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## Income Mobility in New Zealand: A Descriptive Analysis

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# Income Mobility in New Zealand: A Descriptive Analysis

Kristie Carter, Penny Mok and Trinh Le

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New Zealand Treasury Working Paper 14/15

November 2014



New Zealand Government

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The views, opinions, findings, and conclusions or recommendations expressed in this Working Paper are strictly those of the author(s). They do not necessarily reflect the views of the New Zealand Treasury or the New Zealand Government. The New Zealand Treasury and the New Zealand Government take no responsibility for any errors or omissions in, or for the correctness of, the information contained in these working papers. The paper is presented not as policy, but with a view to inform and stimulate wider debate.

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Income Mobility in New Zealand: A Descriptive Analysis

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**Statistics New Zealand Security Statement**

Access to the data used in this study was provided by Statistics New Zealand in a secure environment designed to give effect to the confidentiality provisions of the Statistics Act, 1975. The results in this study and any errors contained therein are those of the authors, not Statistics New Zealand.

# Abstract

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The purpose of this paper is to examine the absolute and relative income mobility in disposable income in New Zealand using the full longitudinal data from the Survey of Family, Income and Employment (SoFIE) from 2002 to 2010. To summarise the patterns of mobility, we analyse the income changes over the short-term (annual) and a longer term interval (eight years). There is change in incomes between one year and the next, with over 60 percent of the population changing income decile group. The movements in income group are more of a short distance (to adjacent income groups) than long distance. There is substantial change in income over the long-run in both absolute and relative income. Only 22 percent stay in the same income decile group eight years later. The findings of mobility income are similar to those found in other international longitudinal surveys.

**JEL CLASSIFICATION**

D31 - Personal Income and Wealth Distribution  
D63 - Equity, Justice, Inequality, and Other Normative Criteria and Measurement

**KEYWORDS**

Income; Mobility; Longitudinal data

# Table of Contents

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<b>Abstract</b> .....	<b>i</b>
<b>Glossary</b> .....	<b>iv</b>
<b>Executive Summary</b> .....	<b>1</b>
<b>1 Background</b> .....	<b>2</b>
<b>2 Income Mobility</b> .....	<b>3</b>
2.1 Definition and conceptual issues .....	3
2.2 Absolute Mobility.....	4
2.3 Relative Mobility.....	4
<b>3 Survey of Family, Income and Employment</b> .....	<b>6</b>
3.1 Survey Methodology .....	6
3.2 Income Data.....	10
<b>4 Results</b> .....	<b>12</b>
4.1 Absolute mobility.....	12
4.2 Relative Mobility.....	15
<b>5 Conclusions</b> .....	<b>18</b>
<b>References</b> .....	<b>20</b>
<b>Appendix</b> .....	<b>22</b>
Appendix 1: Income Data.....	22
Appendix 2: Benchmarking of Income Data .....	29
Appendix 3: Descriptive Tables .....	30
Appendix 4: Decile Transition Tables .....	33

## List of Tables

---

Table 1 – Response rates over time in the original SoFIE sample.....	8
Table 2 – Income sources included in personal disposable income .....	10
Table 3 – Correlation of income at wave 1 (origin) with future waves (destination) .....	13
Table 4 – Absolute change in real disposable income wave 1 to 2 (2002/03-2003/04), wave 1 to 8 (2002/03-2009/10), overall and working age (wave 1).....	14
Table 5 – Percentage change in real disposable income wave 1 to 2 (2002/03-2003/04), wave 1 to 8 (2002/03-2009/10), overall and prime working age (wave 1).....	14
Table 6 – Average annual transitions (t, t+1) of real disposable household equivalised income, quintiles .....	15
Table 7 – Long term transitions across the study period, (wave 1 to wave 8), of real disposable household equivalised income, quintiles .....	16

## List of Figures

---

Figure 1 – Example transition probability plots (a) stability, (b) independence, (c) short-term mobility .....	5
Figure 2 – Sample retention rates in three household panel surveys in the original sample population, (a) wave on wave, (b) balanced panel .....	9
Figure 3 – Trends in mean (solid) and median (dashed) real equivalised household income (gross, disposable, disposable after housing costs) across eight waves .....	11
Figure 4 – Change in real equivalised household income from wave 1, based at 100 (gross, disposable, disposable after housing costs) across eight waves .....	12
Figure 5 – Change in (a) median income from wave 1 and (b) year on year change in median real disposable equivalised household income, by wave 1 income quintile.....	13
Figure 6 – Transitions in the relative position of income short-term mobility from wave 1 to wave 2, (a) overall and (b) prime working age (25 to 55 years at wave 1), deciles of real disposable equivalised household income .....	15
Figure 7 – Transitions in the relative position of income long-term mobility from wave 1 (2002/03) to wave 8 (2009/10), (a) overall and (b) prime working age population (25 to 55 years at wave 1), deciles of real disposable equivalised household income .....	17
Figure 8 – Transitions in the relative position of real disposable household income, from wave 1 to wave 8, using deciles by origin (wave 1) age group (a) 0-17 years, (b) 18-64 years, (c) 65+ years .....	17

## Glossary

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AHC – After housing costs

ARP – Annual reference period

BHPS – British Household Panel Survey

CPI – Consumer Price Index

Disposable income – gross income removing taxes and compulsory payroll deductions

Equivalised income – household income equivalised for household size and composition

Gross income – income from all sources such as wages and salary, benefits and non-taxable income such as tax credits

HED – Household enumeration date

HILDA – Household Income and Labour Dynamics of Australia

Household income – sum of all personal income in the household

OSM – Original Sample Member

Real income – income adjusted for changes in the consumer price index

SoFIE – Survey of Family, Income and Employment

# Executive Summary

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The study of the distribution of incomes, and how the incomes of individuals change over time, is integral to the understanding of changes in the economic situation and living standards in the New Zealand population over time. Research of inter-temporal dynamics presents a more comprehensive understanding of income than point-in-time (multiple cross-sectional) studies. However, there is limited information describing mobility in income over long periods within individuals in New Zealand. This paper focuses on the intra-generational income changes in absolute and relative terms at two different time periods. The aim of this paper is to describe short- and long-term mobility in income in New Zealand using longitudinal data and a measure of disposable income.

The data presented in this paper utilises the recent release of eight years of data from the longitudinal Survey of Family, Income and Employment (SoFIE) to examine dynamics in income for individuals from 2002 to 2010. SoFIE was conducted by Statistics New Zealand and began in October 2002 and re-interviewed the same group of individuals over eight years (or 'waves'), to build a picture of how their circumstances and lifestyles change over time. Over 18,000 individuals were interviewed in all eight years of the survey. We also focus on change in income in working age individuals (aged 25 to 55 years at wave 1) to control for life cycle effects such as education or retirement.

This paper uses a measure of real disposable equivalised household income (before housing costs are removed). This is the total income after-tax and compulsory payroll deductions are removed for all individuals in the household, together with Working for Families Tax Credits and other non-taxable income. This is adjusted for household size and composition (equivalised) and to the consumer price index for comparisons over time. The unit of analysis is the individual.

One of the main findings in this paper is that there is substantial change in incomes between one year and the next, for people of all income levels. The largest increases in income could be seen in respondents who started out in the lowest income groups and stability or declines in incomes were found in those who were in the highest income group at baseline. Although there are strong correlations in individual's income between the years, there was much mobility in relative income from year to year. Over 60 percent of the population changed income decile groups over the first two years of the study. The movements in income groups were more likely to be of a short distance (to adjacent income groups) rather than long distance. The patterns of mobility were greater over the eight year period with only 20 percent of the population staying in the same income decile group over the study period. There were similar trends in increasing and decreasing income groups. The findings were similar in the working age population.

The levels of income mobility are similar to other international panel surveys. More research is needed examining what factors, such as changes in employment or family circumstances, influence changes in income and what is causing people to move up and down the income ladder. The next steps for this research are to examine income inequality and poverty dynamics in the New Zealand context using panel data.



# Income Mobility in New Zealand: A Descriptive Analysis

## 1 Background

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The Treasury's vision is working towards improving the living standards for New Zealanders (Gleisner, Llewellyn-Fowler and McAlister 2011). The study of how the incomes of individuals change over time is integral to the understanding of changes in the economic situation, living standards and poverty in the New Zealand population over time. Most of this knowledge was drawn from cross-sectional data, with limited studies using longitudinal data (see Stillman, Le, Gibson, Hyslop and Marè 2012; Perry 2013). Cross-sectional data are used to provide estimates of population level income for different years to different samples of individuals. While cross-sectional studies have their own strengths and purpose, they do not provide information on how people move in and out of higher and lower income groups. In contrast, longitudinal data track the income changes over time of the same set of individuals. Therefore, we use longitudinal data to examine how individuals' incomes change over a certain period of time, to better understand short and long-run income mobility in New Zealand.

The current paper builds on previous work on income mobility in New Zealand which used a measure of gross household income in the longitudinal data, Survey of Family, Income and Employment (SoFIE) up to wave 7 (Carter and Imlach Gunasekara 2012; Imlach Gunasekara and Carter 2012). In this paper, we use a measure of disposable income up to wave 8 of SoFIE which allows us to better explore some of the economic changes over a longer period of time and to provide a complementary perspective on income mobility to the other longitudinal and cross-sectional data in New Zealand. Changes in the disposable income of a household arise through changes in earnings and non-labour incomes such as investments, income benefits, tax and superannuation. It is widely agreed that analysis of the income distribution and mobility trends over time should use disposable income rather than gross income measure as it better reflects the money available to households and their standard of living (Jenkins, 2011; Perry 2013).

This paper is the first exploratory study of income mobility using disposable income derived from the complete (eight waves) SoFIE data in New Zealand. This paper aims to provide an understanding of income mobility in New Zealand and stimulate interest for further research using this data such as the impact of mobility on income inequality reduction which will not be the focus of this paper. The analysis of income mobility follows the structure of the work by Jenkins (2011) based on 16 years of the longitudinal British Household Panel Survey (BHPS), allowing for cross-country comparisons to be made.

This paper focuses on the intra-generational income changes in absolute and relative terms across two different time periods. Specifically, this paper aims to:

1. Describe changes in income between one year and the next - short-term (annual) income mobility.
2. Describe changes in income over the eight year period - long-term income mobility.

Mobility concepts differ depending on how we summarise the longitudinal relationship, cross-sectional origin and destination distributions (Jenkins 2011; Jäntti and Jenkins forthcoming). Therefore, it is important to clarify what is meant by income mobility, as the concepts of mobility are complex. Section 2 of this paper, addresses the concepts and measurement of income mobility we specifically use in this analysis. Section 3 describes the survey information and the development of the measure of disposable income. We utilise graphical and tabular methods to summarise the patterns of mobility, which are presented in Section 4. Finally, Section 5 summarises the findings and brings the data into perspective with international literature.

