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Abstract.

We explore asset holding diversification by Australian households, in particular, the household asset diversification participation decision (whether or not to diversify at all) is jointly estimated with the decision of how much to diversify. In so doing, recent literature on the modelling of proportions is combined with the growing body of research concerning household financial decision making. Our findings are consistent with the participation of households operating in diverse financial markets being constrained by ineffective information conduits, influencing the decision of whether or not to diversify. We further find that short term concerns over job security or health are associated with less participation in, as well as a lower extent of, asset holding diversification.

Key words: asset allocation, asset diversification, household finance, Zero-Inflated Beta. JEL J3, J7

* This paper uses unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research Melbourne Institute). The findings and views reported in this paper, however, are those of the authors and should not be attributed to either DSS or the Melbourne Institute.

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1. Introduction

Household finance is a relative new research field which has yet to establish a set of commonly accepted stylised facts (Campbell 2006). Finance and portfolio theory predicts that households, once they have taken fixed costs into account, should gamble with expected positive returns and participate in a range of asset holdings (Merton 1971, 1973; Campbell 2006, page 6). Nevertheless, there are a substantial number of even wealthy households who have no exposure to equity risk (Carroll 2002). This empirical finding characterizes household finance and represents a challenge to finance theory.

The literature on household diversification in financial markets also notes that household asset diversification behaviour differs strongly across the wealth distribution (Bertaut and Haliassos, 2006; Bertaut and Starr-McCluer, 2002; Tracy *et al*. 1999). In particular, households in the lower quartile of the wealth distribution often hold almost exclusively liquid assets and vehicles, with few homeowners. Moving towards the median, the number of households holding real estate (mainly owner-occupied housing) increases and mortgage debt is consequently important for these middle-class households. Households in the top quartile of the wealth distribution are considerably more likely to include risky assets holdings in the form of private business assets (Gentry and Hubbard, 2004). Equity has less relevance for middle class households, while portfolio share sensibly increases for wealthy households.

The limited participation by many households in the equity market observed in practice has also been explained by "ignorance" of stocks as an asset class, for example, Guiso and Jappelli (2005) find that 35% of Italian households were unaware of stocks as an investment possibility. Ignorance and misperceptions may constitute a barrier to stockholding that can be overcome by relevant education and free acquisition of information (Haliassos and Bertaut, 1995 and Guiso *et al.* 2005). More educated households may also diversify their portfolios more efficiently and expect to earn higher returns per unit of risk when they decide to participate in financial markets. Further explanations include the presence of non-standard household preferences or the presence of fixed-costs that prevent financial market participation (Vissing-Jorgensen, 2003); lack of trust in other people (Guiso *et al.*, 2005); and/or social isolation (Hong *et al.*, 2004).

This study exploits the very rich information collected by the Household, Income and Labour Dynamics in Australia (HILDA)[1] survey on household asset allocations to analyse the

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determinants of Australian households' savings allocations. In particular, we jointly estimate the household asset diversification participation decision (whether or not to diversify) with the decision of how much to diversify, where the distribution of household's assets holdings is measured in terms of a standardised Gini Index.

Household wealth has only been rarely measured in Australia. The first survey was included in the national census of 1915 which found the top decile of the population was holding some 90% of the population's wealth (Headey *et* al, 2008, page 2). The second survey undertaken was the Australian Survey of Consumer Expenditures and Finances (ASCEF); a joint effort between Macquarie and Queensland Universities, with data for over 5,000 urban households collected between 1966 and 1968 (Edwards et al, 1968). The ASCEF survey was used by Podder (1971) to explore consumption patterns at the family level and by Kakwani and Podder (1973) to consider alternative procedures for estimating Lorenz curves for Australia. The ASCEF survey is also employed by Izan and Clements (1985) to estimate Engel curves for, and the dispersion of, portfolio holdings across households. The ASCEF survey was constrained, however, by its focus on urban households and was criticized for consequently ignoring many poorer households in Australia. The third survey of household wealth was that included in the HILDA survey of 2002, in a special wealth module devised with the assistance of the Research Bank of Australia. The findings are reviewed at length in Heady *et al* (2008). A common feature across all these surveys is that the share of wealth devoted to home ownership is very high in Australia, reflecting distinctive institutional features of the Australian economy.

