THE DISTRIBUTIONAL IMPACT OF POPULATION AGEING

BACKGROUND RESEARCH PAPER

LONG-TERM FISCAL STATEMENT 2012

NEW ZEALAND TREASURY

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DRAFT WORK IN-PROGRESS

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ABSTRACT

Two important assumptions about the future that underpin Treasury’s Long-Term Fiscal Model are those of demographic change – *population-ageing* – and changes in *labour force participation*. Using a non-behavioural micro-simulation approach, this research offers a preliminary assessment of the distributional impacts of these assumptions by quantifying their effects on: 1) commonly used measures of income inequality and poverty and 2) the incidence of tax and government spending across age-groups. The results suggest that population-ageing and expected changes in labour force participation, in isolation, do not have a significant impact on measures of income inequality. However they do lead to compositional shifts in the income distribution thereby affecting relative measures of poverty. The incidence of tax and spending is found to be significantly affected as a consequence of population-ageing.
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1. Introduction

Income inequality is affected by many interacting factors such as social and demographic changes, the domestic and international economic environment, labour and goods markets and tax and spending policy settings. The present paper analyses the isolated impact of two factors that may play a role in determining the distribution of income in New Zealand: long-term demographic change – population ageing – and expected changes in rates of labour force participation over the next 50 years.

There are two broad aims. First, it investigates whether population-ageing and assumptions about future increases in labour force participation are, in isolation, determinants of aggregate measures of income inequality and poverty. Second this paper examines how tax and various forms of government spending are currently distributed across age-groups and how their future distribution may change as a result of population ageing and expected changes in rates of labour force participation across the population.

To provide an assessment of these research questions, this analysis imposes the projected demographic and labour force participation profile of New Zealand for the years 2020, 2030, 2040, 2050 and 2060 on data from the 2009/10 Household Economic Survey (HES) by Statistics New Zealand. That is, it calibrates the 2009/10 HES to reflect the demographic and labour market participation profiles for future years while keeping the aggregate population size fixed. In this way it isolates the effect of population-ageing and expected changes in labour force participation while holding a range of factors constant. The results can therefore be interpreted as showing the implications for the income distribution and the age-incidence of tax and spending, if future demographic and participation rate assumptions were to be realised in the year 2009/10. While acknowledging the vast range of factors that may influence distributional outcomes in the long-term, the advantage of this approach is in isolating the ‘pure’ impact of future demographic and labour market changes.

In isolating these two influences, the strong assumption is made that all households in the HES retain their demographic and labour market characteristics. The only variables that are allowed to change are the sample weights attached to each individual and household in aggregating from sample to population values. In other words, households in the hypothetical 2020, 2030, 2040, 2050 and 2060 population are similar to those in 2010, while the proportion of distinct household types varies. The resulting distributions are cross-sectional in nature, as no longitudinal information is available about the experience of individuals and their lifecycles.

Section 2 describes how the demographic profile and patterns of labour-force participation across the working population of New Zealand are expected to change over the next 50 years. The methodology and assumptions used are detailed in Section 3. Sections 4 and 5 discuss the empirical results and the extent to which measures of income inequality and poverty might be affected by population ageing and associated changes in labour force participation. The current and expected future distribution of tax and government spending across age-groups is also presented. Section 6 begins by setting forward a possible framework to assess the link between intra-generational income inequality and inter-generational equity and concludes with comments about how such a framework could be used to inform policy options that aim

to balance a response to the growing fiscal challenges and distributional concerns of the future.

2. Long term trends

2.1 Population ageing

New Zealand in common with many industrialised countries is expected to experience significant demographic change as a result of an ageing population in the coming decades. As shown in Figure 1, people aged 65 and over are projected to feature more prominently as a percentage of the working-age and indeed the total population over the next 50 years.

Figure 1 - New Zealand Population Age Structure: 1960, 2010 and 2060\(^2\)

Figure 2 indicates that between 2010 and 2060, the percentage of people aged 65 and over is expected to increase from 13% to 26% of the total population. Concurrently, the proportion of people between the ages of 15 and 64 is expected to decrease and those over the age of 65 are therefore expected to represent a higher proportion of the total working-age population over time. While the baby-boomer generation reaching retirement age is expected to create a temporary bulge, the long-term ageing of New Zealand’s population will be affected by declining fertility and mortality rates and characterised by an ‘ageing of the aged’ whereby the proportion of people over 80 is expected to increase substantially (Creedy et. al. 2010).

\(^2\) Buckle and Cruickshank (2012)
2.2 Labour force participation

Changes in rates of labour force participation are also expected in the long term. Figure 3 shows Statistics New Zealand’s projections of labour force participation rates for different age-groups over the next 50 years. Participation rates for females between the ages of 25 and 64 are expected to increase slightly over the next 20 years and then stabilise. A marked increase in rates for those aged 65 and over are projected; hence better health outcomes are expected to lead to prolonged labour market activity and increased life expectancy for individuals in these age groups.

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Figure 3 - Projected Changes in Labour Force Participation by Age: 2006 to 2060

3. Methodology

Two types of analysis are required to shed light on the questions raised in the introduction. First, to investigate the projected impact of population ageing and labour force participation on income inequality and poverty, a detailed micro-simulation model of the income distribution is needed. The present paper uses Treasury’s non-behavioural tax-benefit microsimulation model, Taxwell and the 2009/10 HES to model this. Survey weights are recalculated for each of the projection years using ‘calibration’ values which correspond to the Treasury’s Long-Term Fiscal Model (LTfM). Details of the reweighting and calibration procedure are given in Appendix B. Second, to analyse the impact of demographic change on the incidence of tax and government spending across age-groups, a model that uses the ‘individual’ as the unit of analysis is developed. The two sections that follow, and the corresponding appendices, discuss the methodological framework used to accomplish this.