## 2 Income Mobility

---

### 2.1 Definition and Conceptual Issues

There are a number of concepts related to income mobility that need to be addressed (Jäntti and Jenkins forthcoming). This is crucial as it has an impact on our choice of measurement and the resulting inferences. In this paper, we accept the view in favour of income as a measure of living standards and acknowledge the existence of multidimensional aspect of the measure (see Sen 1979; Townsend 1979; Alkire, Bastagli, Burchardt, Clark, Holder, Ibrahim, Munoz, Terrazas, Tsang and Vizard 2009). Multidimensional measures of well-being offer a wider aspect of well-being besides individuals' money income (Perry 2009). However, due to the same reason, this poses a number of complexities in terms of the choice of indicators and level of aggregation (Jenkins 2011). In addition, most household panel surveys focus their data collection on income and its components rather than on consumption expenditure and its components. Due to these reasons, we focus on the income measure as a proxy for living standards in this paper.

Much of previous research on intra-generational income mobility is based on the household incomes but the unit of analysis is the individual level as households change (form, grow, dissolve and shrink) over time (Jenkins 2011). Hence, longitudinal surveys follow individuals rather than households over time. In aggregating the incomes from the individual to household level, we follow the common practice which assumes that incomes are pooled and shared among household members. Past research has highlighted the possibility of unequal sharing between partners and between parents and children (see Pahl 1983; Middleton, Ashworth and Braithwaite 1997). However, the assumption of equal sharing dominates the literature due to the unsatisfactory recommendation of its application in income distribution analyses (Creedy and Sleeman 2004).

Another aspect of income mobility reflects the period of time and/or generation that mobility is over. Much research has examined changes in income and social class from one generation to another (Gibbons 2010; Corak 2013). This is known as intergenerational mobility and compares our income as adults with that of our parents at a

similar age. Whereas, intra-generational mobility examines changes in income or social class over a period within an individual's lifetime. This paper focuses on the latter and does not examine inter-generational mobility in income.

We describe intra-generational income mobility in terms of absolute changes in income and changes in relative income position over a short and longer period of time. The absolute change in income, defined as increase or decrease of a certain amount of income, is often described as mobility even if relative positions are preserved. In contrast, the relative measure shows the income changes relative to other individuals. Both mobility concepts tell different stories of mobility. Hence, to understand *how the incomes of individuals change over time* depends on the concepts adopted. In this paper, we provide both measures of absolute and relative mobility to enable better understanding of the issue. Detailed explanations of these measures are provided below. To summarise the patterns of mobility, we analyse the income changes over the short-term and a longer term interval. Short-run income measures differ from long-run measures because of transitory fluctuations. Hence, longer reference periods would smooth out temporary variations and measurement errors, providing a better measure of average living standards. In the current analysis the long-run analysis is determined by the maximum length of SoFIE, eight years, which ended in 2010.

## 2.2 Absolute Mobility

Absolute mobility refers to change in incomes experienced by individuals over time. The change might be a gain or a loss, and can be summarised in absolute terms (an increase or decrease of so many dollars in household income per year) or in proportionate terms (expressed as a percentage of original income).

Absolute change in income over the short-term (annual) is calculated by taking income at  $t$  away from income at  $t+1$  (eg, income wave 2 – income wave 1). Absolute change in income over the longer-term is calculated by taking income at  $t$  away from income at  $t+m$ , where  $m$  is the maximum number of years of follow-up (income wave 8 – income wave 1).

The percentage change in income over the survey period for each individual was calculated as:

$$\text{Short-term: } (\text{income}_{t+1} - \text{income}_t) / \text{income}_t * 100\%$$

$$\text{Long-term: } (\text{income}_{t+m} - \text{income}_t) / \text{income}_t * 100\%.$$

## 2.3 Relative Mobility

Relative income mobility examines the positional changes in a person (or households) income rank relative to the other people (or households) in the sample. Therefore, relative mobility for a person depends not on whether their income has increased or decreased but on how their position changes relative to others. However, not everyone can be upwardly mobile, if someone moves up the income rank, then someone must move down to replace the income rank that moved up. Therefore, there is a zero sum game. The same concept applies to mobility in income decile groups if someone moves up an income decile group (or two) their spot in the starting decile group will be replaced. It is worth noting that if someone's income rank changes within the bounds of an income decile, this will not be indicated as a change in income.

Relative income mobility is presented as transition tables of deciles/quintiles of household income summing transition probabilities ( $p_{ij}$ ) across two time points. This is viewed as a first-order Markov process (Shorrocks 1976). Transition matrices show the degree of mobility across income groups. Short term (annual) income mobility sums transitions from wave ( $t$ ) to wave ( $t+1$ ) across the eight waves. Long term (eight year) income mobility sums of the transition probabilities between wave 1 and 8 (1).

$$p_{ij} = \Pr(X_{t+1}=j|X_t=i), p_{ij} = N_{ij}/\sum N_{ij} \quad (1)$$

The transition matrix partitions the sample into groups depending on percentile of income ( $X$ ) that they are assigned to in time  $t$  and time  $t+1$ . The transition probabilities present the probability of transitioning from the starting income group  $i$  at an earlier time period of origin ( $t$ ) to a destination ( $t+1$ ) income group  $j$ . From the output of the transition matrices, we assume that the same transition rates apply to all individuals in the particular group and individuals in income class  $i$  at time  $t$  have the same transition probabilities regardless of their past history (Shorrocks 1976). These assumptions might not hold given the heterogeneity of the population. It is beyond the scope of this paper to test the validity of these assumptions. We examine transitions in the prime working age population (aged 25 to 55 years at wave 1) to control for some of this heterogeneity. In addition, this allows us to account for common life-cycle effects of moving into work in youth and retirement in older age.

Transition probabilities can be represented graphically using programmes that have been developed for geographical mapping (Van Kerm 2011; Van Kerm 2011). Movements between income groups over time can be shown by the extent to which the original groups (origin) end up in different income groups at their destination. The advantage of the transition plots is that they visually show the extent of mobility in income through the use of colours.

**Figure 1 – Example transition probability plots (a) stability, (b) independence, (c) short-term mobility**

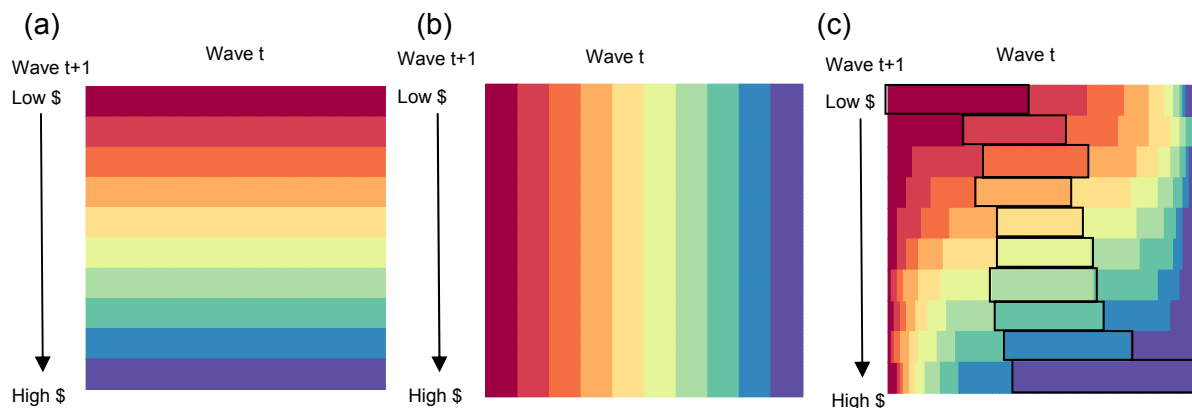


Figure 1 presents examples of transition probability plots showing stability and mobility in income decile groups. There is a strip for each income group, with the poorest group at the top of the picture and the richest group at the bottom. The different colours in the plot are used to identify which origin (wave  $t$ ) group a person belongs to. The destination (wave  $t+1$ ) income decile group (in ascending order) is shown on the y-axis. The colours denote the decile group of income in the origin year, where red corresponds to the lowest income decile group and blue the highest, by the latter wave (destination) income decile group. Figure 1 (a) is an example showing complete stability in income (the destination group is the same as the origin). Everyone in the lowest income decile group in wave  $t+1$  were in the lowest income decile group in the prior wave ( $t$ ), denoted by the line of red at the top of the figure. Figure 1 (b) presents an example of complete independence, if every person had an equal chance of moving to another income decile ie, in each income decile at wave  $t+1$ , there are equal proportions of the population who came from the other income deciles. Figure 1 (c) presents the mobility in income from wave  $t$  to wave  $t+1$ . This highlights the extent of mobility in income. Almost half of the people in the lowest income decile group in wave  $t+1$  were in the lowest income decile group (red) the wave prior ( $t$ ), highlighted by the black boxes (stability). Over half of the population in the highest income decile group in wave  $t+1$  were in the highest income decile group (dark blue) in the prior wave ( $t$ ). Perfect mobility occurs when a person's income destination is unrelated to one's income origin ('origin independence').

## 3 Survey of Family, Income and Employment

---

The Survey of Family, Income and Employment (SoFIE) was conducted by Statistics New Zealand and is the largest panel survey in New Zealand. The original objectives of SoFIE were to examine the changes in individual, family and household income, and the factors that influence these changes, such as involvement in the labour force, and family composition (Statistics New Zealand 2008; Carter, Cronin, Blakely, Hayward and Richardson 2010). The survey began in October 2002 and re-interviewed the same group of individuals annually over eight years (or 'waves'), to build a picture of how their circumstances and lifestyles change over time.

The data presented in this working paper utilises the recent release of eight years of data from SoFIE to examine dynamics in income for individuals from 2002 to 2010 (Wave 1 to 8 data version 2). Data for the whole population are presented (including everyone aged 0 years upwards), as well as a specific focus on the group of prime working age individuals (aged 25 to 55 years at wave 1).

### 3.1 Survey Methodology

#### 3.1.1 Design

In SoFIE, face-to-face interviews (using computer-assisted interviewing) were used to collect information annually on income levels, sources and changes, and on the major influences on income such as employment and education experiences, household and family status and changes, demographic factors and health status.

Two separate questionnaires were used to collect information for SoFIE. The household questionnaire was answered by one person in each household and collects household characteristics (Statistics New Zealand 2008). A personal questionnaire was completed

with every original sample member (OSM) in the household aged 15 years and over. At each interview, the respondent is asked to recall information specific to the 12 months prior to the month of interview. The SoFIE questionnaires collected both point-in-time data and time-spell data. Point-in-time data relates to a single date, usually the interview date (eg, the respondent's educational qualifications as at the interview date). Time-spell data relates to a period of time with a defined start and end date reported by the respondent. For example, the period of time a respondent is in paid employment is referred to as a labour market time spell or 'spell'. An example of labour market time-spell data containing two spells is:

- Spell one: 17 July 2004 – 4 March 2005 worked for ABC Company
- Spell two: 5 March 2005 – 14 July 2005 [interview date] worked for BCD Company.

