Saving Rates of New Zealanders: A Net Wealth Approach

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A portion of the analysis in this paper is based on data from the Survey of Family Income and Employment (SoFIE). Access to the SoFIE data was provided by Statistics New Zealand in a secure environment designed to give effect to the confidentiality provisions of the Statistics Act 1975. Statistics New Zealand has initiated a systems review for SoFIE. Therefore data contained in this paper could be subject to change. However, any errors in the analysis are those of the authors, not Statistics New Zealand.

Abstract

Reliable estimates of actual household saving rates in New Zealand have proved elusive as existing sources of data have in the past given disparate estimates, making it difficult to reach a consensus of the real rate of household saving. For the first time in New Zealand, however, longitudinal data on the assets and liabilities of households at the unit record level are becoming available from Statistics New Zealand's multi-year national longitudinal Survey of Family Income and Employment (SoFIE).

In this paper we first update estimates from the Reserve Bank's aggregate data on the household sector (a stock approach) and those from Statistics New Zealand's national accounts (a flow approach). These continue to give widely different estimates of the overall household saving rate, although both were negative in 2008 and both below their long-run trend values.

We then present initial estimates derived from SoFIE by comparing individuals' net wealth in 2004 with that in 2006 and computing the implied real saving rate on an annual basis. This yielded an overall median estimate of 16%. This is virtually the same as the long-run average annual saving rate measured from the aggregate household balance sheet from RBNZ. Furthermore, the estimated saving rates between 2004 and 2006 for the whole household sector in total are almost identical using RBNZ and SoFIE data.

However, it must be stressed that median estimates should be complemented with a measure of dispersion. There is a strikingly wide distribution of saving rates. For example across many categories of individuals around 40% are estimated to have had a decline in net wealth, implying a negative rate of saving. Initial explorations into the reasons for this are undertaken in the paper, but as yet are not fully understood. Measurement errors in the data can account for some of the disparities but much remains for further research.

Finally we demonstrate that over the period 2004 to 2006, passive saving in the form of the revaluation of house prices constituted a major part of the total change in net wealth. After removing owner-occupied property as an asset, the median saving rate remained positive at 5%, close to the long run average rate from the aggregate RBNZ data after correcting for changes in house prices.

JEL CLASSIFICATION D18 Personal Finance
D31 Personal Income, wealth
D91 Intertemporal choice, life-cycle models, saving
E21 Consumption, saving

KEYWORDS Net wealth; saving; saving rates; unit records; permanent wealth; transitory components; New Zealand

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Saving Rates of New Zealanders: A Net Wealth Approach

1 Introduction

Savings play a central role in the New Zealand economy. It is widely recognised that domestic savings have been less than gross investment, with borrowing from foreign savers making up the difference. That difference is recorded in the external accounts of the nation as a current account deficit (and a corresponding capital account surplus). Continuing annual deficits add to the stock of net foreign liabilities. As well as increasing future debt servicing costs, higher levels of foreign liabilities can leave the economy exposed to sudden changes in the external flow of capital. Even in the absence of precipitous changes, foreigner lenders tend to demand a risk premium which would be expected to increase with higher levels of indebtedness. This can lead to higher costs of capital with consequences for the rate of capital formation. In short, the level of domestic savings has widespread implications for the nation's external liabilities, the cost of capital, the rate of capital formation and the development of financial markets.

A central and on-going question in pension and superannuation research relates to the saving behaviour of individuals or households. To what extent are they saving adequately for retirement? The question is important as it has potentially significant implications for public policy with respect to retirement income. Are current policy settings such that the living standards of retirees relative to the working age population acceptable? Will population ageing create greater fiscal pressures through the demands on public pension systems? The extent of retirement savings and hence the private provision of retirement income impinge very directly on these policy questions.

In assessing whether people are saving adequately, the researcher immediately confronts a series of methodological and practical issues. In the first place, one must decide on a measure of adequacy. Second, regardless of how an "adequate" savings rate is to be defined, one must be able to measure the rate at which people are actually saving. Only then can a judgement be made about whether the observed saving rates are adequate. This paper focuses on the second question; ie, the measurement of actual saving rates. The paper is focussed on saving by individuals; it is not intended to address the broader question of national savings, the current account deficit and associated levels of foreign debt.[1]

[1] For a discussion of these macroeconomic aspects see Treasury (2007).

Savings can be measured either from "flow" data as the difference between income and consumption expenditure, or alternatively, by a "stock" approach which measures saving from changes in the balance sheet.[2] These approaches are discussed in Section 2. The pattern of New Zealand savings at the aggregate level is illustrated in Section 3. This is followed in Section 4 by a brief description of a major longitudinal survey which has allowed estimates of individual saving rates from detailed information on assets and liabilities. This is the first time that the stock approach has been applied to unit record data in New Zealand. Section 5 summarises the key findings, and the paper concludes in Section 6 with future directions for this work.

The evidence to date for aggregate household savings has relied very largely on measures derived from the national accounts. However a number of limitations of this particular source of data on savings have been identified. In addition, such aggregate measures cannot address the distribution of saving rates and so identify particular segments of the population whose saving rates might be of concern. The present study draws on a new source of data and provides estimates of the level and distribution of saving rates

[2] NATSEM are currently developing a dynamic simulation model to measure savings as the difference between the accumulation of assets and debt for Australian households (Kelly and Keegan 2008).

2 Measuring Savings

Saving can be measured in two fundamentally different ways. The first is a *flow measure* where savings is defined as the difference between income and current consumption. The second is a *stock measure*, based on the difference between the net wealth (assets minus liabilities) at the beginning and end of a period. While being cognizant of an extensive series of issues surrounding the definitions and measurement of savings under both approaches, we do not rehearse these here.[3]

In broad terms, the flow measure of saving by households (S^f) is simply defined as:

$$S^f = Y - C \tag{1}$$

the difference between income (Y) and current consumption (C). It is however important to note that this is related to the stock measure of saving (S^s):

$$S^s = \Delta NW = S^f + \mathrm{Re}\,v + Captrf + Other \tag{2}$$

where:

ΔNW = the change in net wealth

Rev = the revaluation of real and financial assets and liabilities

Captfr = capital transfers to the household sector from other sectors including overseas (eg, net migrant transfers)

Other = other changes in wealth holdings that may arise from loss or destruction, or discovery.

In short, once adjustments are made for the revaluations, transfers and any other exogenous changes to household wealth, it is conceptually straightforward to reconcile the two measures. In practice such reconciliation has proved difficult and is typically only partially achieved.

A further important distinction is whether the data is drawn from national aggregates or from unit record data for individuals or households, based on survey data. Table 1 summarises the sources of data available in New Zealand for the measurement of saving by both the flow and stock methods. In this paper we will examine flow measures from the national accounts. In addition we form estimates of saving rates based on the stock approach drawing on both the aggregate household sector data on assets and liabilities, and on a new source of unit record data based on a household survey.

[3] See for example Savage (1999), Moulton (2001), Orr (2001), Claus (2002b), Scobie (2004), Cashell (2005), Hodgetts (2006), Bascand (2006), and Statistics New Zealand (2007).

Table 1: Approaches and sources of data for measuring savings

	Approach	
	Flow approach: Income less Consumption	Stock approach: Change in Net Wealth
Microeconomic data (eg, household)	*Household Economic Survey*	*SoFIE* (Survey of Family Income and Employment: Asset and Liability modules)
Macroeconomic aggregates	*System of National Accounts:* *Institutional Sector Accounts* Household Income and Outlay Account (experimental)	*Reserve Bank of New Zealand:* Household Financial Assets and Liabilities and Housing Values

3 The Aggregate Picture

This section reviews the evidence for both fundamental approaches to the measurement of saving (the flow and stock measures) using macroeconomic aggregates. The section concludes with a comparison of the two approaches.

3.1 Flow measures

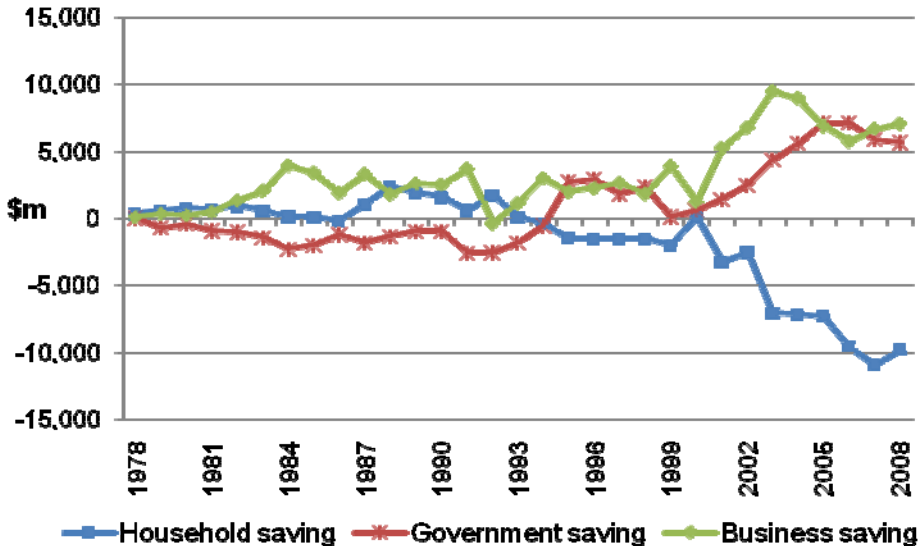
The overall level of national savings derived from the System of National Accounts can be disaggregated into the savings of six economic sectors, including the household sector. For each sector a series of accounts can be developed including production, income and outlay, capital, financial, reconciliation and balance sheet. It is on the basis of the household income and outlay account (HIOA) that household savings is estimated as a residual between income and expenditures. Theoretically it is equivalent to summing the income and expenditure of every individual household and computing the difference. The HIOA is currently labelled "experimental" and is subject to on-going methodological enhancements.

Setting aside the relatively small amounts of saving from the non-profit and financial intermediaries this leaves the three major sectoral categories of saving depicted in Figure 1. The most striking result is the long downward trend in household savings and the apparent "dissaving" (ie, negative saving) by the household sector since the early 1990s.

Based on work at the Reserve Bank of Australia (Edey and Britten-Jones 1990), Claus and Scobie (2002a) have shown that inflation affects the flow measure of household savings, to the extent that inflation erodes the value of government debt held by households. The latter authors find that once the adjustment for inflation is made, there was no evident downward trend in private savings in the 1990s.

There are well recognised "boundary" issues between the three categories of savings. Contributions made from tax revenues to pre-fund superannuation could well be classified as retirement savings by households. A similar issue arises on the boundary between household and business savings (Bascand, Cope *et al* 2006). To the extent for example that business earnings are retained rather than being distributed to the households that own the businesses, some of what is arguably household savings will be recorded as business savings.

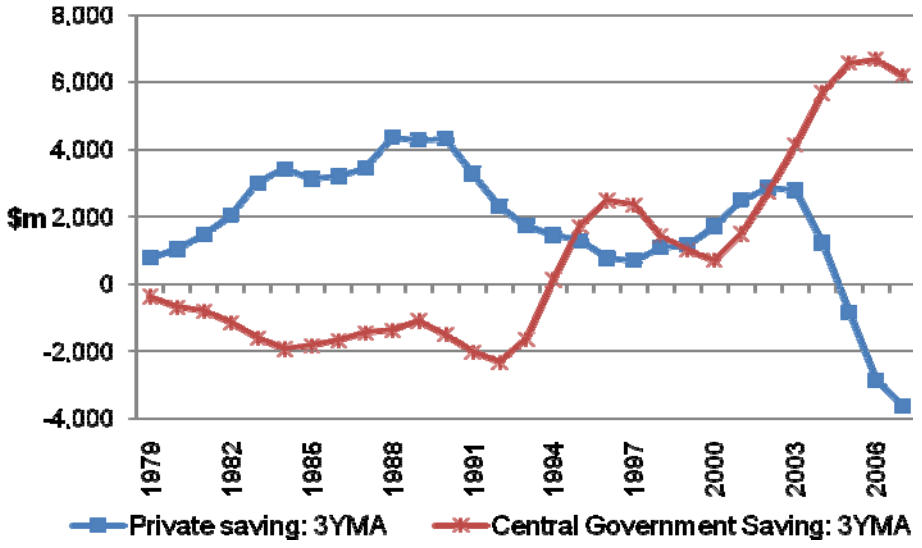
Figure 1: Major sectoral trends in savings (flow measures): 1978-2008



Source: Statistics NZ National Accounts; authors' calculations

One way to overcome this problem is to consider the sum of household and business savings, denoted private savings. However it remains the case that this measure has also become significantly negative in recent years, leaving core government surpluses as the sector which has offset this apparent dissaving by households. As illustrated in Figure 2 there is a marked long run tendency for private savings to move inversely with government savings, as the private sector adjusts its saving rate in recognition of increased tax burdens needed to service and repay public debt.

Figure 2: Private and government savings: 3 year moving averages



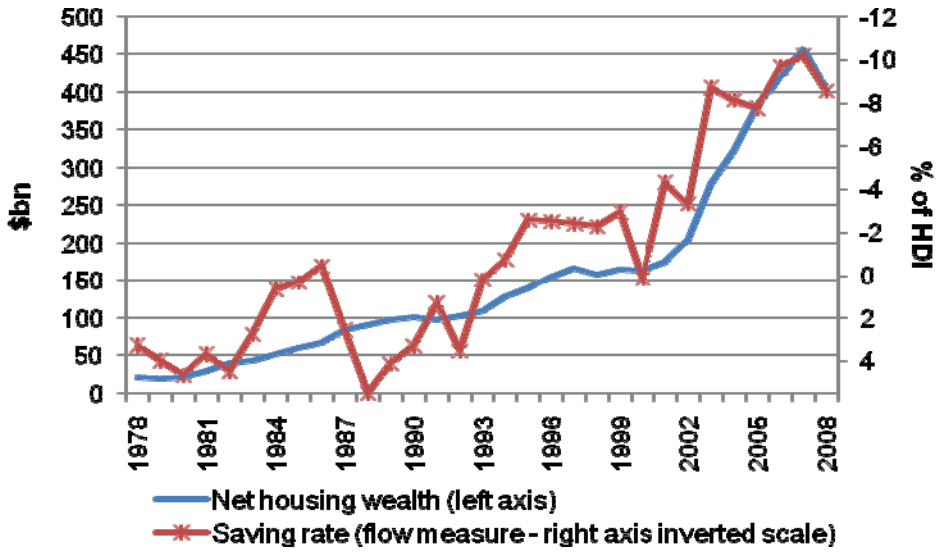
Sources: Statistics NZ National Accounts; authors' calculations

While the so-called "Ricardian equivalence" phenomenon has been widely debated (Seater 1993), the evidence for New Zealand is not inconsistent with at least a partial relationship.[4] An appreciation of this is important in assessing the extent of retirement savings by the household sector.

[4] Edwards (1995) estimates that a rise in government saving is partially offset by a corresponding decline in private saving. Similar findings are reported by Nicoletti (1988).

Finally we note that the marked decline in the household saving rate (as a percentage of household disposable incomes) has paralleled a rise in net housing wealth which itself rose unprecedentedly following 2001 (Figure 3). Referring to equation (2) it is quite consistent that increase in house prices (revaluation) could be accompanied by a decline in the flow measure of savings. It is of interest that in the 2008, the last year of the available series, a decline in house prices (and hence net housing wealth) was matched by an increase in the household saving rate, although it is premature to predict whether this trend will continue.

Figure 3: Net housing wealth and household saving: 1978-2008



Sources: RBNZ; Statistics NZ National Accounts; authors' calculations

Hodgetts (2006) notes that dissaving necessarily involves a drawing down on net equity. In other words some of the existing wealth can be used to fund consumption at a level greater than that which would be possible if households were constrained solely by current disposable income. Both Hodgetts (2006) and van Zijll de Jong (2006) provide evidence of equity withdrawal. This mechanism underlies the contemporaneous sharp rise in equity and the increasingly negative saving rates depicted in Figure 3.

3.2 Stock measures

In this section we provide an overview of household balance sheets derived from aggregate data on assets and liabilities prepared by the Reserve Bank of New Zealand.[5] Table 2 summarises the major trends over the last three decades. Net wealth has increased as a multiple of household disposable incomes as asset growth far outstripped the increase in liabilities (principally home mortgages). Since the deregulation of the financial sector in the late 1980s, households have had greater capacity to adjust their portfolios and have become more leveraged partly accounting for the concomitant rise in debt servicing.

[5] See http://www.rbnz.govt.nz/statistics/az/2989639.html

Table 2: Key elements of the balance sheet of the household sector: percentage of household disposable income

	1978	1988	1998	2008
Real assets (housing) (%)	227	250	327	498
Financial assets (%)	145	148	176	170
Total assets (%)	373	398	503	668
Financial liabilities (%)	45	50	95	155
Net wealth (%)	327	348	403	504
Debt servicing (%)	5	7	6	12
Gearing: ratio of liabilities to assets (%)	12	13	19	23
Real net wealth (2008 constant prices) ($bn)	190	253	343	575
Real net wealth per capita ($000)	60	76	90	134

Sources: RBNZ; authors' calculations

When measured in constant prices, real household sector wealth expressed per capita has more than doubled over the 30 year period. The annual average growth rate of net wealth per capita is estimated to have been 2.7%. A comparison of the growth rates with other countries is presented in Table 3. The data include the effect of changes in house prices. The comparison, based on real per capita household wealth, starts from 1989 as the year for which comparable data were available for each of the three countries. Because of the fall in real wealth in all countries in 2008, the comparisons are presented for the periods ending 2007 and 2008. Of particular note is the much slower growth of real wealth in New Zealand compared to Australia and the effect of a much sharper downturn in the USA in 2008.

Table 3: International comparisons of annual average percentage growth rates of real net household wealth per capita

	1989-2007	1989-2008
	%	%
Australia	3.9	3.2
New Zealand	2.4	1.9
United States	2.5	1.1

Notes:

1. Data for New Zealand are from the Reserve Bank. See http://www.rbnz.govt.nz/statistics/az/2989639.html
2. Australian data are from the Australian Bureau of Statistics (Wealth: Australian System of National Accounts, Table 41. Household Balance Sheet, Current prices - as at 30 June, Series ID: A2422094T; CPI: Consumer Price Index, Australia, TABLES 1 and 2. CPI: All Groups, Index Numbers and Percentage Changes, Series ID: A2325846C; Population: Australian Demographic Statistics, TABLE 1. Population Change, Summary - Australia ('000), series ID: A2133251.
3. For the USA: Wealth: Federal Reserve, Flow of Funds Accounts of the United States, Dec year; CPI: Bureau of Labor Statistics, Dec year ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt; Population: U.S. Census Bureau Population Estimates, http://www.census.gov/popest/national/national.html.

It should be stressed that the estimates of household wealth for New Zealand do not include a number of potentially important categories[6], and as such are almost certainly an underestimate of total net wealth. However, there is no presumption that this would necessarily result in the savings rate being underestimated. The saving rate would be underestimated for periods where net wealth held in the omitted categories increased

[6] The Reserve Banks notes that the estimates of household wealth do not include equity in farms, directly held in commercial or unincorporated businesses, shares in unlisted incorporated businesses, capitalisation of the NZ Alternative Market, direct ownership of some classes of assets (eg, forestry), consumer durables, and overseas property owned by NZ residents. Of even greater importance (and not listed in the exclusions by the Reserve Bank) is the value of human capital. For estimates of the extent this contributes to net wealth see Scobie (2005).

relatively faster than the measured sectors, and conversely overestimated for periods where net wealth held in the omitted categories fell relatively faster.

It is immediately apparent from the data summarised in Table 2 that a significant part of the increase in net wealth has been driven by greater equity in housing. This increase can come about through increases in either the quantity of housing (new investment and renovation) or through revaluation of the existing stock of housing. The flow measures of saving presented in the previous section make no allowance for asset revaluation. Hence in order to increase comparability, saving rates from the stock measure need to be corrected for asset revaluations.[7] Such correction should be applied to all asset classes held by households. However for simplicity we have chosen to focus solely on housing, which represents by far the greatest share of total assets.

Since the late 1970s the gross value of housing has risen substantially. The rise in this nominal value can be decomposed into that due to an increase in the physical housing stock and that arising from increased prices. The following procedure was used:

$$V = P \times Q \tag{1}$$

where

$V =$ the gross value of housing

$P =$ the price of housing

$Q =$ the quantity of housing

Then

$$\%\Delta V = \%\Delta P + \%\Delta Q + \%\Delta P * \%\Delta Q \tag{2}$$

Where $\%\Delta V = \left[\frac{V_t - V_{t-1}}{V_{t-1}}\right]$, and likewise for P and Q

That is the total change in the gross value of housing can be decomposed into price effect, a quantity effect, and an interaction term.