Our contribution to the household finance literature is to combine recent literature on the modelling of proportions (Cook et al. (2008) with the small but growing body of empirical research concerning household financial decisions and assets allocations (Campbell 2006) to estimate asset holding diversification by Australian households. In the process, we will include findings from both the 2002 and the newer wealth module survey included in the 2006 wave of HILDA.

The remainder of the paper is organized as follows. Section 2 provides a brief overview of the estimation issues that arise when modelling the Gini index and a description of the model used in this study. Section 3 discusses the HILDA data, sample selection and the observed diversification of asset allocations. Section 4 considers the estimation results, Section 5 addresses robustness and Section 6 provides conclusions.

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2. Estimation.

Measuring Assets Holdings Diversification and the Gini Index

There are a range of possible measures of diversification that could be used; amongst the most popular are the Thiel, the Atkinson, and the Gini indices (for an extensive comparative discussion of these, and other, inequality measures see De Maio (2007)). The latter two indices can be generalised to allow for more (or less) weight on selected parts of the distribution being addressed. The Theil index is a General Entropy measure which is set equally sensitive to changes across the distribution (rather than, for example, applying higher weights to changes at the lower end of the distribution). The Atkinson indices have a variable weighting parameter measuring aversion to inequality, and share many properties with the more familiar Gini index. The Gini is often the preferred measure for economic researchers (and will be the preferred measure for for our study) because, deriving as it does from a comparison of the Lorenz curve with the diagonal of equality, it has relevant theoretical and statistical properties for economic analysis. It is a full information measure addressing all parts of the distribution, allows for flexible weighting possibilities, and enables direct comparison across populations.

The diversification of household assets holdings is therefore measured here in terms of the familiar Gini Index:

$$Y = 1 - \sum_{i=1}^{k} f_i^2 , \qquad 0 \le \sum_{i=1}^{k} f_i^2 \le \sum_{i=1}^{k} f_i = 1$$

where f_i is the value of asset *i* on the value of the total *k* classes of assets.

The Gini index is able to describe full homogeneity, full heterogeneity, and the scenarios in between. The full homogeneity situation occurs when the household keeps all its assets holdings in the form of one asset. In this case the weight of the j^{th} asset is equal to 1 and is equal to 0 for the remaining assets:

$$f_j = 1, j \in (1,\ldots,k); f_i = 0, \forall i \neq j .$$

and the Gini Index is equal to 0:

$$Y = 1 - \sum_{i=1}^{k} f_i^2 = 1 - 1_j^2 - \sum_{i=1}^{k-1} 0^2 = 0 .$$

In the full heterogeneity situation, the household keeps all the assets holdings equally distributed across the *k* assets and the weights are equal across the different assets:

$$f_1 = f_2 = \ldots = f_k = \frac{1}{k}.$$

In order to have a standardized measure whose bounds do not depend on the number of assets *k* the following transformation is usually applied, yielding the *standardized* Gini Index (SGI):

$$y = \frac{k}{k-1} Y \, .$$

The standardized Gini Index (SGI) is used in this study as the dependent variable in the empirical estimation.

Modelling Strategy

The preferred estimation model is strongly dictated by the nature of the dependent variable (the standardised Gini Index, SGI). Whilst the SGI is not a proportion *per se,* it is a function of proportions and can be regarded as a "proportion" from a modelling strategy perspective. It is essential to allow for the bounded nature of the dependent variable which ranges continuously from 0 to 1, inclusively. A simple way to model response variables that range continuously from 0 to 1 is to use a logit transformation[2], however, the logit transformation does not address the extreme values of 0 and 1. A practical solution would be to drop the observations with 0/1 values but that would imply a truncation problem. An alternative solution is to recode the extreme values ("winsoring") as 0.0001 or 0.9999. Some researchers have also used censored normal regression models to handle the presence of 0/1 values in proportion data (see Rajan and Zingales (1995); Cardac and Wilkins (2009)). The Tobit model may seem appropriate for modelling the conditional mean of a continuously measured proportion, however, as Maddala (1991) points out, this kind of variable is not observationally censored but rather is defined only over the interval [0,1].

The Fractional Logit approach, developed by Papke and Wooldridge (1996), can handle proportions where both zeros and ones may appear. This approach makes a combined use of the logit transformation for the response variable and the binomial distribution. While

[2] Using Ordinary Least Squares to model proportions gives rise to the same problem encountered in the linear probability model, that is, the predictions of the model can be outside the range [0,1].

properly handling 0/1 values, the model does not allow for an alternative data generating process for the extreme values. If different processes or factors yield the observations at the limiting point, a sample selection issue arises (Li and Nagpurnanand, 2007).