Spell two above is an example of an ongoing time spell that has been given an artificial end date to allow processing. The end date is set at the last known continuing date (the interview date) and further information on this spell will be collected at the next interview.

A detailed module collecting information on assets and liabilities was collected in waves 2, 4, 6, and 8. In waves 3, 5 and 7 a module of health questions was asked about the following health-related domains: health status, chronic conditions (heart disease, diabetes, and injury-related disability), tobacco smoking, alcohol consumption, health care utilisation, and an individual deprivation score (Carter, Cronin et al. 2010).

### **3.1.2 Survey period**

Interviewing of the OSMs was spread across the 12 months of wave 1, making it a continuous process throughout the year. Therefore, the aim was to interview respondents for all subsequent waves in approximately the same month as at wave 1.

- Wave 1: 1 October 2002 – 30 September 2003
- Wave 2: 1 October 2003 – 30 September 2004
- Wave 3: 1 October 2004 – 30 September 2005
- Wave 4: 1 October 2005 – 30 September 2006
- Wave 5: 1 October 2006 – 30 September 2007
- Wave 6: 1 October 2007 – 30 September 2008
- Wave 7: 1 October 2008 – 30 September 2009
- Wave 8: 1 October 2009 – 30 September 2010.

### **3.1.3 Sample**

The target population for SoFIE was the usually resident population of New Zealand living in private dwellings based at October 2002 (Statistics New Zealand 2008). Therefore the survey excludes overseas visitors who intended to stay in New Zealand for less than 12 months, non-New Zealand diplomats and diplomatic staff and their dependants, members of non-New Zealand armed forces stationed in New Zealand and their dependants, or

people living in institutions or in establishments such as boarding houses, hotels, motels and hostels. The sample population surveyed was restricted to people whose usual residence at the time of sample selection was a permanent private dwelling on the North Island, South Island or Waiheke Island.

At wave 1, a total of 15,100 randomly-selected households were approached to take part in SoFIE and approximately 11,500 (77 percent) of eligible households responded to the first wave of SoFIE. Data was collected from 22,200 eligible respondents (aged 15 years or older) as well as 7,500 children (aged under 15 years). Therefore, the original sample size was over 29,700 individuals. Once a child turns the age of 15 years he/she is interviewed as an adult. A strength of SoFIE is that if an original sample household split over the study period, all arms of the household were followed and subsequently interviewed. Also, if an OSM moved into a household with others (or if others moved into a household with an OSM) then all people in that household were interviewed in that wave. These non-OSMs were interviewed as long as they resided with the OSM.

### 3.1.4 Response rates

Response rates in longitudinal surveys inevitably decline over time, as individuals are unable to be located, leave the country, move into institutions, or pass away. Statistics New Zealand attempted to minimise the cumulative impact of attrition (loss of respondents), by putting considerable effort into maintaining contact with OSMs (Statistics New Zealand 2008).

There were over 29,700 individuals in the original SoFIE sample, which reduced to just over 26,500 in wave 2, a total response rate of 89 percent (11 percent attrition). After wave 2, the wave on wave response rate was around 94 percent (Table 1). However, the attrition accumulates over time and only 63 percent of the original sample were interviewed in wave 8. The attrition looks like it was greater in children, however, this does not take into account moving the child to adult respondent between waves. Previous studies have shown that respondents reporting Māori or Other ethnicity, low income and sole parents were more likely to drop out over the study period (Statistics New Zealand 2008; Carter, Cronin et al. 2010; Carter and Imlach Gunasekara 2012). This may have led to an over-estimation of income in the balanced panel analysis. However, the bias is likely to be less in the prime working age sample.

**Table 1 – Response rates over time in the original SoFIE sample**

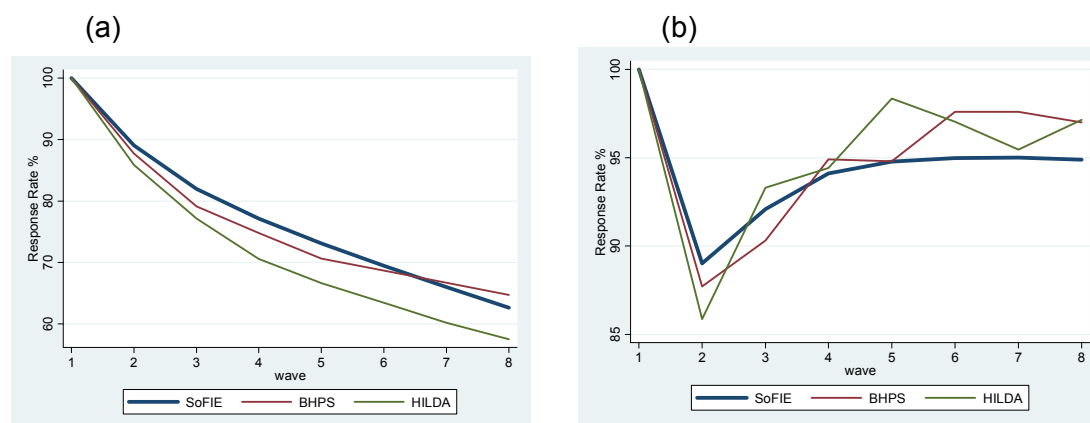
wave	Responses			percent wave on wave	percent wave 1*
	child	adult	total	total	total
1	7,520	22,270	29,790		
2	6,095	20,420	26,515	89.0	89.0
3	5,160	19,260	24,415	92.1	82.0
4	4,510	18,470	22,980	94.1	77.1
5	3,910	17,870	21,780	94.8	73.1
6	3,335	17,345	20,685	95.0	69.4
7	2,830	16,825	19,655	95.0	66.0
8	2,440	16,210	18,220	94.9	62.6

\* Percentage of original wave 1 sample responding in all previous waves

Figure 2 presents comparisons of the survey sample retention in three similar household panel surveys, from New Zealand (SoFIE), the UK, the British Household Panel Survey:

BHPS (Lynn 2006; Jenkins 2011) and Australia, the Household Income and Labour Dynamics in Australia Survey: HILDA (Wilkins and Warren 2012). There are similar retention rates in all three surveys. The wave on wave retention at latter years is lower in SoFIE compared to other surveys. However, the retention of OSMs across all waves (up to wave 8) is slightly higher in SoFIE. This may be due to the ownership of the survey by the National statistical agency (Statistics New Zealand) and the legal obligation to respond to the survey under the *Statistics Act 1973* (although this was not enforced).

**Figure 2 – Sample retention rates in three household panel surveys in the original sample population, (a) wave on wave, (b) balanced panel**



### 3.1.5 Analytical sample

The sample population used for the analyses in this paper was SoFIE participants who were eligible at wave 1, who responded in *all eight waves* (balanced panel), giving a sample size of 18,220. The balanced panel was used to ensure a constant sample over the descriptive analysis. It is important for longitudinal analyses looking at the experiences of the same individuals over time to keep the same cohort of people, even as they age.

The unit of analysis is based on the individual not the household, so if there were two or more individuals in a household then their equivalised household income was represented two or more times in the analysis population. As discussed earlier, data for the whole population are presented. The sub-sample of 8,650 prime working aged individuals (aged 25 to 55 years at wave 1) is used to examine mobility in income, controlling for life-cycle effects of moving into work in youth and retirement in older age.

### 3.1.6 Weighting

A survey weight indicates the probability of that unit being included in the sample. Two types of adjustment are then applied to the survey weights to improve the reliability of the survey estimates. The weights are first inflated to adjust for non-response, and are then further adjusted to ensure that estimates of relevant population characteristics match known population totals (Statistics New Zealand 2011). The population totals for the different age and sex groups used for SoFIE were derived from population estimates produced by Statistics New Zealand.

Longitudinal survey weights (at wave 8) were applied to weight the analytical sample back to the original sample population (resident living in private dwellings) as at October 2002.



These weights account for the original survey sampling as well as attrition from the sample over the study period.

## 3.2 Income Data

As discussed above SoFIE collected both point-in-time data and time-spell data. Annual gross personal income was derived by adding together the following: Employee earnings were the 'usual/regular' pay received in a spell with an employer, government transfer income, as well as non-taxable income received from government transfers within the reference period, income from self-employment, interest from bank accounts, income from other investments, income from private superannuation and pension schemes, other income received as regular payments and other irregular income. In the SoFIE data 10 percent of respondents had a missing component of personal income, which may be only a small component over their overall income across the wave (eg, missing the dollar amount of employee earnings or benefit for a short spell over the 12 months). Missing data was more common in respondents who reported multiple spells and components of income over the annual reference period, who were also more likely to be in lower income groups. Therefore the household income may be slightly underestimated leading to a small overestimation of those in low income. However, annual personal income in SoFIE has been found to follow income trajectories from the NZ Income Survey closely (SoFIE User Network Meeting February 2012).

Table 2 presents the various income sources that are used to compile a measure of personal disposable income. In essence, personal disposable income is the sum of non-taxable and taxable income minus deductions (taxes and compulsory payroll deductions are removed). Household disposable income was derived by totalling adult annual personal disposable income from all sources within a household for the 12 months prior to the interview date, so annual income estimates for wave 1 relate to the 2001-2002 annual reference period (which may vary by individual).

