to 30 June 2008 and to reflect recent rises in fertility. These were delivered in March 2009.

On 27 October, two days before the publication of the *2009 Statement,* Statistics New Zealand released its new population projections with the provisional population estimate as at 30 June 2009 as the base.

This annex examines how changes in these projections (the mid-range Series 5) have affected the fiscal position out to 2050, using the 2009 LTFM.

Table A1.1 – Assumptions and outputs – Series 5

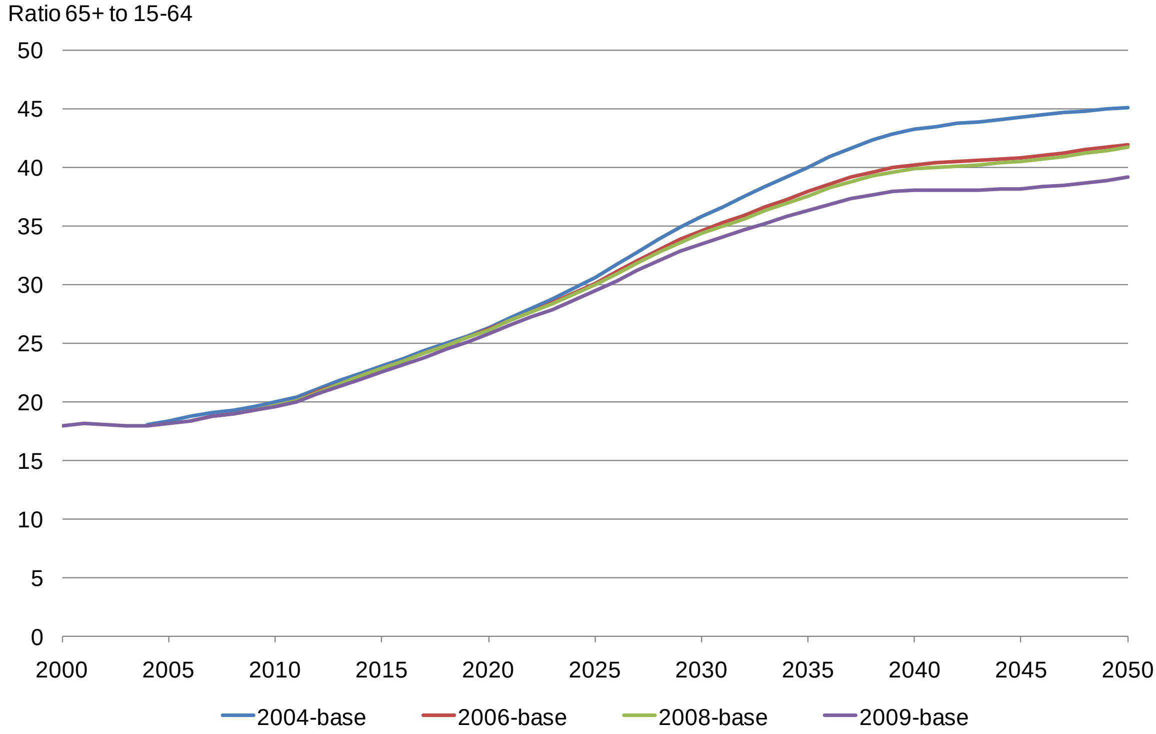
Base year	2010	2030	2050	Base year	2010	2030	2050
Total fertility rate				Net migration			
2004	1.94	1.85	1.85	2004	10,000	10,000	10,000
2006	2.08	1.90	1.90	2006	10,000	10,000	10,000
2008	2.16	1.90	1.90	2008	10,000	10,000	10,000
2009	2.11	1.90	1.90	2009	10,000	10,000	10,000
Life expectancy - males				Life expectancy - females			
2004	78.5	82.0	83.5	2004	83.0	85.8	87.0
2006	78.8	82.4	84.2	2006	82.7	86.0	87.7
2008	78.8	82.4	84.2	2008	82.7	86.0	87.7
2009	78.8	82.0	84.4	2009	82.5	85.2	87.5
Total population				Old age dependency ratio			
2004	4.3	4.8	5.0	2004	19.9	35.8	45.0
2006	4.4	5.1	5.5	2006	19.6	34.6	41.9
2008	4.4	5.1	5.5	2008	19.6	34.3	41.7
2009	4.4	5.1	5.6	2009	19.5	33.4	39.1