Rearranging (2) yields:

$$\%\Delta Q = \frac{\%\Delta V - \%\Delta P}{1 + \%\Delta P} \tag{3}$$

Changes in gross value (ΔV) are obtained directly from the observed housing wealth series. Changes in house prices (ΔP) were based on the national residential house price index obtained from Quotable Value NZ. Once ΔQ is found using equation (3), the decomposition shown in equation (4) can be computed:

$$(V_t - V_{t-1}) = (\%\Delta P \times V_{t-1}) + (\%\Delta Q \times V_{t-1}) + (\%\Delta P \times \%\Delta Q) \times V_{t-1} \tag{4}$$

= [Price effect] + [Quantity effect] + [Interaction term]

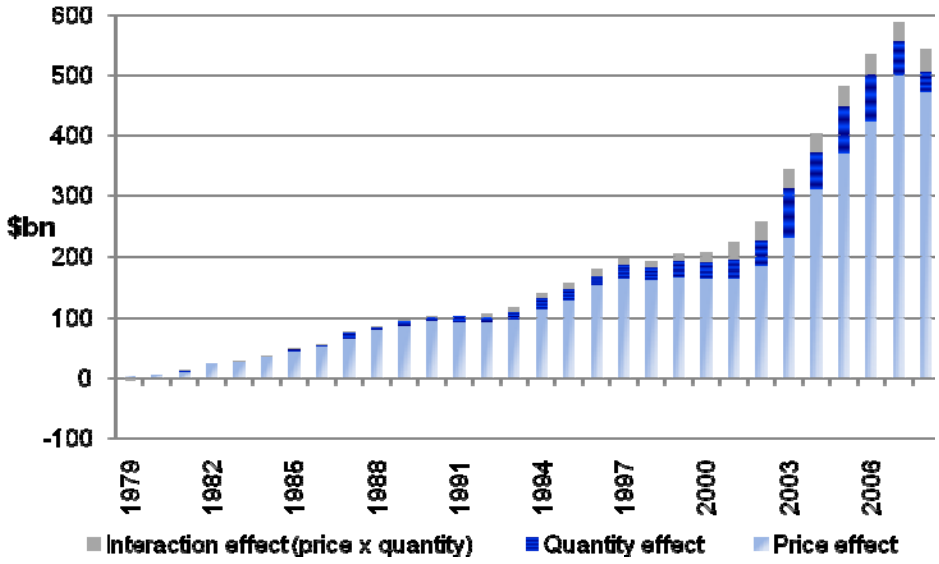
[7] For a discussion of other adjustments see Hodgetts (2006).

In circumstances where the price and quantity changes are both very small, the interaction effect will be negligible and can be ignored. However, given the substantial price rises of housing in recent years, this is not the case here; hence it is important to allow for an interaction term.

The house price index from Quotable Value NZ does incorporate some allowance for quality changes. "Another feature of the QV methodology is that periodic exogenous adjustments to allow for depreciation and renovations are made to the housing stock. Assuming these adjustments are fairly accurate and consistently applied, this would largely mitigate one of the key drawbacks of the assessment information approach, namely that it does not allow for the changing quality of the housing stock" (McDonald and Smith 2009, p6).

The results of the decomposition are depicted in Figure 4, from which it is strikingly evident that by far the major part of the growth in housing value is attributable to increases in prices. In fact, 87% of the change in gross housing value between 1978 and 2008 is estimated to be due to increases in house prices. This underscores the importance of adjusting wealth measures for asset revaluations if comparisons are to be made between the stock and flow measures of household saving.

Figure 4: Decomposition of changes in gross housing value: cumulative effects



Sources: RBNZ; QVNZ; authors' calculations

Having established the decomposition, we now turn to estimating wealth adjusted for house price changes. A decision has to be made as to the treatment of housing wealth and the associated liabilities (ie, mortgages). Two approaches are possible. In the first gross housing wealth is deflated by the index of house prices, while in the second net housing wealth is deflated by the index of house prices. The critical difference is that in the first case, mortgage liabilities are deflated by the Consumer Price Index. This case is applicable where the house serves as collateral for a mortgage some or all of which can be used for consumption. In the second case the mortgage is viewed as solely tied to the investment in the house.

In recent years there has been greater use made of housing equity for other purposes; witness the rise in equity withdrawals referred to in the previous section.[8] So while it is likely that the majority of outstanding mortgages do in fact finance solely the investment in housing, the reality will be somewhere between these two positions. As there is no data which would allow us to compute a weighted average, we present the results of both cases and refer to them for convenience as adjustments based either on gross or net housing. In the case of gross housing (Equation 5) the implicit assumption is that the mortgage may be funding assets other than housing (eg an unincorporated business) or consumption. In the case of net housing (Equation 6) it is assumed that the outstanding mortgage was used solely for the financing of the house.

Equations (5) and (6) set out the details:

$$\text{Gross: } V_h / HPI + (A_f - L_h - L_o) / CPI \quad (5)$$

$$\text{Net: } (V_h - L_h) / HPI + (A_f - L_o) / CPI \quad (6)$$

where:

V_h = gross value of housing

L_h = mortgage liabilities

A_f = non-housing (financial) assets

L_o = non-housing liabilities

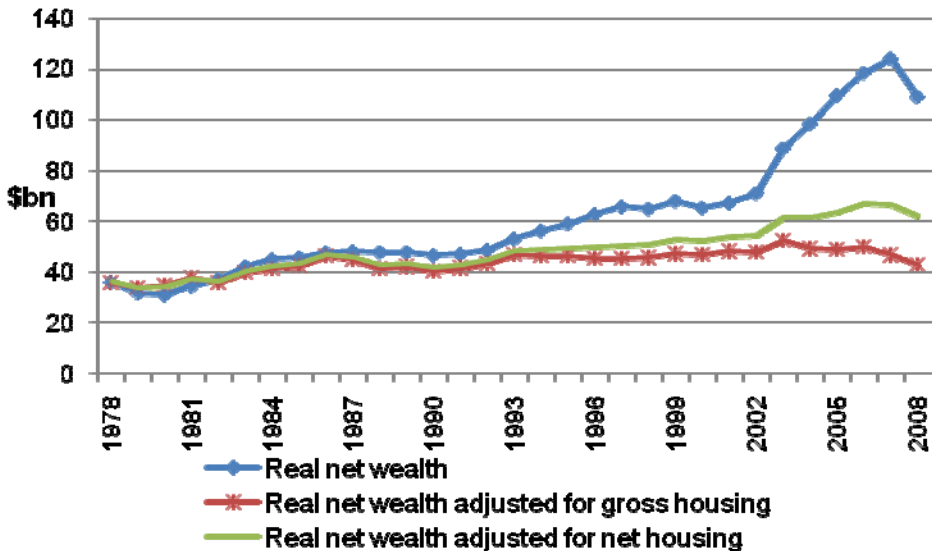
HPI, CPI = house price index and consumer price index

Note that the "gross" and "net" adjusted series will tend to diverge if house prices and consumer prices grow at different rates. When the HPI is higher than the CPI, the gross-adjusted series will tend to be below the net-adjusted series. This is because the "real" mortgage will be larger when it is deflated by the CPI (gross adjustment) than when it is deflated by the HPI (net adjustment).

Both measures are shown in Figure 5 together with total net wealth, each expressed in constant prices based on 1978. There are four notable results. First, total real net worth has risen steadily since 1978 but accelerated since 2001. Second, house prices clearly explain a large part of the recent rise. Third, all measures show a decline in real terms in 2008 and this is due to falling housing values. And fourth, until the latter part of the 1990s, measures of real wealth adjusted on the basis of gross or net tracked very closely and were only slightly below the unadjusted series. Since then there has been a divergence between the three measures as house prices began to grow at a much faster rate than consumer prices (see Figure 6).

[8] There are no data to indicate the split of equity withdrawals in New Zealand between investment and consumption. Australian evidence is that about two-thirds of the withdrawals in 2004 were used for investment in other assets or paying down loans (Reserve Bank of Australia 2005).

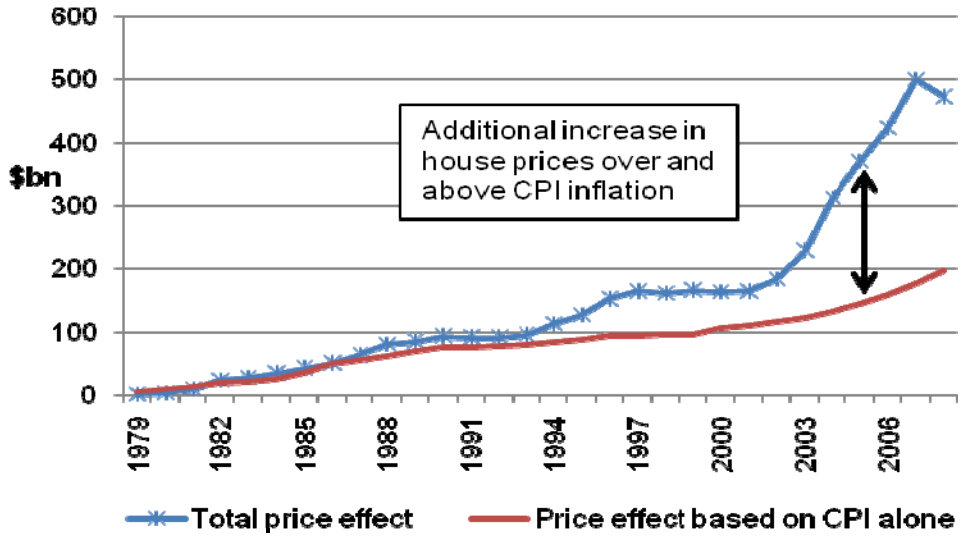
Figure 5: Three measures of real net household wealth: constant 1978 prices



Sources: RBNZ; QVNZ; authors' calculations

Until 1993 house prices rose approximately in line with the CPI. This was followed by an acceleration in the mid 1990s. After a slow down in the late 1990s, house prices rose at an unprecedented rate, and by 2007 were two and one half times higher than those that would have prevailed had the rate of increase been confined to the increases in the CPI. This trend was halted only with the onset of the global financial crisis in 2008 (see Figure 6).

Figure 6: Trend in house prices in excess of the CPI



Sources: QVNZ; Statistics NZ National Accounts; authors' calculations

We are now in a position to compute annual saving rates as:

$$\tilde{S}_t^s = [\widetilde{NW}_t - \widetilde{NW}_{t-1}]/HDI_t \qquad (7)$$

where:

$\tilde{S}_t^s$ = stock measure of saving in year t based on changes in new wealth adjusted for changes in house prices (either gross or net)

$\widetilde{NW}_t$ = net wealth in year t adjusted for changes in house prices

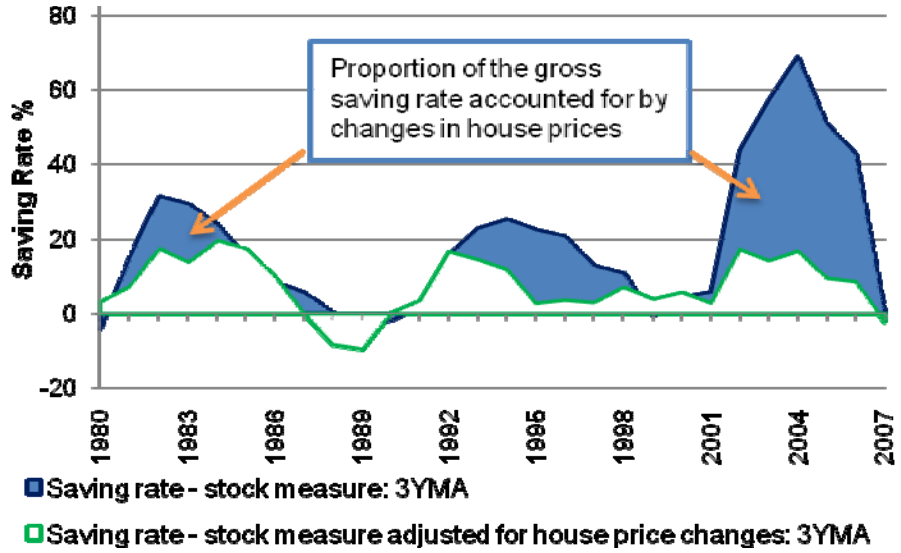
HDI_t = household disposal income in year t

Figure 7 shows saving rates as a percentage of household disposable incomes. There is a striking difference between the total rate and that adjusted for house price changes. Both are relevant measures depending on the question being addressed. Increases in total real wealth regardless of its source represent potentially greater command over goods and services in the future. Retirees may plan to "trade-down" and use some of their enhanced equity to support retirement consumption. In contrast, if retirees expect to remain in the principal residence, then the greater valuation of their housing asset may eventually translate into a higher bequest rather than high living standards during retirement.

3.3 Comparing flow and stock measures

We conclude this section with a brief comparison of stock and flow measures of household saving rates. As the flow measures from the national accounts do not allow for changes in asset values, the relevant comparison is with stock measures of saving rates that have been adjusted for asset revaluations.

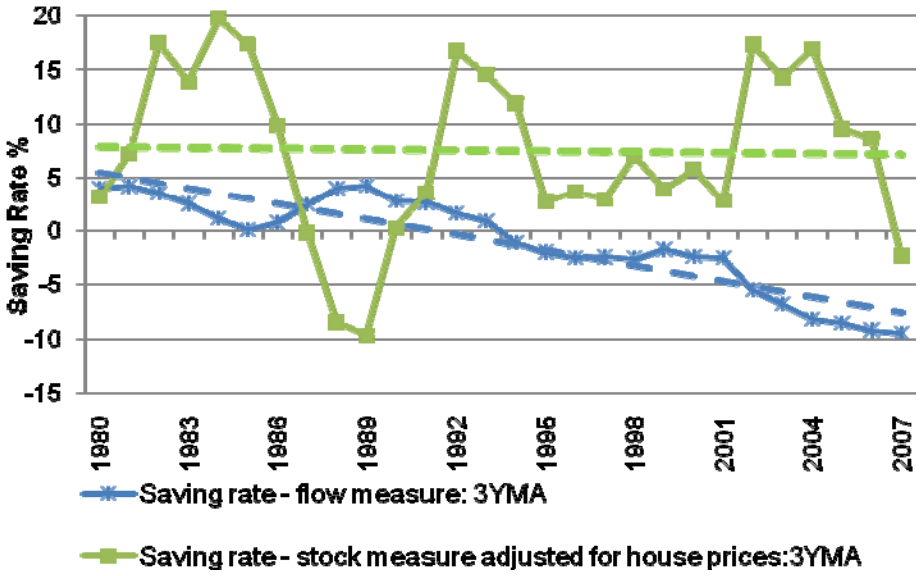
Figure 7: Stock measures for saving rates with and without adjustment for house prices (net housing wealth deflated by HPI)



Sources: RBNZ; QVNZ; authors' calculations

As noted we have adjusted for house prices, the major source of asset revaluation. As shown in Figure 8, the adjusted stock measure (based on deflating net housing wealth by the HPI) is typically higher than the flow measure but at the same time quite volatile. While the flow measure has been consistently negative since 1993, the adjusted stock measure has had two episodes of negative rates. Of note is the fact that after adjusting for house price revaluations the stock measure shows no long run declining trend.

Figure 8: Stock (adjusted) and flow measures of household saving: 1980-2008



Sources: Statistics NZ National Accounts; RBNZ; QVNZ; authors' calculations

Table 4 summarises all the measures on the saving rate based on aggregate data for the household sector. Even after adjusting for house prices the stock measures are substantially higher on average than the flow measure. Note that the stock measures have higher standard deviations than the flow measure but they are less volatile relative to their means.

Table 4: Measures of household saving rates as a share of household disposable income: 1978-2008

	Based on flow measure	Based on stock of net wealth		
		Unadjusted	After removing change in house prices	
			Gross Value	Net Value
(1) Annual average rate (%)	-1.0	15.5	2.5	6.1
(2) Standard deviation (%)	4.7	29.8	15.5	15.4
(3) Coefficient of Variation = (2)/(1)	-4.7	1.9	6.2	2.5

Sources: Statistics NZ National Accounts; RBNZ; QVNZ; authors' calculations

We conclude this section by estimating what the level of net wealth would have been based on the flow measure of savings. We compare this with the stock measure of net wealth, from which we have removed the house price effect by deflating net housing wealth by the house price index.

The estimated level of net wealth based on the accumulated effects of the flow measure of saving is given by:

$$\widehat{NW}_{t+1} = \widehat{NW}_t + S_t^f \qquad (8)$$

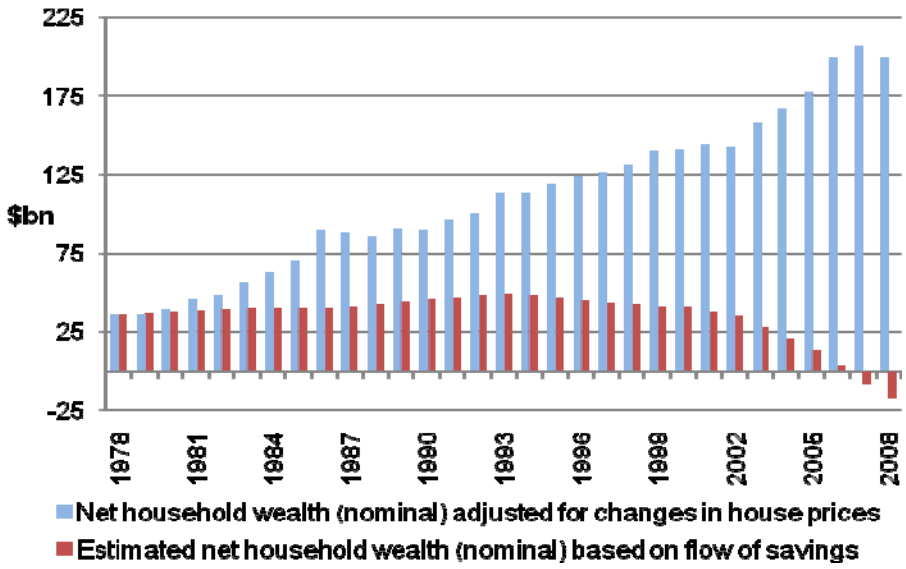
where:

$\widehat{NW}_t$ = the estimate of net wealth in year t based on the accumulation of the flow measure of saving;

S_t^f = flow measure if saving in year t.

Both series were started from the same initial value of net wealth in 1978. The results portrayed in Figure 9 add weight to the case for treating with caution the flow measure of saving from the national accounts. Were it to accurately reflect household saving, net wealth would by now be negative, a clearly implausible result.

Figure 9: Adjusted net wealth compared to net wealth estimated on the basis of the accumulated flow measure of saving



Sources: Statistics NZ National Accounts; RBNZ; QVNZ; authors' calculations

What conclusions can be drawn from this synopsis of the aggregate level data on household savings?

- Given the limitations of current data sources, a full reconcilation of the stock and flow approaches to measuring rates of saving remains elusive.
- Even after adjusting for changes in the valuation of housing, arguably the largest difference between the measures, the stock approach yields a significantly greater average level of household savings.
- The unadjusted stock measure of the saving rate exhibits less volatility than the flow measure (based on the coefficient of variation).
- The flow measure of the saving rate declines over the period 1978 to 2008. In contrast, the adjusted stock measure of the saving rate (using net housing wealth) exhibits no long run trend and has a positive average rate of around 6% per annum.
- The trends in private savings are consisent with the hypothesis that they adjust to partially offset changes in government savings.
- The flow measure in the national accounts treats expenditure on durables and education as consumption, which will tend to understate the true flow measure of saving.

- The flow measure implies a substantial degree of continuous dissaving over the last 15 years. Based on this accumulated dissaving, the implication is that household wealth, excluding the effects of house price changes, would have declined continously since 1993 and by 2008 would have been negative. However there is irrefutable evidence from the estimates of the stock of net wealth that this is not the case further underscoring the need for a fuller reconciliation of different savings measures.

In addition to the uncertainty about the true rates of household saving which emerges from this overview, aggregate data reveal nothing of the distribution of saving among households. Consider an economy in which the working aged adults are saving at a high rate, while those who are retired are drawing down on past accumulations; ie, they are dissaving. It is perfectly possible in such a case that the aggregate measure of household saving could be consistently low or even zero; in short aggregate measures of household saving, even if correctly measured, provide no information about the accumulation of retirement wealth. In addition, in such an economy, suppose both household and government savings were zero. It would still be possible to observe a current account deficit if business investment exceed business savings, the balance financed by foreign investment. In other words, household saving levels bear no necessary relation to current account deficits (Wilkinson and Le 2008).