**Table 2 – Income sources included in personal disposable income**

	(a)	earnings from paid employment (both permanent and casual)
+	(b)	profit or loss from self-employment
+	(c)	social security benefits
+	(d)	private and occupational pensions
+	(e)	income from investments and saving
+	(f)	Accident Compensation Corporation (ACC) payments
+	(g)	other regular taxable income (eg, student allowances, director's fees)
+	(h)	irregular taxable income (eg, lump sum payments from a family trust, income from hobbies, lottery winnings)
+	(i)	non-taxable income, such as tax credits, scholarships and private transfers
–	(j)	income taxes
–	(k)	ACC levies for paid employees (employees and self-employed)
–	(l)	KiwiSaver contributions
–	(m)	student loan repayments
=		<b>Total disposable personal income</b>

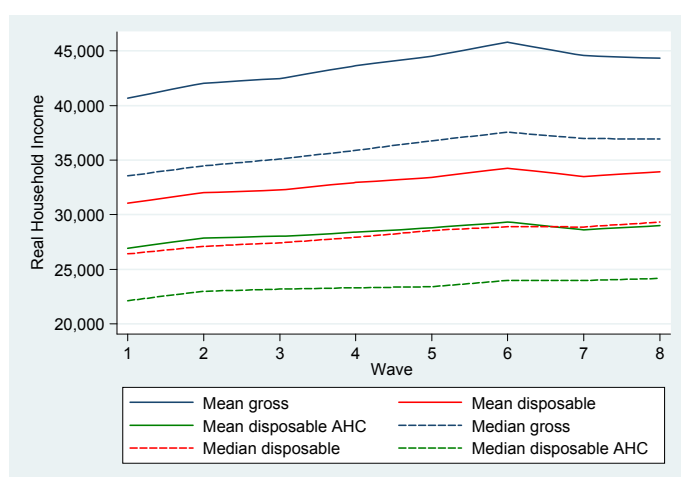
In order to compare the incomes in households of differing composition and to make comparisons over time, the value of household income needs to be adjusted by a household equivalence scale as well as an inflation index. The Revised Jensen Scale 1988 was used to equalise household income (Jensen 1988; Creedy and Sleeman 2004). To be able to compare household incomes over time, we need to adjust for

inflation using the Consumer Price Index (CPI). Nominal incomes were inflated to June 2010 as the base year. As the interview period occurs over 12 months, for each person, the CPI date is the nearest quarter before the annual reference period ends, eg, if the annual reference period ends in August, then CPI quarter is June.<sup>1</sup>

Most data presented in this paper is real disposable equivalised household income before housing costs, applied to all individuals in the household. Income after housing costs were removed was also calculated as housing costs have been shown to disproportionately affect the available income in lower income households (Perry 2013). The top and bottom 1 percent of the income distribution were trimmed (set to missing) to control for some measurement error in the income data and extreme changes over time. More detailed information on the measure of disposable income and benchmarking to standard (cross-sectional) data sources can be found in Appendix 1 and 2, respectively.

Figure 3 shows an increasing trend in household income over the eight years from 2002 to 2010. Although medians and means travel in the same direction, the medians are flatter and more stable than means over time. There is a non-linear increase in the mean income in wave 3, which is discussed in more detail below. There is a flattening of the trends in the latter years of the survey (2008 to 2010) indicating the impact of the global financial crisis, as shown in other cross-sectional surveys (Perry 2013). The variability in the income data is mainly influenced by the means and medians in the top income quintile group at wave 1 (Appendix Figure 3: income quintile 5). There were increases in median level of disposable income in people who had incomes in the lower (three) income quintiles at wave 1, indicating an upwards shift in the distribution of income in these quintiles. On average 55 percent of income is composed of earnings from employment, ranging from 53 to 56 percent over the eight waves (Appendix Figure 4). Other core sources of income come from earnings from self-employment, superannuation and other government transfers, making up 30 percent of household income (10 percent each).

**Figure 3 – Trends in mean (solid) and median (dashed) real equivalised household income (gross, disposable, disposable after housing costs) across eight waves**



<sup>1</sup> It is possible to adjust wage income by the wage index and non-wage income by the CPI. However, we chose to adjust income by the CPI only to reflect changes in real "purchasing power" income over time.

## 4 Results

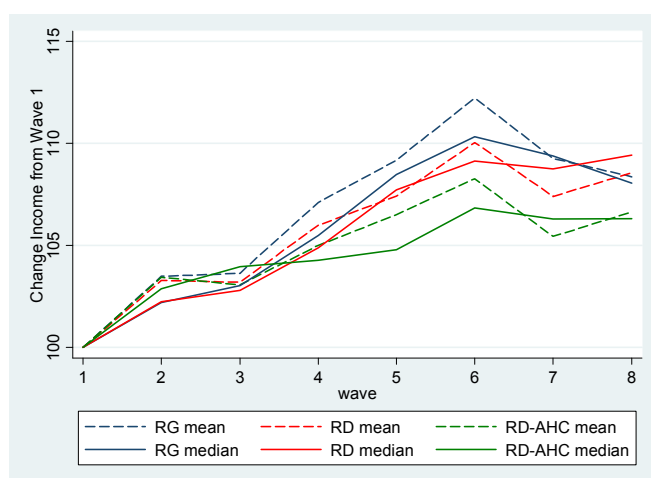
### 4.1 Absolute Mobility

Figure 4 presents the percentage changes in income (at a population level) from wave 1 (base set to 100), where 110 indicates an increase of 10 percent since wave 1; 95 means a decrease of 5 percent, and so on. Figure 4 shows that there was relatively steady growth in median income over the study period in all measures of household income. The changes in the real disposable income after housing costs were removed were less clear due to variability in the housing costs in the data.

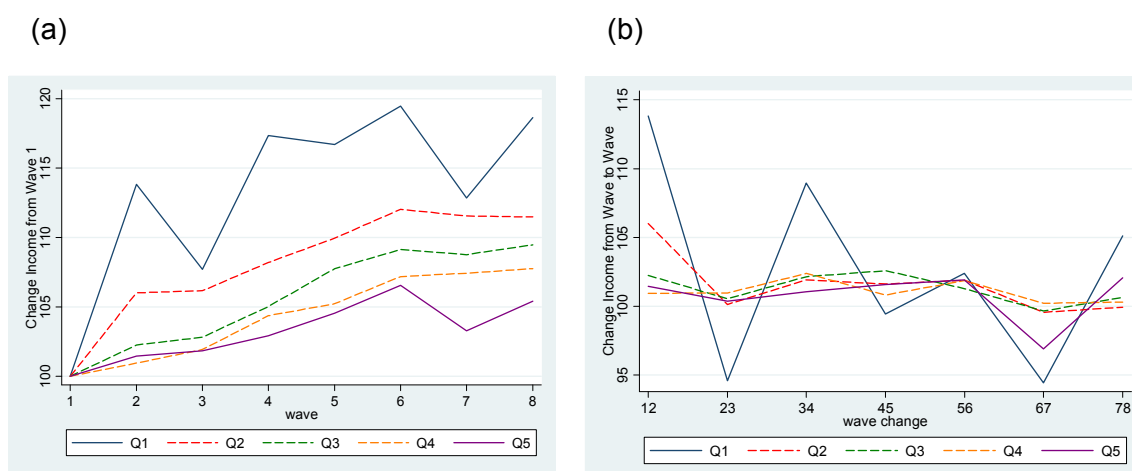
There were differential trends in the change in mean and median real disposable income and by baseline income quintile. Figure 5 (a) shows that the changes in median income are unstable over time, particularly by baseline (origin) income quintile. There was a large increase in median income in quintile 1 up to wave 2, with a slight decline and large increase in median income in the top income quintile (Q5). Take this together with the decline in income in wave 3 in Q1, corresponds to the large increase in spread (standard deviation) at wave 3. The changes in median income show clearer trends over time (Figure 5 b). Increases in income (from wave 1) were larger in the lowest income group (Q1), but they were also more variable showing greater fluctuations over time.

There were large increases in the mean and median income in the lowest income quintile (Q1) at wave 1. The median income increased to about 20 percent in wave 6, which then declined in wave 7 and started to recover in wave 8. The biggest declines occurred in the highest and lowest income quintiles in wave 7, indicating the impact on these groups of the Global Financial Crisis. There is likely to be different causes for these declines. Research has shown that low income groups were hit by the high unemployment during the Global Financial Crisis and high income groups had declines in income from other sources (such as investments) (Aziz, Gibbons, Ball and Gorman 2012; Perry 2013).

**Figure 4 – Change in real equivalised household income from wave 1, based at 100 (gross, disposable, disposable after housing costs) across eight waves**



**Figure 5 – Change in (a) median income from wave 1 and (b) year on year change in median real disposable equivalised household income, by wave 1 income quintile**



### 4.1.1 Correlation in income

The correlation in real disposable income between wave 1 and wave 2 was 0.71 (Table 3). The correlation was slightly higher for real gross income (0.74) and lower for real disposable income after housing costs have been removed (0.68). These correlations are lower than those reported using the BHPS data (0.80 between the first two waves) (Jenkins 2011), possibly reflecting the differences in the collection of income data in the two surveys (BHPS collects current income compared to annual income in SoFIE). The correlation in income between waves reduces as the time between waves increases (Table 3). After eight years income is still significantly correlated but the correlation has reduced to 0.50. This provides evidence of mobility in income but also “stickability” (non-independence) of income over time.

**Table 3 – Correlation of income at wave 1 (origin) with future waves (destination)**

	Correlation
<b>Wave 1-2</b>	0.714
<b>Wave 1-3</b>	0.653
<b>Wave 1-4</b>	0.609
<b>Wave 1-5</b>	0.577
<b>Wave 1-6</b>	0.549
<b>Wave 1-7</b>	0.516
<b>Wave 1-8</b>	0.497

### 4.1.2 Absolute change in income

Table 4 describes the distribution of changes in the absolute level of income (at an individual level) between waves 1 and 2 and over the study period between waves 1 and 8. Over half of the population (55 percent) experienced an increase in absolute income. Over 25 percent experienced no change or small increases or decreases in income of between \$2,000. There were much larger changes in income over a longer period between waves 1 and 8. A larger proportion of the population experienced an increase in income over eight year the study period (58 percent), but there was also a larger proportion of decreases in income of over \$10,000. The results for working age (aged 25 to 55 years at wave 1) were very similar, however there were much larger increases in income over \$20,000 over the study period. When examining changes in absolute income by wave 1 (origin) income quintile, there were larger increases in absolute levels of income in the lowest wave 1 income quintile than in other income quintiles (Appendix

Table 5). Correspondingly there were large decreases in income in the highest wave 1 income quintile (Wave 1 Q5), with 37 percent of this group having a decrease in income of over \$20,000 over the eight year period. As discussed earlier this could reflect the impact of the Global Financial Crisis on higher income groups (Aziz, Gibbons et al. 2012).

**Table 4 – Absolute change in real disposable income wave 1 to 2 (2002/03-2003/04), wave 1 to 8 (2002/03-2009/10), overall and working age (wave 1)**

	Decrease in income					Increase in Income				
	<20k	10-20k	5-10k	2-5k	0-2k	0-2k	2-5k	5-10k	10-20k	>20k
<b>Overall</b>										
<b>Change w1 - w2</b>	6%	7%	8%	9%	12%	14%	14%	12%	9%	6%
<b>Change w1 - w8</b>	10%	10%	7%	6%	6%	7%	9%	12%	16%	14%
<b>Working age</b>										
<b>Change w1 - w2</b>	6%	7%	9%	9%	11%	13%	13%	12%	9%	7%
<b>Change w1 - w8</b>	11%	10%	7%	6%	6%	6%	8%	12%	16%	16%

#### 4.1.3 Percentage change in income

On average people experienced positive increases in their income of a three percentage point change over the short-term (from wave 1 to wave 2) and almost a nine percentage point change over the eight year period from wave 1 to wave 8 (Appendix Table 6). The results were similar for the working age population, with an average 2.9 percentage change increase from wave 1 to 2 and an 8.8 percentage change increase over the eight years from wave 1 to 8. It is important to note that these changes (increases) in income are over and above the CPI increase or inflation over the years<sup>2</sup> as the disposable income is adjusted to the CPI. This is similar to the shown in the BHPS data, where the average percentage change was 8.1 percent over the eight years from 1991 to 1998 (Jenkins 2011). Table 5 describes the distribution of percentage changes in the level of income (at an individual level) between waves 1 and 2 and over the study period between waves 1 and 8. The majority of the population experienced increases in income. Over forty percent of the population experienced an increase in their income of more than 20 percent of their original wave 1 income over the eight years, with 20 percent having an increase of over 70 percent of their original income. The trends were similar for the working age population.