3.1 Modelling the income distribution

Studies of the incidence of tax and government spending and their effect on the distribution of income are conducted routinely in New Zealand and overseas. Beginning with an observed distribution of income from wages, self-employment and investments – usually referred to as market income – these studies analyse the net effect of income-support payments, housing subsidies and income taxes to construct a distribution of disposable income. The cash value of in-kind benefits such as health and education is estimated and attributed to households using various allocation rules. The incidence of indirect taxes is then estimated and the net effect of these ‘secondary’ forms of state assistance and taxes is added to disposable income and a distribution for a proxy measure for the economic resources available to households is

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4 For this analysis, a particular year such as 2010 refers to the 12 month period from 1 April in the previous year to 31 March of the year mentioned. Hence 2010 refers to the New Zealand tax year from 1 April 2009 to 31 March 2010.
derived. This measure is frequently referred to as final income. A more comprehensive understanding of the redistributive extent of government activity, beyond that affected by a progressive income tax and transfer system, can therefore be gained. Figure 4 describes the sequence of allocations made.

**Figure 4 - Analytical Framework**

To undertake such fiscal incidence studies, detailed micro-level data on household or family income and expenditure is obtained from surveys and the rules of the tax and welfare system are applied to estimate the tax liability and eligibility for and entitlement to welfare receipts. Estimates of the amounts of the indirect taxes paid are similarly derived. Demographic characteristics of households or families are used to impute the cash-value of the expected consumption of health and education services. Views on the redistributive efficacy of government policy can therefore be informed by analysing disparities between income groups and calculating aggregate inequality and poverty measures.\(^5\)

This analysis implements the framework described in Figure 4 for the year 2009/10 and then imposes the expected demographic profile of New Zealand for 2020, 2030, 2040, 2050 and 2060 to model changes in the income distribution.

### 3.2 Modelling the incidence of tax and spending by age-group

Fiscal incidence studies often use households or families as the unit of analysis.\(^6\) However, since part of the aim of this analysis is to investigate how the age-distribution of tax and spending changes as a consequence of population ageing, it implements the framework indicated by Figure 4 using individuals as the unit of analysis. To do this, rules to model the

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\(^6\) The model defines families as economic family units (EFUs). Each family contains an adult principal earner, for couples a spouse of the principal earner, and dependent children. Adult children are deemed not to be dependent on their parents and are therefore not part of their parents’ family, even if they happen to live in the same household. A household is the largest unit in this model and consists of an economically independent group of families.
age-incidence of tax and spending and the sharing of resources within families and households need to be implemented.\(^7\)

As with modelling the income distribution, HES data for 2009/10 are used to achieve this. Market income is attributed to the earner as are estimates of tax liabilities on that income. Working-age welfare entitlements and any tax owed on those entitlements are generated from Treasury’s micro-simulation model, Taxwell and attributed equally to the principal earner and, if applicable, spouse in each family. The eligibility and entitlement rules for Working for Families (Wff) tax credits are determined in Taxwell at a family level. Any Wff entitlement for eligible families is attributed to the adult with the least market income, as they are assumed to be the main caregiver for dependents. Government spending on the Income Related Rental Subsidy (IRRS) is imputed based on data obtained from the Department of Building and Housing and is available at a household level. This is divided equally amongst all families in a household and then divided among the adults in each family. The Accommodation Supplement (AS) is also attributed in a similar way for eligible families.

This information enables the calculation of each earning individual’s disposable income. However the analysis assumes that disposable income is the main mechanism for intra-family sharing. That is, individuals in a family earn market income, pay taxes, and/or receive transfers and then pool their disposable income which is then allocated to the members of the family based on need. In contrast to an equal sharing rule, this analysis assumes that consumption needs are different for adults and children. For a couple with two non-earning dependent children for instance, the disposable incomes of the parents are added up and then shared across the four members of the family based on relative need. This analysis divides a family’s disposable income among its individuals using the consumption weights in the OECD-modified equivalence scale. The principal earner of a family is assigned a weight of 1, a partner of the principal, 0.5, and every dependent, 0.3. Our analysis therefore reflects the fact that even individuals with no market income or direct cash-transfers from the state have access to a family’s resources.

Expenditure on in-kind benefits – health and education – is attributed directly to individuals. Health expenditure is attributed using demographic per capita expenditure profiles provided by the Ministry of Health. Education expenditure is based on total government spending on particular types of education. For example, primary and secondary education is broken down into government spending on each schooling year or age. Those people in HES who are report as being involved in that type of education and who match the additional characteristics, such as age, are then allocated the government expenditure appropriate for their education. See Aziz et al (2012) for further details.

Finally, the incidence of indirect taxes is modelled. Indirect taxes included in this study are GST and fuel, alcohol and tobacco excises and customs duties. Information on indirect taxes is available in HES at a household level. Therefore these are first attributed from the household to the family and then further attributed to people within the family depending on their assumed consumption needs and age.\(^8\) GST and fuel excises are attributed in the same manner

\(^7\) Phipps and Burton (1995) provide an overview of alternative intra-family sharing rules.

\(^8\) Allowances are made for households with multiple families. For multi-family households, the amount a family will pay in indirect taxes is a factor of their consumption needs. Thus, we divide these according to the share of disposable income earned by each family. There is one exception. If there is a family earning negative or below ‘subsistence level’ disposable income (below $60/week) in a household, we deem their income to be too low to satisfy their consumption needs. We then allocate this household’s
as family disposable income. However, alcohol and tobacco excises are only split equally to those who are 18 years of age or over, reflecting the ability to buy these items legally.

Appendix C describes the attribution principles used for this analysis in further detail.

The age-based incidence analysis depicts the distribution of tax, spending and income at various dates between 2010 and 2060. However, it does not accomplish this by projecting each individual’s life-course nor does it model behavioural or structural changes across the time. Rather it applies static-ageing to investigate how the relative distribution of tax, spending and income will change across age-groups as the demographic profile of New Zealand evolves. As mentioned earlier another way to think about this approach is to say that the analysis imposes the projected demographic and labour force participation profile of New Zealand for the years 2020, 2030, 2040, 2050 and 2060 on data from 2009/10.