Furthermore, aggregate measures can conceal the fact that, while both low and high income households may have adequate saving rates, there can be a significant number of middle income households whose current rates of saving would not permit them to sustain pre-retirement living standards once they leave the workforce (Le, Scobie *et al* 2009).

For these reasons, individual data on assets and liabilities obtained from longitudinal household surveys are an important additional data source. Up until recently, unit record data has only allowed estimates of the flow measure of savings based on the Household Economic Survey. Estimates of the saving rates by age and income based on these data are provided by Gibson and Scobie (2001a). In the next section we briefly describe a new source of unit record data, and use these to form some initial estimates of household saving behaviour based on the stock measure.

4 Unit Record Data

4.1 Survey methodology

The analysis that follows in Section 5 is based on unit record data from the Survey of Family, Income and Employment (SoFIE). SoFIE is a longitudinal survey where the original sample members are tracked and surveyed each year. The target population for SoFIE is the usually resident population of New Zealand living in private dwellings.

The survey began in October 2002 with an original sample size of about 11,500 households, amounting to over 22,000 individuals 15 and over. Children younger than 15 who were living in households selected for the survey will also be tracked and will be surveyed from age 15. The survey will be run for a total of 8 years. The core survey collects information on family characteristics and labour market and income spells. An assets and liabilities module and a health module are included in alternate years. At the time of carrying out this analysis, the first four waves of the data were available to researchers. This includes the assets and liabilities modules at waves 2 and 4, which relate to the years ending 30 September 2004 and 30 September 2006 respectively.

SoFIE interviewers visit the respondent's home and conduct the interview electronically using computer-assisted interviewing. Interviews for each wave are evenly spread over a 12 month period so that some households are interviewed in October and others are interviewed the following September.

The advantage of unit record data over aggregate data is that it enables analysis of associations between variables at the unit level. In particular, we have been able to examine the levels and variability of net wealth and savings across characteristics such as age and income. On the other hand, survey data can suffer from sampling error and potential bias.

Sampling error is a measure of the variability that we would expect to see in an estimate if it is computed from repeated samples of the population. If sufficient random samples[9] are taken, we would expect the average estimate to be equal to the population estimate. Sampling error can be quantified as it is a function of the size of the sample (relative to the population) and survey design (eg, the use of stratification).

Bias is more difficult to deal with and, although it can be minimised with a good survey design and the minimisation of non-response, it is usually not able to be quantified. Bias can arise for a number of reasons, with non-response being the most likely cause. When non-response results in a sample with different characteristics than the target population of the survey, inferences based on analyses of the data may not be representative of the target population. The response rate for the first wave of SoFIE was 77% ie, 11,500 of the randomly chosen 15,000 households agreed to participate. Further attrition bias may enter as people drop out of the survey in subsequent waves eg, 76% of those who responded to wave 1 also responded to wave 4.

To the extent that they can, Statistics NZ attempt to adjust for non-response bias by adjusting the weights so that the data matches targets for selected demographic characteristics of the New Zealand population. Statistics NZ provide two sets of weights for each wave so that the

[9] A sample is considered to be "random" if every individual in the target population has an equal chance of being selected. In the case of a stratified sample, the probabilities of selection are equal within strata.

data can be analysed both cross-sectionally and longitudinally. Wave 4 longitudinal weights were used in our analysis of savings. Longitudinal weights are calibrated to population totals for age, gender and Maori ethnicity as at October 2002.[10] Imputation is also carried out to fill in missing data for key variables such as income. More information about SoFIE is available on the Statistics NZ website.[11]

4.2 Selection of sample for analysis

For the purpose of analysing changes in net wealth and saving rates, we consider those who were Original Sample Members (OSMs) at wave 1, who were aged 15 and over at wave 2 and who responded to both waves 2 and 4. Dependent children have been excluded from the analysis.[12] Note that respondents to wave 2 who were institutionalised or die prior to wave 4 will be excluded from the analysis.[13]

The number of OSMs who met these criteria was 16,585.[14] This represents a total of 2,830,900 individuals at wave 4 (applying wave 4 longitudinal weights).[15] This group can be thought of as representing individuals who lived in non-private dwellings on the main islands of NZ (including Waiheke Island) in October 2002, who were 15+ at 2003/04 and remained in the scope of the survey.

In order to calculate meaningful savings rates, we restricted most of our analysis to those who responded to the wealth module in both waves and who had positive average real income when calculated over three waves. Our sample for analysing savings rates reduced to 15,940 OSMs and represents a total of 2,707,700 adults. The population represented by the sample will be referred to as the "longitudinal population" in the analysis.

The results that follow in Section 5 are based on analysis at the individual level. Longitudinal analysis at the family-unit or household level is complicated by changes in the composition of families and households. With the exception of property assets, individuals are asked to report their share of the value of any jointly-held assets or liabilities. For property assets, individuals are asked to report the rateable value and the number of other owners (if any). We have assumed that the value of the property is shared evenly among joint owners.

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10 However, it is not reasonable to expect calibration techniques to eliminate bias due to non-response. At best, we can expect them to restore estimates of the population totals chosen for benchmarking and other estimates that are directly correlated. This will not correct for bias due to non-respondents within these benchmark categories having different characteristics than respondents eg, if females aged 35-40 who have low incomes are less likely to respond to the survey than females in this age group with higher incomes then calibration to age/sex totals will improve the estimate of the number of females aged 35-40 but estimates of income will remain upwardly biased.

11 http://www.stats.govt.nz/NR/exeres/D8603CF9-77D4-4592-B1FE-090B82F563FC.htm

12 SoFIE classified all individuals under 15 as dependent, as well as those aged 15-17 (inclusive) who are not employed more than 30 hours a week. The child does not need to be directly related to the respondent eg, nieces, nephews, grandchildren, foster children can be included if the respondent is acting as their parent. Child dependency is only determined for children living in the same household as the respondent.

13 Note that the weights of OSMs who respond are adjusted for non-response, but are not adjusted for those who are institutionalised or die or move overseas (ie, those who move out of scope). Those who move out of scope are assigned longitudinal weights but are explicitly marked as being out of scope. The total population represented at 2002 is the sum of the weights of respondents and the weights of those who have moved out of scope.

14 The response rate for OSMs who were adults at wave 2 and remained in scope of the survey was estimated at 74%. It is not possible to accurately determine dependency for those who are in scope but who don't respond to the survey. Therefore this response rate is calculated including dependent children, provided they were 15+ at wave 2 and were in the scope of the survey.

15 At Statistics NZ's request, all counts of respondents in this paper have been rounded to 5; all weighted counts have been rounded to 100.

4.3 Assets and liabilities in SoFIE

There are some key differences between the coverage of the Reserve Bank aggregate data and the SoFIE data. As noted in Section 3.2, the RBNZ data exclude a range of assets that are covered by SoFIE.[16] But on the other hand, RBNZ data include assets and liabilities held by non-residents and individuals living in non-private dwellings.

An important difference between the two data sources is the treatment of assets and liabilities held in family trusts. In SoFIE, the value of any outstanding assets owed to an individual by a trust is attributed to them (ie, when an individual is in the process of gifting assets to a trust). SoFIE also asks for the total value of assets that have been gifted to a trust but these assets are treated as being owned by the trust and are not attributable to individuals. However, property assets and mortgages held by trusts will be picked up by the RBNZ estimates of property assets and liabilities held by households.

Ideally we would attempt to adjust for this difference by adding the reported total value of assets held by trusts to our SoFIE estimates. However, the data is of poor quality with many of those reporting assets owed to them by a trust failing to report the total value of assets held by the trust. We have not pursued this further at this stage.

Assets in SoFIE are classified as follows:

- Property assets in 5 categories: owner-occupied housing; rental property; other residential property (including land); timeshare; and overseas property;
- Bank account assets;
- Financial assets in 2 categories: financial investments in unit trusts or funds; and financial investments not in unit trusts or funds;
- Life insurance assets in 3 categories: bonds or investment-linked policy; whole of life or endowment policy; and other types of life insurance policy;
- Superannuation assets in 2 categories: employee-related super scheme; and other personal super scheme;
- Net business assets[17] (although not broken down further, this includes business or business investment, equity in farms, orchards, vineyards, forests, and commercial property);
- Outstanding assets owed by a trust to which assets were being gifted;
- Durables in 3 categories: household items; vehicles; and leisure equipment;
- Other assets: cash; art or antiques and collectables; miscellaneous.

Liabilities in SoFIE are classified as follows:

- Mortgages;
- Personal bank or finance company loan;
- Student loan;
- Bank account liabilities;
- Net business liabilities[18];

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[16] See footnote 6.

[17] SoFIE records business assets and liabilities as a net value ie, business liabilities are subtracted from business assets. For our purposes we have treated respondents who have a positive value for net business as having net business assets and those with a negative value as having net business liabilities.

- Credit card debt;
- Hire purchase debt; and
- Other debt.

Our preliminary analysis of the raw assets and liabilities data revealed some inconsistencies and probable errors in the data. In a small number of cases, it was relatively clear what the intended values were and in these cases we applied an edit. This had no material effect on the estimates of total assets and liabilities.

In Table 5 we summarise the RBNZ data and data from Waves 2 and 4 of SoFIE. For the purpose of making comparisons with the aggregate RBNZ data, it was appropriate to use cross-sectional household weights for waves 2 and 4 (these were provided by Statistics NZ). We exploit the longitudinal richness of the SoFIE data in the analyses presented in Section 5.

It is recognised that high wealth individuals are under-represented in the SoFIE sample, and this in part explains why the estimates of total assets, liabilities and net wealth are lower than those reported by the RBNZ. While we have endeavoured to place the two sources on as common a footing as possible, inevitable differences will remain. Further work is needed to explore these. However, it is striking that the initial estimates of the aggregate household saving rate between 2004 and 2006 are remarkably similar when using the stock method applied to two totally independent data sources: one at the sector level; and the other based on unit record data from a large national survey.

[18] See footnote 17.

Table 5: Comparisons of assets, liabilities and saving rates between SoFIE cross-sectional estimates and RBNZ aggregates

Asset/liability category	2004 values indexed to March 2006			2006 values indexed to March 2006		
	SoFIE $m	RBNZ $m[1]	Percentage difference	SoFIE $m	RBNZ $m[1]	Percentage difference
Housing	348,856	410,011	18%	419,614	519,250	24%
Financial	118,203	153,721	30%	153,311	170,750	11%
Subtotal	467,059	563,731	21%	572,925	690,000	20%
Business[2]	111,420	na	na	144,318	na	na
Durables[3]	119,922	na	na	128,759	na	na
Total assets	698,401			846,002		
Housing	81,054	100,704	24%	95,223	126,250	33%
Financial	24,103	18,649	-23%	22,425	21,250	-5%
Total liabilities	105,157	119,353	14%	117,648	147,500	25%
Net housing	267,803	309,306	15%	324,390	393,000	21%
Net financial	94,100	135,072	44%	130,886	149,500	14%
Net wealth[4]	361,902	444,378	23%	455,277	542,500	19%
Total gross income[5]	108,846	110,165	1%	120,461	117,600	-2%
Aggregate annual saving rate[6,7]				41%	43%	6%
Excluding effect of house price changes (net adjustment)[8]				19%	18%	-6%
Excluding effect of house price changes (gross adjustment)[9]				12%	10%	-23%

Sources: SoFIE waves 2 and 4, cross-sectional weights, with adjustments to property assets based on QVNZ data at TLA level; RBNZ

Notes:

1. The RBNZ publishes totals for the household sector as at December. Based on these totals, we estimate totals for March by using a three-quarter/one-quarter split eg, a total for March 2006 is estimated as three-quarters of the December 2005 value plus one-quarter of the December 2006 value.
2. Business assets in SoFIE include farms, orchards, commercial property such as a factory or shop. Business assets are not included in the RBNZ totals for the household sector.
3. Durables consist of motor vehicles, leisure equipment, household items and other miscellaneous assets such as art. Durables are not included in the RBNZ totals.
4. In this table, business assets and durables have been excluded from the SoFIE estimates of net wealth and savings for better comparability with RBNZ. As business assets are recorded as "net" of liabilities in SoFIE, business liabilities have also been excluded from the comparison.
5. Total gross income used in the calculation of the RBNZ savings rate is taken from Statistics NZ's Household Income and Outlay Account. It is estimated as total income receivable minus gross operating surplus on owner-occupied dwellings (ie, imputed rent). Total gross income used in the calculation of the SoFIE savings rate is aggregate total personal income as reported by respondents.
6. The aggregate annual savings rate is defined as the change in aggregate real net wealth divided by the average of 2004 and 2006 real income, divided by 2 to convert to an annual rate.
7. The RBNZ totals include assets and liabilities that are held by Trusts, whereas the SoFIE totals do not.
8. The value of net housing wealth for 2004 was inflated to 2006 using the House Price Index (rather than the CPI) prior to estimating the saving rate.
9. The value of gross housing assets for 2004 was inflated to 2006 using the House Price Index (rather than the CPI) prior to estimating the saving rate.
10. The RBNZ data will include assets and liabilities held by non-residents. Non-residents are not included in the SoFIE population.

4.4 Adjusting for differences in the timing of valuations

4.4.1 Residential property assets

For residential property assets, respondents in SoFIE were asked to provide the most recent rateable valuation. In most cases, respondents reported rateable valuations that were a year or two old (sometimes more). Further, there is variation in the length of time between reported valuations.

Given the rapid growth in house prices since 2000, there is reason to expect that the reported valuations will tend to be underestimates of market value for the years ending September 2004 and September 2006. In order to take into account house price trends between the time of valuation and the interview date, and to ensure that the time period between wave 2 and wave 4 values is consistent across individuals, we adjusted the reported values by applying separate house price indices for each of 73 Territorial Local Authorities (TLA), obtained from Quotable Value New Zealand. This required identifying in which of the TLAs each respondent who reported property assets was located.

The valuations reported for wave 2 were indexed to approximately 31 March 2004; the valuations reported for wave 4 were indexed to approximately 31 March 2006.[19] These adjustments tended to reduce estimates of the change in wealth between 2004 and 2006 because the property adjustments for wave 2 tended to be larger than for wave 4. There are two reasons for this:

1. House price growth between valuation date and interview date tended to be stronger over the two years leading up to wave 2 than for the two years leading up to wave 4. At the national level, house prices grew by 41% between March 2002 and March 2004 compared with 27% between March 2004 and March 2006; and

2. Valuations provided for wave 2 tended to be slightly older (relative to the interview date) than those provided for wave 4. For wave 2, 21% were more than 2 years old compared with 9% for wave 4.

4.4.2 Other assets

As explained in Section 4.1, interviews for SoFIE were conducted throughout the year with the sample spread evenly over the 12 month period between 1 October and 30 September. Although Statistics NZ makes an effort to keep interviews 12 months apart, inevitably time between wave 2 and wave 4 interviews was not always exactly two years. Further, individuals' experiences may be expected to be different depending on the two year period between their wave 2 and wave 4 interviews. In particular, differences in economic conditions may lead to differences in asset price growth. Therefore there is scope for timing inconsistencies to have an effect on comparisons of the change in other asset values.

Ideally, we would reduce the effect of timing inconsistencies by indexing all other classes of assets to a common point within waves. However, we have not attempted to do this because the data requirements are too high to carry out adjustments that we can be confident about. Unlike our property adjustments where we were able to apply detailed price indices at the TLA level, it will not be possible for us to apply asset price indices specific enough to the respondent to make indexing worthwhile. Furthermore, the SoFIE categories of assets are

[19] An average of the indices for the March and June quarters was used as a proxy for 31 March, which is the centre of the reference period (1 October to 30 September).

quite broad; for example, it is impossible to distinguish finance company assets from shares if a respondent reports holdings of both. For these reasons, even if we could obtain broad enough asset price indices on a quarterly basis, assuming that these "average" indices accurately represent changes in asset prices for all assets in the category and for all individuals, reporting them is likely to be false. Applying "average" indices to reported values is not a satisfactory solution as it may well bias the distribution of changes in asset values and net wealth.

However, the effect of timing inconsistencies on the comparison of changes in non-property asset values should be small in comparison to the timing effects for property. There are two reasons for this. First, property assets are a much larger component in household wealth. Second, the difference in the time between reported values for non-property assets between individuals within a wave is at most one year. Therefore we suggest that our results based on using reported values of non-property assets are likely to be robust.

4.4.3 CPI adjustment

Our analysis of changes in wealth and savings rates is carried out in real terms. This has the advantage of allowing estimates of change in net wealth to be interpreted in terms of a change in the command over goods and services experienced between waves 2 and 4.

All asset, liability and income variables for both waves were indexed to 31 March 2006, which was the centre of the wave 4 reference period.[20] For non-property assets and income, the indexing was carried out with respect to interview dates. As the CPI increased over the period, values reported at the beginning of October 2003 faced the largest adjustment with a factor of about 7.8% applied; values reported at the end of September 2006 had a factor of about -1.3% applied. No adjustment was necessary for values reported at around 31 March 2006. The property asset price adjustment outlined in Section 4.4.1 aligned property values within each wave. The CPI adjustment for wave 2 adjusted property values inflated them to 31 March 2006. No CPI adjustment was applied to wave 4 property values, which were already expressed in 31 March 2006 dollars.

[20] 31 March has been proxied by an average of March and June quarter CPI values.

5 Results

In this section we present some initial results of the changes in net wealth and saving rates based on waves 2 and 4 of SoFIE. All results in this section are estimated by applying wave 4 longitudinal weights to Original Sample Members who responded to the wealth module in both waves and who had positive average real income when calculated over three waves. The sample size was 15,940 and represented a total of 2,707,700 adults. For more detail see Section 4.2.

5.1 Change in wealth by category

We start by summarising the median value and change in value for broad classes of assets and liabilities over 2004 and 2006. For each component, estimates are for individuals who held the item in both years. This is to avoid creating under or over estimates of the change in net wealth, where the reporting may not be comprehensive.[21] For example a renter in 2004 who by 2006 had purchased an owner occupied property would not be included in the first row of Table 6. However they could appear in any of the other rows where appropriate. For this reason the population counts in the first column vary with the item being analysed.

Table 6: Median values for individuals with item in both 2004 and 2006

Asset/liability item	Number with item in both years	Median 2004 value (real)	Median 2006 value (real)	Median change (real)	Median percentage change (real)
Owner occupied property	1,259,100	146,869	175,535	23,707	18%
Investment property	207,300	132,147	162,388	23,133	24%
Financial assets	2,294,000	9,202	10,077	188	15%
Other assets	2,688,400	34,321	35,581	976	5%
Total assets	2,705,400	143,192	170,378	8,459	17%
Mortgages	719,400	62,818	65,754	-2,479	-6%
Student loans	209,300	11,706	14,794	-252	-2%
Other liabilities	1,205,300	2,140	2,032	-25	-3%
Total liabilities	1,633,900	22,622	25,147	-83	-2%
Net wealth	2,707,700	103,930	122,764	7,571	12%
Net property wealth	1,373,700	113,975	142,396	24,159	19%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. The number of individuals in each category has been individually rounded to the nearest 100.
2. All values have been indexed to 31 March 2006, which is the centre of the wave 4 reference period.
3. Medians calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
4. Note that a median change is not equal to the change in medians.

[21] This issue is pursued in Section 5.2.2.

For the longitudinal population, the median change in net wealth expressed in 2006 dollars was about $7,600 and the median percentage change in wealth over this period was estimated to be 12%. For all categories of assets, estimated median values increased in real terms for those holding the item in both years. For all categories of liabilities, median levels fell in real terms for those holding them in both years.

5.2 Basic descriptive analysis of saving rates

5.2.1 Trends in median saving rates

Table 7 summarises the median saving rates based on real changes in net wealth by income deciles. These have been calculated by estimating the saving rate for each individual in the decile and selecting the median value. Estimated saving rates are positive for all levels of income, unsurprisingly rising substantially among the upper income deciles.

Table 7: Change in real net wealth and saving rates by income decile of individuals

Income decile	Income cut off for decile (real)	Number of individuals	Median change in wealth (real)	Median saving rate (real)
1	less than $8,523	261,200	$744	10%
2	$13,399	266,900	$1,316	6%
3	$17,399	272,600	$4,842	15%
4	$22,172	270,500	$5,665	14%
5	$28,056	273,100	$6,052	12%
6	$34,858	271,700	$8,487	14%
7	$42,702	271,200	$13,953	18%
8	$53,560	274,400	$16,452	18%
9	$71,624	273,700	$26,609	22%
10	greater than $71,624	272,600	$59,141	28%
Total		2,707,700	$7,571	16%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Income deciles are constructed based on average real income over waves 2, 3 and 4, excluding those with zero or negative average real income for whom a saving rate was not meaningful.
2. The number of individuals in each category has been individually rounded to the nearest 100.
3. Median change in net wealth calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
4. Income cut offs for deciles and median change in net wealth are expressed in 31 March 2006 dollars.
5. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

Previous work based on flow estimates has confirmed that New Zealand households follow a widely recognised inverted U-shaped pattern of saving over the life cycle (Gibson and Scobie 2001b). Table 8 confirms that a similar pattern for individuals is found using stock estimates. Median saving rates are low for the youngest age groups. In part this reflects lower incomes and in part the fact that measured net wealth does not account for the acquisition of human capital. Median saving rates peak in the 45-55 age group, and eventually fall as retirees start to consume previous accumulations. It should be noted that, while the results are based on longitudinal data, they do not correct for cohort effects. Clearly a very much longer survey period would be needed to achieve this.