**Table 5 – Percentage change in real disposable income wave 1 to 2 (2002/03-2003/04), wave 1 to 8 (2002/03-2009/10), overall and prime working age (wave 1)**

	Decrease in income				Increase in Income					
	<50%	30-50%	10-30%	0-10%	0-5%	5-10%	10-20%	20-40%	40-70%	>70%
<b>Overall</b>										
<b>Change w1 - w2</b>	6%	7%	13%	15%	10%	7%	10%	11%	7%	10%
<b>Change w1 - w8</b>	10%	9%	11%	8%	4%	4%	8%	11%	11%	20%
<b>Working age</b>										
<b>Change w1 - w2</b>	5%	8%	14%	16%	10%	7%	10%	11%	6%	10%
<b>Change w1 - w8</b>	10%	10%	12%	8%	4%	4%	8%	11%	11%	19%

<sup>2</sup> Since 2000, New Zealand CPI inflation has averaged around 2.7% (Source: Reserve Bank of New Zealand) [http://www.rbnz.govt.nz/statistics/key\\_graphs/inflation/](http://www.rbnz.govt.nz/statistics/key_graphs/inflation/)

## 4.2 Relative Mobility

This section describes relative mobility in income, how individuals move up or down the income scale (relative to the rest of the population) over the short (year on year) and medium to long term (eight years).

### 4.2.1 Short term mobility (annual)

Table 6 presents the year on year average transition probabilities of mobility in disposable income quintiles. The transition table shows that there is much mobility in income between waves. This typically is a short distance, ie, to a neighbouring quintile rather than two to three quintiles higher (or lower). However, 64 percent of the people who are in the lowest income quintile in wave one remain in the lowest quintile in the next. Correspondingly, 70 percent of those in the highest income quintile in one wave remain in that quintile in the next. The higher level of stability in income in the highest income quintile compared to the lowest may reflect that the unbounded upper limit of income quintile 5. There are slightly higher percentages of people increasing annual income quintile than decreasing, reflecting the greater increases in income reported in the previous section.

**Table 6 – Average annual transitions ( $t, t+1$ ) of real disposable household equivalised income, quintiles**

		Quintile $t+1$				
		1	2	3	4	5
Quintile $t$	1	<b>64.4</b>	23.1	7.2	3.5	1.9
	2	21.1	<b>50.4</b>	20.4	5.8	2.3
	3	7.5	17.1	<b>49.1</b>	20.5	5.7
	4	3.8	6.4	17.6	<b>52.6</b>	19.6
	5	2.9	3.2	5.9	17.9	<b>70.1</b>

**Figure 6 – Transitions in the relative position of income short-term mobility from wave 1 to wave 2, (a) overall and (b) prime working age (25 to 55 years at wave 1), deciles of real disposable equivalised household income**

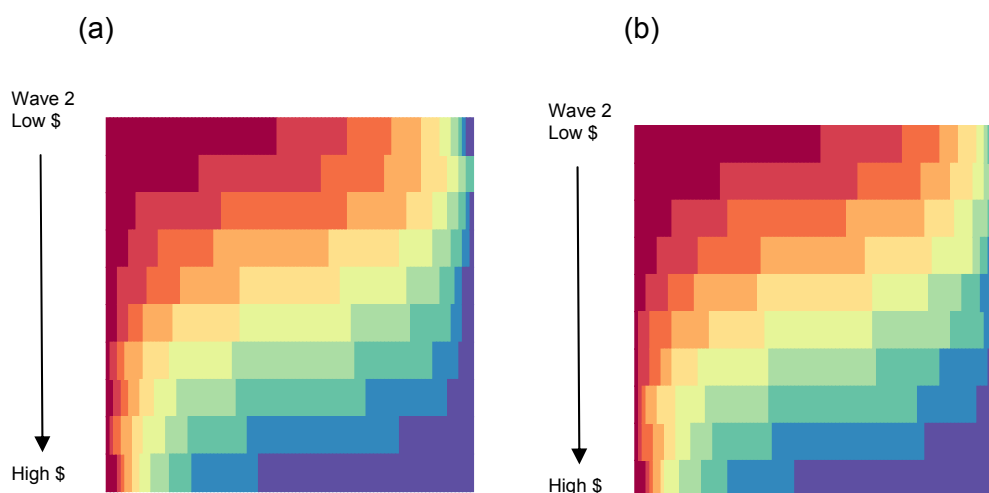


Figure 6 presents transition probability plots of income mobility over one year, using deciles of real disposable equivalised household income. As described earlier, the colours denote the income decile group in the origin year (wave 1) by the destination (wave 2) income decile group (rows), where red denotes the lowest income decile group and blue

the highest. Figure 6 (a) presents short term mobility in income from wave 1 (2002/03) to wave 2 (2003/04) in the whole population. This shows there is mobility in income, with on average 37 percent of the population staying in the same income decile group, on the leading diagonal, in the next year (the same as shown in Jenkins 2011 over the first two waves of BHPS, 1991-1992). Of those in the lowest decile group in wave 2, almost 50 percent remained in the lowest income decile from the previous wave 1. Nearly 60 percent of those who were in the highest income decile group in wave 2 were in that group in the previous wave. The distance of mobility tends to be over a short distance ie, a much higher probability of moving to an adjacent decile group (up or down), than moving greater distances in income (up or down three or more deciles). This can be seen in the transition colour probability plots as the diminishing size of the colour band as we move further away from the origin to destination income decile group. Mobility over long distances, such as from the lowest decile group to the highest are rare. Over 70 percent of the population stay in the same or move to an adjacent income group in the next wave, which is similar to that shown in the BHPS data (73 percent) (Jenkins 2011). Trends in income mobility in the working age population, Figure 6 (b), were similar. Examining mobility in income after housing costs are removed showed slightly higher levels of mobility.

#### 4.2.2 Long term mobility (eight years)

Table 7 presents the transition probabilities of mobility in disposable income quintiles over the study period, from wave 1 (2002/03) to wave 8 (2009/10). The transition table shows that there is much more mobility in income over a longer period (eight years). About 45 percent of people who were in income quintile 1 at wave 1 were also in income quintile 1 at wave 8. This does not necessarily mean that they remained in income quintile 1 for all waves, they may have moved in and out over the time period. On average 38 percent of people were in the same income quintile eight years later. This is similar but slightly lower than the 41 percent stability shown in the Australian HILDA survey (Wilkins, Warren, Hahn and Hough 2011).

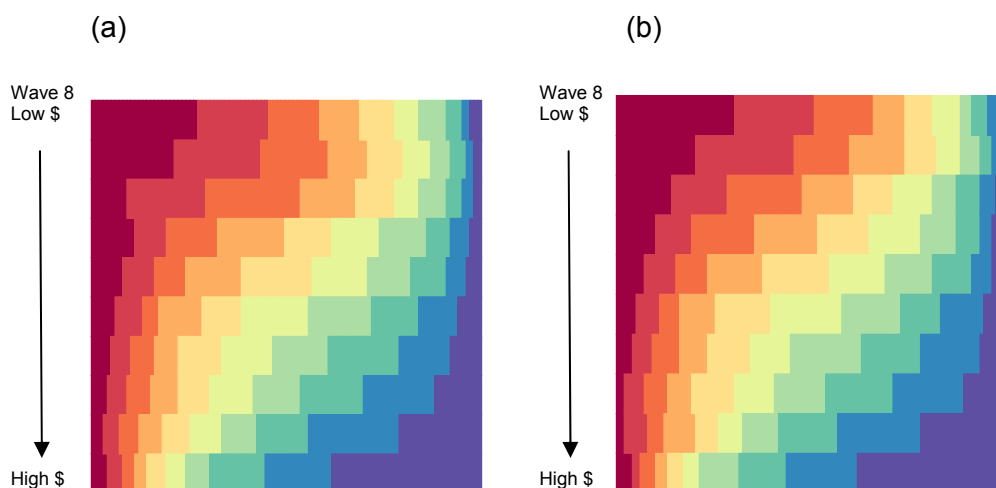
**Table 7 – Long term transitions across the study period, (wave 1 to wave 8), of real disposable household equivalised income, quintiles**

		Quintile wave 8 2009/10				
		1	2	3	4	5
Quintile wave 1 2002/03	1	<b>44.7</b>	25.4	15.7	9.7	4.5
	2	24.0	<b>34.5</b>	20.8	13.9	6.8
	3	14.5	19.3	<b>30.1</b>	24.2	11.9
	4	9.7	12.7	20.8	<b>30.8</b>	26.1
	5	7.4	8.5	12.7	21.7	<b>49.7</b>

Figure 7 presents transition probability plots of changes in deciles of income between waves 1 and 8 for real disposable income in the whole population (a) and prime working age (b). On average 22 percent of the sample are in the same income decile group, on the leading diagonal, eight years later, with 50 percent in the same or moving to an adjacent income group in wave 8. These are lower than those found using eight years of BHPS data (Jenkins 2011), indicating that there is slightly more mobility in income in New Zealand compared to the UK. However, it is important to note that these studies covered different time periods with the SoFIE wave 8 data potentially showing the impact of the Global Financial Crisis in 2009/10. We also examined mobility income over the eight year period using two year averaged income (combining waves 1 and 2 and waves 7

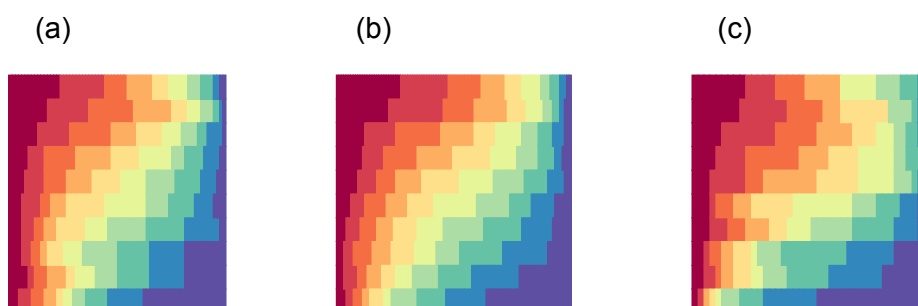
and 8) to control for random fluctuations in income or regression to the mean and found similar trends in income mobility.