Source: The Treasury

The old age dependency ratio has fallen in the 2009-base projections, implying that NZS will be a smaller share of GDP by 2050. These ratios show little change between the 2006-base projections and those based on 2008.

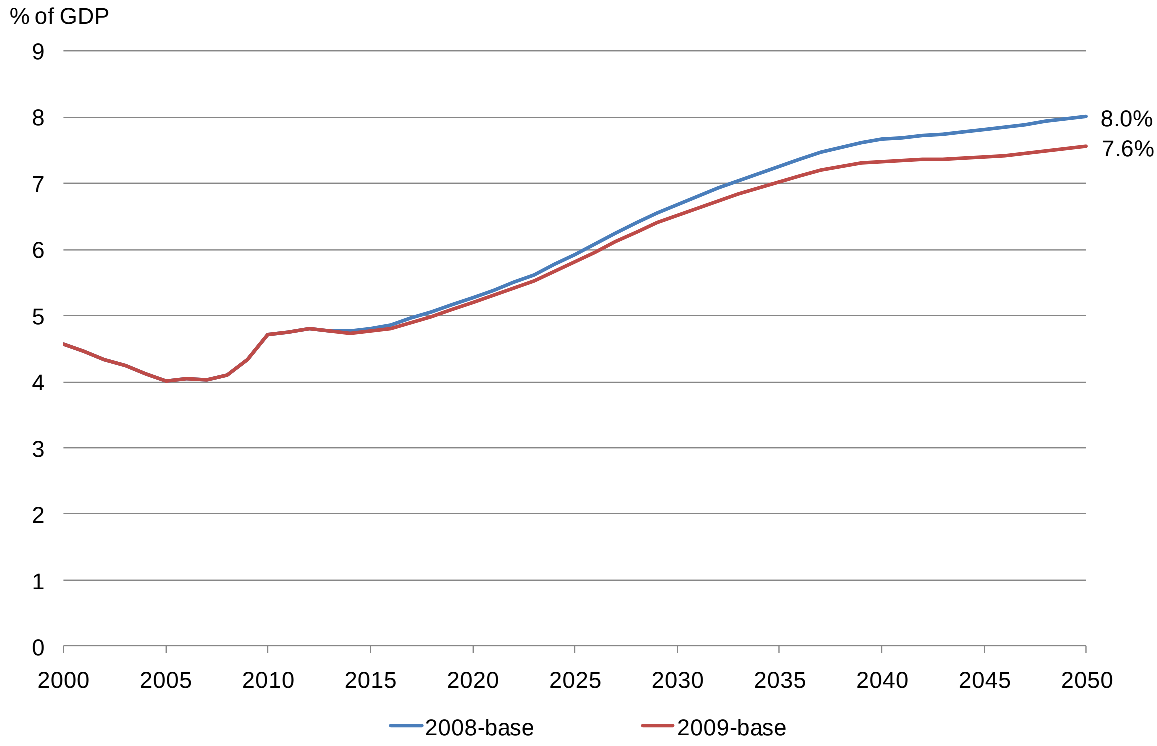
Flowing the 2009-base projections through the LTFM produces lower net debt, from 223% to 189% of GDP in 2050.