The Zero-Inflated Beta (ZIB) model addresses the self-selection issue by allowing for differential influences on the zero and nonzero values (Cook *et al.,* 2008). The ZIB model exploits the idea of having a probability mass at zero and adopts the two-parameter beta distribution for the continuous portion of the distribution. Kieschnick and McCullough (2003) and Ferrari and Cribari-Neto (2004) provide evidence that a regression model based on the two-parameter beta distribution is a reasonable specification for modelling the conditional expectation of a variable distributed over (0,1). Following Cook *et al.* (2008), the components of the Zero-Inflated Beta regression model are formulated as follows:

$$f\left(\mathbf{y_i} = 0 \mid \mathbf{X_i}\right) = 1 - C\left(\boldsymbol{\alpha}'\mathbf{X_i}\right) \text{ for } \mathbf{y_i} = 0. \qquad (1)$$

Where $\mathbf{X_i}$ is a matrix of explanatory variables, and $C\left(\boldsymbol{\alpha}'\mathbf{X_i}\right)$ represents the probability of choosing to diversify. Implementing a pooling approach implies each $\left(\mathbf{y_i}, \mathbf{X_i}\right)$ has *T* rows. Equation (1) models the probability mass at 0, but should be interpreted in terms of the probability of whether or not *not* to diversify. The second component of the model is:

$$f\left(\mathbf{y_i} \mid \mathbf{X_i}\right) = C\left(\boldsymbol{\alpha}'\mathbf{X_i}\right)\left[\frac{\Gamma(\varphi)}{\Gamma\left(\boldsymbol{\mu_i}\varphi\right)\Gamma\left((1-\boldsymbol{\mu_i})\varphi\right)}\mathbf{y_i}^{\boldsymbol{\mu_i}\varphi-1}\left(1-\mathbf{y_i}\right)^{(1-\boldsymbol{\mu_i})\varphi-1}\right] \text{ for } 0 < \mathbf{y_i} < 1. \qquad (2)$$

The likelihood can be represented as:

$$L_i\left(\alpha, \mu_i(\beta), \varphi \mid \mathbf{y_i}\right) = \begin{cases} 1 - C\left(\boldsymbol{\alpha}'\mathbf{X_i}\right) & \text{for } \mathbf{y_i} = 0, \\ C\left(\boldsymbol{\alpha}'\mathbf{X_i}\right)\left[\dfrac{\Gamma(\varphi)}{\Gamma\left(\boldsymbol{\mu_i}\varphi\right)\Gamma\left((1-\boldsymbol{\mu_i})\varphi\right)}\mathbf{y_i}^{\boldsymbol{\mu_i}\varphi-1}\left(1-\mathbf{y_i}\right)^{(1-\boldsymbol{\mu_i})\varphi-1}\right] & \text{for } 0 < \mathbf{y_i} < 1. \end{cases}$$

Where φ is a parameter of the beta distribution (in the square brackets of equation 2 and the likelihood function). The beta distribution is defined according to the Generalized Linear Model convention where one models the mean of the distribution of the dependent variable changing as the explanatory variables change. The explanatory variables $\mathbf{X_i}$ enter the beta distribution through $\boldsymbol{\mu_i}$ (where each $\boldsymbol{\mu_i}$ has *T* rows):

$$\boldsymbol{\mu_i} = \beta_0 + \beta_1 X_{\mathbf{1i}} + \beta_2 X_{\mathbf{2i}} + \ldots + \beta_k X_{\mathbf{ki}} \qquad (3)$$

The coefficients on X are not constrained to being the same, equivalently the vector $\boldsymbol{\alpha}$ is not assumed to be the same as the vector $\boldsymbol{\beta}$, since the discrete part of the distribution can potentially be modelled separately to the continuous part. In other words, the exogenous variables can have different effects on the decision to diversify than on the decision of how much to diversify. A logistic function is used here to represent the probability, $C(\boldsymbol{\alpha}'\mathbf{X_i}) = \Lambda(\boldsymbol{\alpha}'\mathbf{X_i})$. Using a logistic function for this selection equation is consistent with other studies in the financial and expenditure literature (see Yoo, 2004) or in more technical studies (see Papke and Wooldridge, 1996).[3]

3. Data and variable description.

We use data collected by the Household, Income and Labour Dynamics in Australia (HILDA) survey. The HILDA survey started in 2001 and is an annual nation-wide longitudinal survey of Australian households occupying private dwellings. For greater detail on the response rates, structure, and changes over time in the HILDA design see Summerfield *et al* (2013).