**Figure 7 – Transitions in the relative position of income long-term mobility from wave 1 (2002/03) to wave 8 (2009/10), (a) overall and (b) prime working age population (25 to 55 years at wave 1), deciles of real disposable equivalised household income**



When examining mobility in more specific age groups (Figure 8) there is a lot more mobility in income, particularly in households with children aged 0 to 17 years. Less than 20 percent of the population remain in the same income decile group eight years later, with 47 percent staying in the same income or moving to an adjacent income decile. In the older age groups (aged 65 years and older at wave 1) there is more stability in income, particularly in the higher income groups (over 53 percent staying in the same or moving to an adjacent income group over the eight waves).

**Figure 8 – Transitions in the relative position of real disposable household income, from wave 1 to wave 8, using deciles by origin (wave 1) age group (a) 0-17 years, (b) 18-64 years, (c) 65+ years**





## 5 Conclusions

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This paper focuses on the intra-generational income changes in absolute and relative terms at two different time periods. The aim of this paper is to describe short- and long-term mobility in income in New Zealand using longitudinal data and a measure of disposable income.

We find evidence of changes in (absolute levels of) income over time, with large increases in the incomes of those respondents who started out in the lowest income groups and stability or declines in incomes in those who were in the highest income group at baseline. Also although there were strong correlations in income between years, there was substantial (relative) mobility in income. Much of the mobility was short distance to adjacent income (quintile or decile) groups. Over the long-run there was much more mobility with almost twice the amount of mobility than shown in the annual change tables.

The patterns of mobility were also similar among the working age group. The restriction of the analysis to the working age group (age 25 to 55 at wave 1) attempts to control for life-cycle effects of the younger ages such as finishing education and moving into work, or the older ages moving into retirement. However, this analysis does not control for all life-cycle effects such as forming relationships and starting families or the separation of relationships or families. Decomposition and regression analysis is needed to examine what factors are causing people's incomes to move up or down both the absolute and relative the income scale.

Mobility in income has also been documented for other developed countries with similar panel datasets, the UK British Household Panel Survey (Jarvis and Jenkins 1998; Jenkins 2000; Jenkins 2011; Van Kerm 2011), the USA Panel Survey of Income Dynamics (Gottschalk 1997; Jenkins and Van Kerm 2006; Hungerford 2008), the German Socioeconomic Panel (Jenkins and Van Kerm 2006; Van Kerm 2011) and the Household Income and Labour Dynamics of Australia panel survey (Wilkins and Warren 2012). The results of the present study are similar to those shown in these international panel surveys, over similar length of time. A cross-national comparison of income mobility in the UK, US, Germany and Canada has also found much mobility in income, but with different patterns across countries (Chen 2009). The UK appears to be slightly more mobile than the other three countries, with lower proportions of stability in relative mobility over time (Jenkins 2011; Jäntti and Jenkins forthcoming).

It is difficult to directly compare the income mobility results of the different international panel surveys to SoFIE, due to differences in survey methodology, the collection and calculation of the income data (BHPS collects current income compared to annual income in SoFIE) and different time periods covered by the surveys (Jenkins 2011). However, the amount of income mobility shown in the SoFIE data is similar to those found in the UK BHPS (Jenkins 2011) as well as the Australian HILDA survey (Wilkins, Warren et al. 2011). Although the correlation in income was lower in SoFIE than BHPS, the measure of stability in income (staying in the same decile group) over two-years was the same (37 percent). Slightly more mobility in income in New Zealand over an eight year period compared to the UK (Jenkins 2011). However, it is important to note that these studies also covered different time periods with the SoFIE wave 8 data potentially showing the impact of the Global Financial Crisis.

This paper presents a descriptive analysis of income mobility and does not examine what factors are causing mobility in income. More research is needed into examining why people are staying in certain income groups and what factors influence movements out of low income as well as those that cause people to move back down the income ladder. The next step for this research is to examine these dynamics in the New Zealand context using New Zealand panel data.

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# Appendix

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## Appendix 1: Income Data

This section provides more detailed data regarding the income data in SoFIE and the calculation of disposable income.

### Gross Income

To calculate gross personal income, all income earned within each annual reference period are summed, employee earnings (annual earnings from paid employment), (profit or loss) from self-employment, core government transfers (social security benefits), Superannuation or veterans pensions, other government transfers, interests investments, other sources of taxable income (eg, student allowances), other sources of non-taxable income (eg, scholarships, tax credits).

The income period is assumed as full year for these income types: Total IRD Lump Sums over Reference period; Last IRD Payment during Reference period; Total Income from Investment over Reference period; Total Income from Regular Income over Reference period; Total Income from Lump Sum Payments over Reference period; Net Profit or Loss from Self-Employment over Reference period; Net Profit or Loss from Self-Employment over Earlier Year; Net Self-Employment Profit/Loss over Reference period for Missed Wave; Net Self-Employment Profit/Loss over Earlier Year Period for Missed Wave.

Gross household income is the sum of gross income of all persons in household.

### Disposable Income

Taxable income is calculated at an individual level and is the total gross income minus non-taxable income. Taxable income includes including these broad types: Employee's earnings, Self-employment income, Other regular income (including regular income other than from employment, such as benefit income, ACC payments, investment income, student allowances and director's fees), Irregular income includes Lump sum payments from a family trust, Income from hobbies, Wins from gaming, Income from overseas, Any other lump sum payments, All lump sum payments combined from missed previous wave. Income taxes are calculated on taxable income, by applying individual income tax rates for the annual reference period. Deductions include: Income taxes, ACC levies for paid employees, ACC levies for self-employed, Student loan repayment, KiwiSaver contributions.

In calculating disposable income, these income types are defined as non-taxable: Family Support paid by IRD (Family Assistance - Child Tax Credit; Family Assistance - Family Tax Credit; Family Assistance - Parental Tax Credit; Orphans or Unsupported Child Benefit; Family Support; Accommodation Supplement; Disability or Rehabilitation Allowance; Special Benefit; Child Disability Allowance); Private Superannuation Fund; Regular maintenance or child support; Regular private accident insurer payments; Educational scholarships; Inheritances; Matrimonial property settlement; Other maintenance payments; Lump Sum Insurance payments; Lump Sum superannuation payments; Lump Sum life insurance payments; Cash gifts or koha.

Deductions include: ACC levies for paid employees are calculated on gross earnings from paid employment, by applying the levy rates for the annual reference period. ACC levies

for self-employed are calculated on gross earnings from self-employment, by applying the levy rates for the annual reference period. Self-employed not only pay the earners' account (current and residual) levies, but also work account (current and residual) levies and Health and Safety levies.

Student loan repayments were calculated as 10% of the taxable income above the (year specific) repayment thresholds. Student loan repayments were capped at the outstanding loan value. For example, if a person earns \$49,084 in 2010 and has an outstanding student loan of \$500, then the repayment amount is only \$500 (not  $10\% \times (\$49,084 - \$19,084) = \$3,000$ ). Information on student loans is only collected in the asset-liability module in waves 2, 4, 6, 8 so student loan variables were imputed for waves 3, 5, 7 using information from previous and subsequent waves.

KiwiSaver was introduced in July 2007 (wave 5), but KiwiSaver membership is only asked as recall question in wave 8, therefore the recalled KiwiSaver joining date was used to impute membership for waves 5, 6, 7. The contribution rate was assumed to be the same as the wave 8 contribution rate. If the contribution rate was missing, it was assumed to be 2% (the most common contribution rate). The KiwiSaver contribution amount was calculated as the contribution rate multiplied by gross earnings from employment (paid or self-), if currently contributing.

Parental, child and family tax credits are paid at the economic family unit level. This is reported by one of the respondents in the family unit and included in one personal income in the household.

## **Household Income**

Household disposable income was derived by totalling adult annual personal disposable income from all sources received within a household for the 12 months prior to the interview date, so annual income estimates for wave 1 relate to the 2001-2002 annual reference period (which varies by individual).

Most data presented in this paper is real disposable equivalised household income before housing costs, applied to all individuals in the household. Income after housing costs were removed was also calculated as housing costs have been shown to disproportionately affect the available income in lower income households (Perry 2013). Annual housing costs were calculated as the sum of annualised household spending on these items: Body corporate fees; Full rates; Land rates; Mortgage payments; Rent payments; Water rates. The maximum costs were annualised as the maximum for those whose "number of weeks covered" is 52 (annual). The amount of last mortgage payment for dwelling was not collected if the mortgage is revolving credit/flexi-loan. This affects 28% of households in the balanced panel. Therefore, housing costs may be underestimated.

## **Equivalisation and Price Indices Adjustment**

In order to compare the incomes in households of differing composition and to make comparisons over time, the value of household income needs to be adjusted by a household equivalence scale as well as an inflation index.

The equivalisation of household income adjusts a household's income based on the size and composition of the household. This is based on the notion that larger households require more income than smaller households to have a similar standard of living, but that there are also economies of scale as the household size increases. Most equivalisation

scales also assume that children cost less than adults. A child is classified as dependent if they are under 15 years of age. The equivalisation adjustment aides in comparisons between different types of households as well as over time.

While considerable research has been undertaken to try to estimate appropriate values for equivalence scales (Creedy and Sleeman 2004; Creedy 2013), there is no universally accepted adult equivalence scale. The 'modified OECD scale' which is used by EUROSTAT, Australia, the United Kingdom and other countries is useful for international comparisons. This scale assigns the first adult a value of 1.0, the second and subsequent adults 0.5 and children 0.3. The OECD equivalence scale of  $\sqrt[n]{n}$  was also used. The primary equivalence scale used in this working paper, the 1988 Revised Jensen Scale, for comparison with other New Zealand relevant research (Perry 2013). The revised Jensen Scale is similar in magnitude and impact to the OECD scale (Perry 2013). It is important to clarify what equivalence scale is used and what are the potential impacts on the distribution of income and levels of income inequality and/or poverty that are reported (Creedy and Sleeman 2004; Creedy 2013).

A simple (but flexible) adult equivalence scale is the following, where,  $n_a$  and  $n_c$  denote respectively the number of adults and children in the household, and  $m$  is the adult equivalent size of the household:

$$m = (n_a + \theta n_c)^\alpha$$

where  $\theta$  is the cost of a child relative to an adult in the household and  $\alpha$  is a measure of economies of scale (Creedy and Sleeman 2004; Creedy 2013). Using the estimates from  $\theta = 0.730$  and  $\alpha = 0.621$  provides similar equivalence estimates to the Revised Jensen Scale 1988 (Jensen 1988; Creedy and Sleeman 2004).