3.3 Assumptions

This analysis makes the following assumptions to model the income distribution and analyse the incidence of tax and government spending:

1. The projected demographic profile of New Zealand at various points between 2010 and 2060 is the primary variable. The analysis imposes the projected demographic and labour force participation profile of New Zealand for the years 2020, 2030, 2040, 2050 and 2060 on data from 2009/10.

2. 2009/10 levels of hours worked across age-groups and trends of partnering and family and household formation are assumed.

3. As incomes of individuals are not projected into the future, no assumptions about wage growth or productivity changes are required. Current consumption behaviours are assumed.

4. Settings of the taxes and welfare system as in the year 2009/10 are assumed. Relativities between benefits and NZS are held constant at their 2009/10 levels. This is most recent comprehensive cross-sectional dataset on household income and expenditure information available. Tax changes made as part of the 2010 budget are therefore not included.

4. Population ageing, inequality and poverty

This section presents a range of income inequality and poverty measures to demonstrate the effect of a changing population structure on the income distribution. Before a discussion of these measures, it is useful to discuss how the income distribution is expected to change as a

GST and excises according to the relative needs of each member, as indicated by the OECD-modified equivalence scale’s consumption weightings.

9 An alternative is to use a dynamic lifecycle cohort projection model. While there are merits of developing such a model, the results are known to be highly sensitive to the many detailed assumptions required about the future state of the economy, the behaviour of individuals and societal preferences of household formation. The static-ageing approach, while limited in its capacity to model behavioural change, has the advantage of providing a simple and intuitive way of modelling the impact of pure-demographic change.
consequence of calibrating the 2009/10 data to reflect the demographic structure of future years.

Figure 5 shows how the proportions of different types of family are expected to change between 2010 and 2060. As would be expected with an ageing population, superannuitant families show the largest increase as a share of family types. The other family categories included in the graph are non-NZS recipient families. It is expected that sole parent families will represent broadly similar proportions, while couples with and without children are expected to decrease as a proportion of the total number of families in the population.

**Figure 5 - Proportion of Family Types: 2010 and 2060**

Figure 6 shows median market incomes by age-group for 2010. Individuals at the lower and upper ends of the age distribution earn relatively low incomes, especially those over the age of 70. Due to population ageing, there will be many more people over the age of 65 and will, as Figures 2 suggested, constitute a higher proportion of the total population. However Figure 7 indicates that they will generally be represented in lower income deciles.

There is however a wide dispersion of incomes in the older age groups. For instance, in Figure 7 the population of individuals aged 65 and over appear either to be converging on decile 2 between 2010 and 2060, or becoming better represented in upper-income deciles. These trends reflect two types of behaviours. First, those who are able or choose to continue working past the age of 64 – by virtue of their skills or good health outcomes – will earn relatively high market incomes in doing so. They will also receive NZS – using this either as an instrument to enhance earnings or reduce hours of work and provide earnings compensation – to retain their position in middle- and higher-income deciles. Those who are not able to continue their participation in the labour market or can only do so at much lower levels after the age of 64, rely on NZS as their main income source and move to the lower income deciles, often using the benefit system to transition to retirement.
4.1 Income inequality

Figure 8 shows trends in the Gini coefficient for households as the demographic structure projected for future years is imposed on data from 2009/10. The graph shows a slight increase in the Gini for market income from 0.504 in 2010 to 0.533 in 2060; an increase of approximately 6%. The Gini measures for disposable, and final incomes are relatively stable across time.

The fact that an increase in the Gini measure for market income between 2010 and 2060 does not lead to a corresponding increase in that inequality measure for disposable and final income is a finding worthy of further comment. As the core working-age population decreases and the population ages and more people become eligible for pension payments, NZS is expected to represent a higher proportion of total transfer payments. Figure 7 suggests that a significant proportion of the age 65+ population currently is and is expected to remain in lower income deciles. Therefore if current indexing arrangements prevail over the next 50 years, NZS
will probably become a more prominent redistributive instrument over time. That is, in the absence of changes to tax and transfer policy settings, it could be reasonably expected that any increase in market income inequality will be somewhat offset by more generous transfer payments in the form of NZS to a larger group of people at the lower end of the income distribution. The distribution of disposable and final incomes will therefore be somewhat immune to the increase in market income inequality in the long-run given assumptions about population ageing. Table 1 shows the percentage change in Gini measures or the rate of redistribution across years. The rate of redistribution between market and disposable incomes will increase from 31% to 35% as a higher proportion of transfers in the form of NZS are directed towards the elderly in lower income deciles. Similarly, a higher proportion of health expenditure directed to lower income groups will lead to an increase in the redistribution rate between disposable and final income.

These findings do not intend to suggest that income inequality, as measured by the Gini coefficient, will not change over the next 50 years. What they clarify however, is that population ageing and assumptions about future rates of labour force participation are not, in isolation, significant determinants of income inequality change in the long-term.

**Figure 8 - Gini Coefficients by Income Type**

![Gini Coefficients by Income Type](image)

**Table 1 - Percentage Change in Gini Measure across Incomes: 2010 to 2060**

<table>
<thead>
<tr>
<th>Year</th>
<th>Market to Disposable</th>
<th>Disposable to Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>31%</td>
<td>9%</td>
</tr>
<tr>
<td>2020</td>
<td>32%</td>
<td>10%</td>
</tr>
<tr>
<td>2030</td>
<td>33%</td>
<td>11%</td>
</tr>
<tr>
<td>2040</td>
<td>34%</td>
<td>11%</td>
</tr>
<tr>
<td>2050</td>
<td>34%</td>
<td>12%</td>
</tr>
<tr>
<td>2060</td>
<td>35%</td>
<td>12%</td>
</tr>
</tbody>
</table>

NZS is a tax funded pension payment available to all individuals aged 65 and over. It is not means-tested and has been indexed to wages since 1978 - unlike Working-age benefits and Working for Families tax credits which are indexed to inflation. This makes an individual receiving NZ Super for a full year, better off than someone receiving a working-age benefit for the same duration.
While there may not be notable changes in the Gini coefficient due to these two factors, the question of whether there will be compositional shifts across the income distribution requires further scrutiny. Figure 9 plots Lorenz curves for equivalised disposable income for 2010 and 2060 using the individual as the unit of analysis.\textsuperscript{11} It suggests less inequality at the lower end of the income distribution which is compensated by more inequality for 2060 at the upper end of the distribution - the Gini coefficient for disposable income in Figure 8 shows no notable change as a result of these offsetting changes. However, because of their impact on relative poverty measures, compositional shifts at the bottom of the income distribution are worthy of further discussion.