Table 8: Change in wealth and saving rates by age group for individuals

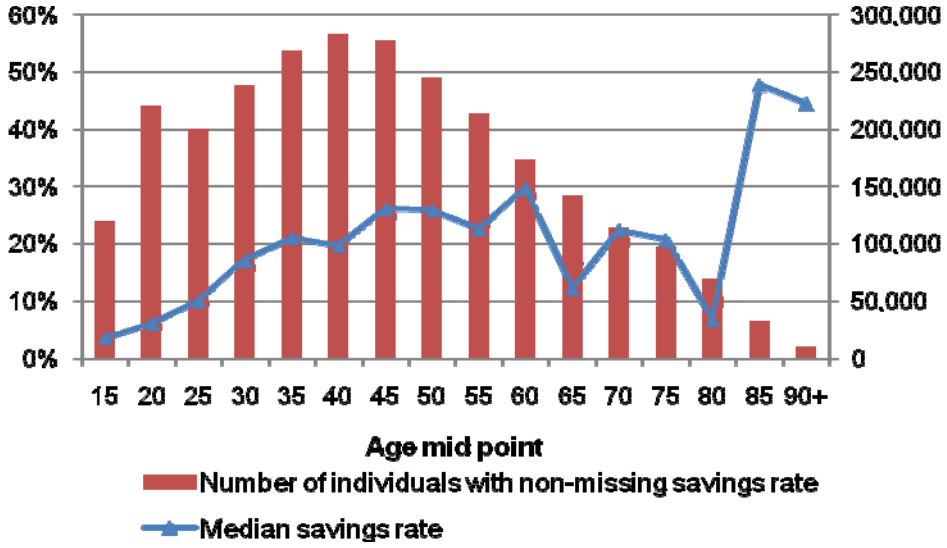
Age	Number of individuals	Median change in wealth (real)	Median saving rate (real)
15-24	419,200	$1,828	6%
25-34	464,400	$8,923	14%
35-44	565,200	$15,810	23%
45-54	492,800	$19,318	27%
55-64	366,700	$10,088	21%
65+	399,300	$8,431	22%
Total	2,707,700	$7,571	16%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. The number of individuals in each category has been individually rounded to the nearest 100.
2. Median change in wealth calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
3. Median change in net wealth expressed in 31 March 2006 dollars.
4. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

The life cycle pattern of saving rates is clearly illustrated in Figure 10. As the age groups have been further disaggregated, in addition to the inverted U pattern one observes the widely recognised sharp upturn in median saving rates by the elderly. Long lived individuals tend to have higher stocks of wealth and typically consumption spending declines at older ages. The net effect is for these individuals to continue accumulating net wealth rather than decumulating.

Figure 10: Median real saving rate by age for individuals



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Note:
1. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

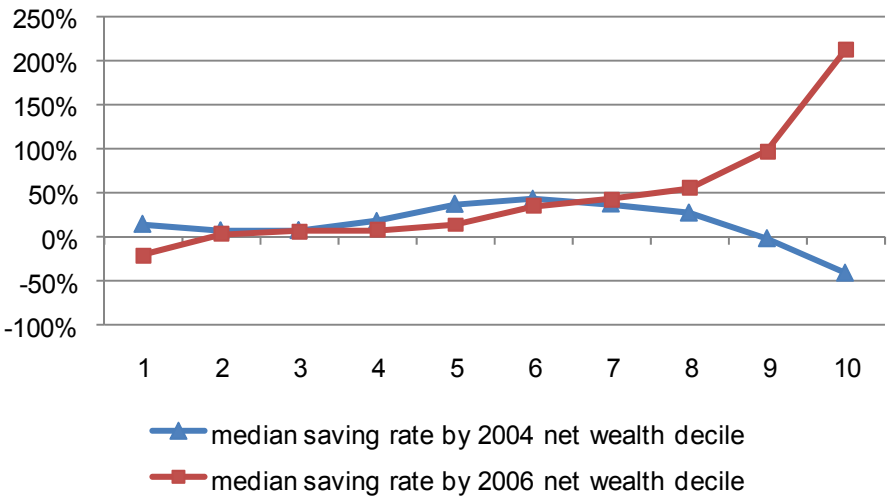
5.2.2 The presence of measurement errors or transitory shocks

In this section we present a puzzle that can potentially be explained by the presence of some kind of random component in net wealth.

Figure 11 and Figure 12 reveal that individuals who were relatively wealthy in 2004 tend to have experienced lower saving rates and changes in net wealth than those who were less wealthy, with the median saving rate being negative for the top two net wealth deciles. This at first seems paradoxical. However, the opposite pattern is observed when the saving rate and change in net wealth are examined with respect to 2006 net wealth decile.

So do the wealthy indeed tend to have higher saving rates or lower saving rates? What we have observed is consistent with the well known concept in statistics of "regression toward the mean", which was made famous by Francis Galton in 1889. This is a statistical phenomenon that is observed when measurements are taken with imperfect precision. The general result is that a variable that is extreme on its first measurement will tend to be less extreme on a later measurement. It also holds in reverse so that a variable that is extreme on its second measurement will tend to have been less extreme on its first measurement.

Figure 11: Median saving rate by 2004 and 2006 net wealth deciles for individuals

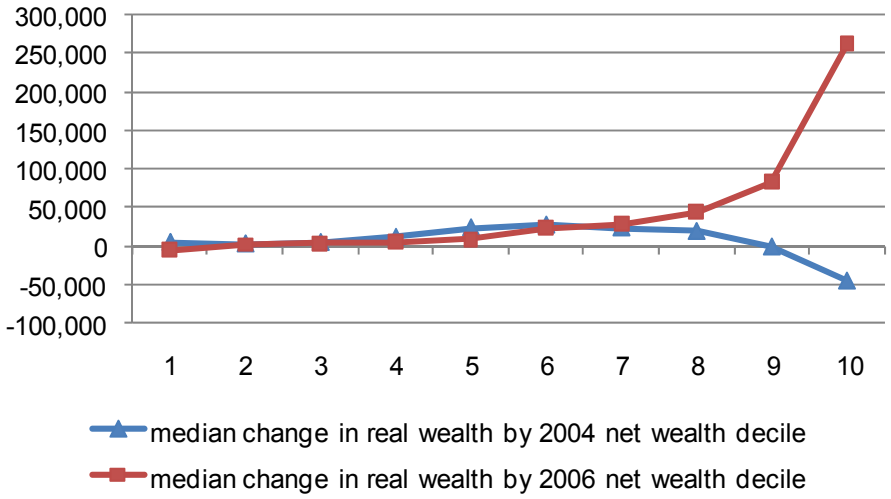


Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Note:

1. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

Figure 12: Median change in real net wealth by 2004 and 2006 wealth deciles for individuals



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Median change in wealth calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Median change in net wealth expressed in 31 March 2006 dollars.

An example of a statistician being caught out by this effect was in 1933, when Horace Secrist wrote *The Triumph of Mediocrity in Business*. "In over 200 charts and tables, Secrist 'demonstrated' what he took to be an important economic phenomenon, one that likely lay at the root of the great depression: a tendency for firms to grow more mediocre over time" (Wainer and Brown 2004). Secrist had observed that the better performing firms a decade earlier tended to have only slightly above average performance a decade later, and that the worst performers had improved to about average. In a review of this book, Harold Hotelling pointed out that Secrist's results "prove nothing more than that the ratios in question have a tendency to wander about."

Hotelling proceeded to show the reverse of what Secrist had obtained ie, that the best performing firms at the end of the decade tended to be only slightly above average at the beginning, and that the firms with poorest performance were only slightly below average a decade earlier. This example is remarkably similar to our saving rate puzzle. The observation that those who were most wealthy at wave 2 tended to save less than those who were less wealthy is analogous to Secrist's argument; the observation that those who were most wealthy at wave 4 had experienced very high saving rates is similar to Hotelling's response.

Why does this occur? A variable is subject to the regression toward the mean effect if it contains a random component. The nature of the random component is not particularly important: it could be due to chance or luck (eg, taking a test); it could be measurement error (eg, measuring speed); or due to imperfect relationships between two variables (eg, predicting children's height from parent's height). It is not difficult to accept that net wealth observed at a point in time is likely to contain a certain degree of error. Perhaps wealth is measured with error so that observed wealth consists of "true" wealth plus random noise. Alternatively, the presence of transitory shocks to wealth that occur by chance may act like measurement error. In this case, observed wealth has a component resulting from pure luck and we can think of observed wealth consisting of a "permanent" component and a "transitory" component.

A study aimed at understanding the effect of changes in wealth on consumption applied variance decomposition techniques to US data covering the post-war period (Lettau and Ludvigson 2004). This estimated that up to 88% of the variation in household net worth was due to transitory fluctuations in the stock market component of wealth, suggesting that the transitory component can be relatively large.

The following example illustrates why a transitory component in wealth can have the effect observed in Figure 11 and Figure 12. Consider a simplification of the real world where an individual's permanent net wealth does not change over time (but can differ across individuals).[22] Further, assume that the transitory shock to wealth is uncorrelated with permanent wealth[23] and exhibits no persistence over time ie, it is random with expected value of zero at each draw.

Under these conditions, individuals whose reported wealth exceeds their permanent wealth at time t will tend to be observed wealthier than those whose reported wealth is below their permanent wealth. Because the expected value of shocks accumulated between t and t+1 is zero, we would expect to observe: falls in wealth between time t and t+1 for those whose wealth is temporarily inflated at time t (who are more likely to be in higher deciles at time t); and increases in wealth for those whose wealth is temporarily deflated at time t (who are more likely to be in lower deciles at time t). This is exactly what regression toward the mean implies. Individuals who are observed relatively wealthy at time t would be expected to be observed less wealthy at time t+1 and so will tend to have a decrease in wealth. Individuals who are observed relatively poor at time t would be expected to be observed less poor at time t+1 and so will tend to have an increase in wealth.

Exactly as was the case for time t, those whose reported wealth at time t+1 exceeds their permanent wealth will tend to be observed wealthier at t+1 than individuals whose reported wealth is below their permanent wealth. As permanent wealth is time invariant in this example, the change in wealth will be equal to the change in the transitory component. On average, the transitory component at time t will be about zero.[24] Therefore those who experienced positive shocks between t and t+1 will tend to have experienced an increase in net wealth and those who experienced negative shocks will tend to have experienced a decrease. This is regression toward the mean in reverse. Individuals observed to be relatively wealthy at t+1 will tend to have been less wealthy than at time t; individuals observed to be relatively poor at time t+1 will tend to have been less poor at time t. Therefore we would expect to see increases in wealth between t and t+1 for the former and decreases for the latter.

It is relatively straightforward to extend this to the more realistic case where an individual's permanent wealth can change over time. The subtle difference is that we would expect to see differences in the size, not necessarily the sign, of the change in wealth between time t and t+1 for the two groups. Specifically, we would expect to see smaller increases in wealth for individuals whose wealth was temporarily inflated at time t than for those whose wealth was temporarily deflated. The former will tend to be distributed towards higher wealth deciles at time t and the latter distributed towards lower wealth deciles so that it will appear that

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[22] Regression toward the mean is defined for bivariate distributions with identical marginal distributions. This means that two measurements of the variable arise from the same probability distribution (the variable has the same mean and variance each time). This helps to simplify the explanation of the phenomenon but it is not important that it holds in order to observe the phenomenon. However, it is the case that regression to the mean is more noticeable if the "true" distribution doesn't change very much over time.

[23] This assumption means that individuals with relatively high permanent wealth are no more or less likely to experience a positive shock than individuals with relatively low permanent wealth (same for negative shocks).

[24] Under the assumption that the shocks to wealth are uncorrelated over time or with permanent wealth, positive shocks are no more or less likely to occur to those who had "inflated" wealth at time t than to those who had "deflated" wealth at time t. The average shock at time t should be about zero for each of these two groups.

changes in net wealth tend to fall with wealth at time t. This is more or less what we observe in the figures, with changes in wealth and saving rates appearing lower and more likely to be negative for those who were wealthy at 2004.

With respect to wealth at t+1, those who accumulated positive shocks will tend to be observed as wealthier, and to have higher saving rates, than those who accumulated negative shocks. Again, this is what we observe in the figures, with median changes in net wealth and saving rates rising with 2006 net wealth decile.

We can also extend this to a case where there is some persistence in the transitory component ie, it is correlated over time with the effect of each shock gradually dying out over a number of periods. In this case, the transitory component is not random with an expected value of zero. But if the effect of each shock gradually dies out, the expected value of the transitory component at time t+1 is less than the expected value at time t, and the regression toward the mean effect will still be present.[25]

Given the pattern observed in Figure 11 and Figure 12, it seems likely that reported net wealth contains a random component. However, it is difficult to estimate the size of this component with two waves of wealth data. In order to do so one would need to be able to estimate a model for permanent wealth, which could be attempted when waves 6 and/or 8 become available with the use of panel data models.

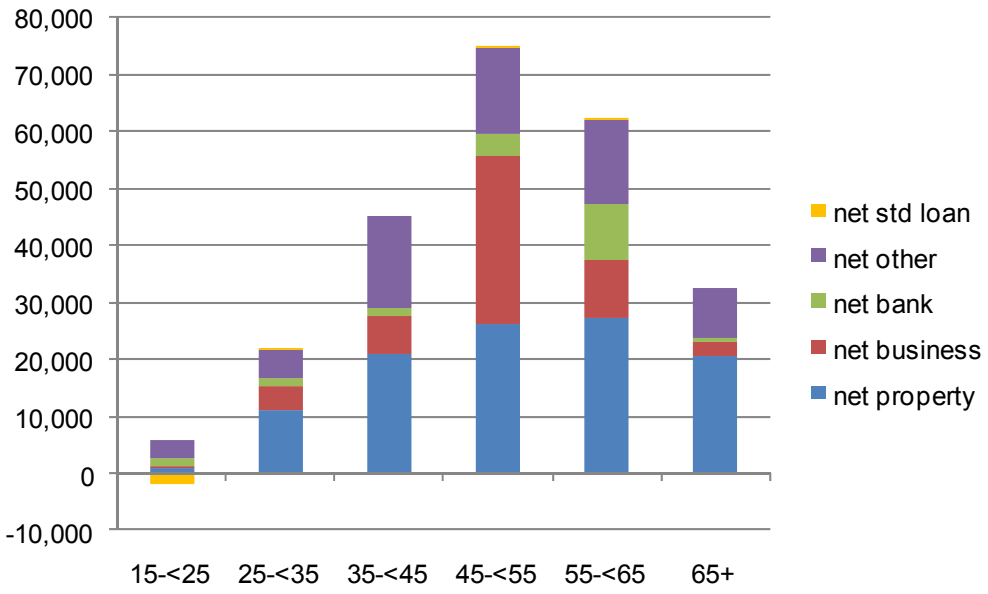
5.3 Breakdown of the change in real net wealth

In the context of changes in net wealth and saving rates, medians are preferred to averages as measures of central tendency as they are less affected by outliers. However, an important advantage that averages have over medians is that they are additive. Average net wealth and its change can be broken down in two useful ways.[26] Average net wealth calculated over all individuals is equal to the sum of the averages for each of the components of wealth. Moreover, when the population over which an average is calculated is split up into mutually exclusive and exhaustive groups, the weighted sum of the average for each group reconciles to the population average.

[25] See Appendix C for a formal statement of the transitory components of wealth.

[26] The focus of this section is to break down the average change in net wealth rather than the average saving rate because the outlier effect is less pronounced for the former, with the median and mean change in net wealth showing broadly similar age group trends.

Figure 13: Breakdown of average change in real net wealth by age group



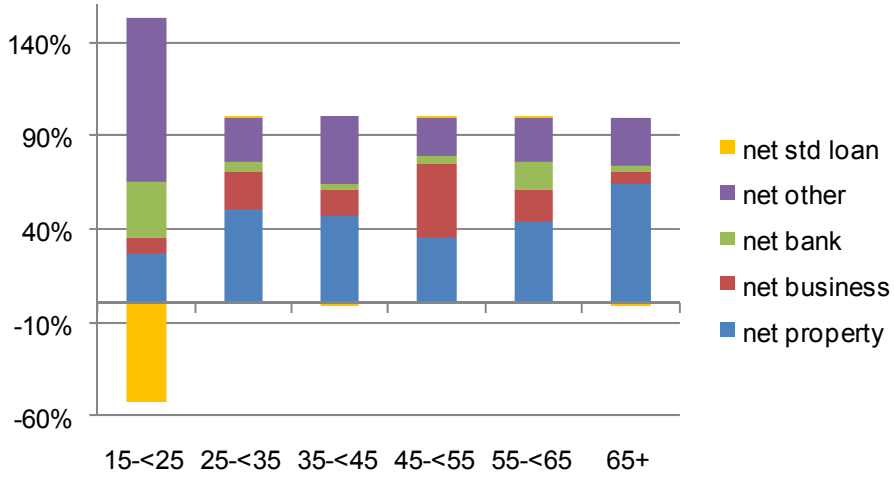
Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. The breakdown is calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Average change in net wealth expressed in 31 March 2006 dollars.

Net wealth can be expressed as the sum of net wealth in each of the following 5 categories: property; business; bank account; other (includes most kinds of financial wealth as well as durables) and student loans.[27] In breaking down the average change in net wealth into these components, we gain some insight into their relative contribution. We are also able to compare the breakdown across various population groups. The breakdown of the average change in real net wealth is displayed graphically by age group in Figure 13 and the percentage that each category contributed is shown in Figure 14. The mean change in the value of each item is calculated over all individuals and so includes zeros.

[27] Other ways of breaking down net wealth were explored but net business assets were always relatively important. Due to the measurement of business assets (business assets and liabilities are recorded as a net amount) it seemed best to use a "net" breakdown. The net other category is unfortunately large as it is not possible to match assets to liabilities for many of the items.

Figure 14: Composition of average change in real net wealth by age group



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Note:
1. The composition is calculated over the group with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.

Figure 14 shows that net property tended to be the largest contributing category to the average change in net wealth for most age groups; the exceptions were the youngest age group and those aged 45-54. For the youngest age group, other net wealth was relatively important, as were student loans which contributed negatively to the average change in net wealth. For those aged 45-54, net business wealth was the largest contributing category.

In order to judge whether a component is under or overrepresented in the change in net wealth, it is helpful to view the composition of net wealth itself. If all components of wealth grow at the same rate, the contribution to the average change in net wealth will be equal to the contribution to average net wealth at 2004. Appendix Table A1 and A2 show: the mean and percentage contribution of each category to average net wealth at 2004; average net wealth at 2006; and the average change in net wealth between 2004 and 2006.

The pattern observed for the average change in real net wealth is generally consistent with the composition of average net wealth at 2004. Net property was the largest contributing category to the average change in real net wealth between 2004 and 2006, making up 44% of the change. This is consistent with its contribution to average net wealth at 2004 of 45%. Net other and net business wealth contributed 26% and 23% to the average change respectively. Net business wealth is perhaps overrepresented in the average change and net other underrepresented. See the appendix tables for the age group breakdowns.

5.4 Saving rate dispersion

To this point, the estimates of saving rates have been based on median rates. While these are arguably better measures than average rates which are strongly influenced by outliers, they convey nothing of the dispersion of saving rates across individuals. One of the key strengths of unit record data relative to aggregate sector-wide data is that measures of dispersion can be derived.

As shown in Table 9, the dispersion is very wide. We estimate that 5% of individuals had annual saving rates in excess of 6 times of their income and 1% had annual saving rates of over 33 times their income. At the other extreme, an estimated 5% of individuals reduced

their real net wealth by over 3.9 times their income and 1% reduced their net wealth by over 17 times their income on an annual average basis.

