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**Working Paper**

## The Distributional Impact of Population Ageing

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# The Distributional Impact of Population Ageing

Omar A. Aziz, Christopher Ball, John Creedy  
and Jesse Eedrah

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The Distributional Impact of Population Ageing

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# Abstract

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This paper examines the potential distributional impacts of demographic change, particularly population ageing, and changes to labour force participation that are projected to arise over the next 50 years. The approach involves calibration weighting of the Treasury's microsimulation model, Taxwell, based on the New Zealand Household Economic Survey. The weights are adjusted for each projection year to ensure that a range of population aggregates (by age and gender) match the projected values provided by Statistics New Zealand. Measures of income inequality and poverty, along with the incidence of income tax, Goods and Services Tax and a number of components of government spending (namely health and education) across age groups, are obtained. The results suggest that population ageing and expected changes in labour force participation, in isolation, do not have a significant impact on population-level measures of income inequality.

**JEL CLASSIFICATION** H24, I14, I24, J1, H24

**KEYWORDS** Inequality; population ageing; survey calibration; poverty; fiscal incidence

## Executive Summary

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This paper examines the potential impact on the New Zealand income distribution of population ageing and expected changes in rates of labour force participation. This ignores many other types of change, but the concentration on these two influences is warranted in view of their importance and the fact that they can be anticipated with some degree of confidence relative to other changes.

The effects on aggregate measures of income inequality and poverty are examined, along with the way income tax, benefits and various forms of government spending (including health and education) are distributed across age groups.

Statistics New Zealand projected population and labour force participation profiles of New Zealand for selected years from 2020 to 2060 are in turn applied to data from the Household Economic Survey (HES). The HES uses sample weights for each individual and household and these are used to produce population-level aggregates from the sample survey information. Hence, the approach is to compute new weights to reflect the demographic and labour market participation profiles for future years. The weights are scaled so that the aggregate population size is fixed, thereby concentrating on 'pure' demographic effects.

It is found that expected population ageing and changes in labour force participation affect mainly the composition of the income distribution and the age-incidence of tax and spending. It is not likely to affect overall income inequality, however measured. The incidence of net tax and government spending across age groups is expected to be more skewed towards older age groups. People aged 65 and over are likely to represent a larger proportion of the total population and receive a higher share of total welfare expenditure in the form of New Zealand Superannuation (NZS). However, if they continue to earn relatively low market incomes, they will be a larger proportion of lower-income deciles. As a result, NZS will constitute a higher proportion of total benefits received by lower income households.

These findings are subject to several caveats. Inequality and poverty are determined by a large range of factors. This study isolates the impact of only two of many such factors and does not take into account the many social, economic and technological changes that may occur in New Zealand over the next 50 years. There is considerable uncertainty regarding these changes.

# Table of Contents

<b>Abstract .....</b>	<b>i</b>
<b>Executive Summary.....</b>	<b>ii</b>
<b>1 Introduction .....</b>	<b>1</b>
<b>2 Long term trends.....</b>	<b>3</b>
2.1 Population ageing .....	3
2.2 Labour force participation .....	4
<b>3 Methodology .....</b>	<b>5</b>
3.1 Modelling the income distribution .....	5
3.2 Modelling the incidence of tax and spending by age group .....	6
<b>4 Population ageing, inequality and poverty .....</b>	<b>9</b>
4.1 Income inequality .....	11
4.2 Poverty measures .....	13
<b>5 The incidence of tax and spending by age group .....</b>	<b>15</b>
<b>6 Conclusion .....</b>	<b>20</b>
<b>Appendix A: Data sources .....</b>	<b>21</b>
<b>Appendix B: Calibrating the Household Economic Survey.....</b>	<b>22</b>
B.1 Method used to project benchmarks .....	23
B.2 Impact of calibration .....	24
<b>Appendix C: Attribution logic for tax and spending incidence analysis.....</b>	<b>25</b>
<b>References .....</b>	<b>28</b>

## List of Figures

Figure 1 - New Zealand Population Age Structure: 1960, 2010 and 2060 .....	3
Figure 2 - Population Share: 2006 to 2060 .....	3
Figure 3 - Projected Changes in Labour Force Participation by Age: 2006 to 2060 .....	4
Figure 4 - Analytical Framework .....	6
Figure 5 - Proportion of Family Types: 2010 and 2060.....	9
Figure 6 – Median Individual Market Income by Age: 2010.....	10
Figure 7 - Proportion of Individuals Aged 65 and Over in each Income Decile .....	11
Figure 8 - Gini Coefficients by Income Type .....	11
Figure 9 - Percentage of Individuals by Disposable Income per Adult Equivalent Person.....	13
Figure 10 - Percentage of Individuals in Households below Median Disposable Income per Adult Equivalent .....	14
Figure 11 - Percentage of Dependents in Households earning below Median Adult Equivalent Disposable Income .....	14
Figure 12 - Distribution of Direct Tax by Age Group: 2010 and 2060.....	15
Figure 13 - Distribution of Indirect Tax by Age Group: 2010 and 2060 .....	16
Figure 14 - Distribution of Income Support Spending by Age Group: 2010 and 2060 .....	17
Figure 15 - Distribution of Education Spending by Age Group: 2010 and 2060 .....	17
Figure 16 - Distribution of Health Spending by Age Group: 2010 and 2060 .....	18
Figure 17 - Net Fiscal Impact by Age Group: 2010 and 2060 .....	19
Appendix Figure 1 - Proportion of Families by Disposable Income Band: 2010 and 2060 .....	24



# List of Tables

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Appendix Table 1 - Benchmark Categories .....	22
Appendix Table 2 - Projection Methodology .....	23
Appendix Table 3 - Attribution Logic for Allocation of Tax, Spending and Income.....	25

# The Distributional Impact of Population Ageing

## 1 Introduction

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The aim of this paper is to analyse the potential impact of two factors that are expected to play a role in determining the distribution of income in New Zealand over the next 50 years. These factors are long-term demographic change – population ageing – and expected changes in rates of labour force participation. Income inequality is of course affected by many interacting factors such as social changes, household structure, the domestic and international economic environment, labour and goods markets and government tax and spending policy settings. The concentration on just two of those influences is warranted in view of their potential importance and the fact that they can be anticipated with some degree of confidence (particularly the extent of population ageing) relative to other changes.

There are two broad aims. First, the paper investigates whether population ageing and assumptions about future increases in labour force participation are likely, in isolation, to have a significant effect on aggregate measures of income inequality and poverty. Second this paper examines how tax and various forms of government spending (including health and education) are currently distributed across age groups and how their future distribution may change as a result of population ageing and changes in rates of labour force participation.

The approach adopted here is to apply the Statistics New Zealand projected demographic and labour force participation profile of New Zealand for the years 2020, 2030, 2040, 2050 and 2060 to data from the 2009/10 Household Economic Survey (HES). The HES uses sample weights for each individual and household and these are used to produce population-level aggregates from the sample survey information. Hence, the approach is to compute new weights, applied to the 2009/10 HES, to reflect the demographic and labour market participation profiles for future years. However, the weights are also scaled so that the aggregate population size is fixed.<sup>1</sup> In this way it isolates the effect of population ageing and expected changes in labour force participation while holding a

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<sup>1</sup> Harding (1995), Guest and McDonald (1999) and Creedy *et al.* (2006) follow a similar approach using Australian data. Creedy *et al.* (2010) use calibration weighting of the New Zealand HES, concentrating on income tax and GST revenues up to 2050. These studies, unlike the present paper, do not examine the fiscal incidence of government expenditure on health and education.

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 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. Hence, potential general equilibrium effects, for example on wage rates, private savings and social expenditures, are not considered.<sup>2</sup> The resulting distributions are cross-sectional in nature, as no longitudinal information is available about the experience of individuals and their life cycles.<sup>3</sup>

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 a number of components of government spending across age groups is also presented. Section 6 concludes.

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<sup>2</sup> Fiscal policy parameters are also held constant. However, sensitivity analyses are reported in Section 5, where income tax thresholds are adjusted to keep aggregate net expenditure roughly constant.

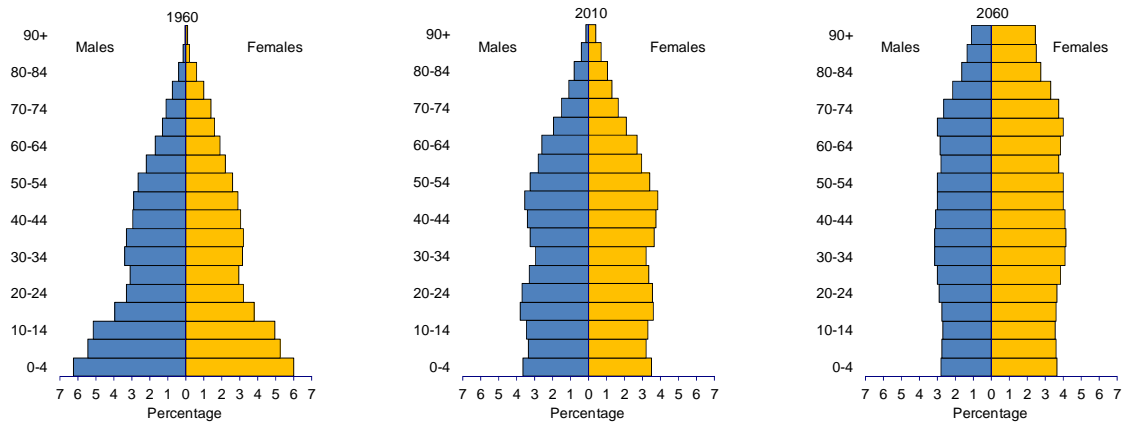
<sup>3</sup> Furthermore, no decompositions are given for ethnic or regional differences.