HILDA collects information on a range of topics including economic and subjective well-being, labour market dynamics and family dynamics. Of particular relevance to a study of the portfolio allocation decisions of Australian households is the wealth survey module included in the second (2002) and sixth (2006) waves of HILDA surveying. The questions covered topics such as cash and equity investments, trust funds, life insurance; home and other property assets and debts; business assets and debts; children's bank accounts; collectables and vehicles. HILDA can be considered an ideal dataset to study household assets allocations as it meets the criteria specified by Campbell (2006).[4] A potential weakness of annual surveys, such as HILDA, is the failure to capture intra-year dynamics. To address

[3] The above approach to modelling the diversification of portfolios could be argued to be essentially reduced form. An alternative approach might be to use the asset holding data themselves to estimate more structural equations. These estimates could then be used to analyse the implications of each variable for Gini.

[4] As argued by Campbell (2006), an ideal dataset should have the following characteristics: (1) be representative of the whole population; (2) wealth should be measured accurately; (3) wealth categories should be exhaustively disaggregated; (4) data should be reported with a high level of accuracy; (5) households should be tracked over time.

this problem, HILDA respondents are asked to recall information, especially with respect to labour market and social security histories, over the course of the previous year.

An additional attractive feature of the HILDA data is the further inclusion of job insecurity measures; this is particularly rare amongst economic surveys. Indeed, to the best of our knowledge, the only other relevant surveys containing similar information on employment prospects are: the Health and Retirement Survey (HRS), conducted at the University of Michigan since 1992; the Survey of Economic Expectations (SEE), conducted at the University of Wisconsin-Madison since 1994; and the Survey on Household Income and Wealth (SHIW) conducted at the Bank of Italy during the years 1995 and 1998. The problem with these latter three surveys, for the purposes of this study, is that they either collect information only at an individual level or they collect information only for a random sample of members within each household. This leaves HILDA as the preferred data source for this study. Table 1 provides definitions for the variables used in the analyses, further explanations are provided below.

The Household

As household characteristics are often summarized by reference to the head of the household (HH), it is clearly important to identify who the "head" of the household is. The criterion changes according to whether the household is represented by (i) a single person (or lone parent) or (ii) a couple (with or without children) family. The identification of the HH for the first household category (i.e. single persons or lone parents) is straightforward. The identification of the HH for the second household category (i.e. couple with/without children) is as follows. If the male is employed then the male is selected as the HH. If the male is not employed and the female is employed, then the female is selected as the HH. This 'male-dominant' ranking is standard in the literature (see Cardak *et al.*, 2009), is consistent with observed employment behaviour in Australia (Mumford and Smith, 1999), and allows for more consistent cross study comparison.

In order to consider the implications of unemployment risks (discussed further below), only those households where the HH is employed are included in the analysis (as information on subjective job insecurity is only available for individuals supplying a positive number of hours of work in HILDA).

Table 2 provides descriptive statistics including the HH gender distribution and their employment status. There are 9083 households in the pooled sample of interest, most of whom have a male HH. On average, 89 per cent of the male HH are employed full-time in

both waves, the full-time employment rate is substantially lower (59 per cent and 62 per cent in the first and second wave, respectively) for female HHs (see Table A1 in the Appendix).

Financial Assets Holdings

Household assets are grouped in the HILDA data according to the following eleven distinct components:

1. Equity investments: shares, managed funds (mutual funds) and real estate investment trusts;
2. Cash investments: government bonds, corporate bonds, debentures, certificates of deposit, mortgage-backed securities;
3. Trust funds also including children's trust funds but excluding property trusts;
4. Bank accounts;
5. Cash-in value of redeemable life insurance policies (policies paid on death excluded);
6. Home value;
7. Other properties value;
8. Businesses value;
9. Vehicles;
10. Collectibles, antiques, works of art;
11. Superannuation.