Table 9: Real saving rate percentiles

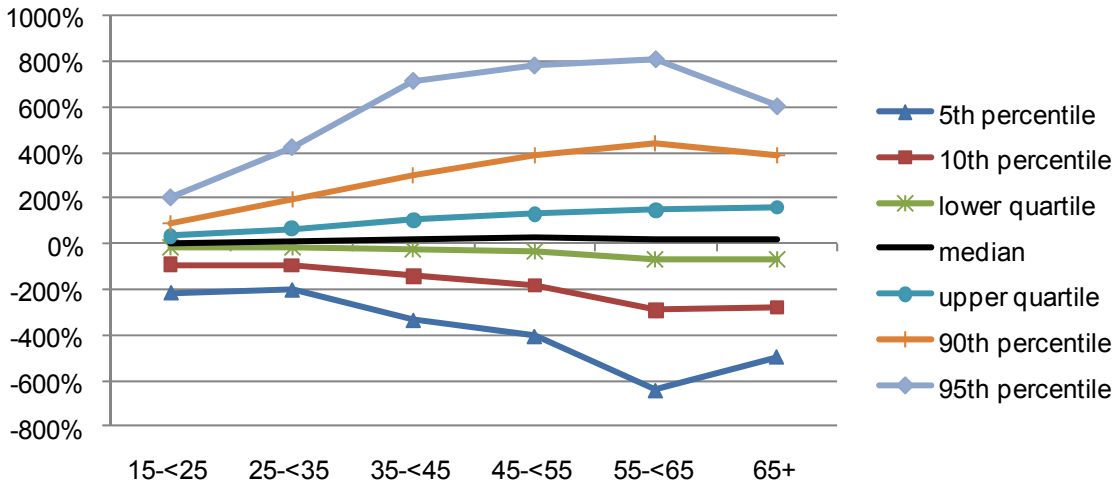
Real saving rate percentile	Real saving rate
1st percentile	-1723%
5th percentile	-391%
10th percentile	-172%
25th percentile	-33%
50th percentile (median)	16%
75th percentile	98%
90th percentile	297%
95th percentile	604%
99th percentile	3326%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Note:
1. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

It is clear from Figure 15 that, at every age level, there was a wide distribution of saving rates with a significant portion of the distribution having had negative saving rates. The dispersion increased with age, peaking among those aged 55-64.

Figure 15: Real savings rates: dispersion by age group for individuals



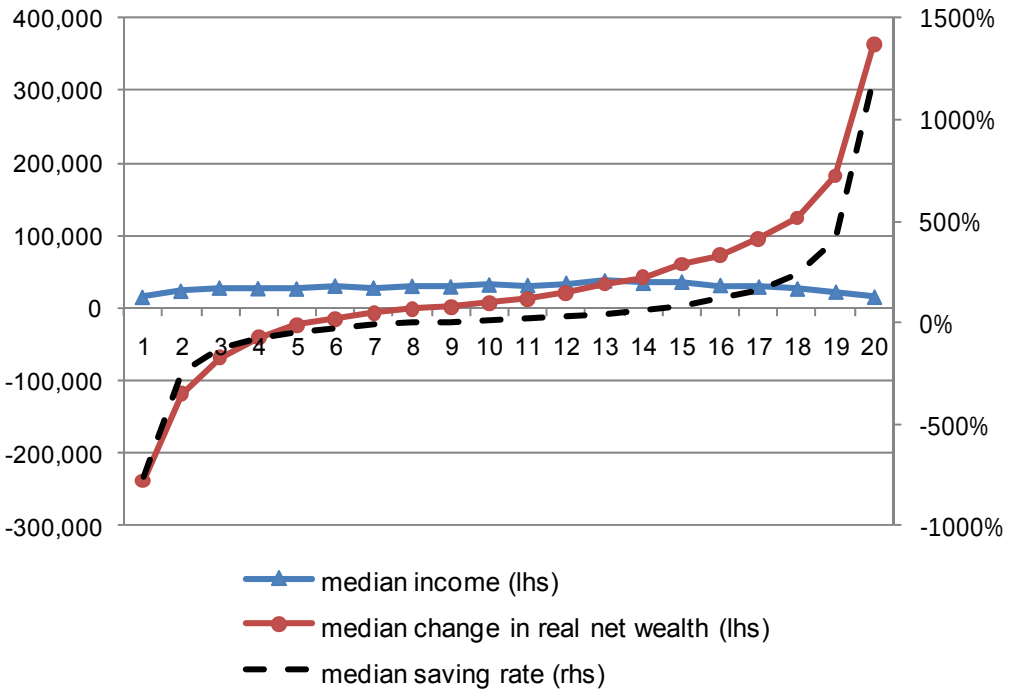
Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Note:
1. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

To what extent was the wide dispersion due to very low average real incomes versus very large changes in real net wealth? Figure 16 shows estimates of the median change in real net wealth and median incomes by saving rate vintile. The estimated median saving rate for the vintile is shown as a dotted line. Vintile 1 contains the bottom 5% of savers who had a median annual dissaving rate of 750% of their income. Vintile 20 contains the top 5% of savers who had a median annual saving rate of 1,200% of their income.

Figure 16 reveals that the wide dispersion of changes in net wealth was the main driver of the dispersion in saving rates. Although incomes tended to be lower in the bottom and top saving rate vintiles and so tended to increase the magnitude of saving rates for individuals in these vintiles, there was considerably less dispersion in income than in changes in wealth across the saving rate vintiles. Median income for those in both the bottom and top saving rate vintiles was about $15,000 compared with the overall median income of $28,000. On the other hand, median change in wealth for the bottom and top vintiles was -$238,000 and $363,000 respectively, compared with an overall median of about $8,000.

Figure 16: Median income, change in net wealth and saving rate by saving rate vintile



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. Median income refers to the median of real income averaged over waves 2, 3 and 4. Individuals with zero or negative average real income for whom a savings rate was not meaningful have been excluded.
2. Median change in net wealth calculated over those with non-missing savings rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
3. Median change in net wealth and median income are expressed in 31 March 2006 dollars.
4. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

Table 10 classifies individuals according to whether they had positive or negative saving rates and shows the distribution of the change in real net wealth for each group. The estimated total number of individuals with negative saving rates was 1.07 million and the estimated total number of individuals with positive saving rates was 1.64 million. About 5% of negative savers had a relatively small reduction in real net wealth of less than $1,000. But three quarters of the negative savers had a reduction in real net wealth of greater than $8,000, with 10% reducing real net wealth by over $205,000 and 1% by more than $1.29 million. For positive savers, the dispersion is even wider.

Table 10: Real change in net wealth percentiles for positive and negative savers

Real change in net wealth percentile	Negative saving rate (39% of individuals)	Positive saving rate (61% of individuals)
1st percentile	-1,291,800	322
5th percentile	-405,307	1,742
10th percentile	-249,680	3,929
25th percentile	-97,660	12,457
50th percentile	-26,841	42,640
75th percentile	-8,001	112,653
90th percentile	-2,489	283,065
95th percentile	-1,098	520,155
99th percentile	-219	1,617,278

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Change in net wealth percentiles calculated over individuals with non-missing saving rates for consistency of sample. Excludes a small number of observations with wealth in both waves but negative average real income.
2. Change in net wealth expressed in 31 March 2006 dollars.

5.4.1 Explaining variation in changes in wealth and saving rates

Regression models were estimated in an attempt to explain the variation in saving rates and changes in wealth; however the results were typically poor. Change in wealth regressions performed better than saving rate regressions but, even so, the best performing regression left 85% of the variation in observed change in wealth unexplained. Further, the majority of the 15% of the variation explained by the model was due to wealth at 2004 alone; demographics and income had virtually no explanatory power. Section 5.2.2 explained that, to the extent that reported net wealth contains a random component, the regression toward the mean effect can lead to misleading conclusions being drawn about the relationship between changes in net wealth and underlying wealth. Therefore, although net wealth at 2004 appeared to be a useful variable in explaining variation in changes in net wealth, it is perhaps dangerous to interpret the coefficients as true associations.

Considering that we are unable to observe potentially important variables such as attitudes to risk, and that the "transitory" changes in wealth have the potential to be quite large, it is perhaps not surprising that our attempts to explain variation in wealth changes have been met with little success. For this reason, the regression results have not been reported.

As an attempt to gain some insight into the wide dispersion of saving rates, the patterns of saving by income, age, labour market affiliation and health status are summarised in Table 11. What is striking is that regardless of the characteristic of the individuals examined, the estimated proportion with negative saving rates between 2004 and 2006 is consistently of the order of 40%. There are predictable patterns in the proportion of individuals with negative saving rates. The share is higher among low income individuals, among the youngest and oldest age groups, for those not in the labour force, and those in poor health.

Table 11: Characteristics of low, medium and high saving individuals

Income decile	"low" savers (savings rate <0)	"medium" savers (savings rate 0-1)	"high" savers (savings rate >1)	Total
1	47%	18%	35%	100%
2	45%	29%	26%	100%
3	41%	32%	27%	100%
4	41%	33%	26%	100%
5	38%	38%	24%	100%
6	38%	40%	22%	100%
7	36%	43%	21%	100%
8	37%	44%	19%	100%
9	36%	42%	22%	100%
10	36%	39%	25%	100%
Age group				
15-24	41%	49%	9%	100%
25-34	37%	43%	19%	100%
35-44	37%	37%	26%	100%
45-54	37%	32%	30%	100%
55-64	42%	27%	31%	100%
65+	42%	25%	33%	100%
Labour market activity				
Working	37%	39%	23%	100%
Unemployed	39%	44%	17%	100%
Not in the labour force	44%	28%	29%	100%
Health status				
Excellent	38%	38%	24%	100%
Very good	39%	36%	25%	100%
Good	41%	33%	26%	100%
Fair	41%	34%	25%	100%
Poor	45%	35%	20%	100%
All individuals	39%	36%	25%	100%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Income deciles are for average real gross income over waves 2, 3 and 4, excluding those with negative average real income for whom a saving rate was not meaningful.
2. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

The breakdown of net wealth for positive savers was compared to that for negative savers in order to determine whether there were associations with particular components of wealth. The method outlined in Section 5.3 was used but instead of age groups, the longitudinal population was split into those whose real wealth increased and those whose real wealth fell. Figure 17 and Figure 18 confirm the importance of both net property and business wealth in the change in net wealth for both groups. There were no clear differences in the composition of underlying net wealth or the change in net wealth for those who experienced an increase in net wealth compared with those who experienced a decrease.

Figure 17: Contribution to mean change in net wealth if net wealth increased

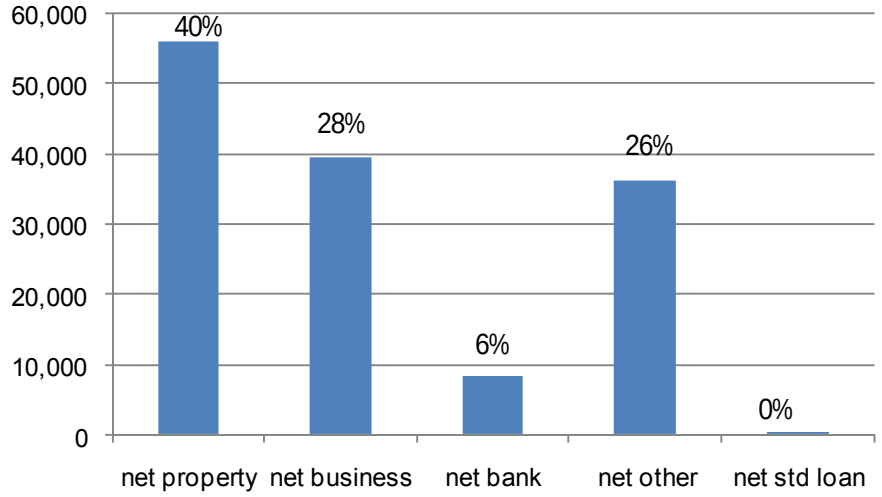
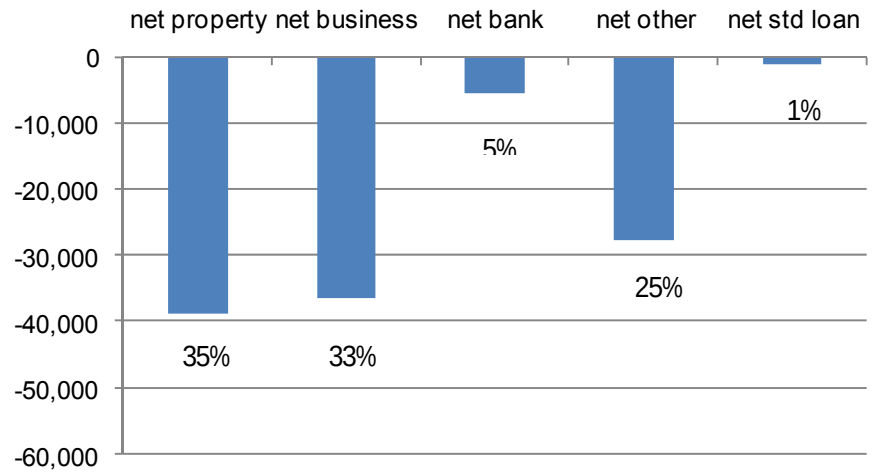


Figure 18: Contribution to mean change in net wealth if net wealth decreased



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes for Figure 17 and Figure 18:

1. Mean change in net wealth calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Change in net wealth expressed in 31 March 2006 dollars.

5.4.2 Extreme savers

An extreme saving rate can result from a very large change in real net wealth (positive or negative) and/or a very low average real income. Figure 16 showed that individuals with very large positive or negative saving rates tended to have very large changes in real net wealth and relatively low average real incomes.

A detailed examination was carried out where the 5% of individuals with the lowest saving rates (annual real saving rate lower than -391%) and the 5% of individuals with the highest saving rates (annual real saving rate higher than 604%) were compared with the rest of the population. There are estimated to be roughly 135,000 individuals in each of these categories[28] and we refer to these individuals as "extreme negative" and "extreme positive" savers in the following analysis.

[28] Estimates based on approximately 770 samples in each of the "extreme positive" and "extreme negative" groups.

Table 12 gives the distribution of extreme negative savers, extreme positive savers and non-extreme savers across net wealth and income deciles. Each decile contains 10% of the longitudinal population. When subgroups of this population are examined, the distribution across deciles may be uneven and this is what we observe in Table 12.

Not surprisingly, extreme savers were overrepresented in the bottom income decile: 30% of extreme negative savers and 36% of extreme positive savers had average real annual income over the period from 2003 to 2006 below $8,500.

We estimated that close to half (44%) of the extreme negative savers were in the top net wealth decile in 2004. Similarly, approximately half (53%) of the extreme positive savers were in the top decile in 2006. This is consistent with the revelation in Section 5.2.2 that those who were in the top net wealth decile in 2004 tended to have relatively low saving rates and those who in the top wealth decile in 2006 tended to have experienced relatively high saving rates.

However, it is notable that extreme positive savers were also overrepresented in the top 2004 net wealth decile: 21% of the extreme positive savers were in this group. Therefore, some of those who were relatively wealthy in wave 2 had an annual saving rate of over 604% of income over the following 2 year period. Further, although not so clearly overrepresented, extreme negative savers were at least not underrepresented in the top net wealth decile in 2006: 13% remain classified as having net wealth in the top 10% of the distribution despite an annual saving rate of less than -391% between 2004 and 2006.

Table 12: Distribution of extreme savers across income and net wealth deciles

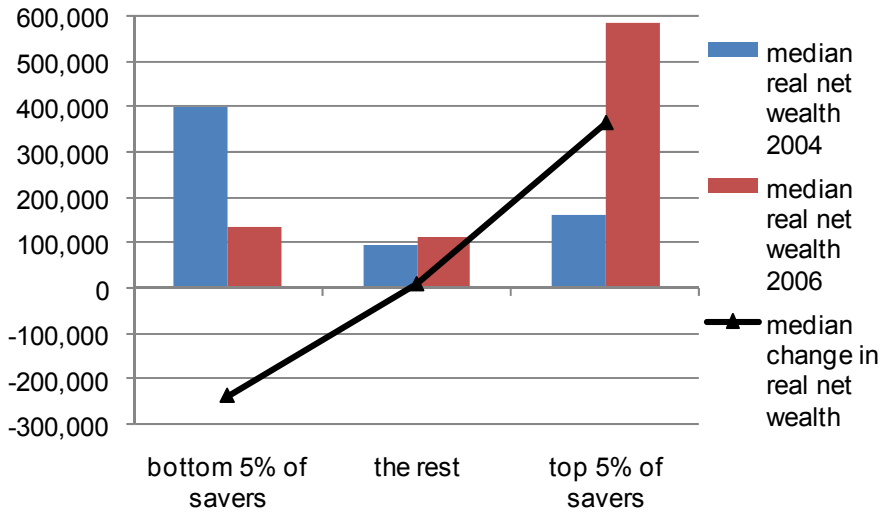
2004 net wealth decile	Extreme negative savers (sr <-391%)	The rest	Extreme positive savers (sr > 604%)	Total
1	3%	11%	7%	10%
2	4%	11%	4%	10%
3	1%	11%	5%	10%
4	2%	11%	8%	10%
5	3%	10%	13%	10%
6	3%	10%	10%	10%
7	7%	10%	11%	10%
8	12%	10%	11%	10%
9	20%	10%	9%	10%
10	44%	7%	21%	10%
2006 net wealth decile				
1	13%	10%	1%	10%
2	4%	11%	2%	10%
3	9%	11%	2%	10%
4	11%	10%	3%	10%
5	11%	10%	4%	10%
6	8%	10%	5%	10%
7	11%	10%	6%	10%
8	10%	10%	9%	10%
9	11%	10%	16%	10%
10	13%	7%	53%	10%
Income decile				
1	30%	7%	36%	10%
2	13%	10%	11%	10%
3	13%	10%	8%	10%
4	9%	10%	9%	10%
5	8%	10%	7%	10%
6	6%	11%	6%	10%
7	6%	11%	4%	10%
8	5%	11%	7%	10%
9	5%	11%	6%	10%
10	5%	11%	7%	10%
All individuals	100%	100%	100%	100%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.
2. Income deciles are for average real gross income over waves 2, 3 and 4.

Figure 19: Median net wealth and change in net wealth for extreme savers



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Extreme savers are the 5% with estimated saving rates less than -391% and the 5% with estimated saving rates greater than 604%.
2. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

Figure 19 confirms that extreme savers, whether positive or negative, tended to have higher levels of wealth than non-extreme savers in both years.

Table 13 shows the estimated percentage of individuals in each net wealth transition cell that were "extreme savers" ie, in the bottom 5% or top 5% in terms of saving rates. Appendix Table A3 shows the net wealth cut-off points for deciles and Appendix Table A4 shows the estimated percentage of the longitudinal population that fell into each cell.

We expect individuals in the bottom left and top right of the table to have been extreme savers ie, individuals making a move from a low decile to a high decile (or vice versa). This is indeed observed: 100% of individuals making a decile 10 to 1 transition are estimated to have been extreme savers; 82% of individuals making a decile 1 to 10 transition are estimated to have been extreme savers. But there are some extreme savers estimated in every cell of the table, even on the diagonal, although the percentages are very low, generally between 1% and 3%. With the exception of the bottom right corner of the table, extreme savers on and around the diagonal are individuals who experienced relatively small changes in net wealth but had relatively low average real incomes.

Consistent with the observation that both extreme positive and negative savers are overrepresented in high net wealth deciles in both years, extreme savers are also overrepresented in the bottom right corner of the table. It seems that there are some individuals who were relatively wealthy in both years who are classified in the bottom or top 5% of savers. Decile 10 is unbounded and so it is quite possible for an individual to have experienced a large change in net wealth but have remained in decile 10. We estimated that nearly 30% of individuals who were in decile 10 in both years were extreme savers. It is interesting that we don't observe something similar for decile 1, which is unbounded from below.