## 2 Long term trends

### 2.1 Population ageing

New Zealand, in common with most industrialised countries, is expected to experience significant population ageing in the coming decades. As shown in Figure 1, from Statistics New Zealand, 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**



**Figure 2 - Population Share: 2006 to 2060**

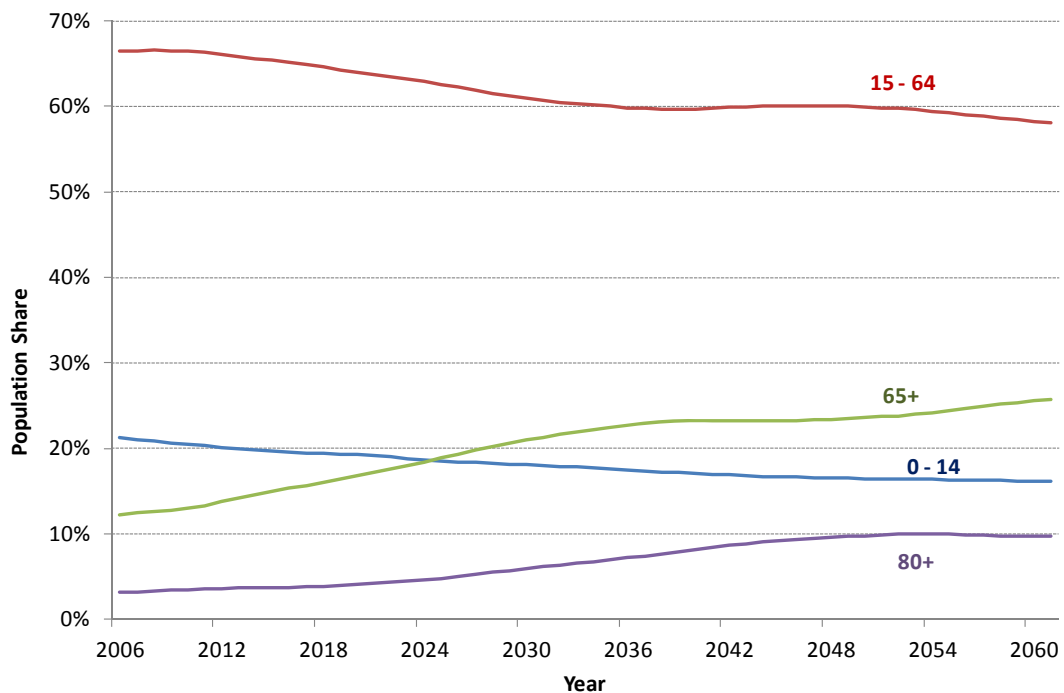
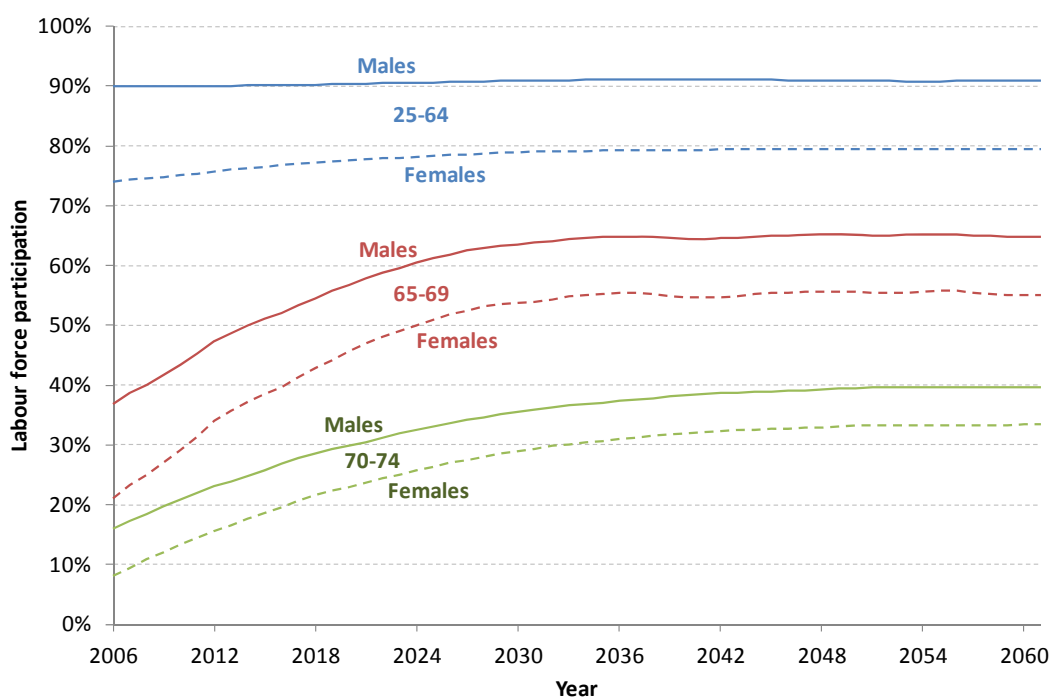


Figure 2 indicates that between 2010 and 2060, the percentage of people aged 65 and over is expected to increase from 13% to 26% of the total population and, more significantly for fiscal analysis, the percentage of the population aged over 80 triples. Concurrently, the proportion of people between the 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.

## 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.<sup>4</sup> 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 participation rates for those aged 65 and over are projected. Hence better health outcomes are expected to be associated with prolonged labour market activity and increased life expectancy for individuals in these age groups.

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



<sup>4</sup> [http://www.stats.govt.nz/browse\\_for\\_stats/population/estimates\\_and\\_projections/NationalLabourForceProjections\\_HOTP06-61Augupdate.aspx](http://www.stats.govt.nz/browse_for_stats/population/estimates_and_projections/NationalLabourForceProjections_HOTP06-61Augupdate.aspx)

## 3 Methodology

The present paper uses the NZ Treasury's non-behavioural tax-benefit microsimulation model, *Taxwell* and the 2009/10 Household Economic Survey (HES).<sup>5</sup> The survey contains sufficient information about incomes, expenditures and household characteristics to compute welfare benefits, along with direct and indirect taxes. It also contains detailed demographic information on individuals which can be used to impute the expected education and health expenditure.

Each individual in the survey is assigned a weight which makes it possible to aggregate from the sample to population values. The approach is to calculate, for each year of interest, a new set of weights. The new weights ensure that aggregate values of a wide range of variables sum to calibration totals, which correspond to the Treasury's Long-Term Fiscal Model (LTFM). The calibration variables include the projected demographic structure of the population, aggregate labour market participation rates, by age and gender, and others. Details of the calibration weighting procedure are given in Appendix B.

### 3.1 Modelling the income distribution

It is possible to compute summary measures of inequality and poverty using a range of types of income unit and income measure. Beginning with an observed distribution of income from wages, self-employment and investments – usually referred to as market income – it is possible to obtain the net effect of income-support payments, housing subsidies and income taxes to estimate the distribution of disposable income.<sup>6</sup> The estimated cash value of in-kind benefits such as health and education is attributed to households using various allocation rules.<sup>7</sup> 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 the resulting distribution of a measure of the economic resources available to households is derived; this measure is referred to as final income. A more comprehensive idea 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.

To undertake such fiscal incidence studies, detailed micro-level data on household or family income and expenditure are 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 health and education entitlements. Views on the redistributive effects of government

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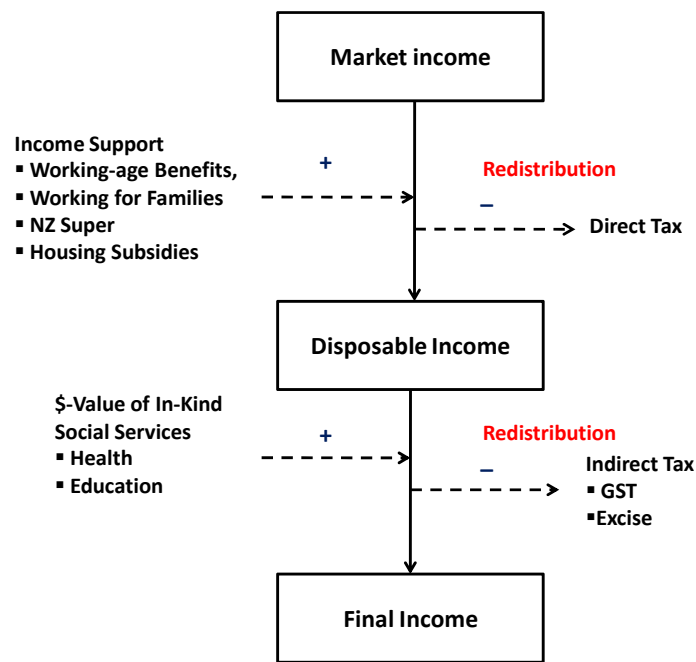
<sup>5</sup> For this analysis, a particular year such as 2010 refers to the 12 month period from 1 April in the previous year to 31 March of the year mentioned. The HES is from July to June, but *Taxwell* is adjusted to 'tax years'.