Figure A1.1 – Changes in old age dependency ratio for medium projections



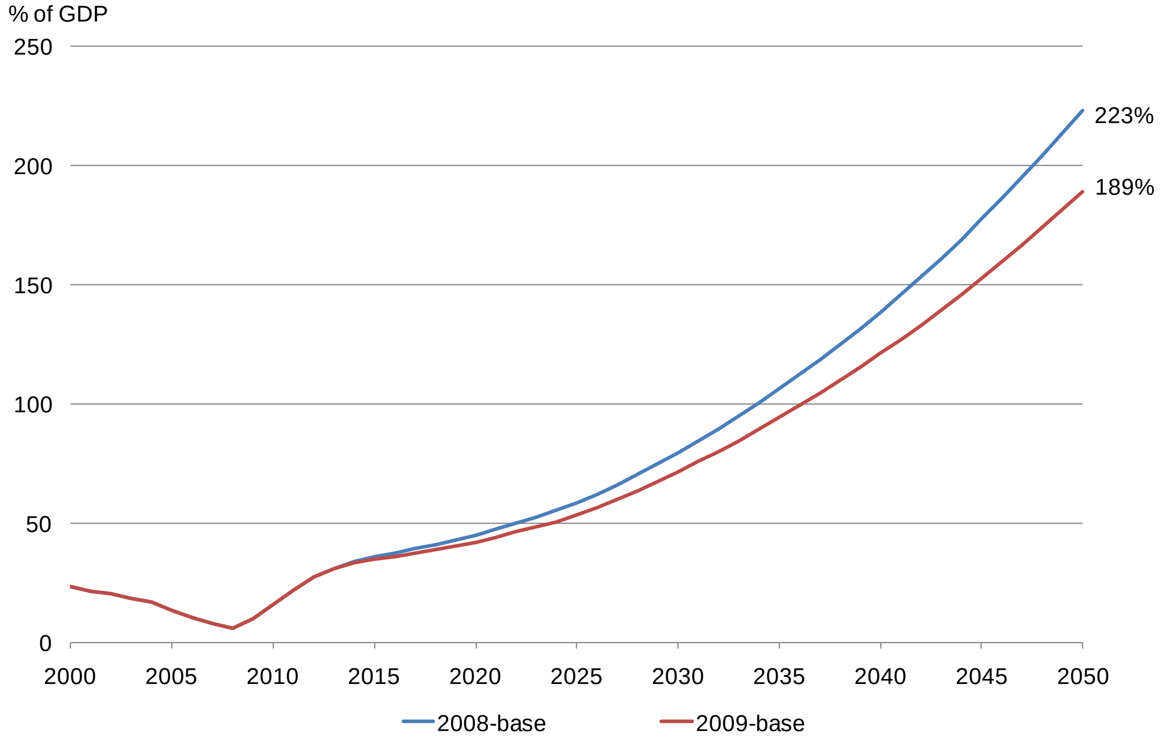
Source: Statistics New Zealand

Figure A1.2 – 2009-base year projection has lower NZS than 2008-base



Source: The Treasury

Figure A1.3 – 2009-base year projection has lower net debt than the 2008-base



Source: The Treasury

Annex 2: Deriving model equations

In Section 6, we describe the modelling of the expenditure on public services. Here we provide further detail on the derivation of this equation.

First we assume that nominal expenditure (E_t) on a given output equals the quantity of inputs (I_t) multiplied by the nominal price of a unit of input (W_t). The subscript t denotes the time period – which is a fiscal year in the model. Assuming a homogenous input, we can write this as:

$$E_t \equiv W_t \times I_t$$

Now assume that there is a simple production function, in which the quantity of outputs (Q_t) is the product of the quantity of inputs and their productivity (A_t). Then:

$$Q_t \equiv A_t \times I_t$$

Thus nominal expenditure is a function of nominal input prices, the quantity of outputs supplied and the productivity of the production process:

$$E_t = W_t \times \frac{Q_t}{A_t}$$

Converting the form of this equation into growth rates, we can see that:

$$\frac{E_t}{E_{t-1}} = \frac{W_t}{W_{t-1}} \times \frac{A_{t-1}}{A_t} \times \frac{Q_t}{Q_{t-1}}$$