Table 13: Percent of net wealth decile transition cell who were extreme savers

	2006 net wealth decile										
2004 net wealth decile	1	2	3	4	5	6	7	8	9	10	Total
1	3%	2%	3%	8%	9%	12%	26%	34%	49%	82%	5%
2	6%	2%	2%	5%	4%	5%	10%	12%	60%	100%	4%
3	4%	1%	1%	1%	10%	9%	16%	40%	37%	88%	3%
4	11%	5%	2%	1%	3%	4%	7%	28%	24%	79%	5%
5	22%	8%	10%	2%	1%	5%	11%	20%	35%	85%	8%
6	29%	11%	20%	9%	2%	2%	3%	10%	17%	69%	7%
7	20%	35%	40%	22%	9%	1%	3%	4%	20%	50%	9%
8	60%	87%	60%	48%	35%	13%	3%	2%	10%	44%	12%
9	84%	69%	83%	52%	30%	32%	31%	7%	2%	22%	14%
10	100%	100%	91%	68%	85%	68%	53%	48%	27%	27%	33%
Total	7%	3%	5%	7%	7%	7%	8%	9%	13%	33%	10%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

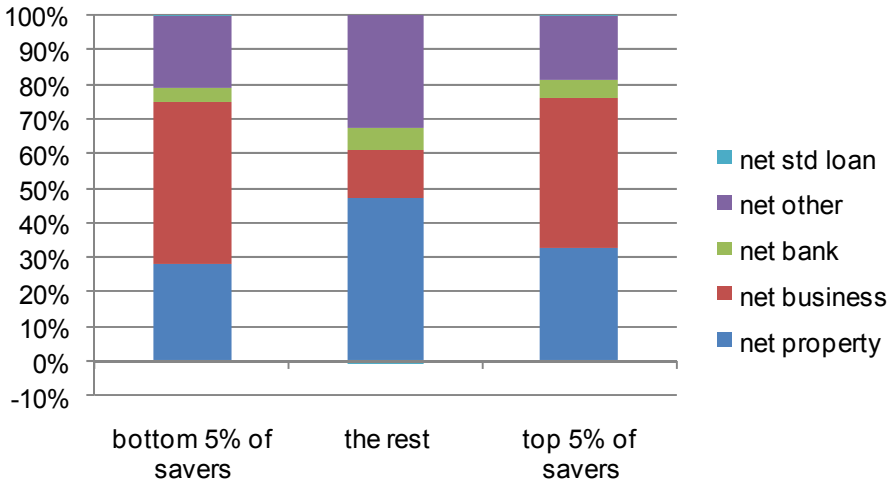
Notes:

1. Transitions have been calculated for those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Extreme savers are the 5% with estimated saving rates less than -391% and the 5% with estimated saving rates greater than 604%.
3. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

We now turn to the question of whether there are noticeable differences in the composition of wealth or the change in net wealth for extreme savers compared with non-extreme savers. As we did in Section 5.3 by age group, we have broken down average net wealth and the change in net wealth into components for extreme savers and non-extreme savers. Figure 20 shows the composition of the average change in net wealth for these groups and the detailed breakdowns can be found in Appendix Tables A5 and A6.

The composition of the average change in net wealth is largely consistent with the composition of average net wealth at 2004, with net business being slightly overrepresented in the change in net wealth across all categories of savers and net property underrepresented (see Appendix Table A6 for details).

Figure 20: Composition of average change in real net wealth for extreme savers



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Extreme savers are the 5% with estimated saving rates less than -391% and the 5% with estimated saving rates greater than 604%.
2. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

It seems that the contribution of net business assets to the average change in net wealth was relatively large for extreme savers: 47% of the average change in net wealth for extreme negative savers is attributable to net business assets; 43% for extreme positive savers; and 14% for non-extreme savers. In terms of proportions, this was largely offset by net property assets ie, extreme savers tended to have net property contributing a lower proportion of the change in net wealth.

Further investigation reveals that extreme savers were more likely to hold net business assets than non-extreme savers: Table 14 shows that 59% and 53% of extreme negative and positive savers respectively held no net business assets compared with 82% of the rest. We also find that extreme savers were more likely to hold property than other individuals: 23% of extreme negative savers held no property; and 20% of extreme positive savers held no property compared with 39% of the rest.

From Table 14 it is clear that extreme savers were more likely than non-extreme savers to hold property in only one year: 2004 for extreme negative savers and 2006 for extreme positive savers. However, extreme savers seem no less likely than non-extreme savers to have held property in both years. For net business, as well as being more likely to have held it in only one year, extreme savers were also more likely to have held net business in both years.

Table 14: Holding of net property and net business for extreme savers

Net property held in:	Extreme negative savers	the rest	Extreme positive savers
both waves	51%	50%	56%
2004 only	22%	5%	6%
2006 only	3%	6%	19%
no item	23%	39%	20%
Net business held in			
both waves	20%	10%	27%
2004 only	18%	4%	4%
2006 only	4%	5%	15%
no item	59%	82%	53%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Extreme savers are the 5% with estimated saving rates less than -391% and the 5% with estimated saving rates greater than 604%.
2. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

Table 15 shows the percentage of the average change in net property and net business wealth that was due to each of these holding patterns. Consider the non-extreme savers ("The rest"). Of the total average change in net property wealth, those who only had property in 2004 contributed -41% of the average change. For extreme savers, a large proportion of the average change in net property and net business wealth was due to those holding the item in one year only. For non-extreme savers, the contributions from those holding in one year roughly cancel out, so that the contribution from those holding the item in both years dominates the change in mean value.

Table 15: Contribution to average change in net property and net business assets by holding pattern for extreme savers

Net property assets	Extreme negative savers	The rest	Extreme positive savers
Both waves	53%	104%	61%
2004 only	50%	-41%	-4%
2006 only	-3%	38%	43%
Net business			
Both waves	54%	82%	60%
2004 only	46%	-73%	-2%
2006 only	0%	90%	42%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Extreme savers are the 5% with estimated saving rates less than -391% and the 5% with estimated saving rates greater than 604%.
2. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

Can the pattern of extreme savers being more likely to hold net business and net property assets in one wave only help to explain the extreme saving rates? Perhaps extreme positive savers acquired property or business assets between 2004 and 2006 and extreme negative savers sold property or business assets. But assets are generally not acquired for nothing or given away for free. Purchasing or selling of assets would be expected to result in a reallocation of wealth. For example, to purchase a house, some combination of a mortgage and a deposit (requiring other assets to be cashed in) is usually required. For illustration, a

house valued at $700K could be purchased by cashing in $200K of financial assets and a mortgage of $500K. In this example, the effect on net wealth is zero.

A situation where assets may plausibly be gifted away is if an individual transfers assets, often property, to a family trust. It is possible that this may explain some of the extreme negative saving rates. In the case of a SoFIE respondent gifting a property to a trust between waves 2 and 4, their net wealth would reduce by the amount gifted to the trust. The outstanding value of the property owed to the respondent by the trust should still have been reported and attributed to the individual. In New Zealand, an individual can gift $27,000 per year without attracting gift duty.[29] For a couple, this implies that $108,000 could have been gifted to a trust over the 2 year period without attracting gift duty. However, the median change in net wealth for extreme negative savers was approximately -$240,000. Although gifting of assets to trusts may explain some of the extreme negative saving, it seems unlikely that it will explain the largest negative saving rates.

The pattern for extreme savers tending to hold net property and net business assets in one wave only seems to distinguish extreme savers from non-extreme savers. Although we might expect to see reallocation rather than huge swings in net wealth when individuals buy or sell assets, there are a couple of reasons why we might be observing extreme saving rates for some individuals who report holding an item in one wave only. The most obvious reason is poor recall, where an individual actually holds an item in both waves but "forgets" to report it in one wave. Alternatively, perhaps the individual holds the asset in one wave only but the value attributed to the asset is very inaccurate eg, a business held by an extreme negative saver in wave 2 may have been valued at $1M but between waves 2 and 4 it may have sold for only $500K, reducing net wealth by $500K.

5.5 Estimating the effect of housing on saving rates

In this section we estimate the effect of housing on saving rates. First we consider the effect of changes in the value of owner-occupied housing on saving rates estimated for owner-occupiers. We then attempt to remove the effect of changes in house prices on saving rates.

5.5.1 Effect of owner-occupied housing on saving rates

Figure 3 showed an apparent inverse relationship between housing wealth and saving. In this section we explore the effect of owner-occupied housing on saving rates.

Whether or not owner occupied housing should be included as a measure of net wealth is a mute question. The answer will depend in part on the purpose to which the measure is put. If the purpose is to measure the total stock of household wealth, then changes in the valuation of all assets including housing are legitimate elements of wealth. On the other hand, if one is interested in retirement saving and one is prepared to start from the assumption that many retirees remain in their pre-retirement home or, even if changing homes buy a smaller newer one of equivalent value, then one might well wish to exclude the value of the principal residence. This notion presumably lay behind the quote from Mervyn King, Governor of the Bank of England, when he is reported to have asserted that "housing wealth isn't wealth" (Buiter 2008).

The results of excluding owner-occupied housing are summarised in Table 16 and illustrated in Figure 21.

[29] http://www.sorted.org.nz/home/sorted-sections/trusts/asset-gifting

Table 16: Effect on estimated saving rates of removing owner-occupied housing from assets for individuals with owner-occupied housing in both years

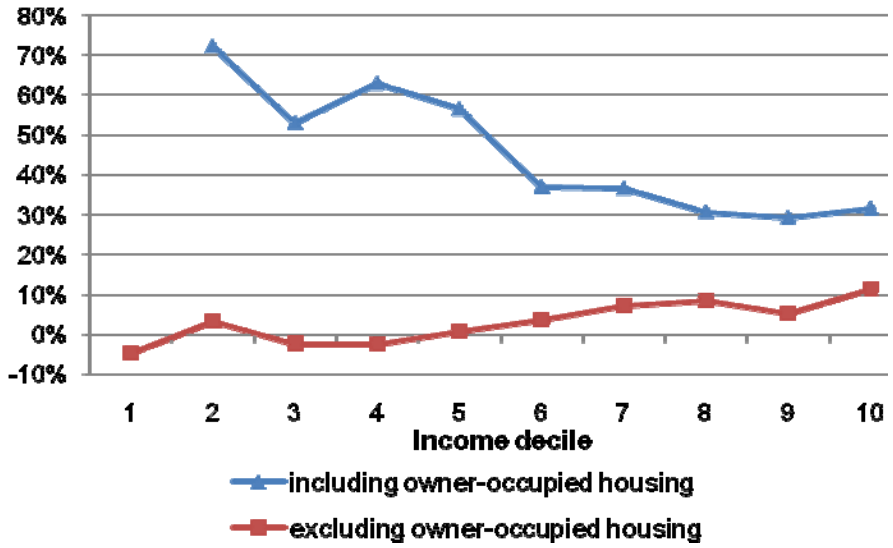
Income decile	Number with owner occupied housing in both waves	Median change in wealth (real)	Median change in wealth excl. owner occupied housing (real)	Median change due to owner occupied housing	Median percent of change due to owner occupied housing	Median saving rate (real)	Median saving rate excl. owner occupied housing (real)
1	70,900	21,699	-280	23,092	62%	263%	-5%
2	114,000	17,567	709	17,851	73%	72%	3%
3	128,700	16,378	-747	20,536	82%	53%	-2%
4	120,800	25,771	-851	25,228	70%	63%	-2%
5	110,000	28,025	460	27,739	66%	57%	1%
6	117,800	24,165	2,543	22,565	54%	37%	4%
7	132,700	28,305	5,715	22,065	51%	37%	7%
8	148,800	30,370	7,770	22,065	47%	31%	8%
9	163,200	35,057	6,407	28,362	41%	29%	5%
10	152,100	67,515	22,599	32,260	28%	32%	11%
Total	1,259,000	26,954	3,056	23,693	55%	42%	5%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. Income deciles are for average real gross income over waves 2, 3 and 4, excluding those with negative average real income for whom a saving rate was not meaningful.
2. The number of individuals in each category has been individually rounded to the nearest 100.
3. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.
4. Saving rate excluding owner-occupied housing is calculated after removing owner-occupied housing assets from wealth in both waves.
5. Median change in net wealth calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
6. Median change in net wealth is expressed in 31 March 2006 dollars.

Figure 21: Median real saving rates by income decile for individuals with owner-occupied housing in both years



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. The median saving rate including owner-occupied housing for decile 1 was 263%. This was excluded from the graph in order to better reveal the underlying trends.
2. Income deciles are for average real gross income over waves 2, 3 and 4, excluding those with negative average real income for whom a saving rate was not meaningful.
3. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.
4. Saving rate excluding owner-occupied housing is calculated after removing owner-occupied housing assets from wealth in both waves.

To allow for a valid comparison, we have restricted the sample to individuals who reported a value for owner occupied housing in both waves 2 and 4. The results are therefore representative of individuals in the longitudinal population who lived in their own house in 2004 and 2006.

In every income decile the estimated median saving rate was positive, with the lowest rate being 29% for decile 9. The median saving rate across all individuals who were owner occupiers in both years is estimated to have been 42%. Once we exclude owner occupied property, the estimate for the same group of individuals falls to 5%, confirming the significant contribution that owner-occupied housing made to changes in net wealth over the period. It should also be noted that the median rate for those in the lower income deciles becomes marginally negative when we exclude their principal residence.

5.5.2 Excluding the effect of house price changes

As explained in Section 3.2, stock measures of saving include a component due to asset revaluations. Excluding this component would produce a measure of saving that is more comparable to a flow measure. It is not possible to identify from the SoFIE data how much of the change in the value of an asset was due to changes in the quantity held and how much was due to a change in its price. We therefore need to estimate the component of the change in wealth that is due to changes in asset prices. This requires detailed data on asset price trends at a disaggregated level. National indices were sufficient to carry out such adjustments at the aggregate level. However, in this section we are primarily interested in questions about the distribution of saving rates. Applying aggregate indices to unit-record data would likely lead to misleading conclusions being drawn about the distribution of resulting "adjusted" measures of saving. Such a method amounts to assuming that each individual holding an asset in a particular class faced the same percentage change in its

value due to price; and so no valid distributional information can be obtained about any measures that depend on this assumption.

Although we have fairly disaggregated data on property prices, we lack suitable data at a disaggregated level on trends in non-property asset prices. Therefore, as in Section 3.2, we have restricted our analysis to calculating a measure of saving that removes an estimate of the effect of property prices only. As outlined in Section 4.4.1, detailed house price indices at the Territorial Local Authority level were the basis for our adjustment of rateable values to bring them in line with the interview period. We have used these same indices to decompose the change in adjusted gross property values between 2004 and 2006 into "price" and "quantity" components and an interaction between the two.

Applying any kind of price index to individuals imposes an assumption that the price changes faced by an individual are equal to some average. The more disaggregated the index, the better this assumption, but distributions of the breakdown must still be interpreted with caution. For instance, in the case of property we have house price indices available at the TLA level, which is fairly detailed, but still requires an the assumption that each individual with property within any one of 73 TLAs faced the same percentage change in the price of their property. This assumption is unlikely to hold, but we have made a judgement that provided our breakdowns are kept relatively broad, we should be able to get some insight into trends across demographic variables. Age group and income decile are quite broad groups and so we have chosen to summarise results by these categories.

Section 3.2 describes the method used at the aggregate level to remove the component of the change in net wealth attributable to changes in property prices. A similar method was used at the individual level, but instead of the National House Price Index, TLA-specific House Price Indices were used. In line with our earlier approach, two methods were used: A "gross" housing adjustment and a "net" housing adjustment. The gross housing adjustment is appropriate if mortgages are used to finance consumption; the net housing adjustment is appropriate if mortgages are used solely to finance the property. Details on the method and equations used to calculate the adjusted measures of the change in real net wealth can be found in Appendix B. Adjusted saving rates were then calculated by dividing the adjusted change in real net wealth by average real income, dividing by 2 to estimate an annual rate.

Table 17 summarises the results for all individuals in the longitudinal population and for the subset with property in both years. In aggregate, excluding the effect of property price changes reduces the estimated median saving rate from 16% to 5% under the assumption that mortgages are tied to the property (net adjustment). The rate is reduced further to 2% under the assumption that mortgages can be used to finance consumption (gross adjustment). For individuals with property in both years, the full effect is observed; the estimated saving rate reduces from 41% to 6% (net adjustment) and becomes negative at -6% (gross adjustment).

Table 17: Median saving rates including and excluding the effect of house price changes

Median saving rate	All individuals	Individuals with property in both years
Real	16%	41%
Real (net housing adjustment)	5%	6%
Real (gross housing adjustment)	2%	-6%

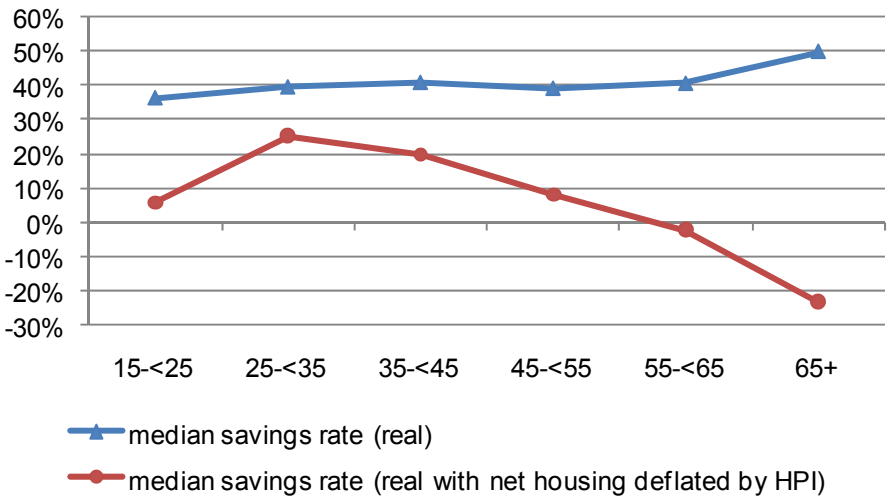
Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Note:

1. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

Figure 22 and Figure 23 display the results by age group and income decile for individuals with property in both years. Appendix Tables A9 and A10 contain more detail. Figure 22 suggests that the effect of changes in house prices on saving rates is largest for older age groups, being particularly large for those aged 65 and over. This is because those aged 65+ tended to have higher levels of net property than the younger age groups and so the property price effect on net wealth tended to be larger (Table 18). The median adjusted saving rate is negative for those aged 65+. This is not unexpected as it is reasonable for those in retirement to not be actively adding to net wealth.

Figure 22: Median saving rates including and excluding the effect of house price changes by age group for individuals with property in both years



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Note:
1. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

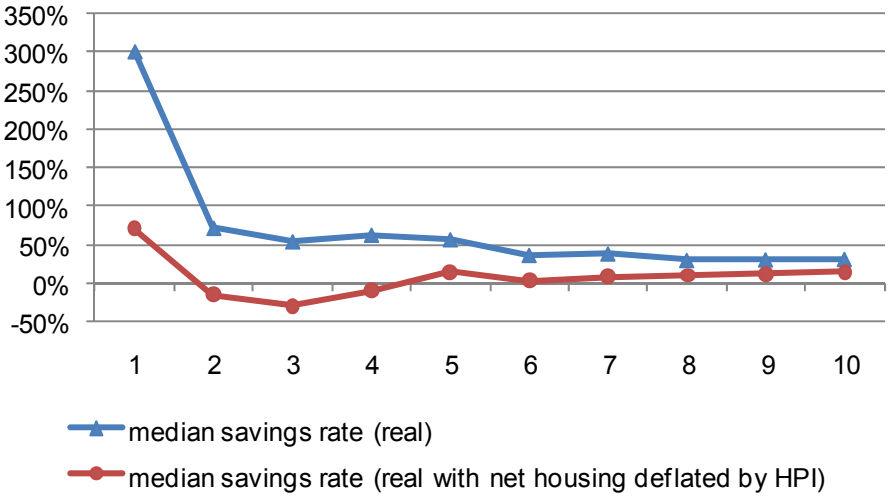
Table 18: Average property price effect on change in net wealth by age group for individuals with property in both years

Age group	Net property 2004 (real)	Net property 2006 (real)	Change in net property (real)	Change in net property (real net adjustment)	Property price effect
15-<25	62,512	69,585	7,073	-9,194	-16,267
25-<35	58,818	88,046	29,229	18,208	-11,021
35-<45	113,078	143,827	30,749	7,861	-22,888
45-<55	172,781	213,554	40,773	7,036	-33,737
55-<65	202,123	239,403	37,280	-4,007	-41,287
65+	211,331	239,536	28,206	-15,683	-43,889
Total	163,283	197,054	33,771	775	-32,996

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Means calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Net property wealth and change in net property wealth expressed in 31 March 2006 dollars.

Figure 23: Median saving rates including and excluding the effect of house price changes by income decile for individuals with property in both years



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Note:

1. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

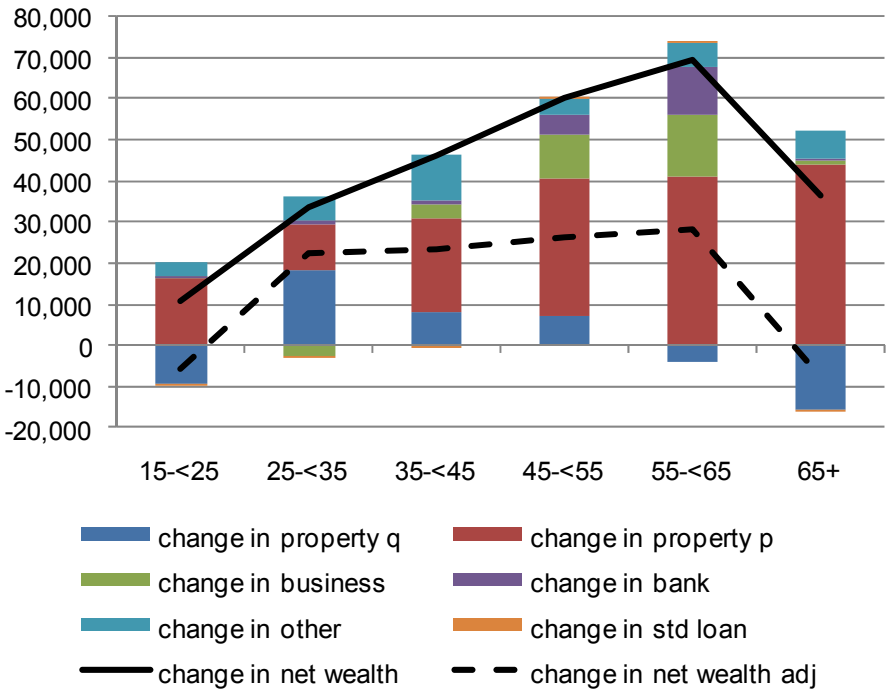
Individuals in the bottom decile had low incomes (less than 8.5K), contributing to relatively high saving rates. New Zealand Superannuation recipients are likely to have been in deciles 2 (each partner in a couple) and 3 (singles alone or sharing)[30] and the pattern here seems consistent with the observation from the previous graph that the 65+ age group have negative adjusted saving rates.