<sup>6</sup> These benefit amounts are based on eligibility and may not reflect actual receipt if take-up is less than 100 per cent.

<sup>7</sup> 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 live in the same household. A household is the largest unit in this model and consists of an economically independent group of families.

policy can therefore be informed by analysing disparities between income groups and calculating aggregate inequality and poverty measures.<sup>8</sup>

**Figure 4 - Analytical Framework**



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

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 age-incidence of tax and spending and the sharing of resources within families and households need to be implemented.<sup>9</sup> Appendix C describes the attribution principles used for this analysis in further detail.

Market income is attributed to the particular earner of that income in the family as are estimates of tax liabilities on the income.<sup>10</sup> Working-age welfare entitlements and any tax owed on those entitlements are generated from Treasury’s micro-simulation model, Taxwell. These are 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

<sup>8</sup> See Crawford and Johnston (2004) and Aziz *et al.* (2012) for an evaluation of the distributional impact of tax and government spending between the years 1988 and 2010.

<sup>9</sup> Phipps and Burton (1995) provide an overview of alternative intra-family sharing rules.

<sup>10</sup> For example, if both persons in a couple are working, they earn market income and pay income tax independently. Thus, the incidence of market income and income tax accrues to the respective earner of the income. If only one person is working, market income and corresponding tax liability is attributed to that person alone. This analysis assumes that a family’s disposable income is the main mechanism by which financial resources are shared among family members.

are determined in Taxwell at a family level. Any WfF entitlement for eligible families is attributed to the adult with the least market income, who is 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 among 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, which is then assumed to be shared within the family. That is, individuals in a family earn market income, pay taxes, and/or receive transfers and then pool their disposable income. This is then allocated to the members of the family using an assumed sharing rule. In contrast to an equal sharing rule, the present analysis assumes a family's disposable income is divided among its individuals using a set of sharing factors, assumed to be the same for each family. In the absence of empirical information about average sharing proportions in New Zealand, the consumption weights in the OECD modified equivalence scale were used as a 'benchmark'. The principal earner of a family is assigned a weight of 1, a partner of the principal, 0.5, and every dependent, 0.3. For example, in a family consisting of two adults and two children, the principal earner would obtain a fraction,  $(1/2.1)$  of total disposable income, while the partner would obtain a fraction,  $(0.5/2.1)$ , and each child would have  $(0.3/2.1)$  of the total. However, the effects of varying these weights were examined and are noted below.

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 decomposed into government spending on each schooling year or age. Those people in the HES who are in that type of education and who match the additional characteristics, such as age, are allocated the government expenditure appropriate for their education.<sup>11</sup>

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 obtained from expenditure data which are available in the 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.<sup>12</sup> GST and fuel excises are attributed in the same manner as family disposable income. However, alcohol and tobacco excises are divided equally among only those who are 18 years of age or over.

The age-based incidence analysis depicts the distribution of tax, spending and income at various dates between 2010 and 2060. As explained above, it does not attempt to project each individual's life-course nor does it model behavioural or structural changes. It applies calibrated sample weights to investigate how the relative distribution of tax, spending and income will change across age groups as the demographic profile of New Zealand

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<sup>11</sup> See Aziz *et al.* (2012) for further details.

<sup>12</sup> For multi-family households, consumption is divided according to the share of disposable income of each family. There is one exception. If there is a family earning negative or below subsistence level disposable income (below \$60 per week) in a household, their income is deemed to be too low to satisfy their consumption needs. This household's GST and excises are allocated according to the OECD-modified equivalence scale's consumption weights, as discussed above.



evolves. 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. As incomes of individuals are not projected into the future, no assumptions about wage growth or productivity changes are required.<sup>13</sup> Current consumption patterns are assumed to hold throughout the projection period.

The tax and welfare settings are for the system in the year 2009/10. Relativities between benefits and NZS are held constant at their 2009/10 levels.<sup>14</sup> This is the most recent comprehensive cross-sectional dataset available on New Zealand households' income and expenditure.

Some results are reported below using total household income per adult equivalent person as the income measure. For convenience the equivalence scales used are the same as the modified OECD scales mentioned above (although sensitivity analyses were also carried out).

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<sup>13</sup> Thus, all dollar values in this paper are denominated in 2010 dollars.

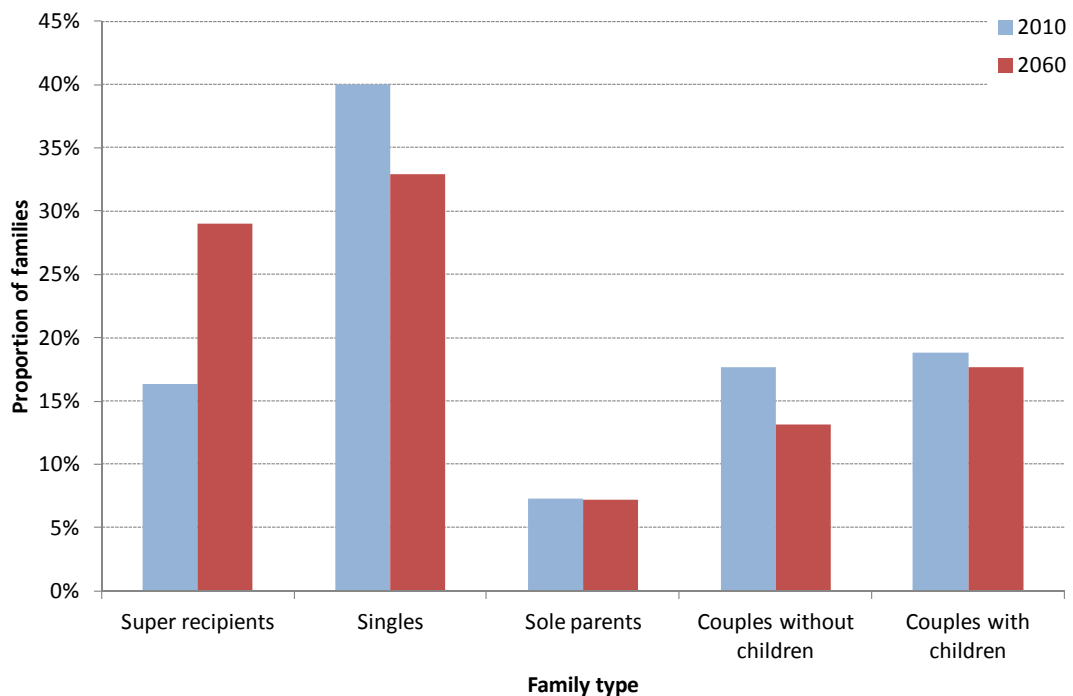
<sup>14</sup> Tax changes made as part of the 2010 budget are therefore not included.

## 4 Population ageing, inequality and poverty

This section presents a range of income inequality and poverty measures to demonstrate the effect on the income distribution of a changing population structure and labour force participation rates. First, it is useful to consider how the income distribution is expected to change as a consequence of calibrating the 2009/10 survey (as described in Appendix B) to reflect the projected 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 expected, families receiving NZS 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.