In an ideal world, the equivalence scales would also take into account other factors such as the age of children, the costs of being employed in low versus high-skill employment, the differing needs for households of the same type but of different incomes, and so on. However, such considerations further complicate the estimation process and the common practice is to settle for simpler scales as an approximation. Once the equivalisation scale is decided upon, equivalised income is calculated by dividing the total household income by the equivalence scale.

To be able to compare household incomes over time, we need to adjust for inflation using the Consumer Price Index (CPI). Nominal incomes were inflated to June 2010 as the base year. For each person, CPI date is the nearest quarter before annual reference period ends, eg, if the annual reference period ends in August, then CPI quarter is June.<sup>3</sup>

## Quality of the Income Data

### Missing data

If income is missing when spell data are available, zero income is assumed for that component. This affects 12% of the sample. The majority of these were missing spell information on the last WINZ benefit payment, specifically family support, accommodation supplement and the disability or rehabilitation allowance

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<sup>3</sup> It is possible to adjust wage income by the wage price index and non-wage income by the CPI. However, we chose to adjust income by the CPI only to reflect changes in real "purchasing power" income over time.

## Zero income

The corresponding proportion for the balanced panel is 4.9% of the sample, across all 8 waves have zero gross income. Nearly all of those who have zero income, 99.9% have “no income sources” as main source of income. Among those who have zero income, 49.7% are aged 0-17, 13.2% aged 18-24.

## Negative income

About 0.5% of the sample, across all 8 waves have negative gross income. Among those who have negative income, 95% have “self-employment” as main source of income, the rest have “interest and investment income”, “other government transfers”, and “other sources”.

As discussed in Section 3.2, there were some extreme outliers (both negative and positive) in the real disposable household income. Therefore the equivalised real disposable income was trimmed if this was less or larger than the bottom and top 1% of the distribution. On average, about 360 (180 top 1%, 180 bottom 1%) observations per wave are dropped. Trimming to avoid these problems is common practice in research on this topic (Gottschalk 1997; Jenkins 2011).

## Description of income data

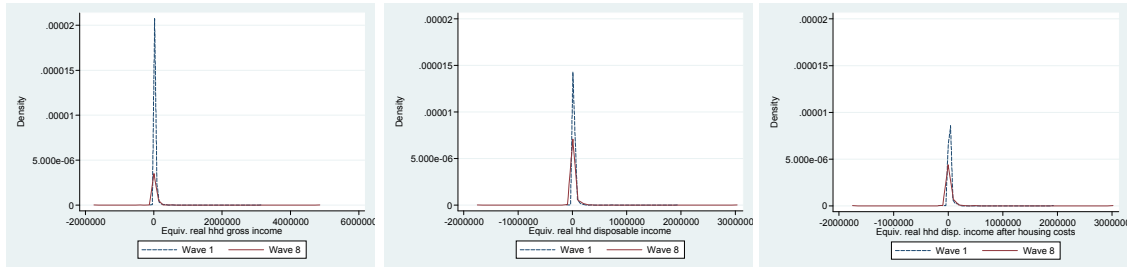
Appendix Figure 1 presents kernel density graphs of the probability density function (distribution) of three different measures of real equivalised household income (Real Gross, Real Disposable and Real Disposable after housing costs [AHC]) at wave 1 and wave 8 on the full and trimmed data. It can be seen that, the probability density of income in wave 1 is tighter, with a higher probability clustered around zero, than wave 8, which has a slightly flatter distribution. Appendix Figure 1 (a) shows that there are extreme outliers in the data. Also wave 1 real gross income is more tightly clustered around zero, with the highest probability density function. After taking into account housing costs the distribution of income in wave 1 and wave 8 are very similar. Appendix Figure 1 (b) presents the density of the income distribution after the extreme incomes (top and bottom 1%) have been removed. It can be seen that removing the extreme incomes evens out the distribution between waves 1 and 8. In real terms there has been a slight increase in income (a shift in the distribution to the right) from wave 1 (2002/03) to wave 8 (2009/10).



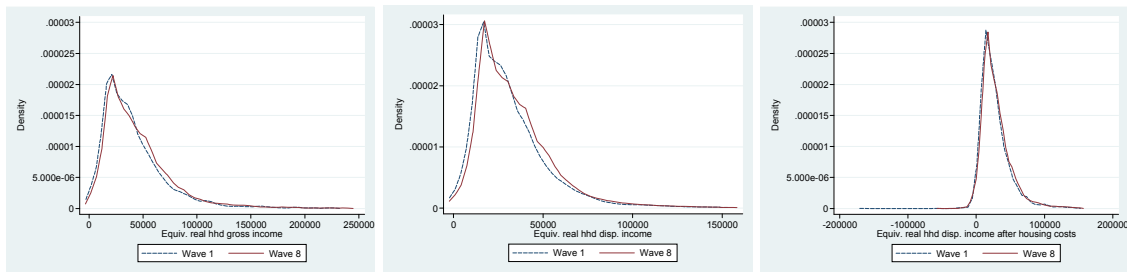
## Description of the Income Data

**Appendix Figure 1. Kernel density graphs of the distribution real equivalised household income (gross, disposable, disposable after housing costs) wave 1 and wave 8, on (a) full and (b) trimmed data**

(a) Distribution on full data



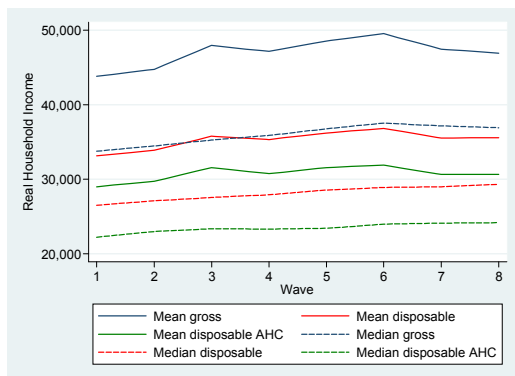
(b) Distribution on trimmed data



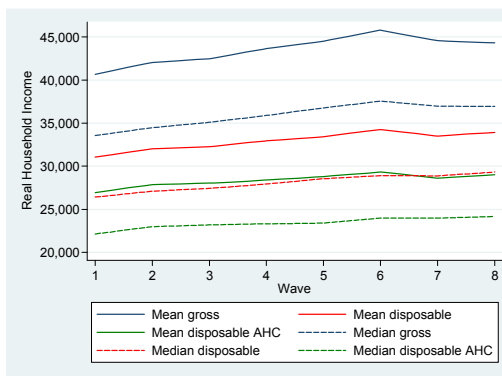
There is a non-linear increase in mean income (across all measures) in wave 3 (Appendix Figure 2 (a)), this corresponds with a large standard deviation (\$150,000) in wave 3, indicating large spread in the crude data. Appendix Figure 2 (b) presents means and medians in income based on the trimmed data and shows a steady increase in income from wave 1 to wave 6 and a slight decline in means after the global financial crisis in 2008/09 (wave 7).

**Appendix Figure 2. Trends in mean (solid line) and median (dashed line) real equivalised household income (gross, disposable, disposable after housing costs) across eight waves, (a) full data, (b) trimmed (final) data**

(a) Full data



(b) Trimmed data



Appendix Table 1 presents means and medians for the measures of income across the eight waves, using the trimmed income data. The data show an increasing trend in household income over the eight years from 2002 to 2010. Although medians and means

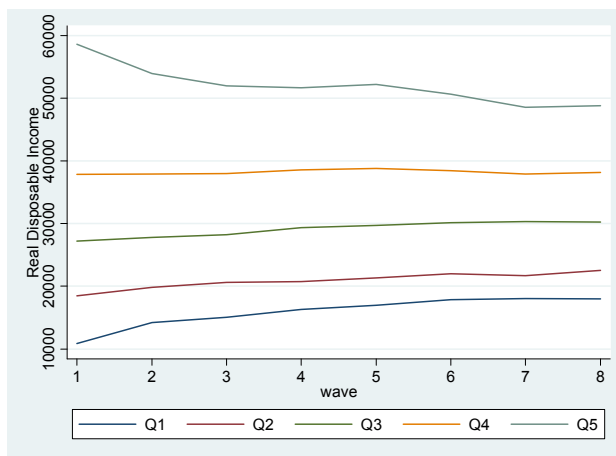
travel in the same direction, the medians are flatter and more stable than means over time. There is a non-linear increase in the mean income in wave 3, which is discussed in more detail below. There is a flattening of the trends in the latter years of the survey (2008 to 2010) indicating the impact of the global financial crisis, as shown in other cross-sectional surveys (Perry 2013).

**Appendix Table 1. Mean and median for eight waves for the three measures of real equivalised household income.**

wave	Real Gross		Real Disposable		Real Disposable – AHC*	
	mean	median	mean	median	mean	Median
1	41,700	34,810	31,740	27,220	27,350	22,780
2	43,160	35,580	32,790	27,830	28,290	23,440
3	43,220	35,870	32,760	27,990	28,190	23,680
4	44,660	36,720	33,640	28,550	28,720	23,750
5	45,530	37,760	34,100	29,330	29,130	23,870
6	46,800	38,410	34,930	29,710	29,610	24,340
7	45,560	38,080	34,100	29,610	28,840	24,220
8	45,190	37,610	34,460	29,790	29,170	24,220

\* AHC – After Housing Costs

**Appendix Figure 3. Median real disposable equivalised household income across the waves, based on income quintiles at wave 1**

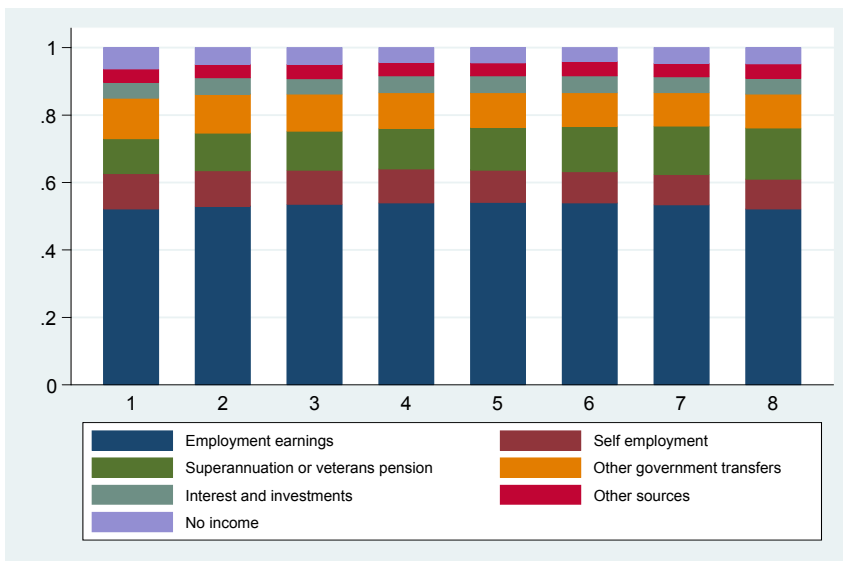


The above figure presents the trends in the median real disposable equivalised household income by income quintile at wave 1. The variability in the income data is mainly influenced by the means and medians in the top income quintile group at wave 1 (Q5). There were increases in median level of disposable income in people who had incomes in the lower (three) income quintiles at wave 1, indicating an upwards shift in the distribution of income in these quintiles.