Figure 24 and Figure 25 summarise the average change in net wealth by age group broken down into components using the method described in Section 5.3. In these figures, the change in net property wealth is split into "price" and "quantity" components. Figure 24 restricts the longitudinal population to individuals with property in both years and Figure 25 shows the overall averages for the longitudinal population. Appendix Table A9 and A10 show the numbers behind these figures. The lines on the graphs show the average change in net wealth before (bold line) and after (dotted line) the removal of an estimate of the change in net property wealth due to prices. For each age group, the unadjusted average change in net wealth is the net height of the bar; the adjusted average change in net wealth is the net height excluding the house price effect shown as the red portion of the bar.

Note that the pattern shown in Figure 24 differs slightly from that implied by the medians in Figure 22 because the distribution of the change in net wealth is highly skewed. Although medians are preferable to means as measures of central tendency, they cannot be broken down into additive components.

[30] 2005/06 rates: NZS couples were entitled to $12,228 each, singles alone and singles sharing were entitled to $16,106 and $14,821 respectively. Income decile boundaries are shown in Table 7.

Figure 24: Breakdown of average change in net wealth by age group for individuals with property in both years



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. The breakdown is calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Average change in net wealth expressed in 31 March 2006 dollars.
3. The dotted line shows the change in average net wealth excluding an estimate of the change in net property wealth due to house price changes.

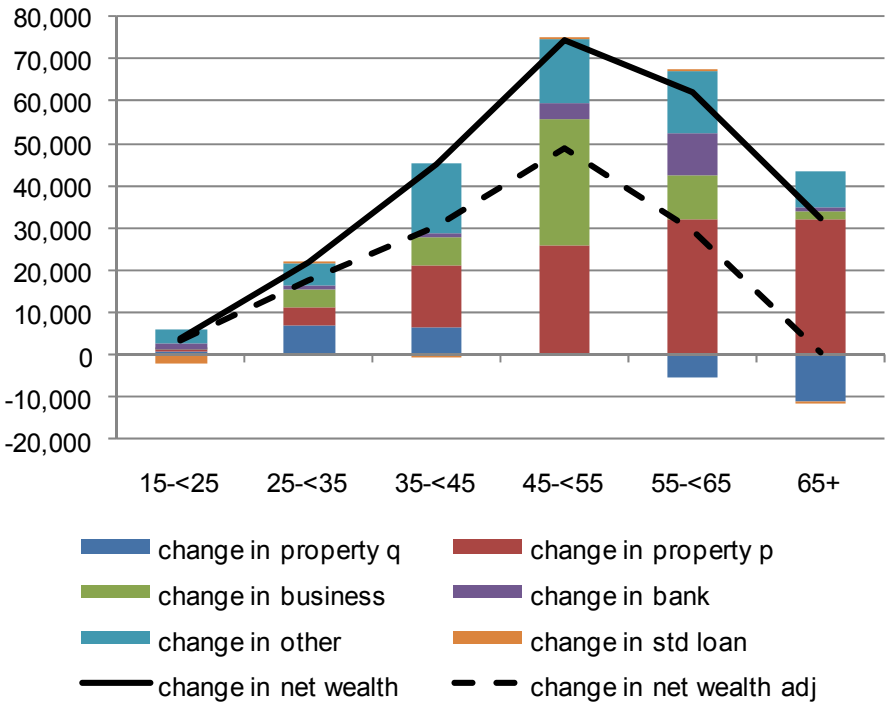
For property holders across all age groups except 25-35 year olds, the average property price effect is the largest component of the average change in net wealth. For both the youngest and oldest age groups, the average property price effect is greater than the change in residual net wealth, resulting in the average adjusted change in net wealth being negative.

The change in net wealth due to changes in the quantity of property is typically much smaller than the change due to property prices and is negative for the youngest and two oldest age groups. This is a consequence of the average estimated price effect tending to exceed the average change in property wealth in these age groups. These results should be interpreted cautiously as our estimated price effects assume that all property holders within a TLA experienced the same rate of house price growth. There will certainly have been a distribution of actual capital gains within each TLA, and to the extent that true variation is related to age, the results implied by Figure 24 may be biased. For instance, it is conceivable that some of the variation may be due to property type (eg, apartments versus stand alone houses versus flats), and certain age groups may have a tendency to live in particular types of property. If we had been able to identify property types in SoFIE and apply average price growth by property type within TLAs, we may well have obtained different average age group patterns.

Figure 25 summarises the breakdown of the average change in net wealth by age group for the longitudinal population. When the average breakdown is considered for the population as a whole, the property price effect is reduced somewhat, particularly for the youngest age group. This is because individuals who did not own property are treated as having zero net property and only 2% of individuals aged 15-25 owned property in both years (see Table 19

below). For the 45-55 year age group as a whole, the change in net wealth due to net business assets is the most important, contributing 40% to the mean change. The adjusted average change in net wealth remains positive for all age groups but only just for those aged 65+.

Figure 25: Breakdown of average change in net wealth by age group for all individuals



Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. The breakdown is calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Average change in net wealth expressed in 31 March 2006 dollars.
3. The dotted line shows the change in average net wealth excluding an estimate of the change in net property wealth due to house price changes.

Table 19: Property holding by age group

	Property in both waves	Property in 2004 only	Property in 2006 only	No property
15-<25	2%	0%	3%	95%
25-<35	31%	5%	11%	53%
35-<45	56%	6%	7%	31%
45-<55	67%	7%	5%	20%
55-<65	68%	7%	5%	20%
65+	68%	6%	3%	23%
Total	51%	6%	6%	38%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Note:
1. Calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.

6 Conclusions and Future Directions

Household saving rates are an important piece of evidence needed for informed policy debate particularly, but not solely, in relation to retirement income policies. Conceptually, estimates of saving rates can be based on a flow measure (income less consumption) or a stock measure (changes in net wealth). The flow measure of saving from the national accounts has shown a strong downward trend, and has been negative since 1993. There appears to be an inverse relation between this measure of savings and net housing wealth. However, regardless of whether the flow or stock method is used, the measurement of saving by households has proved less than straightforward.

Existing measures for New Zealand have become increasingly disparate, making it difficult to obtain a clear picture. Attempts at reconciling differences arising from different data sources have only partly narrowed the gaps. However, for the first time in New Zealand, longitudinal data on the assets and liabilities of households at the unit record level are becoming available from SoFIE, a large national longitudinal survey undertaken by Statistics New Zealand.

Updated estimates from the Reserve Bank's aggregate data on the household sector (a stock approach) and those from the national accounts (a flow approach) continue to give widely different estimates of the overall household saving rate, although both were negative in 2008 and both below their long run trend values.

After updating estimates from two the existing sources, this paper presents initial estimates derived from SoFIE. While this paper reports results from SoFIE at the individual level, future work will extend this analysis to the level of the family unit and the household. The estimates were made by comparing net wealth in 2004 with that in 2006 at the individual level and computing the implied real saving rate on an annual basis. This yielded an overall median estimate of 16% of gross income. This is of the same order of magnitude as the long run average annual saving rate measured from the aggregate household balance sheet from RBNZ, which was 16% of disposable income, equivalent to about 12% of gross income.

When estimates for the aggregate net wealth of the household sector were made from SoFIE and adjusted to be on a comparable basis with data on net wealth for the household sector from the Reserve Bank, it was found that the implied saving rates were very similar. We take this as supporting the claim that estimates from SoFIE are reasonable indicators of the population at large.

However, it must be stressed that median estimates of saving rates should be complemented with a measure of dispersion. There is a strikingly wide distribution of saving rates. For example across many categories of individuals around 40% are estimated to have had a decline in net wealth implying a negative rate of saving. Some of this is to be expected as for example, when young individuals invest in education and acquire student loans, and older people draw on past savings in retirement. However, the number of negative savers exceeds that which could be attributed to these two groups.

We have proposed that observed net wealth is comprised of a permanent component and a random or "transitory" component, which could be quite large. To the extent that this is the case, the transitory component may in fact be contributing importantly to changes in net wealth and thereby leading to the wide dispersion that we have observed. Some of the transitory component could have arisen through measurement errors. For example, survey respondents may have reported having a particular asset in wave 2 and omitted to mention it

in wave 4. Some changes in wealth could have arisen through marriage dissolutions, or through equity withdrawals for consumption. Much remains to be done to develop a fuller insight into the magnitude of the transitory component of net wealth and its effect on saving rates.

Clearly, changes in the value of assets influence the change in net wealth. Ideally, we would want to decompose the change in the gross value of all assets into that due to prices and that due to a real change in quantity (together with an interaction effect). The price effect constitutes "passive" saving, while changes in the quantity reflect "active" saving. While we were able to estimate the effect of changes in house prices on saving rates, this was not extended to other types of assets due to data constraints. However, for many individuals housing represents the single biggest asset (after their human capital) and changes in the value of housing would constitute the major source of passive saving.

Our estimate of the median saving rate for property holders fell from 41% to 6% when we removed an estimate of the effect of house prices. For the longitudinal population as a whole, the effect was to reduce the estimated median saving rate from 16% to 5%. Asset revaluations are therefore a potentially large contributor to changes in household net wealth.

Finally, this initial study underscores the value of longitudinal data. The ability to hold constant many unobservable characteristics of individuals, by observing them at repeated points in time, offers the opportunity to address a wide range of social policy questions in a manner not previously possible. As additional waves of data from SoFIE become available, the real value of a major longitudinal study will grow markedly. The evidence from long standing surveys of this type in other countries bears testimony to their value.

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Appendix A: Additional tables

Appendix Table A.1: Breakdown of average net wealth and average change in net wealth by age group

Real Net wealth w2	Net property	Net business	Net bank	Net other	Net std loan	Net wealth	Age group's contribution
15-24	1,237	934	1,587	7,426	-3,546	7,638	957
25-34	20,708	11,794	2,659	33,853	-4,236	64,778	10,526
35-44	70,786	46,466	3,765	60,978	-895	181,100	36,946
45-54	129,973	61,562	9,951	87,439	-388	288,536	55,625
55-64	155,289	68,762	18,634	106,180	-111	348,754	50,013
65+	153,831	25,547	26,165	83,191	-3	288,731	49,648
Total	91,739	37,635	10,489	65,261	-1,407	203,717	203,717
Real net wealth w4							
15-24	2,287	1,255	2,758	10,829	-5,604	11,525	1,445
25-34	31,748	16,173	3,793	38,994	-4,068	86,641	14,079
35-44	91,804	53,018	4,998	77,287	-980	226,126	46,132
45-54	156,078	91,071	13,700	102,685	-365	363,168	70,013
55-64	182,373	79,129	28,364	120,846	-88	410,625	58,886
65+	174,530	27,696	27,098	91,807	-20	321,111	55,216
Total	110,429	47,269	13,350	76,374	-1,650	245,772	245,772
Change in real net wealth							
15-24	1,050	322	1,171	3,402	-2,058	3,887	487
25-34	11,041	4,379	1,134	5,141	168	21,863	3,553
35-44	21,018	6,552	1,232	16,308	-85	45,026	9,186
45-54	26,105	29,509	3,749	15,246	23	74,632	14,388
55-64	27,084	10,368	9,730	14,666	23	61,872	8,873
65+	20,699	2,149	933	8,615	-17	32,380	5,568
Total	18,690	9,634	2,861	11,113	-243	42,055	42,055

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. The age group contribution is calculated by multiplying the average change in net wealth by the proportion of the population estimated to be in the age group. The following age distribution was used in order from youngest to oldest: 13%, 16%, 20%, 19%, 14%, 17%.
2. Means are calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
3. Net wealth for both waves was indexed to 31 March 2006.

Appendix Table A.2: Composition of average net wealth and average change in net wealth by age group

Contribution to real net wealth at w2	Net property	Net business	Net bank	Net other	Net std loan	Net wealth	Age group's contribution
15-24	16%	12%	21%	97%	-46%	100%	0%
25-34	32%	18%	4%	52%	-7%	100%	5%
35-44	39%	26%	2%	34%	0%	100%	18%
45-54	45%	21%	3%	30%	0%	100%	27%
55-64	45%	20%	5%	30%	0%	100%	25%
65+	53%	9%	9%	29%	0%	100%	24%
Total	45%	18%	5%	32%	-1%	100%	100%
Contribution to real net wealth at w4							
15-24	20%	11%	24%	94%	-49%	100%	1%
25-34	37%	19%	4%	45%	-5%	100%	6%
35-44	41%	23%	2%	34%	0%	100%	19%
45-54	43%	25%	4%	28%	0%	100%	28%
55-64	44%	19%	7%	29%	0%	100%	24%
65+	54%	9%	8%	29%	0%	100%	22%
Total	45%	19%	5%	31%	-1%	100%	100%
Contribution to change in real net wealth							
15-24	27%	8%	30%	88%	-53%	100%	1%
25-34	50%	20%	5%	24%	1%	100%	8%
35-44	47%	15%	3%	36%	0%	100%	22%
45-54	35%	40%	5%	20%	0%	100%	34%
55-64	44%	17%	16%	24%	0%	100%	21%
65+	64%	7%	3%	27%	0%	100%	13%
Total	44%	23%	7%	26%	-1%	100%	100%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. The age group contribution is calculated by multiplying the average change in net wealth by the proportion of the population estimated to be in the age group, expressed as a percentage of the overall change in net wealth. The following age distribution was used in order from youngest to oldest: 13%, 16%, 20%, 19%, 14%, and 17%.
2. Contributions are calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
3. Net wealth for both waves was indexed to 31 March 2006.

Appendix Table A.3: Real net wealth decile boundaries and range of change in net wealth permitted while remaining in the same decile

	Real net wealth decile boundaries		To remain in same decile	
Net wealth decile	Wave 2	Wave 4	Minimum change in wealth	Maximum change in wealth
1	<=$1,596	<=$2,386	large -ve	large +ve
2	$10,518	$14,303	-$8,132	$12,706
3	$30,779	$36,973	-$16,476	$26,455
4	$63,892	$77,134	-$26,919	$46,355
5	$103,930	$122,764	-$26,796	$58,871
6	$148,744	$175,188	-$25,980	$71,258
7	$208,384	$240,627	-$33,197	$91,883
8	$294,089	$335,602	-$53,463	$127,218
9	$461,015	$541,529	-$125,413	$247,440
10	>$461,015	>$541,529	large -ve	large +ve

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Deciles calculated for those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Net wealth for both waves was indexed to 31 March 2006.

Appendix Table A.4: Real net wealth decile transition table

	2006 Net wealth decile										
2004 Net wealth decile	1	2	3	4	5	6	7	8	9	10	Total
1	5.4%	2.6%	0.9%	0.5%	0.2%	0.1%	0.1%	0.1%	0.0%	0.1%	10%
2	2.7%	4.3%	2.0%	0.6%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%	10%
3	1.0%	2.2%	3.9%	1.7%	0.6%	0.3%	0.2%	0.1%	0.1%	0.0%	10%
4	0.3%	0.5%	2.0%	3.6%	1.8%	0.8%	0.4%	0.2%	0.2%	0.2%	10%
5	0.3%	0.2%	0.6%	1.7%	3.2%	2.2%	0.8%	0.4%	0.3%	0.3%	10%
6	0.1%	0.1%	0.2%	0.8%	2.1%	3.2%	2.0%	0.8%	0.5%	0.3%	10%
7	0.1%	0.1%	0.2%	0.5%	1.0%	1.9%	3.1%	1.9%	0.9%	0.4%	10%
8	0.1%	0.0%	0.1%	0.3%	0.4%	0.8%	2.1%	3.5%	2.1%	0.6%	10%
9	0.1%	0.0%	0.1%	0.2%	0.4%	0.5%	1.0%	2.3%	3.9%	1.7%	10%
10	0.1%	0.0%	0.1%	0.2%	0.2%	0.2%	0.3%	0.7%	1.9%	6.4%	10%
Total	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	100%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Transitions have been calculated for those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.

Appendix Table A.5: Breakdown of average net wealth and average change in net wealth for extreme savers

Real net wealth w2	Net property	Net business	Net bank	Net other	Net std loan	Net wealth
Bottom 5% of savers	247,855	290,067	31,143	195,406	-617	763,854
The rest	80,791	19,505	9,350	57,480	-1,501	165,624
Top 5% of savers	132,686	111,549	10,323	75,149	-496	329,212
Total	91,739	37,635	10,489	65,261	-1,407	203,717
Real net wealth w4						
Bottom 5% of savers	115,805	69,363	12,368	96,018	-1,530	292,024
The rest	94,451	23,521	11,248	67,153	-1,724	194,649
Top 5% of savers	392,918	453,018	52,206	222,838	-426	1,120,553
Total	110,429	47,269	13,350	76,374	-1,650	245,772
Change in real net wealth						
Bottom 5% of savers	-132,050	-220,704	-18,775	-99,389	-913	-471,830
The rest	13,660	4,017	1,898	9,673	-223	29,024
Top 5% of savers	260,232	341,468	41,882	147,689	70	791,341
Total	18,690	9,634	2,861	11,113	-243	42,055

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. Extreme savers are the 5% with estimated saving rates less than -391% and the 5% with estimated saving rates greater than 604%.
2. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.
3. Breakdown calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
4. Net wealth for both waves was indexed to 31 March 2006.

Appendix Table A.6: Composition of average net wealth and average change in net wealth for extreme savers

Contribution to real net wealth at w2	Net property	Net business	Net bank	Net other	Net std loan	Net wealth
Bottom 5% of savers	32%	38%	4%	26%	0%	100%
The rest	49%	12%	6%	35%	-1%	100%
Top 5% of savers	40%	34%	3%	23%	0%	100%
Total	45%	18%	5%	32%	-1%	100%
Contribution to real net wealth at w4						
Bottom 5% of savers	40%	24%	4%	33%	-1%	100%
The rest	49%	12%	6%	34%	-1%	100%
Top 5% of savers	35%	40%	5%	20%	0%	100%
Total	45%	19%	5%	31%	-1%	100%
Contribution to change in real net wealth						
Bottom 5% of savers	28%	47%	4%	21%	0%	100%
The rest	47%	14%	7%	33%	-1%	100%
Top 5% of savers	33%	43%	5%	19%	0%	100%
Total	44%	23%	7%	26%	-1%	100%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. Extreme savers are the 5% with estimated saving rates less than -391% and the 5% with estimated saving rates greater than 604%.
2. Saving rate is defined as change in real net wealth divided by average real income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.
3. Breakdown calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
4. Net wealth for both waves was indexed to 31 March 2006.

Appendix Table A.7: Median change in net wealth including and excluding the effect of house price changes by age group and income decile

	All individuals			Individuals with property in both waves		
Age group	Change in net wealth (real)	Change in net wealth (real with net housing deflated by HPI)	Change in net wealth (real with gross housing deflated by HPI)	Change in net wealth (real)	Change in net wealth (real with net housing deflated by HPI)	Change in net wealth (real with gross housing deflated by HPI)
15-24	1,415	1,347	1,306	20,963	2,248	-7,871
25-34	7,761	6,397	4,046	29,019	19,282	4,674
35-44	13,847	6,952	2,907	32,649	13,807	1,799
45-54	19,234	4,420	-508	29,915	5,486	-4,077
55-64	13,260	-234	-2,761	25,667	-2,370	-8,314
65+	7,235	-6,299	-6,556	20,110	-10,698	-10,927
Income decile						
1	744	-173	-444	25,166	5,835	-2,029
2	1,316	-733	-1,193	17,474	-3,909	-7,277
3	4,842	-462	-1,130	16,745	-9,356	-12,226
4	5,665	98	-613	24,203	-3,942	-7,807
5	6,052	2,992	1,951	28,205	6,939	13
6	8,487	3,504	2,013	22,774	1,622	-6,004
7	13,953	7,108	3,208	29,669	6,538	-5,350
8	16,452	8,547	3,137	29,306	8,622	-3,568
9	26,609	13,153	7,635	36,077	13,779	655
10	59,141	33,126	23,958	66,715	30,571	16,524
Total	7,571	2,197	751	27,045	3,873	-3,997

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. Income deciles are constructed based on average real gross income over waves 2, 3 and 4, excluding those with zero or negative average real income for whom a saving rate was not meaningful.
2. Median change in net wealth calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
3. Median change in net wealth expressed in 31 March 2006 dollars.