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



**Figure 6 – Median Individual Market Income by Age: 2010**

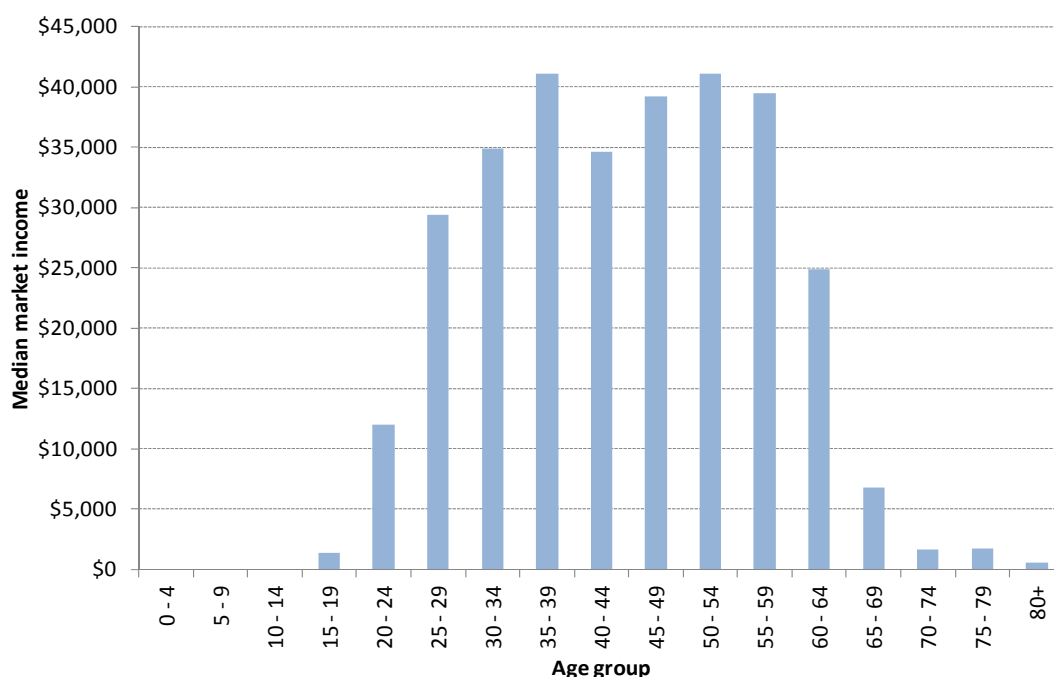
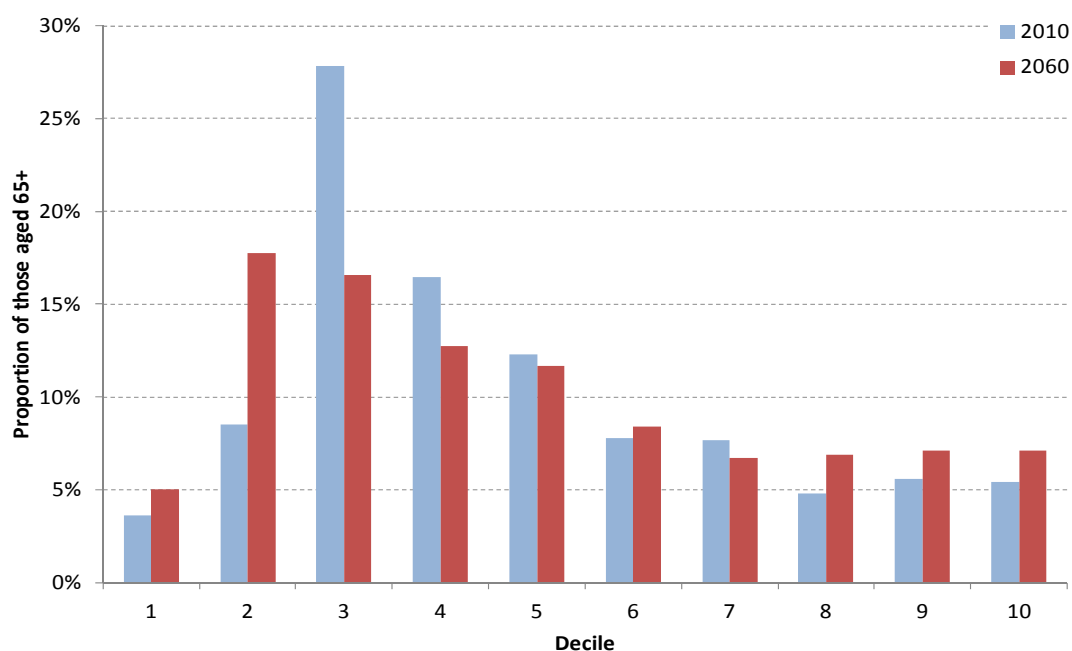


Figure 6 shows median individual market income by age for 2010, where the distributions include zeros for those with no market income. Clearly the zeros dominate for those in the age groups below 19 and above 65 years.

Figure 7 shows the proportion of individuals aged 65 and over in each disposable income decile. The deciles were computed using total household disposable income per adult equivalent person, with the household as the unit of analysis. Hence, while exactly 10 per cent of households are in each decile, the proportion of individuals in each decile varies somewhat.<sup>15</sup> Those over 65 years form a relatively high proportion of individuals in the lower-income deciles. However, there is a wide dispersion of incomes in the older age groups. For instance, in Figure 7 the largest proportion of individuals aged 65 are in decile 3 in 2010, but by 2060 the largest proportion are in decile 2. Nevertheless, older individuals are expected to become better represented in upper-income deciles. These trends reflect two types of change. First, those who work past the age of 64 will earn relatively high market incomes and will also receive NZS. Those who do not participate 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.

<sup>15</sup> The proportion varies between 9 and 11 per cent.

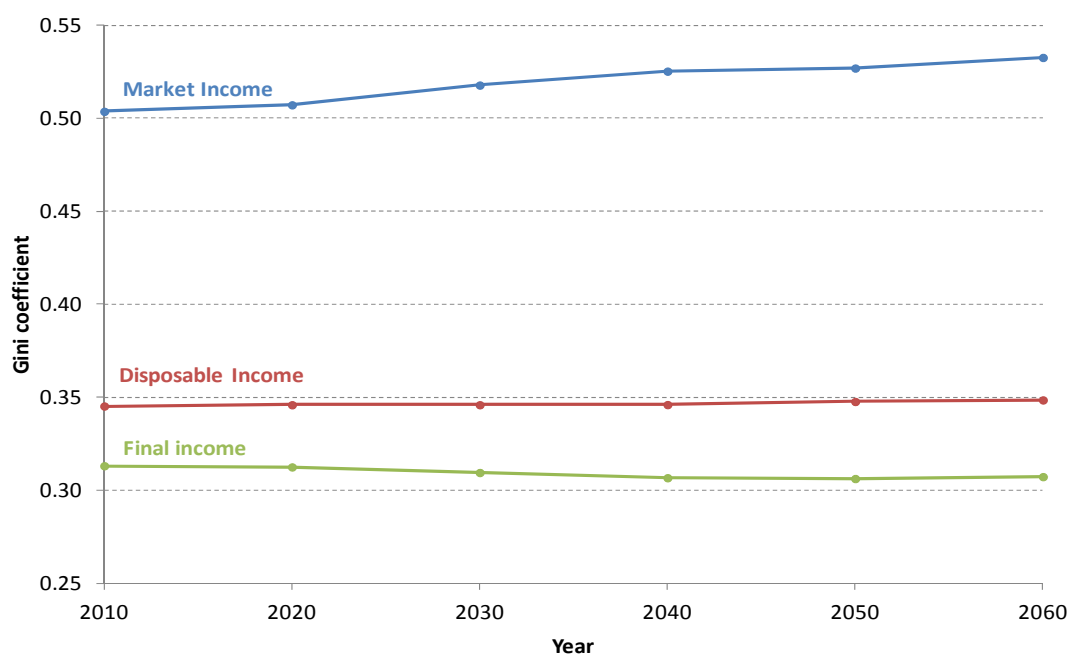
**Figure 7 - Proportion of Individuals Aged 65 and Over in each Income Decile**



## 4.1 Income inequality

Consider the effects of ‘pure’ population ageing and labour force participation changes on an aggregate measure of inequality, the Gini measure. First, Figure 8 shows variations in the Gini coefficient for a range of household income concepts. In each case the household is the unit of analysis and no adult equivalent scales or sharing rules have been applied. The graph shows a slight increase in the Gini measure of household market income from 0.504 in 2010 to 0.533 in 2060; an increase of approximately 6%.<sup>16</sup> The Gini measures of disposable and final incomes are relatively stable across time: the rises very slightly from 0.345 to 0.349, while the latter falls slightly from 0.313 to 0.307.

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



<sup>16</sup> The Gini measures of household market income per adult equivalent person, obtained using the household as the unit of analysis, actually falls from 0.331 to 0.298 over the period.

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 is expected to remain in lower income deciles. Therefore if current indexing arrangements prevail over the next 50 years, NZS will become a more prominent redistributive instrument over time.<sup>17</sup> That is, in the absence of changes to tax and transfer policy settings, any increase in market income inequality may be 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 percentage reduction in the Gini measure between market and disposable household incomes increases from 31% in 2010 to 35% in 2060 as a higher proportion of transfers in the form of NZS are directed towards the elderly in lower income deciles. This percentage reduction changes by only 1 percentage point per decade up to 2040, and remains constant at 34% by 2050. Similarly, a higher proportion of health expenditure directed to lower income households leads to an increase in the percentage reduction in the Gini from disposable to final income of 9% in 2010, rising to 11% in 2030 and 2040, then to 12% in 2050 and 2060.

If the unit of analysis is the individual, the general picture remains similar to that in Figure 8 but the absolute values are somewhat different. For example, the Gini value of individual market income increases from 0.674 to 0.699; these are larger than above because of the large number of zero individual market incomes. The inequality of household disposable income per adult equivalent person, using the individual as the unit of analysis, actually falls from 0.296 to 0.281 from 2010 to 2060. The use of income per adult equivalent person implies a type of equal sharing, whereas the use of an explicit sharing rule, as discussed above, leads to more inequality. Thus the Gini measure of disposable income per person, after explicit sharing and using the individual as the unit of analysis, falls slightly from 0.427 to 0.411 over the period. The inequality of individual final income, after sharing, falls from 0.329 to 0.320.