## Sources of Incomes

Appendix Figure 4 presents the composition of the main sources of income (based on personal income) that make up household income. On average 55% of income is composed of earnings from employment, ranging from 53% to 56% over the eight waves. Other core sources of income comes from earnings from self-employment, superannuation and other government transfers, making up 30% of household income (10% each). The share of superannuation and pensions is getting larger over the years, showing the older population of the cohort moving into retirement.

**Appendix Figure 4. Composition of main sources of (personal) income for eight waves (real disposable equivalised household income)**



## Appendix 2: Benchmarking of Income Data

To check the reliability of the income data in SoFIE we compared the disposable household incomes to the ones produced by the Treasury’s tax-benefit microsimulation model (Taxwell) for 2006/07 to 2009/10. Taxwell utilises the Household Economic Survey (HES), which is a cross-sectional data produced by Statistics New Zealand. It is currently conducted every three years collecting information on household expenditures and incomes and a range of demographic variables. A shorter version of the HES is conducted every other year and only collects income and demographic information. Households are interviewed throughout the year and the quarter of interview is recorded. On average, the sample is around 8,000 individuals (2,500 to 3,000 households) in each survey year over the period 2006/07 to 2009/10. Perry (2013) provided a detailed description of the data and variables derived from the Taxwell. For simplicity, we defined HES 2007 which represents the 2006/07 HES. The 2007 survey runs from 1 July 2006 to 30 June 2007. Therefore, this is not entirely comparable with SoFIE wave 5 (which runs from 1 October 2006 to 30 Sept 2007).

It is also worth noting that the derivation of real equivalised disposable household income used in this analysis differs from Perry (2010, 2013) due to several factors. In the current analysis housing costs includes all mortgage principal and interest payments, rents and rates mainly for primary property for all household members (after housing costs data not presented here). To allow for comparison with the results from SoFIE, we dropped the top and bottom 1 percent of real equivalised disposable household incomes in each year and adjust the incomes to June 2010 prices. We also did not use separate CPI adjustment to incomes after housing costs as done by Perry (2013).

**Appendix Table 2. Comparison of SoFIE income with TaxWell HES data real disposable equivalised household income (June 2010 prices)**

wave	SoFIE			HES		
	year	mean	median	year	mean	median
5	2006/07	34,099	29,329	2007	32,776	28,525
6	2007/08	34,934	29,710	2008	35,652	30,442
7	2008/09	34,095	29,606	2009	35,730	30,970
8	2009/10	34,460	29,789	2010	35,649	31,083

Appendix Table 2 presents the mean and median income for real disposable household income over the four comparable years of data. The mean and median in wave 5 (2007) were lower in HES than in SoFIE. Then the incomes in HES increased by about \$2,500 in the following year. The trends in SoFIE are much more stable. The potential reasons for the differences in results between SoFIE and HES are differences in the reference period covered by each survey, weights (longitudinal for SoFIE, cross-sectional for HES), and the quality of surveys (recall bias etc).

## Appendix 3: Descriptive Tables

**Appendix Table 3. Descriptive table of sample baseline (Wave 1) characteristics, mean, median and percentile cutpoints for waves 1 and 8 for real disposable equivalised household income by demographics.**

	Wave 1				Wave 8			
	mean	median	p10	p90	mean	median	p10	p90
<b>Total</b>	31,800	27,300	10,900	58,700	34,500	29,800	12,900	61,900
<b>Age Group Wave 1</b>								
0-17	26,600	22,800	8,700	48,000	30,200	26,600	10,000	53,400
18-64	34,800	30,700	11,800	62,300	37,400	32,900	14,000	65,100
65+	25,200	18,300	12,800	46,500	26,600	20,100	16,000	46,200
<b>Sex</b>								
Male	32,900	28,400	11,400	60,300	35,900	31,200	14,000	63,200
Female	30,700	26,100	10,600	57,200	33,100	28,300	12,100	59,500
<b>Ethnicity</b>								
NZ European	34,500	29,800	13,100	62,000	36,900	31,900	14,700	65,100
Māori	24,400	20,700	8,400	45,300	26,300	22,500	9,400	47,400
Pacific	21,800	19,600	5,700	38,400	25,700	22,400	10,600	42,400
Asian	22,900	19,100	4,200	44,900	29,500	26,700	11,300	52,800
Other	28,300	20,600	8,400	53,100	33,900	30,600	11,900	57,300
<b>Family Wave 1</b>								
Couple only	39,500	35,400	14,500	70,800	37,500	31,400	16,100	67,000
Couple and child(ren)	31,000	27,400	11,300	54,000	35,600	31,500	12,700	62,600
Sole parent and child(ren)	20,600	16,100	7,200	39,100	25,100	21,100	9,400	44,900
Single	30,800	26,200	10,300	56,500	32,400	26,700	13,600	58,400
<b>Education Wave 8</b>								
No qualification	25,600	21,400	9,500	46,700	27,400	23,100	12,100	48,500
School qualification	31,600	27,400	11,300	56,900	33,900	29,600	12,700	59,300
Vocational qualification	34,100	30,200	12,500	60,200	35,700	31,500	14,500	61,700
Degree or higher	39,700	36,400	11,500	72,500	45,200	40,400	15,700	81,300

\* Equivalised household income (revised Jensen)

**Appendix Table 4. Table of the mean income by decile and the percentage share of income of the top 10% for 8 waves (RDEHI)**

Mean income by income decile	Wave							
	1	2	3	4	5	6	7	8
<b>P1</b>	6100	8400	6800	8600	8300	8500	7100	8200
<b>P2</b>	13200	14400	14200	15000	14900	15200	15000	15300
<b>P3</b>	16700	17700	17900	18300	18400	18800	18700	18800
<b>P4</b>	20800	21700	21600	22100	22500	23000	22800	22800
<b>P5</b>	25200	25900	25900	26400	27000	27500	27300	27400
<b>P6</b>	29600	30300	30500	31000	31600	32200	32100	32200
<b>P7</b>	34700	35500	35600	36600	36900	37600	37700	38000
<b>P8</b>	41400	42100	42000	43000	43700	44400	44100	44600
<b>P9</b>	51200	52400	52300	53100	53800	54500	53200	54400
<b>P10</b>	79100	80300	81300	83000	84400	88000	83600	83500

**Appendix Table 5. Absolute change in real disposable income wave1 to 2, wave 1 to 8, overall and by wave 1 income quintile, 2002-2010.**

	Decrease in income					Increase in Income				
	<20k	10-20k	5-10k	2-5k	0-2k	0-2k	2-5k	5-10k	10-20k	>20k
<b>Change w1 - w2 Overall</b>	6%	7%	8%	9%	12%	14%	14%	12%	9%	6%
<b>Change w1 - w8 Overall</b>	10%	10%	7%	6%	6%	7%	9%	12%	16%	14%
<b>W1 Q1</b>	0%	2%	3%	4%	6%	8%	13%	18%	23%	21%
<b>W1 Q2</b>	0%	5%	7%	6%	9%	12%	13%	14%	17%	13%
<b>W1 Q3</b>	2%	12%	10%	7%	7%	7%	9%	12%	17%	13%
<b>W1 Q4</b>	11%	16%	9%	7%	5%	4%	8%	12%	14%	12%
<b>W1 Q5</b>	37%	14%	6%	4%	3%	3%	4%	5%	9%	10%

**Appendix Table 6. Percentage change in income over the short and long term**

	Real disposable income	
	change w1 - w2	change w1 - w8
<b>Overall</b>	3.3%	8.6%
<b>W1 Q1</b>	67.9%	129.0%
<b>W1 Q2</b>	15.8%	40.0%
<b>W1 Q3</b>	8.2%	18.3%
<b>W1 Q4</b>	2.6%	3.1%
<b>W1 Q5</b>	-13.9%	-20.6%

## Appendix 4: Decile Transition Tables

**Appendix Table 7. Transitions table, from wave 1 to wave 2, Deciles**

		Decile w2									
		1	2	3	4	5	6	7	8	9	10
Decile w1	1	46.05	18.95	12.65	7.42	5.45	3.57	1.58	1.63	1.05	1.64
	2	26.84	33.07	17.01	9.16	6.44	3.16	2.21	1.49	0.33	0.29
	3	8.22	24.00	33.27	16.32	7.06	4.22	2.75	1.88	1.12	1.17
	4	6.32	8.02	16.2	31.32	18.92	8.25	5.00	3.19	2.22	0.55
	5	3.43	7.78	9.35	15.57	27.28	18.91	9.11	3.17	2.81	2.58
	6	2.59	3.24	4.17	8.21	18.55	29.87	16.7	10.12	3.39	3.16
	7	0.98	1.83	2.73	4.16	7.30	17.42	34.57	19.41	7.46	4.16
	8	2.08	1.97	1.83	2.82	4.53	5.70	17.36	36.01	21.16	6.54
	9	1.62	1.10	1.39	2.91	3.41	5.90	6.14	15.78	42.32	19.44
	10	2.65	1.07	1.40	1.69	1.67	3.33	5.68	6.42	18.47	57.62

**Appendix Table 8. Transitions table across the study period, from wave 1 to wave 8, Deciles**

		Decile w8									
		1	2	3	4	5	6	7	8	9	10
Decile w1	1	27.19	18.27	12.68	10.55	8.86	6.72	6.97	3.36	2.63	2.77
	2	20.68	23.29	17.11	10.41	9.03	6.75	4.65	4.46	1.55	2.07
	3	9.26	19.54	23.8	14.97	9.54	7.01	7.03	3.74	3	2.12
	4	10.81	8.35	12.96	17.24	13.48	11.64	11.36	5.65	6.03	2.47
	5	9.23	7.50	8.39	14.73	16.84	14.29	11.22	8.92	5.11	3.76
	6	6.07	6.10	5.25	10.21	12.56	16.51	15.16	13.15	8.71	6.28
	7	5.16	5.11	5.85	6.44	10.34	12.02	15.71	17.24	14.14	8.00
	8	4.43	4.67	6.67	6.50	7.98	11.15	12.78	15.88	18.14	11.8
	9	3.16	3.91	4.90	5.30	6.76	7.63	9.87	14.13	23.1	21.25
	10	4.37	3.46	2.92	3.72	5.13	5.75	5.63	13.75	17.48	37.78