Appendix Table A.8: Median saving rates including and excluding the effect of house price changes by age group and income decile

Age group	All individuals			Individuals with property in both waves		
	saving rate (real)	saving rate (real with net housing deflated by HPI)	saving rate (real with gross housing deflated by HPI)	saving rate (real)	saving rate (real with net housing deflated by HPI)	saving rate (real with gross housing deflated by HPI)
15-24	5%	5%	5%	36%	6%	-14%
25-34	13%	11%	7%	39%	25%	7%
35-44	21%	11%	5%	41%	20%	4%
45-54	26%	6%	-1%	39%	8%	-6%
55-64	25%	-1%	-5%	41%	-2%	-12%
65+	20%	-16%	-17%	50%	-23%	-24%
Income decile						
1	10%	-2%	-6%	301%	71%	-27%
2	6%	-3%	-5%	72%	-16%	-33%
3	15%	-1%	-4%	54%	-30%	-39%
4	14%	0%	-2%	63%	-10%	-19%
5	12%	6%	4%	57%	14%	0%
6	14%	6%	3%	36%	3%	-10%
7	18%	9%	4%	38%	8%	-7%
8	18%	9%	3%	30%	9%	-4%
9	22%	11%	6%	31%	11%	1%
10	28%	17%	12%	31%	14%	9%
Total	16%	5%	2%	41%	6%	-6%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:

1. Income deciles are constructed based on average real gross income over waves 2, 3 and 4, excluding those with zero or negative average real income for whom a saving rate was not meaningful.
2. Saving rate is defined as change in real net wealth divided by average real gross income, divided by 2 to convert to an annual rate. A rate is calculated for those who have net wealth in both waves and positive average real income.

Appendix Table A.9: Breakdown and composition of average change in net wealth by age group for individuals with property in both years

Age group	Change in property quantity	Change in property price	Change in business	Change in bank	Change in other	Change in std loan	Change in net wealth
Breakdown of average change in net wealth							
15-24	-9,194	16,267	197	399	3,361	-358	10,672
25-34	18,208	11,021	-2,565	1,283	5,621	-5	33,563
35-44	7,861	22,888	3,425	1,028	11,267	-105	46,364
45-54	7,036	33,737	10,585	4,830	3,805	55	60,048
55-64	-4,007	41,287	14,597	12,058	5,604	40	69,580
65+	-15,683	43,889	1,186	235	6,686	-1	36,313
Total	775	32,996	6,347	3,977	6,646	-3	50,737
Composition of average change in net wealth							
15-24	-86%	152%	2%	4%	31%	-3%	100%
25-34	54%	33%	-8%	4%	17%	0%	100%
35-44	17%	49%	7%	2%	24%	0%	100%
45-54	12%	56%	18%	8%	6%	0%	100%
55-64	-6%	59%	21%	17%	8%	0%	100%
65+	-43%	121%	3%	1%	18%	0%	100%
Total	2%	65%	13%	8%	13%	0%	100%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Breakdown and composition calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Net wealth for both waves was indexed to 31 March 2006 using CPI.
3. Change in net property quantity estimated by inflating 2004 net property to 2006 using TLA House Price Indices. See Appendix B for details.

Appendix Table A.10: Breakdown and composition of average change in net wealth by age group for all individuals

Age group	Change in property quantity	Change in property price	Change in business	Change in bank	Change in other	Change in std loan	change in net wealth
Breakdown of average change in net wealth							
15-24	710	340	322	1,171	3,402	-2,058	3,887
25-34	7,004	4,037	4,379	1,134	5,141	168	21,863
35-44	6,595	14,423	6,552	1,232	16,308	-85	45,026
45-54	250	25,855	29,509	3,749	15,246	23	74,632
55-64	-5,178	32,262	10,368	9,730	14,666	23	61,872
65+	-11,204	31,903	2,149	933	8,615	-17	32,380
Total	-48	18,738	9,634	2,861	11,113	-243	42,055
Composition of average change in net wealth							
15-24	18%	9%	8%	30%	88%	-53%	100%
25-34	32%	18%	20%	5%	24%	1%	100%
35-44	15%	32%	15%	3%	36%	0%	100%
45-54	0%	35%	40%	5%	20%	0%	100%
55-64	-8%	52%	17%	16%	24%	0%	100%
65+	-35%	99%	7%	3%	27%	0%	100%
Total	0%	45%	23%	7%	26%	-1%	100%

Source: SoFIE waves 2 and 4, with adjustments to property assets based on QVNZ data at TLA level

Notes:
1. Breakdown and composition calculated over those with non-missing saving rate for consistency of sample. Excludes a small number of respondents that have wealth in both waves but negative average real income.
2. Net wealth for both waves was indexed to 31 March 2006 using CPI.
3. Change in net property quantity estimated by inflating 2004 net property to 2006 using TLA House Price Indices. See Appendix B for details.

Appendix B: Adjusting change in net wealth for changes in house prices

Unadjusted change in real net wealth

All components of wealth were CPI-indexed to 31 March 2006 prior to calculating the change in real net wealth:

$$\Delta NW = \left(V_{h,w4} - V_{h,w2} \times \frac{CPI_{i,mar06}}{CPI_{i,mar04}} \right) + (A_{f,w4} - L_{h,w4} - L_{o,w4}) \times \frac{CPI_{mar06}}{CPI_{w4,hed}} - (A_{f,w2} - L_{h,w2} - L_{o,w2}) \times \frac{CPI_{mar06}}{CPI_{w2,hed}}$$

Gross housing adjustment

To remove the effect of property prices on gross housing wealth, wave 2 total property assets (which had been expressed in 31 March 2004 dollars) were inflated to 31 March 2006 using TLA-specific house price indices. The difference between total property assets at wave 4 and adjusted wave 2 total property assets excludes an estimate of the change due to house prices.

The change in net wealth with the gross housing adjustment was computed by adding the adjusted change in gross property assets to the change in other components of net wealth that were CPI-indexed to 31 March 2006:

$$\Delta NW_{gross} = \left(V_{h,w4} - V_{h,w2} \times \frac{HPI_{i,mar06}}{HPI_{i,mar04}} \right) + (A_{f,w4} - L_{h,w4} - L_{o,w4}) \times \frac{CPI_{mar06}}{CPI_{w4,hed}} - (A_{f,w2} - L_{h,w2} - L_{o,w2}) \times \frac{CPI_{mar06}}{CPI_{w2,hed}}$$

Net housing adjustment

The same procedure was used to remove the effect of property prices on net housing wealth, but net housing wealth (rather than gross housing wealth) was inflated to 31 March 2006 using TLA-specific house price indices.

The change in net wealth with the net housing adjustment was computed by adding the adjusted change in net property wealth to the change in other components of net wealth:

$$\Delta NW_{net} = \left(V_{h,w4} - V_{h,w2} \times \frac{HPI_{i,mar06}}{HPI_{i,mar04}} \right) - \left(L_{h,w4} \times \frac{CPI_{mar06}}{CPI_{w4,hed}} - L_{h,w2} \times \frac{HPI_{i,mar06}}{HPI_{i,mar04}} \right) +$$

$$(A_{f,w4} - L_{o,w4}) \times \frac{CPI_{mar06}}{CPI_{w4,hed}} - (A_{f,w2} - L_{o,w2}) \times \frac{CPI_{mar06}}{CPI_{w2,hed}}$$

Note that these formulas leave the interaction term in the "quantity" component of the change. If we had deflated 2006 property wealth to 2004 and then calculated the difference in 2004 prices the interaction term would have been excluded from the quantity component.

$V_{h,w4}$ = Gross housing assets at wave 4, reported RV indexed to 31 March 2006

$V_{h,w2}$ = Gross housing assets at wave 2, reported RV indexed to 31 March 2004

$L_{h,w4}$ = Mortgages reported at wave 4, value as at Household Enumeration Date (HED)

$A_{f,w4}$ = Non-housing (financial) assets at wave 4, value as at HED

$L_{o,w4}$ = Non-housing (other) liabilities at wave 4, value as at HED

$HPI_{i,mar06}$ = House price index as at 31 March 2006 for TLA (i), proxied by average of March and June quarter

$HPI_{i,mar04}$ House price index as at 31 March 2004 for TLA (i), proxied by average of March and June quarter

CPI_{mar06} = Consumer price index as at 31 March 2006, proxied by average of March and June quarter

$CPI_{w4,hed}$ = Consumer price index at wave 4 HED

Appendix C: Effect of random shocks to wealth

The following specifies a simple model for wealth at a point in time, where wealth is the sum of a "permanent" component and an orthogonal "transitory" component:

$w_{i,t}$ = observed wealth for individual i at time t

$\overline{w}_{i,t}$ = permanent wealth for individual i at time t, which is a function of a set of explanatory variables represented by the vector $Z_{i,t}$ (note that permanent wealth is not necessarily constant over time)

$u_{i,t}$ = transitory component of wealth for individual i at time t

Assume that the permanent and transitory components are additive:

$$w_{i,t} = \overline{w}_{i,t} + u_{i,t}$$

$$\overline{w}_{i,t} = f(Z_{i,t})$$

Assume that $u_{i,t}$ is serially correlated according to an AR(1) process and is orthogonal to $\overline{w}_{i,t}$ where ρ captures the persistence of the transitory component:

$$u_{i,t} = \rho u_{i,t-1} + e_{i,t}$$

$$0 \le \rho < 1$$

$$\text{cov}(\overline{w}_{i,t}, u_{i,t}) = 0$$

If $\rho = 0$ the transitory component is not persistent ie, it will be purely random. If $0 < \rho < 1$ the transitory component will be persistent to some degree. Provided that $0 \le \rho < 1$ observed wealth will tend back towards its "permanent" value.

Random shocks to wealth come through $e_{i,t}$

The following are the distributional properties:

$$e_{i,t} \sim iid(0, \sigma_e^2)$$

$$u_{i,t} \sim iid(0, \sigma_u^2)$$

$$\overline{w}_{i,t} \sim iid\left(\mu_{\overline{w},t},\ \sigma_{\overline{w}}^2\right)$$

$$w_{i,t} \sim iid\left(\mu_{\overline{w},t},\ \sigma_{\overline{w}}^2 + \sigma_u^2\right)$$

What does this mean for the distribution of the change in wealth and saving rates by wealth at time t?

Case 1: Assume that permanent wealth is constant for an individual across time but can vary across individuals

$$\overline{w}_{i,t} = \overline{w}_i \qquad \forall t$$

$$E[w_{i,t}] = E[\overline{w}_{i,t} + u_{i,t}] = E[\overline{w}_i + u_{i,t}] = \mu_{\overline{w},t} + 0$$

$$E[w_{i,t} \mid u_{i,t}] = E[\overline{w}_{i,t} + u_{i,t} \mid u_{i,t}] = E[\overline{w}_i + u_{i,t} \mid u_{i,t}] = \mu_{\overline{w},t} + u_{i,t}$$

$$E[w_{i,t+1} \mid u_{i,t}] = E[\overline{w}_{i,t+1} + u_{i,t+1} \mid u_{i,t}] = E[\overline{w}_i + \rho u_{i,t} + e_{i,t+1} \mid u_{i,t}] = \mu_{\overline{w},t} + \rho u_{i,t} + 0$$

Now take the difference:

$$E[w_{i,t+1} - w_{i,t} \mid u_{i,t}] = (\mu_{\overline{w},t} + \rho u_{i,t}) - (\mu_{\overline{w},t} + u_{i,t}) = (\rho - 1)u_{i,t}$$

Compare results for those with negative vs. positive transitory components at time t:

Negative transitory component at time t implies that:

1. Observed wealth at t is less than permanent wealth, and is expected to be less than the mean;
2. Wealth at t+1 is expected to be higher than at t but is expected to remain below the mean if $\rho > 0$;
3. The change in wealth is expected to be positive so that a movement up the wealth distribution is expected.

The following three equations confirm this:

$$u_{i,t} < 0 \xrightarrow{yields}$$

$$E[w_{i,t} \mid u_{i,t}] = \mu_{\overline{w},t} + u_{i,t} < \mu_{\overline{w},t}$$

$$E[w_{i,t+1} \mid u_{i,t}] = \mu_{\overline{w},t} + \rho u_{i,t} < \mu_{\overline{w},t}$$

$$E[w_{i,t+1} - w_{i,t} \mid u_{i,t}] = (\rho - 1)u_{i,t} > 0$$

Positive transitory component at time t implies that:

1. Observed wealth at t is greater than permanent wealth, and is expected to be above the mean;
2. Wealth at t+1 is expected to be lower than at t but is expected to remain above the mean if $\rho > 0$;
3. The change in wealth is expected to be negative so that a movement down the wealth distribution is expected.

The following three equations confirm this:

$u_{i,t} > 0 \xrightarrow{yields}$

$$E[w_{i,t} \mid u_{i,t}] = \mu_{w,t} + u_{i,t} > \mu_{w,t}$$

$$E[w_{i,t+1} \mid u_{i,t}] = \mu_{w,t} + \rho u_{i,t} > \mu_{w,t}$$

$$E[w_{i,t+1} - w_{i,t} \mid u_{i,t}] = (\rho - 1)u_{i,t} < 0$$

The implication is that those who experienced positive (negative) transitory components at time t are expected to have wealth above (below) the mean at time t and are expected to face a fall (rise) in net wealth between t and t+1.

Compare results for two randomly chosen individuals:

Consider two randomly chosen individuals j and k and suppose that $u_{j,t} < u_{k,t}$

Individual j is expected to have a lower level of observed wealth than individual k at both time t and t+1 if $\rho > 0$:

$$E[w_{j,t} \mid u_{j,t}] = \mu_{w,t} + u_{j,t} < \mu_{w,t} + u_{k,t} = E[w_{k,t} \mid u_{k,t}]$$

$$E[w_{j,t+1} \mid u_{j,t}] = \mu_{w,t} + \rho u_{j,t} < \mu_{w,t} + \rho u_{k,t} = E[w_{k,t+1} \mid u_{k,t}]$$

The increase in observed wealth for individual j is expected to be larger than for individual k:

$$E[w_{j,t+1} - w_{j,t} \mid u_{j,t}] = (\rho - 1)u_{j,t} > (\rho - 1)u_{k,t} = E[w_{k,t+1} - w_{k,t} \mid u_{k,t}]$$

Note:

$(\rho - 1)u_{j,t} > (\rho - 1)u_{k,t}$ as $0 < \rho < 1$ and $u_{j,t} < u_{k,t}$

We would therefore expect to observe higher (lower) levels of wealth at time t and smaller (larger) increases in wealth between t and t+1 for those with relatively high (low) transitory components at t.

Case 2: "Permanent" wealth differs across individuals and across time

Assume that permanent wealth can change over time. Recall that the transitory component is uncorrelated with permanent wealth:

$$\mathrm{cov}(\overline{w}_{i,t}, u_{i,t}) = 0$$

This assumption amounts to saying that those with relatively high levels of permanent wealth are no more or less likely than those with relatively low levels of permanent wealth to experience positive (or negative) shocks to wealth.

Assume that the change in permanent wealth between t and t+1 is uncorrelated with observed wealth at t:

$$\mathrm{cov}(\overline{w}_{i,t+1} - \overline{w}_{i,t}, w_{i,t}) = 0$$

The following expectations can be derived:

$$E[w_{i,t}] = E[\overline{w}_{i,t} + u_{i,t}] = \mu_{\overline{w},t}$$

$$E[w_{i,t} \mid u_{i,t}] = E[\overline{w}_{i,t} + u_{i,t} \mid u_{i,t}] = \mu_{\overline{w},t} + u_{i,t}$$

$$E[w_{i,t+1} \mid u_{i,t}] = E[\overline{w}_{i,t+1} + u_{i,t+1} \mid u_{i,t}]$$

$$= E[\overline{w}_{i,t+1} + \rho u_{i,t} + e_{i,t+1} \mid u_{i,t}]$$

$$= \mu_{\overline{w},t+1} + \rho u_{i,t} + 0$$

$$E[w_{i,t+1} - w_{i,t} \mid u_{i,t}] = (\mu_{\overline{w},t+1} + \rho u_{i,t}) - (\mu_{\overline{w},t} + u_{i,t})$$

$$= (\mu_{\overline{w},t+1} - \mu_{\overline{w},t}) - (\rho - 1)u_{i,t}$$

Consider two randomly chosen individuals j and k and suppose that $u_{j,t} < u_{k,t}$

Recall that the transitory component is assumed to be uncorrelated with permanent wealth and so the expected value of permanent wealth will be the same for these two individuals. It follows that individual j is expected to have a lower level of observed wealth than individual k both at time t and t+1 if $\rho > 0$:

$$E[w_{j,t} \mid u_{j,t}] = \mu_{\overline{w},t} + u_{j,t} < \mu_{\overline{w},t} + u_{k,t} = E[w_{k,t} \mid u_{k,t}]$$

$$E[w_{j,t+1} \mid u_{j,t}] = \mu_{\overline{w},t+1} + \rho u_{j,t} < \mu_{\overline{w},t+1} + \rho u_{k,t} = E[w_{k,t+1} + \mid u_{k,t+1}]$$

Under the assumption that the expected change in permanent wealth is uncorrelated with observed wealth, the change in permanent wealth is expected to be the same for both individuals. However, the increase in observed wealth for individual j is expected to be larger than for individual k:

$$E[w_{j,t+1} - w_{j,t} \mid u_{j,t}] = [(\mu_{\overline{w},t+1} - \mu_{\overline{w},t}) + (\rho - 1)u_{j,t}]$$

$$> [(\mu_{\overline{w},t+1} - \mu_{\overline{w},t}) + (\rho - 1)u_{k,t}]$$

$$= E[w_{k,t+1} - w_{k,t} \mid u_{k,t}]$$

Note:

$(\rho - 1)u_{j,t} > (\rho - 1)u_{k,t}$ as $0 < \rho < 1$ and $u_{j,t} < u_{k,t}$

We would therefore expect to observe higher (lower) levels of wealth at time t and smaller (larger) increases in wealth between t and t+1 for those with relatively high (low) transitory components at t.

Therefore the distribution of the change in wealth between t and t+1 by observed wealth at time t will tend to show lower increases for those towards the top of the distribution than for those further down the distribution. Those at the top of the distribution at time t are also more likely to experience a fall in wealth between t and t+1.

The distribution of change in wealth between t and t+1 by observed wealth at time t+1 will show the opposite pattern. The more positive the transitory shock at wave t+1, the higher observed wealth at time t+1 is likely to have been, the higher the expected increase in wealth from time t, and the lower the likelihood of a decrease in wealth over this period.

Is it better to look at the distribution of the change in wealth by wealth averaged over t and t+1?

$$E[w_{i,t+1} + w_{i,t} \mid u_{i,t}] = E\left[\tfrac{1}{2} \times (\overline{w}_{i,t} + u_{i,t} + \overline{w}_{i,t+1} + u_{i,t+1}) \mid u_{i,t}\right]$$

$$= \tfrac{1}{2} \times (\mu_{\overline{w},t} + \mu_{\overline{w},t+1}) + \tfrac{1}{2} \times \mathrm{E}\left[u_{i,t} + u_{i,t+1} \mid u_{i,t}\right]$$

$$= \tfrac{1}{2} \times (\mu_{\overline{w},t} + \mu_{\overline{w},t+1}) + \tfrac{1}{2} \times \mathrm{E}\left[u_{i,t} + \rho u_{i,t} + e_{i,t+1} \mid u_{i,t}\right]$$

$$= \tfrac{1}{2} \times (\mu_{\overline{w},t} + \mu_{\overline{w},t+1}) + \tfrac{1}{2} \times \mathrm{E}\left[u_{i,t}(1+\rho) \mid u_{i,t}\right] + 0$$

$$= \tfrac{1}{2} \times (\mu_{\overline{w},t} + \mu_{\overline{w},t+1}) + \tfrac{1}{2} \times u_{i,t}(1+\rho)$$

Average of observed wealth would be expected to equal average permanent wealth if the transitory component is not persistent ie, if $\rho = 0$. Therefore only in this case would taking averages of wealth at t and t+1 overcome the problem above.