A sharing rule that involves smaller differences in the weight attached to each type of person is obviously expected to produce less inequality within each family. However, it is not clear how overall inequality may change. Suppose the weight attached to subsequent adults, after the first adult, is 0.8 and the weight attached to children is 0.5. The Gini measure of final income, after sharing and with the individual as unit, varies from 0.302 in 2010 to 0.291 in 2060. The corresponding measure of disposable income falls from 0.389 to 0.371 over the period. These are somewhat lower than in the previous paragraph but show similar variations over time.

The important result remains that whichever income measure or unit is used, population ageing and assumptions about future rates of labour force participation are not, in isolation, expected to affect income inequality, as measured by the Gini coefficient, significantly.<sup>18</sup>

<sup>17</sup> NZS is a tax-funded and taxable pension available to all individuals aged 65 and over. It is not means-tested and is indexed to CPI subject to remaining above a wage floor - 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.

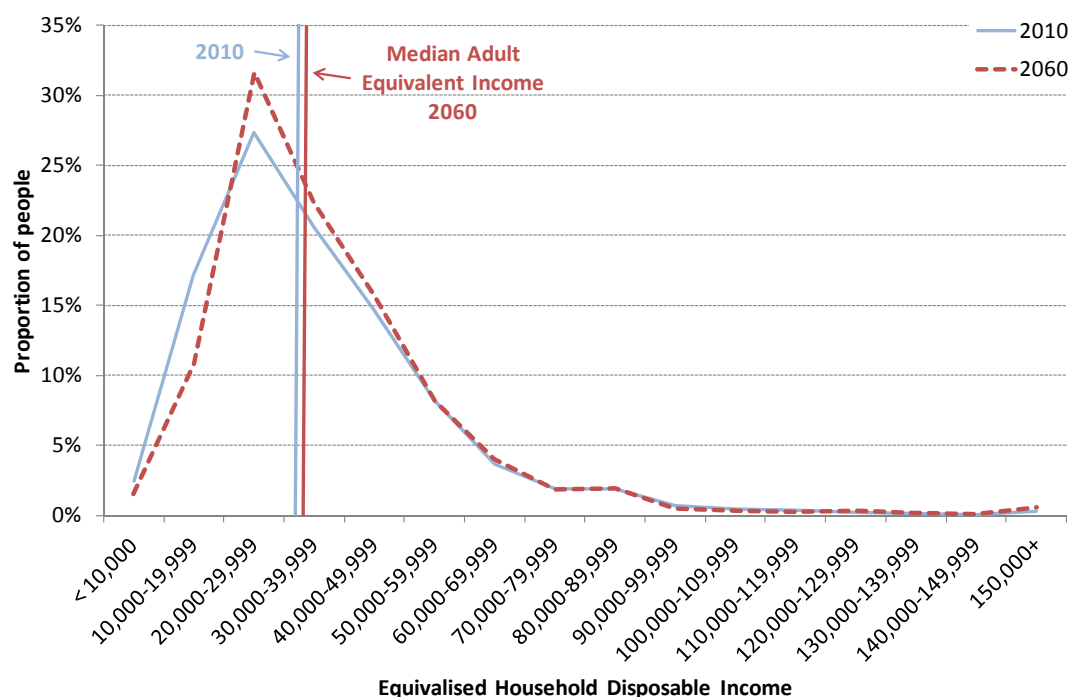
<sup>18</sup> Furthermore, Lorenz curves of disposable income for 2060 are slightly closer to the line of equality than the corresponding curve for 2010 over nearly all of its length. The curves are indistinguishable for the top decile.

## 4.2 Poverty measures

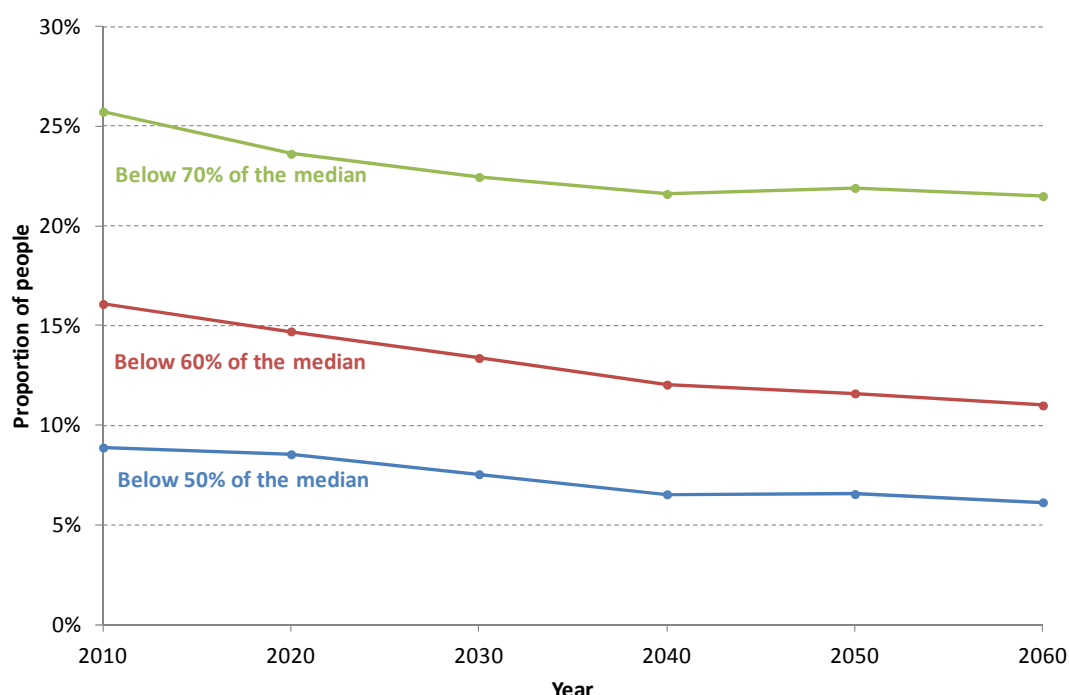
Figure 9 shows the proportion of individuals in each adult equivalent disposable income band for 2010 and 2060. It indicates that a larger number of individuals will be living in households earning closer to the median adult equivalent income in 2060.

NZS settings enable recipients to access an adult equivalent income of roughly between 60% and 70% of the median disposable income per adult equivalent person (where the individual is the unit of analysis). As the population ages and the composition of the income distribution changes as a result with the elderly more concentrated 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 disposable income per adult equivalent person for a particular year, but they do affect the number of households at or below 50%, 60% and 70% of the median equivalised disposable income. With 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. The 80/20 ratio for the income distribution falls from 2.38 in 2010 to 2.32 in 2020 and 2.22 in 2030. Thereafter the decline is much slower, falling from 2.18, 2.15 and 2.13 in 2040, 2050 and 2060 respectively. Furthermore, Figure 10 shows that headcount poverty measures, when using poverty lines of 50% and 60% of the median disposable income per adult equivalent person, 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 9 - Percentage of Individuals by Disposable Income per Adult Equivalent Person**