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{lorenz_curves.png}
\caption{Lorenz Curves: 2010 and 2060}
\end{figure}

4.2 Poverty measures

The two population subgroups most prominently represented at the lower end of the income distribution are beneficiary and superannuitant individuals and households. Movements at lower income deciles therefore suggest changes in the relative position of these two subgroups. Studies of poverty often use relative poverty measures; changes in the relative positions of these subgroups will be reflected in these measures.

Figure 7 suggested that as the population ages, individuals aged 65 and over would become more prominently represented in lower income deciles despite expectations of increased rates of labour force participation. A significant proportion of individuals in this age-group rely on NZS as their main income source and earn relatively low market incomes when they do participate in the labour market.

Figure 10 shows the proportion of individuals in each adult equivalent disposable income band for 2010 and 2060.\textsuperscript{12} It indicates that a larger number of individuals will be living in households earning closer to the median adult equivalent income in 2060.

\textsuperscript{11} The modified OECD scale is used for equivalisation.

\textsuperscript{12} Adult equivalent disposable income is a cash measure of the standard of living accessible by each member of a household after adjusting the household’s total disposable income for size and economies of scale. The modified OECD scale is used for equivalisation.
NZS settings enable recipients to access an adult equivalent income of roughly between 60% and 70% of the median adult equivalent disposable income. As the population ages and the composition of the income distribution changes as a result with the elderly better represented in lower income deciles, a larger proportion of people in the population will have access to this income level. Compositional changes at the lower end of the income distribution do not significantly change the median equivalised income for a particular year, but they do affect the number of households earning at or below 50%, 60% and 70% of the median equivalised disposable income. By virtue of current settings, NZS will enable a higher proportion of lower income households to have a standard of living closer to that of the median household across the income distribution. Therefore the 80/20 ratio for the income distribution – as shown in Table 2 – and relative poverty measures at 50% and 60% of the median equivalised disposable income – shown in Figure 11 – are expected to decrease over time, due to the interaction of demographic change, expected rates of labour force participation and current tax and transfer policy settings.

**Figure 10 - Percentage of Individuals by Adult Equivalent Disposable Income Band**

![Percentage of Individuals by Adult Equivalent Disposable Income Band](image)

**Table 2 - 80/20 Ratio Adult Equivalent Income: 2010 to 2060**

<table>
<thead>
<tr>
<th>Year</th>
<th>2010</th>
<th>2020</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
<th>2060</th>
</tr>
</thead>
<tbody>
<tr>
<td>80/20 Ratio</td>
<td>2.38</td>
<td>2.32</td>
<td>2.22</td>
<td>2.18</td>
<td>2.15</td>
<td>2.13</td>
</tr>
</tbody>
</table>
Figure 11 - Percentage of Individuals in Households Below Median Adult Equivalent Disposable Income

Figure 12 indicates that relative child poverty rates are also expected to decrease in the long-term. There are two reasons for this. First, families with children are expected to constitute a smaller proportion of the population. Compared to 2010, they will be a less prominent proportion of the lower end of the income distribution in 2060. Second, people are in general expected to have children at older ages and on average earn market incomes at or above the median income when they do. The labour force participation of working-age females is also expected to increase and transfers such as Working for Families will continue to provide additional cash assistance. The combined impact of these factors will determine the relative positions of families with children in the income distribution. Therefore, the percentage of children living in households earning less than 50%, 60% or 70% of the median income is expected to decrease in the long-term.

Figure 12 - Percentage of Dependents in Households earning below Median Adult Equivalent Disposable Income
5. The incidence of tax and spending by age-group

To analyse the incidence of tax and spending by age-group, the analytical framework illustrated by Figure 4, is implemented using the individual as the unit of analysis. Once market income, direct and indirect taxes and government spending are attributed, the information can be used to calculate disposable and final incomes for individuals. This section discusses the impact that population ageing and changes in labour force participation rates, in isolation, are expected to have on the incidence of tax and government spending across age-groups.

Figure 13 shows the incidence of direct tax by age-group for 2010 and 2060. Direct tax includes tax liabilities on market income, taxable working-age benefits and New Zealand Superannuation. The graph for 2060 is generated by imposing the projected demographic and labour force participation profile of New Zealand for that year on data from 2009/10.

The distribution is strongly influenced by the earnings profile of individuals over the lifecycle - people in younger and older age-groups earn relatively low incomes and correspondingly pay less direct tax in absolute terms than the core working age population. This is reflected in the graph for the year 2010 in Figure 13. As the population ages, the incidence of direct tax is expected to change with people over the age of 65 paying a higher proportion of total direct tax. This is due mainly to a greater number paying tax on NZS. The labour market participation rates for this group are also expected to rise. However they are currently observed to earn relatively low market incomes, this will only be a small proportion of their expected tax liabilities.

The proportion of direct taxes paid by those aged 25 to 64 is expected to decrease over time, corresponding to the decrease of this age-group as a share of the total population as indicated by Figure 2. While their labour force participation rates are projected to increase over the next 50 years, which will have a positive revenue impact, demographic changes will dominate this increase, the net effect of which will be a diminishing contribution to total direct tax. However, any significant changes in the hours worked by these age groups may lead to the opposite effect.