Now assume that the growth in quantity demanded for outputs is a function of a demographic growth factor (d_t) and non-demographic demand factors (p_t):

$$\frac{Q_t}{Q_{t-1}} \equiv (1 + d_t)(1 + p_t)$$

Assume that nominal input price growth equals inflation (π_t), plus a factor for real growth (w_t) such as for wages:

$$\frac{W_t}{W_{t-1}} \equiv (1 + \pi_t)(1 + w_t)$$

We define public sector productivity growth rate as follows:

$$\frac{A_t}{A_{t-1}} \equiv 1 + a_t$$

Putting this together we can see that:

$$\frac{E_t}{E_{t-1}} = \frac{W_t}{W_{t-1}} \times \frac{A_{t-1}}{A_t} \times \frac{Q_t}{Q_{t-1}}$$
$$= (1 + \pi_t)(1 + w_t) \times \frac{1}{1 + a_t} \times (1 + d_t)(1 + p_t)$$

References

Baumol, William J. (1967) "Macroeconomics of unbalanced growth: the anatomy of urban crisis," American Economic Review, 57(3):415-426

Briggs, Phil (2003) “Looking at the numbers: a view of New Zealand's economic history,” Research monograph, New Zealand Institute of Economic Research

Bryant, John, Audrey Teasdale, Martin Tobias, Jit Cheung and Mhairi McHugh (2004) “Population Ageing and Government Expenditures in New Zealand, 1951-2051.” New Zealand Treasury Working Paper 04/14. Wellington, New Zealand Treasury, September 2004

Burniaux, Jean-Marc, Romain Duval and Florence Jaumotte (2003) “Coping with Ageing: A Dynamic Approach to Quantifying the Impact of Alternative Policy Options on Future Labour Supply in OECD Countries.” OECD Economics Department Working Paper No. 371

Chessa, A. and F. Kleima (2006) “The Dutch experience in measuring health output and labour productivity.” Discussion paper 06002, Statistics Netherlands. http://www.cbs.nl/NR/rdonlyres/AB007F36-7BD7-4601-9A72-872E8BB1A2ED/0/200602x10pub.pdf

Congressional Budget Office (2008) "Technological change and the growth of heath care spending. A CBO paper." Washington DC, Congress of the United States. http://www.cbo.gov/ftpdocs/89xx/doc8947/01-31-TechHealth.pdf

Congressional Budget Office (2009) *The Long-Term Budget Outlook*, Report, http://www.cbo.gov/doc.cfm?index=10297, June 2009.

Douglas, James (2006) “Measurement of Public Sector Output and Productivity,” New Zealand Treasury Policy Perspectives Paper 06/09.

Dumont, Jean-Christophe and Georges Lemaître (2005) “Counting immigrants and expatriates in OECD countries: a new perspective.” OECD Social, Employment and Migration Working Papers No.25, Paris, OECD. http://www.oecd.org/dataoecd/34/59/35043046.pdf

HM Treasury (2005) “Long-term public finance report: an analysis of fiscal sustainability.”

Irwin, Timothy and Oscar Parkyn (2009) “Improving the management of the Crown’s exposure to risk”, New Zealand Treasury Working Paper 09/06.

Janssen, John (2002) “Long-term fiscal projections and their relationship with the intertemporal budget constraint: An application to New Zealand,” New Zealand Treasury Working Paper 02/04.

Medical Training Board (2009) *The Future of the Medical Workforce: First Annual Report Nov 2007–Dec 2008*. Wellington, Ministry of Health. http://www.moh.govt.nz/medicaltrainingboard

Ministry of Health (2008) *Health and independence report 2008*. Online appendix. http://www.moh.govt.nz/moh.nsf/indexmh/health-independence-report08

Ministry of Health (2009*) Annual Report for the year ended 30 June 2009*. Wellington, Ministry of Health, October 2009. http://www.moh.govt.nz/moh.nsf/indexmh/annual-report-2009?Open

Morgan, Gareth and Geoff Simmons (2009) *Health Cheque*, Public Interest Publishing.