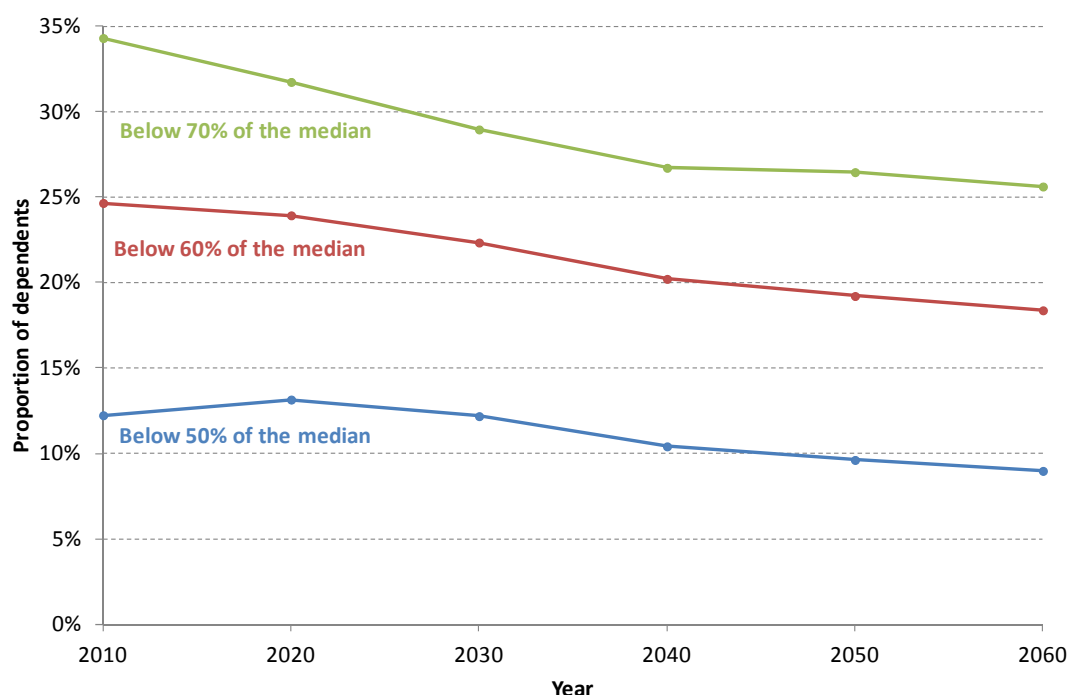


**Figure 10 - Percentage of Individuals in Households below Median Disposable Income per Adult Equivalent**



Families with children are expected to constitute a smaller proportion of the population over time. Compared with 2010, they will also be a smaller proportion of the lower end of the income distribution in 2060. Figure 11 indicates that relative child poverty rates are expected to decrease in the long-term. The main reason for this is that mothers are expected to have children at older ages and on average earn higher market incomes. The labour force participation of working-age females is expected to increase and transfers such as Working for Families (WfF) will continue to provide cash assistance. Therefore, the percentage of children living in households with disposable incomes of less than 50%, 60% or 70% of the median is expected to decrease.

**Figure 11 - Percentage of Dependents in Households earning below Median Adult Equivalent Disposable Income**



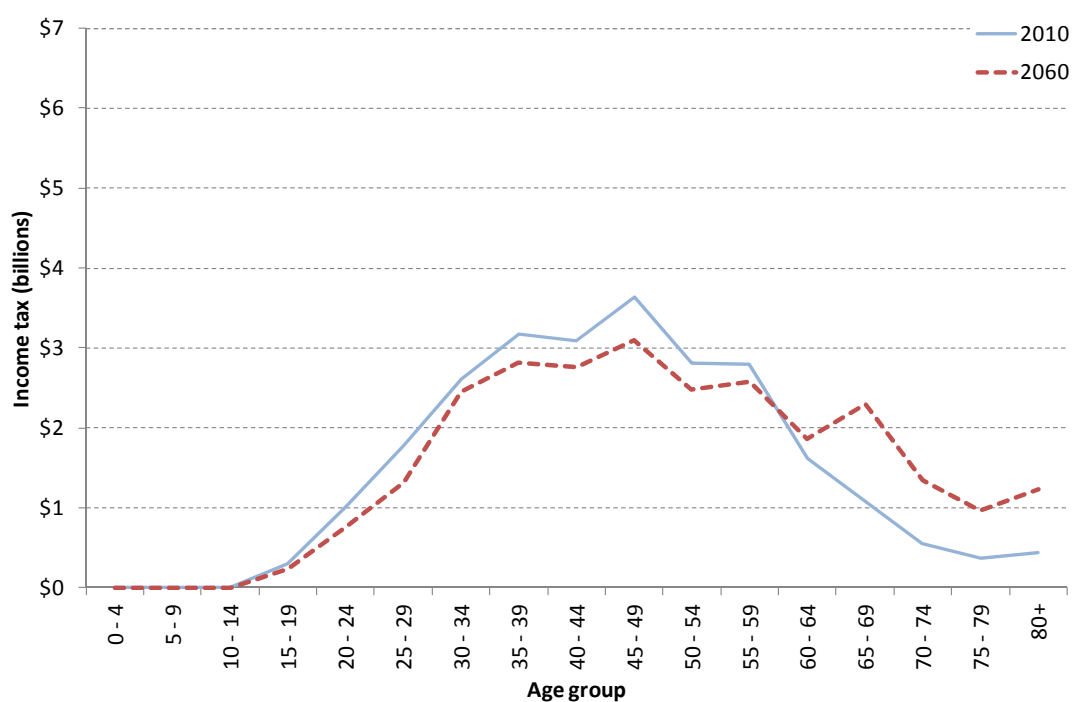
## 5 The incidence of tax and spending by age group

This section examines 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. Here the unit of analysis is consistently the individual, using the allocation framework set out in Figure 4 above. Figure 12 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 distribution is strongly influenced by the earnings profile of individuals over the life cycle. People in younger and older age groups typically earn relatively low incomes, have lower labour force participation rates, 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 12. As the population ages, people over the age of 65 pay 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 if they continue to earn relatively low market incomes, as currently observed, 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.<sup>19</sup>

**Figure 12 - Distribution of Direct Tax by Age Group: 2010 and 2060**

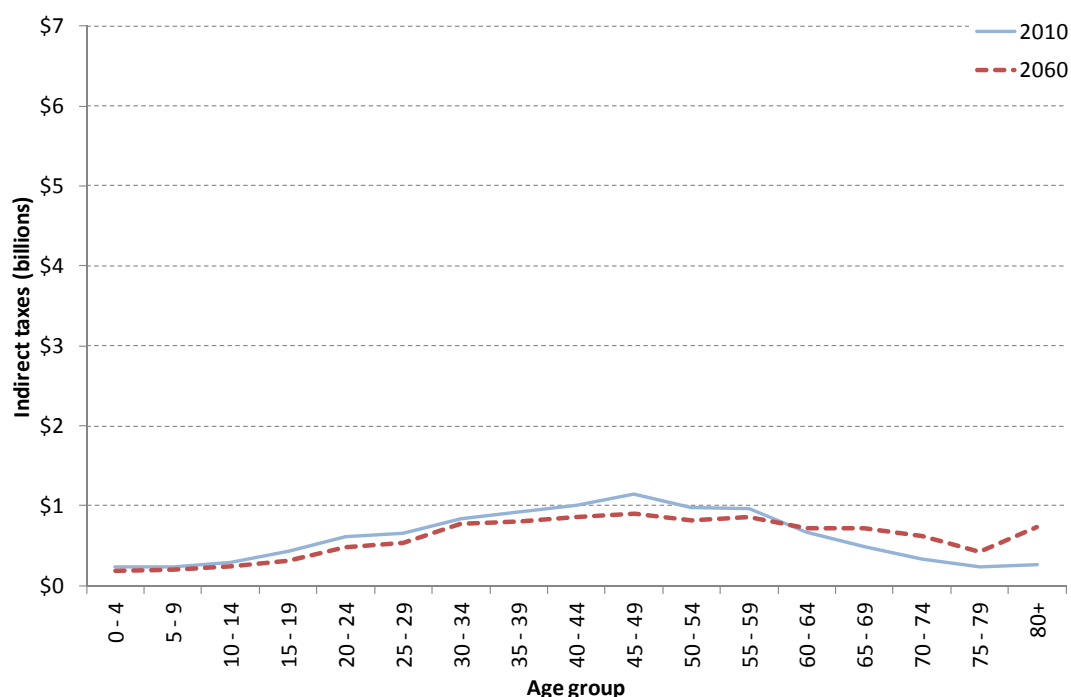


<sup>19</sup> The present approach assumes that hours worked by each type of individual remain unchanged.



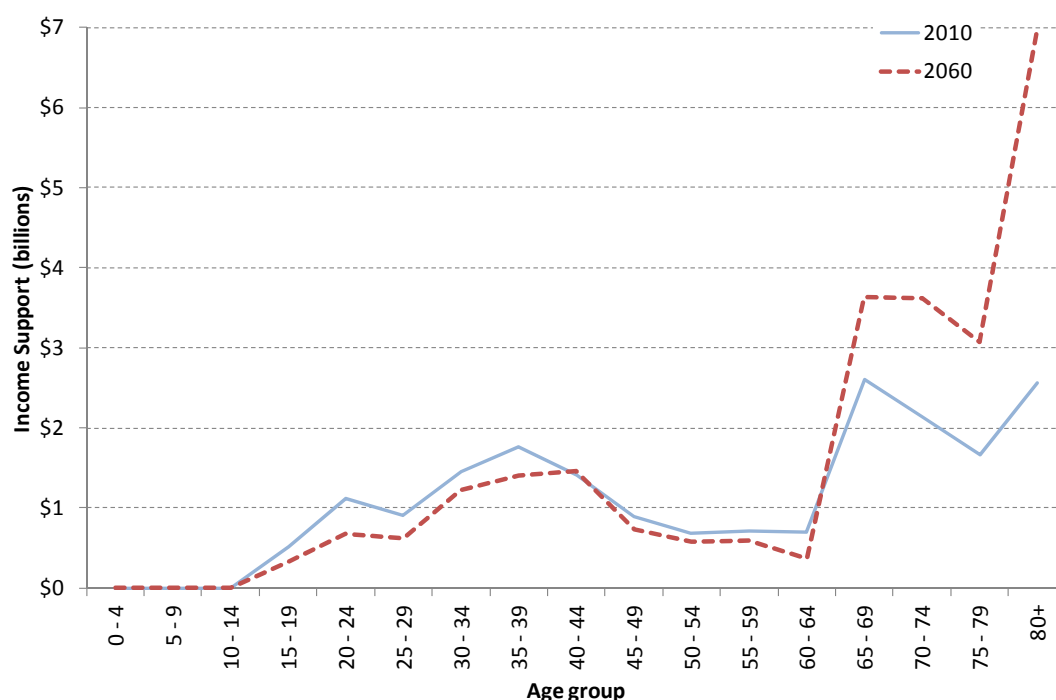
Figure 13 shows the distribution of indirect tax by age-group. Indirect tax includes GST, excises and customs duties on tobacco, alcohol and fuel. The age incidence of indirect tax is expected to change slightly, with those aged 65 and over being expected to pay a slightly higher proportion of total indirect tax. However, should the consumption patterns of this age-group change due to higher labour force participation and higher incomes, they may pay a higher proportion of the total indirect tax than suggested by Figure 13.