Figure 13 - Distribution of Direct Tax by Age-Group: 2010 and 2060
Figure 14 shows the distribution of indirect tax by age-group. Indirect tax includes GST, excises and customs duties on tobacco, alcohol and fuel. The age incidence of indirect tax is expected to change slightly. Since this analysis assumes current consumption patterns, the changes are determined by calibrating the data to model population ageing. Over time, those aged 65 and over are expected to pay a slightly higher proportion of the total indirect tax.

Figure 14 - Distribution of Indirect Tax by Age-Group: 2010 and 2060

The distribution of cash-benefits, which include receipts of working-age benefits, Working for Families, housing subsidies and NZS is shown in Figure 15. Between the ages of 16 and 64, individuals receive working-age transfers and Working-for-Families. Transfers for those over the age of 65 are mainly NZS payments, though these individuals are also eligible for some second- and third-tier benefits such as the Accommodation Supplement. The incidence of welfare payments for the core working-age is similar across time, affected only by the decreasing share of this age-group as a proportion of the total population. In addition, there is an increase in the absolute amount of spending received by older individuals which is directly correlated to the extent of ageing in the population and entitlements to NZS.
The distributions of education and health expenditure follow predictable patterns as shown in Figures 16 and 17. Education expenditure is predominantly spent on people of primary and secondary school ages, and tertiary students. The decrease in the amount spent on individuals in these age groups over time reflects changes in the demographic profile of the country not any change in policy settings. Similarly, a significant amount of health expenditure is currently diverted to people in older age groups. Their share of total health spending is expected to increase from 31% in 2010 to 51% in 2060, because they will feature more prominently as a proportion of the total population.
Figure 17 - Distribution of Health Spending by Age-Group: 2010 and 2060

Figure 18 shows the net fiscal impact of tax and spending by age-group - that is, the aggregate amount of direct and indirect tax paid by each age-group less the spending received by way of income support, health and education. The graph shows that population ageing and changes in labour force participation, in isolation, lead to a distribution of tax and spending more heavily skewed towards older age-groups. These age-groups will form a higher proportion of the total population over time, and so it would be expected that correspondingly they would benefit from a larger share of net government spending. Individuals of the core working-age are expected to form a smaller proportion of the total population over time and would be to pay a relatively lower share of the total tax under current policy settings. There will also be fewer people under the age of 14. The reduced net fiscal impact on these individuals represents a decrease in their proportion of the total population and not any change in policy settings that would lead to less per capita expenditure spent on them.

Figure 18 also gives an indication of the aggregate annual fiscal gap arising from tax and spending items included in this model. The fiscal gap between tax payments and spending on commodity items captured here increases from approximately -$8 billion in 2010 to -$15 billion as a consequence of population ageing and changes in rates of labour force participation expected in 2060. While there are other taxes and spending categories not included in this model, such as corporate taxes and spending on justice, infrastructure, culture and heritage, the findings align closely with the current and expected fiscal situation of general revenue and spending trends in the long term. Treasury’s Long-Term Fiscal Model (LTFM) suggests that should current policy settings prevail over the next 50 years, the cumulative fiscal gap, including debt financing costs is expected to increase to around 5% of GDP.  

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13 Bell (2012)
The incidence of tax and government spending varies by age groups and is expected to change as the population ages. The incidence however varies by gender as well. Appendix D shows the incidence across age-groups of males and females for 2010 and 2060. Future research will examine the implications of introducing policy changes which ensure a constant fiscal gap.

6. Conclusion

The findings presented in this paper suggest that population-ageing and expected changes in labour force participation will, in isolation, mainly affect the composition of the income distribution and the age-incidence of tax and spending. Inequality in the distribution of market income may increase, but this may not lead to an increase in inequality in disposable and final incomes due to a change in the composition of lower income deciles. People aged 65 and over will, over time, represent a more significant proportion of the total population and receive a higher share of total welfare expenditure in the form of NZS. However if they continue to earn low market incomes relative to the core working-age population, they will be significantly represented in lower income deciles, and due to population ageing, in larger numbers. As a result, NZS will constitute a higher proportion of total transfer payments received by lower income households.

Therefore, if the current indexing arrangements and eligibility and entitlement criteria of NZS remain, a higher rate of redistribution in the direct tax and transfer system will be observed which will offset any increase in inequality in the distribution of market income. Inequality in the distribution of disposable income is therefore expected to remain stable.

A similar argument applies for the distribution of final income. The elderly receive a high proportion of the total health expenditure, and increasingly this will be directed to a larger population of those aged 65 and over in lower income deciles. As a result the distribution of final income is also expected to remain stable.
The incidence of net tax and government spending across age groups is expected to be more skewed towards older age groups as a result of changes in the demographic profile and labour market participation rates.

These findings are subject to several assumptions and caveats. Income inequality and poverty are complex phenomena determined by a range of factors. This study isolates and analyses the impact of only two of many such factors - population ageing and labour market participation. In doing so it does not take into account the many social, economic and technological changes that may occur in New Zealand over the next 50 years. The previous 50 years have witnessed significant changes in the ethnic composition of the population, fertility and mortality rates, the structure of families, education, the demand for and supply of different types of skills, the distribution of earnings and the economic environment. While assuming that currently observed trends in these factors will persist in the long term, this study does not suggest that these will be insignificant in determining the distribution of income in the future.

The caveat with perhaps the most important implications for policy is that these findings are cross-sectional and not longitudinal in nature. They therefore do not provide a distributional perspective over the life course of particular individuals or across generations. Research that provides deeper insights into the dynamics of income inequality and poverty would be a way to develop this analysis further. In addition to providing perspectives on income mobility and poverty persistence across population subgroups, such analysis would also provide useful insights into savings and consumption behaviours over the lifecycle and how policies such as KiwiSaver will enable income adequacy and influence the distribution of income in the future.