New Zealand Treasury (2006) *New Zealand's long-term fiscal position*. Wellington, New Zealand Treasury, June 2006.

New Zealand Treasury (2008) "New Zealand's Productivity Performance" New Zealand Treasury Productivity Paper TPRP 08/02. http://www.treasury.govt.nz/publications/research-policy/tprp/08-02.

Nordhaus, William D. (2006) "Baumol's Diseases: A Macroeconomic Perspective," NBER Working Paper 12218.

OECD (2006) "Projecting OECD health and long-term care expenditures: What are the main drivers?" Economics Department Working Papers No.477, OECD, Paris. <www.oecd.org/dataoecd/57/7/36085940.pdf>

OECD (2008) *OECD Compendium of Productivity Indicators 2008,* OECD, Paris. http://www.oecd.org/document/17/0,3343,en_2649_34445_40581201_1_1_1_1,00.html

Office for National Statistics (2006) "Public service productivity: health. Office for National Statistics, February 2006. http://www.statistics.gov.uk/cci/article.asp?ID=1429

Office for National Statistics (2009) "Total Public Service Output and Productivity," Report, June, http://www.statistics.gov.uk/cci/article.asp?ID=2212

Parham, Dean and Paul Roberts (2004) "Productivity growth and its sources: How do NZ and Australia compare?" Conference paper for workshop convened by the Treasury, RBNZ and MED, 28-29 July 2004

Preston, Samuel H., Patrick Heuveline and Michel Guillot (2001) *Demography, Measuring and Modelling Population Processes*, Blackwell Publishers

Productivity Commission (2005) *Economic Implications of an Ageing Australia*, Research Report, Canberra. http://www.pc.gov.au/projects/study/ageing/docs/finalreport

Rodway, Paul and Peter Wilson (2006) "Modelling New Zealand's Long-term Fiscal Position," New Zealand Treasury Policy Perspectives Paper 06/01

Ryan, Michael and Kam Leong Szeto (2009) "An Introduction to the New Zealand Treasury Model," New Zealand Treasury Working Paper 09/02 http://www.treasury.govt.nz/publications/research-policy/wp/2009/09-02

Smith, Sheila, Joseph P. Newhouse, Mark S Freeland (2009) "Income, insurance, technology: why does health spending outpace economic growth?" Health Affairs, 28(5): 1276-1284

Statistics New Zealand (2009) "National Population Projections," http://search.stats.govt.nz/search?w=2009%20National%20Population%20projections

Szeto, Kam Leong and Melody Guy (2004) "Estimating a New Zealand NAIRU," New Zealand Treasury Working Paper 04/10. http://www.treasury.govt.nz/publications/research-policy/wp/2004/04-10

Tripplett, Jack E. and Barry P. Bosworth (2003) "Productivity Measurement Issues in Services Industries: 'Baumol's Disease' Has Been Cured," FRBNY Economic Policy Review, September.

Werding, Martin (2007) "Ageing, Productivity and Economic Growth: A Macro-level Analysis," Working paper, Ifo Institute for Economic Research and CESifo

Winton, Paul (2009) "New Zealand's addiction to healthcare: diagnostic, trends and initiatives to manage cost growth." Draft for discussion. May, Auckland, Temple: Capital Investment.

Work and Income New Zealand (2009) "Rates of Superannuation," http://www.workandincome.govt.nz/manuals-and-procedures/deskfile/main_benefits_rates/new_zealand_superannuation_tables.htm

Van der Plaug, Frederick (2006) "Sustainable Social Spending in a Greying Economy with Stagnant Public Services: Baumol's Cost Disease Revisited," CESIFO Working Paper No. 1822.