**Figure 13 - Distribution of Indirect Tax by Age Group: 2010 and 2060**



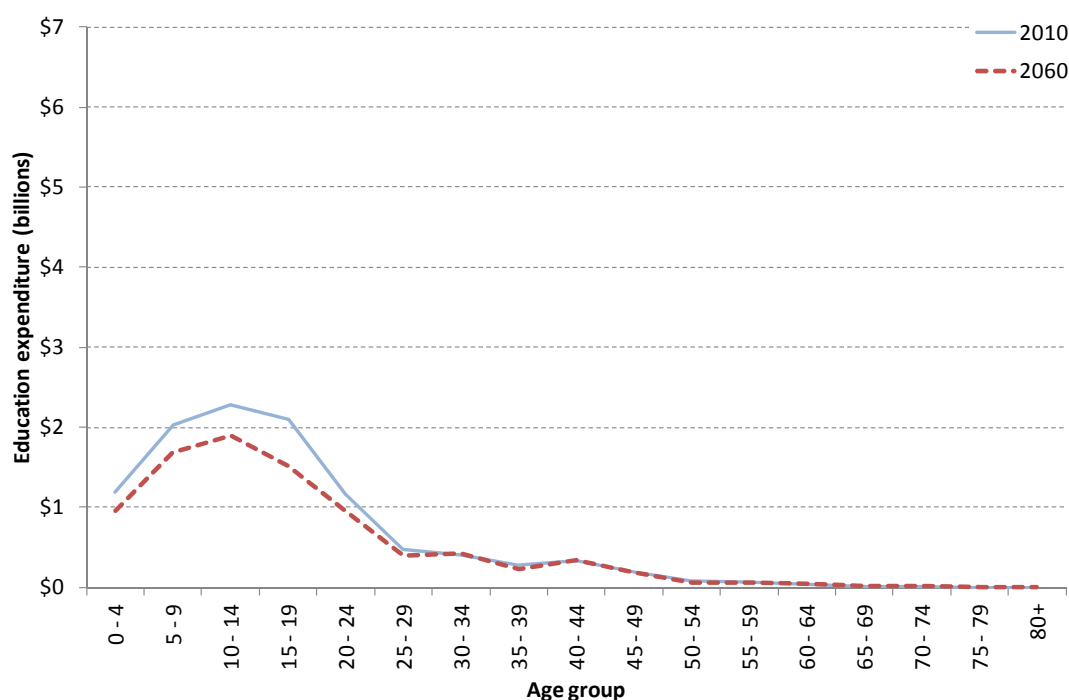
The distribution of cash-benefits, which include receipts of working-age benefits, Working for Families, housing subsidies and NZS is shown in Figure 14. Between the ages of 16 and 64, individuals receive working-age transfers and Working for Families. Transfers for those over the age of 65 are mainly 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.

**Figure 14 - Distribution of Income Support Spending by Age Group: 2010 and 2060**



The distributions of education and health expenditure follow expected patterns, as shown in Figures 15 and 16. Education expenditure is predominantly devoted to 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 rather than any change to policy settings. Similarly, a significant amount of health expenditure is currently devoted to people in older age groups. Their share of total health spending is expected to increase from 31% in 2010 to 51% in 2060. In particular, the near tripling of the health spending on those aged 80 and over corresponds to an increase of this age group as a percentage of the population from its current level.<sup>20</sup>

**Figure 15 - Distribution of Education Spending by Age Group: 2010 and 2060**



<sup>20</sup> See Figure 2

**Figure 16 - Distribution of Health Spending by Age Group: 2010 and 2060**

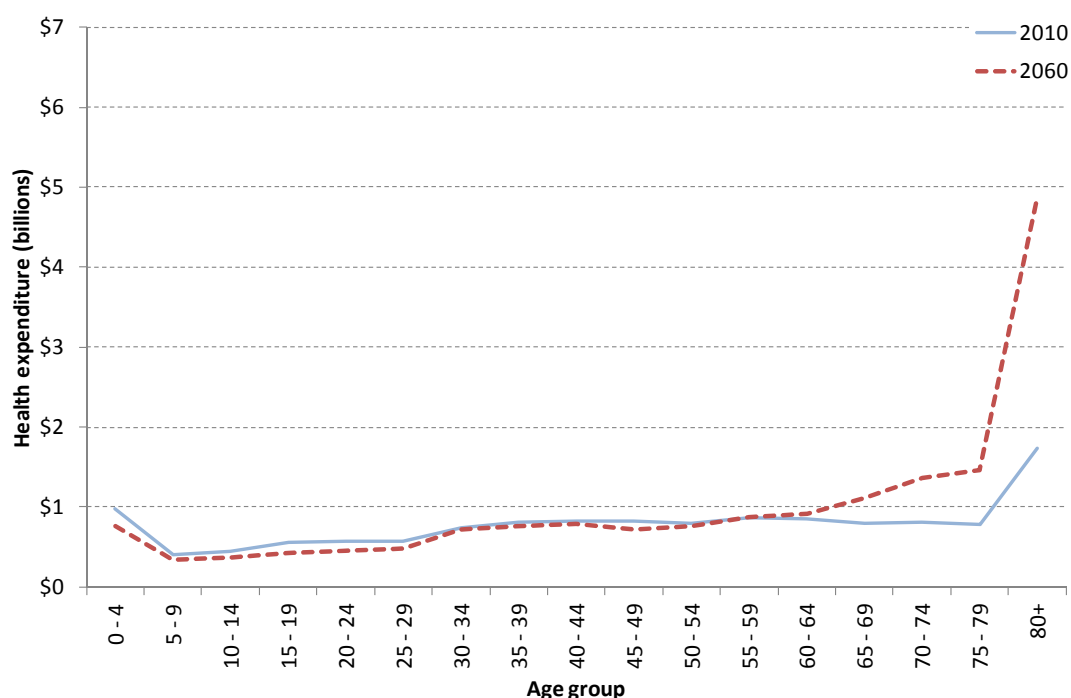
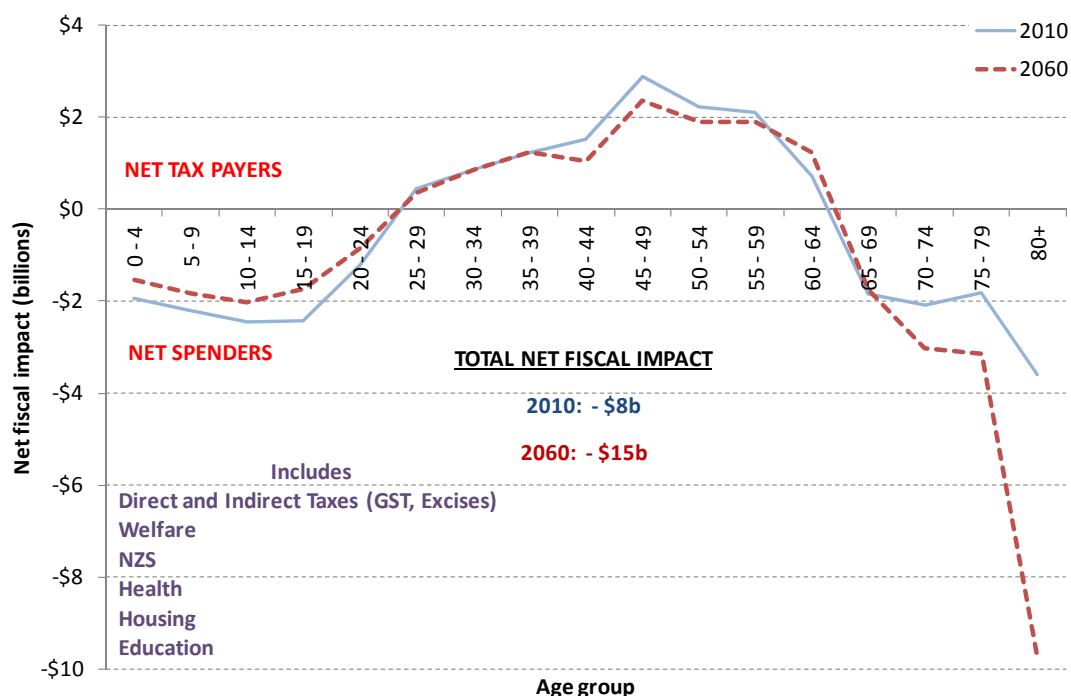


Figure 17 shows the net fiscal impact of tax and spending by age-group. This is measured by the aggregate amount of direct and indirect tax paid by each age-group less the spending received by way of income support, health and education. This shows that population ageing and changes in labour force participation lead to a distribution of tax and spending more heavily skewed towards older age groups. These age groups 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 core working-age groups are expected to form a smaller proportion of the total population over time and pay a relatively lower share of the total tax under current policy settings. There are also expected to be fewer people under the age of 14.