However a qualitative assessment of the link between intra-generational (within generations) and intergenerational (future generations) perspectives of income inequality and poverty can still be made. As noted earlier, Treasury’s LTFM suggests that if current tax and spending policies were to prevail over the next 50 years, it is likely that a gap in revenue and spending of approximately 5% of GDP will be realised. Increased spending in the long term will be due mainly to a higher demand for health services and entitlement to NZS. The fact that current redistributive policies that maintain stable income inequality and poverty outcomes are being increasingly funded by debt and not revenue present a burden and an opportunity cost to future generations and therefore lead to distributional consequences that are intergenerational in nature.

Therefore any future policy decisions to address a widening fiscal gap will have distributional consequences. The extent to which these decisions affect intra-generational income inequality and relative poverty measures and inter-generational outcomes will depend on the design of those policies. This suggests that the timing of when and how governments take policy action to address the fiscal challenges is important for the intra- and inter-generational distributional outcomes. For instance, policy action to significantly reduce the fiscal gap over a short period, via an increase in taxes and/or a decrease in spending, may have an immediate effect on measures of household income inequality and poverty. Compared with current policy settings, such action would involve future taxpayers bearing less of the burden of current spending. Alternatively, if marginal changes to current policy settings are implemented with a view to reducing the fiscal gap over a longer time horizon, cross-sectional income inequality and poverty levels may not be significantly affected, but future taxpayers will continue to fund high levels of spending over the transition period. Examining how policy instruments could be used to moderate the effect on intra- and inter-generational outcomes would be a future avenue for this research.
Appendix A: Data sources

This paper follows a method similar to that of Aziz et al (2012) in utilising Treasury’s non-behavioural microsimulation model, Taxwell and associated models to analyse the incidence of tax and government spending. These models use the Household Economic Survey (HES) as the primary dataset. The HES provides “comprehensive survey information about income and expenditure by New Zealand’s normally resident population living in private dwellings.” While a shortened form of HES is carried out every year, a more comprehensive HES with information on household income and expenditure is undertaken every three years. This study uses the 2009/10 HES - the latest dataset that contains information on both income and expenditure.

HES 2009/10 contains data on the income and consumption patterns of 8,074 individuals, 4,012 families and 3,126 households. It provides a detailed breakdown of income and combines this information with household demographic data, allowing comparison across different peoples’ circumstances.

The HES is a cross-sectional and not a longitudinal dataset. It does not follow the same individuals over time so cannot examine how people’s circumstances change from year to year. Also, the HES only captures income flows and not the wealth of individuals, though it does include income generated from assets.

To model the incidence of government spending this analysis combines the HES with data from the Ministry of Health, the Ministry of Education and the Department of Building and Housing. This expanded dataset is used to calculate the market, disposable and final incomes of individuals, families and/or households.

Like other microsimulation tools, this model relies on sample weights to simulate the effect of population ageing. Each individual, family and household in the dataset is assigned a weight which represents how common that unit’s characteristics are across the population. What is valuable about this approach is that the heterogeneity within the population can be captured while still keeping to population level aggregates. Appendix B provides details on how the HES data are reweighted for the purposes of this analysis.

Appendix B: Calibrating the Household Economic Survey

This section outlines how the 2010 Household Economic Survey (HES) was calibrated to be consistent with projected demographics and changes in rates of labour market participation.

The HES is provided by Statistics N.Z. with population weights attached to the unit record data and is designed to meet certain demographic benchmarks relating to the population distributions such as age and gender. As part of constructing the source dataset to determine tax liabilities, eligibility and entitlement to welfare payments (via Taxwell) and the attribution of in-kind benefits, this study requires calibrating the sample to additional benchmarks to reflect the population subgroups of interest. These could include the number of benefit recipients and superannuitants in projected years in additional to the breakdown of the total population into demographic subgroups such age, gender, ethnicity.
A list of the 9 broad benchmark categories used for this study is provided in Appendix Table 1.\textsuperscript{14}

**Appendix Table 1 - Benchmark Categories**

<table>
<thead>
<tr>
<th>Category</th>
<th>Detailed description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age/Sex</td>
<td>Number of people in each five year age bands from 0 to 79 and 80+ by gender.</td>
</tr>
<tr>
<td>Number of occupants</td>
<td>Number of households by region with 1,2,3 or 4+ occupants.</td>
</tr>
<tr>
<td>Region</td>
<td>Number of people in each region as provided by HES.</td>
</tr>
<tr>
<td>Maori</td>
<td>Number of people who self identify with the Maori ethnicity between 15 and 29 and &gt; 30.</td>
</tr>
<tr>
<td>Person Type</td>
<td>Number of people living in specific family situations that determine receipt of Working for Families.</td>
</tr>
<tr>
<td>Household Type</td>
<td>Number of households that have 2 adults or other composition.</td>
</tr>
<tr>
<td>Tenure</td>
<td>Number of households that are owned, held by a trust or other by region.</td>
</tr>
<tr>
<td>Benefit</td>
<td>Number of people receiving core benefits during the year.</td>
</tr>
<tr>
<td>Labour Force</td>
<td>Number of people participating in the labour force by gender and 5 year age band from 15 to 69, and 70+.\textsuperscript{15}</td>
</tr>
</tbody>
</table>

The GREGWT SAS macro, produced by the Australian Bureau of Statistics, was used to carry out calibration of the benchmarks listed above.\textsuperscript{16,17}

**B1 Method used to project benchmarks**

The calibration method requires four inputs: person level demographic characteristics, starting weight, weight limits and benchmarks for the aggregates of demographic and beneficiary subgroups described in Appendix Table 1. Data on person characteristics are the same as used for Taxwell with the addition of information on labour force participation.

Initial weights for the 2009/10 HES are provided by Statistics N.Z. These weights are further calibrated to administrative totals for each of the benchmarks listed above. Calibrating to projected totals of these benchmarks for future years – 2020, 2030,...,2060 – is an iterative process and the re-calibrated weights for 2009/10 are used as the starting weights for projected years.