Figure 17 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 items included here increases in absolute terms 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.<sup>21</sup>

<sup>21</sup> 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; see Bell (2012)

**Figure 17 - Net Fiscal Impact by Age Group: 2010 and 2060**



In view of the increase in the net fiscal deficit, shown in Figure 17, it may be thought that the inequality comparisons presented above could be misleading, to the extent that policy changes will in practice have to be made, or a higher deficit could have distributional implications. In view of the considerable number of possible changes, it was decided to examine the implications simply of adjusting income tax thresholds in line with inflation, rather than wage changes (which are expected to be higher as a result of productivity change). Hence, in the present context instead of holding thresholds constant, they were reduced to reflect fiscal drag from the base year. This resulted in the income tax thresholds being reduced from 0; 14,000; 48,000 and 70,000 in 2010 to 0; 4,982; 17,082 and 24,911 in the year 2060. This was found to produce a reduction in the net fiscal deficit to \$5.5b in 2060, which is lower than the 2010 figure. Importantly, the Gini measure of inequality of income per adult equivalent person, using the individual as the unit of analysis, becomes 0.276 in 2060, compared with the value of 0.281 reported above. This reduction, arising from the increased progressivity of the income tax structure as a result of fiscal drag over 50 years, is clearly very small and has no substantive effect on the earlier inequality comparisons.

## 6 Conclusion

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This paper has found that population ageing and expected changes in labour force participation affect mainly the composition of the income distribution and the age-incidence of tax and spending. It is not likely to affect income inequality, however measured. People aged 65 and over will represent a larger 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 a larger proportion of lower-income deciles. As a result, NZS will constitute a higher proportion of total transfer payments received by lower income households.

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 force 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. It does not take into account the many social, economic and technological changes that may occur in New Zealand over the next 50 years. There is of course considerable uncertainty regarding these changes. 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 skill, industrial structure and the economic environment. Nevertheless, the focus on anticipated changes in age structure and labour force participation is warranted by the considerable attention paid to these factors in current debates and the fact that there is relatively more confidence about their nature.

## Appendix A: Data sources

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This paper follows a method similar to that of Aziz *et al.* (2012) in utilising Treasury's non-behavioural microsimulation model, Taxwell, 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.

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.

## Appendix B: Calibrating the Household Economic Survey

Like other microsimulation models, Taxwell relies on sample weights to adjust from sample to population values. Each individual, family and household in the dataset is assigned a weight which represents how common that unit's characteristics are across the population. This appendix provides details on how the HES data are reweighted for the purposes of this analysis.

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 include the number of benefit recipients and superannuitants in projected years in addition to the breakdown of the total population into demographic subgroups such as age, gender and ethnicity.

A list of the 9 broad benchmark categories used for this study is provided in Appendix Table 1. 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. The GREGWT SAS macro, produced by the Australian Bureau of Statistics (2000), was used to carry out calibration of the benchmarks listed above.<sup>22</sup>

**Appendix Table 1 - Benchmark Categories**

Category	Detailed description
Age/Sex	Number of people in each five year age bands from 0 to 79 and 80+ by gender.
Number of occupants	Number of households by region with 1,2,3 or 4+ occupants.
Region	Number of people in each region as provided by HES.
Maori	Number of people who self identify with the Maori ethnicity between 15 and 29 and > 30.
Person Type	Number of people living in specific family situations that determine receipt of Working for Families.
Household Type	Number of households that have 2 adults or other composition.
Tenure	Number of households that are owned, held by a trust or other by region.
Benefit	Number of people receiving core benefits during the year.
Labour Force	Number of people participating in the labour force by gender and 5 year age band from 15 to 69, and 70+. <sup>23</sup>

<sup>22</sup> On this macro, see Bell (2000)

<sup>23</sup> Using the same definition of participation as the National Labour Force Projections.

## B.1 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 calibrated weights for 2009/10 are used as the starting weights for projected years.

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 values 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**

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

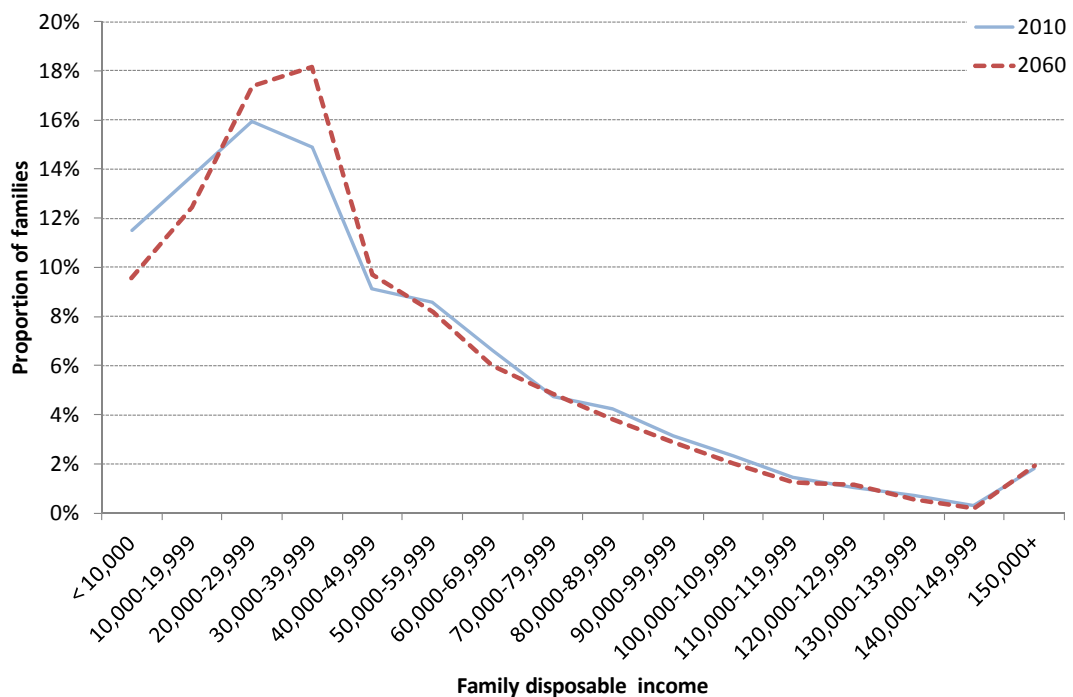


## B.2 Impact of calibration

Calibrating 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 - \$29,999 and \$30,000 - \$39,999 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 C: Attribution logic for tax and spending incidence analysis

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

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

Category	Attribution Logic	Rationale
Disposable Income	<p>'Family disposable income' is shared among members of a family.</p> <p>It is attributed according to an assumption around the 'need' of each family member.</p> <p>Secondary earners and dependents receive a lower proportion of disposable income than the primary earner.</p> <p>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</p>	<p>Disposable income is the main mechanism for intra-family sharing.</p> <p>The assumption is that individuals in a household earn market income, pay taxes, and/or receive transfers, and then pool disposable income which is allocated to members of the family based on need.</p> <p>Different individuals are assumed to have different needs (see column <i>attribution logic</i>).</p>
Health	<p>Attribution of health expenditure on an individualised <i>insurance value</i> basis.</p> <p>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</p>	<p>MoH funding of health boards takes into account the demographic and socioeconomic composition of each region.</p> <p>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.</p>
Education	<p>Attribution of education expenditure on an individualised basis.</p> <p>Use HES data on the reported use of early childhood and tertiary education services.</p> <p>Compulsory education expenditure attributed to those age-eligible.</p> <p>Student allowances are attributed based on self-reports in HES</p> <p>Those attributed allowances are attributed lower student loan write-offs.</p>	<p>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.</p>
GST	<p>For multi-family households, GST is allocated in proportion to disposable income of each family, unless one of the families earns below subsistence level (\$60/week), when it is divided equally among the families.</p> <p>Then GST is attributed according to an assumption of relative needs of each individual.</p> <p>Secondary earners and children, <i>individually</i>, are expected to consume a lower proportion of the household expenditure than the primary earner.</p> <p>These proportions are based on the consumption weights of the OECD-modified scale; the head is assigned 1, each additional adult 0.5, and each child is assigned 0.3</p>	<p>GST is a tax on consumption, and the amount each person pays is a factor of how much he/she is expected to consume.</p> <p>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.</p> <p>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.</p>

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

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