\textsuperscript{14} These 9 broad categories consist of 129 benchmarks. There are 34 benchmarks for age and sex, 24 for the number of occupants by household, 6 regional, 2 Maori, 12 person type, 2 household type, 18 tenure, 7 benefit and 24 labour force benchmarks.

\textsuperscript{15} Using the same definition of participation as the National Labour Force Projections.

\textsuperscript{16} ABS (2000)

\textsuperscript{17} Bell (2000)
Weight limits are added to the calibration specification to ensure that no unit record has a negative weight in the final output and that the results are not dominated by outliers with high weights. The weights were adjusted from the Taxwell starting limits used for the 2009/10 year and then further adjusted to model the expected demographic and labour force participation profile of future years.

The projection methodology for the benchmarks is listed in Appendix Table 2.

**Appendix Table 2 - Projection Methodology**

<table>
<thead>
<tr>
<th>Benchmark Category</th>
<th>Projection Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age/Sex</td>
<td>Projected out with growth of relevant age/sex category in Population projections</td>
</tr>
<tr>
<td>Number of occupants</td>
<td>The number of people per household is kept constant, grown out with no changes in proportions of household in each occupancy type.</td>
</tr>
<tr>
<td>Region</td>
<td>Grown with regional growth implied by Number of Occupants benchmark.</td>
</tr>
<tr>
<td>Maori</td>
<td>Grown with age driver from age/sex population assuming constant proportion of Maori in each age group.</td>
</tr>
<tr>
<td>Person Type</td>
<td>Grown with relevant age driver assuming constant proportions within each age category</td>
</tr>
<tr>
<td>Household Type</td>
<td>Grown with total growth in number of households implied by Number of Occupants, assuming constant proportions of 2 adult households.</td>
</tr>
<tr>
<td>Tenure</td>
<td>Grown with regional growth implied by Region benchmark, assuming constant proportion of tenure type within region.</td>
</tr>
<tr>
<td>Benefit</td>
<td>Grown with weighted demographic driver by benefit type similar to the demographic growth assumed in the Long Term Fiscal Model</td>
</tr>
<tr>
<td>Labour Force</td>
<td>Projected out with growth of relevant age/sex category in Labour Force projections</td>
</tr>
</tbody>
</table>

**B2 Impact of calibration**

Recalibrating sample weights from HES 2010 to reflect the demographic profile and labour market participation rates of 2060 changes the shape of the income distribution and the relative numbers of different family and household types in the population.

Appendix Figure 1 shows how the distribution of family disposable income changes as a result of this. Most superannuitants are at the lower end of the income distribution and the increase in the proportion of families in the $20,000 - $29,000 and $30,000 - $39,000 income bands indicates the relative increase of these older groups as a proportion of the total population.
Appendix Figure 1 - Proportion of Families by Disposable Income Band: 2010 and 2060

Appendix Figure 2 shows how the proportions of different family types change from 2010 to 2060. As would be expected with an ageing population superannuitant families have shown the largest increase as a share of family type. The other family categories included below are non-NZS recipient families.

Appendix Figure 2 - Proportion of Family Types: 2010 and 2060
Appendix C: Attribution logic for age-based tax and spending incidence analysis

To analyse the incidence of tax and spending by age-group, the analytical framework illustrated by Figure 5, is implemented using the individual as the unit of analysis. Once incomes, direct and indirect taxes and government spending are attributed to individuals, comparisons across time can be made based on the relative weighting of people of different age-groups in the population.

Appendix Table 3 below summarises the attribution logic used for the age-based analysis.

Appendix Table 3 - Attribution Logic for Age-Based Allocation of Tax, Spending and Income

<table>
<thead>
<tr>
<th>Category</th>
<th>Attribution Logic</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market income</td>
<td>- Attributed entirely to the earner of market income</td>
<td>- Amount of income earned by an individual reflects their employability (demand for skills, experience etc) and personal choices around labour market activity</td>
</tr>
<tr>
<td>Direct Taxes</td>
<td>- Attributed entirely to the person earning/receiving taxable income</td>
<td>- An 'individual' based tax system in NZ; tax liability does not depend on family/household status</td>
</tr>
<tr>
<td>Working-age benefits</td>
<td>- Attributed to the principal earner in a family or divided equally between principal earner and spouse, if applicable</td>
<td>- Benefits are intended to support individuals of ‘working-age’ (aged 16 – 64) through hardship</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Assumption made here is that carers allocate income shares to dependents on the basis of total disposable income earned by the family</td>
</tr>
<tr>
<td>Working for Families (WfF)</td>
<td>- Attributed to the ‘carer’ in a family – the spouse if a couple, else the principal</td>
<td>- WfF tax credits are a means to provide additional support / compensation to families with children</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Assumption made here is that parents allocate income shares to children on the basis of total disposable income earned by the family</td>
</tr>
<tr>
<td>NZ Super</td>
<td>- Amount attributed to individuals by family status as reflected in NZS payment schedule e.g. single, married, NQS etc.</td>
<td>- NZ Super is a universal payment for individuals ages 65 and over; different amounts are received depending on partnering status</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- If there are dependents the assumption made here is that carers allocate income shares on the basis of the total disposable income earned by the family</td>
</tr>
<tr>
<td>Housing (AS)</td>
<td>- Attributed equally among families within a household, then attributed to the principal earner in a family or divided equally between principal earner and spouse, if applicable.</td>
<td>- AS is intended to support low-income families with their housing costs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Assumption made here is that carers allocate income shares to dependents on the basis of total disposable income earned by the family</td>
</tr>
<tr>
<td>Housing (IRRS)</td>
<td>- Attributed equally among families within a household, then equally</td>
<td>- IRR is intended to support low-income families with their housing costs</td>
</tr>
</tbody>
</table>
between principal earners/spouse within each family. - Assumption made here is that carers allocate income shares to dependents on the basis of total disposable income earned by the family.

<table>
<thead>
<tr>
<th>Disposable Income</th>
<th>‘Family disposable income’ is shared among members of a family.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>It is attributed according to an assumption around the ‘need’ of each family member.</td>
</tr>
<tr>
<td></td>
<td>Secondary earners and dependents receive a lower proportion of disposable income than the primary earner.</td>
</tr>
<tr>
<td></td>
<td>These proportions are based on the consumption weightings of the ‘OECD-modified scale’; the head of the household is assigned a value of 1, each additional member 0.5, and each dependent is assigned 0.3</td>
</tr>
<tr>
<td></td>
<td>Disposable income is treated as the main mechanism for intra-family sharing.</td>
</tr>
<tr>
<td></td>
<td>The assumption made here is that individuals in a household earn market income, pay taxes, and/or receive transfers, and then pool their disposable income which is allocated to members of the family based on need.</td>
</tr>
<tr>
<td></td>
<td>Different individuals are assumed to have different needs (see column attribution logic).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health</th>
<th>Attribution of health expenditure on an individualised insurance value basis.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>An individual’s characteristics are taken into account to determine the amount of expenditure that should be attributed – these characteristics are: age, gender, ethnicity and deprivation index</td>
</tr>
<tr>
<td></td>
<td>MoH funding of health boards takes into account the demographic and socioeconomic composition of each region.</td>
</tr>
<tr>
<td></td>
<td>The criteria used in determining the level of funding each DHB receives, takes into account the age, gender and ethnic profile of the region and socioeconomic status of the population.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th>Attribution of education expenditure on an individualised basis.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Use HES data on the reported use of early childhood and tertiary education services.</td>
</tr>
<tr>
<td></td>
<td>Compulsory education expenditure attributed to those age-eligible.</td>
</tr>
<tr>
<td></td>
<td>Student allowances are attributed based on self-reports in HES</td>
</tr>
<tr>
<td></td>
<td>Those attributed allowances are attributed lower student loan write-offs.</td>
</tr>
<tr>
<td></td>
<td>The universal provision of education services means that most education expenditure isn’t targeted by income group. Therefore the incidence of this expenditure needs to be determined either by assuming recipients are age-eligible to receive it (compulsory education) or have reported participation in certain types of educational activities or receipts of education subsidies e.g. student allowance, loans etc.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GST</th>
<th>For multi-family households, GST is allocated in proportion to the</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GST is a tax on consumption, and the amount each person pays is a factor of</td>
</tr>
</tbody>
</table>
disposable income earned by each family, unless one of the families earns below ‘subsistence level’ income ($60/week), in which it is divided equally among the families.

- Then GST is attributed according to an assumption around the relative consumption needs of each individual in the family.

- Secondary earners and children, individually, are expected to consume a lower proportion of the household expenditure than the primary earner.

- These proportions are based on the consumption weightings of the ‘OECD-modified scale’; the head of the household is assigned a value of 1, each additional member 0.5, and each child is assigned 0.3 how much he/she is expected to consume.

- It is assumed that individuals in a household have different consumption needs; the share of the total household expenditure that a person gets is the same as the share of the total household disposable income that they have access to.

- There are very few consumption items that are GST exempt, so it is assumed that each person in a household pays the same share of the total household GST as the share of expenditure they have received.

<table>
<thead>
<tr>
<th>Excises</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>- Alcohol</strong></td>
<td>- For families that have reported alcohol consumption in HES,</td>
<td>- In the absence of more granular information on who in the</td>
</tr>
<tr>
<td></td>
<td>excises are attributed equally across all persons of legal age</td>
<td>family/household is consuming alcohol, it is assumed that all</td>
</tr>
<tr>
<td></td>
<td>in the family.</td>
<td>adults bear the incidence of alcohol excises equally.</td>
</tr>
<tr>
<td></td>
<td>- For multi-family households, allocate initially by proportion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>of total household disposable income earned by each family.</td>
<td></td>
</tr>
<tr>
<td><strong>- Tobacco</strong></td>
<td>- For families that have reported tobacco consumption in HES,</td>
<td>- In the absence of more granular information on who in the</td>
</tr>
<tr>
<td></td>
<td>excises are attributed equally across all persons of legal age</td>
<td>family/household is smoking, it is assumed that all adults</td>
</tr>
<tr>
<td></td>
<td>in the family.</td>
<td>bear the incidence of tobacco excises equally.</td>
</tr>
<tr>
<td></td>
<td>- For multi-family households, allocate initially by proportion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>of total household disposable income earned by each family.</td>
<td></td>
</tr>
<tr>
<td><strong>- Fuel</strong></td>
<td>- For households that have reported fuel consumption in HES,</td>
<td>- In the absence of more granular information on who in the</td>
</tr>
<tr>
<td></td>
<td>excises are attributed equally across all persons of in the</td>
<td>household is consuming fuel expenses, it is assumed that all</td>
</tr>
<tr>
<td></td>
<td>household in according to the share of the total household</td>
<td>members bear the incidence of fuel excises according to their</td>
</tr>
<tr>
<td></td>
<td>expenditure they are assumed to be receiving.</td>
<td>share of household income and expenditure.</td>
</tr>
</tbody>
</table>

| Final Income     | Calculated on an individualised basis as net of income earned/received, tax paid and spending received | Gives a broad indication of the economic resources available to an individual |
Appendix D: The incidence of tax and spending by gender and age

Appendix Figure 3 - Distribution of Direct Tax by Gender and Age-Group: 2010 and 2060

Appendix Figure 4 - Distribution of Indirect Tax by Gender and Age-Group: 2010 and 2060
Appendix Figure 5 - Distribution of Income Support Spending by Gender and Age-Group: 2010 and 2060

Appendix Figure 6 - Distribution of Education Spending by Gender and Age-Group: 2010 and 2060
Appendix Figure 7 - Distribution of Health Spending by Gender and Age-Group: 2010 and 2060

Appendix Figure 8 - Net Fiscal Impact by Gender and Age-Group: 2010 and 2060
References