Table 3 presents descriptive statistics for the households' holdings of these assets (as well as income and wealth measures). The largest shares in the households' financial portfolio are equity investments, bank accounts and superannuation. Superannuation is a mandatory employer-based retirement saving scheme in Australia introduced in 1992 as a support to the existing pay-as-you-go pension scheme whereby employers are required by Federal law to contribute to the employee's retirement account. Originally this contribution was around 3% of the gross salary and has subsequently increased through the years reaching 9%. This mandatory retirement saving scheme now covers some 90% of the employees. (The superannuation scheme does not apply to employees who are older than 70; earn less than a minimum threshold per month; or younger than 18 and work less than 30 hours per week.) Given the primarily mandatory nature of superannuation, this variable is excluded from the computation of the dependent variable, leaving 10 distinct categories of assets households can choose between. (The sensitivity of the results to this assumption is considered in Section

5 when robustness is addressed and the analysis is replicated with the inclusion of superannuation.)

The main class of assets in equity investments are shares or common stock. Share ownership is widespread in Australia with 43% of households holding shares (see Table 3). Other important household assets are houses, other properties and businesses. Differences in asset ownership through the wealth distribution are very apparent in Table 3, this is particularly so for household net income; equivalised income[5]; net worth (the difference between total assets, financial and non-financial, and total debts); and the risky assets ratio (the ratio of equity investments to total financial assets holding). The distribution of equity assets is highly skewed; the median household typically holds no risky assets, while households at the 75th and 90th percentiles hold on average $9,000 and $60,000 of these assets, respectively. The distribution of other holdings can also be seen to be highly skewed in Table 3 (such as cash holdings). As expected, there are also many zero recordings, especially amongst the lower percentiles.

Figure 1 reports the distribution of the Standardised Gini Index (SGI) measuring how homogeneously, or heterogeneously, households' assets holdings are diversified across the ten different assets categories. The distribution seen in Figure 1 is quite common in financial applications; the spike at 0 indicates that a large number of Australian households do not diversify and instead keep all assets holdings in a single asset category (typically bank accounts, homes or vehicles). The spike also indicates that there could be a selection mechanism occurring. Implying factors affecting the decision to diversify could impact differently on the decision of how much to diversity given that the household has decided to diversify.[6] We will explore this further via estimation with the ZIB model below.

Explanatory variables.

Attitudes to Risk

It has long been recognised in the economic literature that individuals may react differently to the same risk scenario according to their attitude towards risk (their risk preferences). Attitudes towards risk are approximated by the information contained in the response to the following survey question:

[5] Equivalised income adjusts income for household size (dividing income by 1 plus 0.5 for each adult other than the head and 0.3 for each child).

[6] Figures plotting the predicted Gini against equivalized income, for all three models, are available from the authors upon request.

Which of the following statements comes closest to describing the amount of financial risk that you are willing to take with your spare cash? That is, cash used for savings or investment.

1. *Take substantial risks expecting substantial returns;*
2. *Take above-average risks expecting above-average returns;*
3. *Take average financial risks expecting average returns;*
4. *Not willing to take financial risks;*

Risk aversion is measured with an indicator variable set equal to 1 if the individual is not willing to take financial risks (response "4") and 0 otherwise. Risk loving is measured with an indicator variable that is equal to 1 if the individual either takes substantial risks expecting substantial returns (response "1") or takes above-average risks expecting above-average returns (response "2") and 0 otherwise. Table 2 reveals that 28 per cent of the households were risk averse in the pooled sample whilst only 11 per cent were risk loving. These are obviously only general indicators of risk attitude. Risk aversion and risk loving behaviour relate to very specific characteristics of the utility function which is clearly not being modelled here and are instead only being approximated (Hanna and Lindamood, 2004). Attitudes towards risk (being risk averse or risk loving) should be interpreted accordingly throughout this paper.

Measures of Background Risk

Many households face common relevant background risks: labour market income risk; health risk; and committed expenditure risk (see Table 2). By definition, all of the heads of households included in this study are employed; male HH are more likely to be employed in full time jobs (89 per cent) than are the female HH (61 per cent), see Table A1 of the Appendix. They may nevertheless be concerned about prospects for future employment in their job. As discussed above, a particularly attractive characteristic of the HILDA survey is the presence of subjective job insecurity information. The job insecurity measure (*future employment worry*) used in this study is a binary variable obtained from the following question: "I have a secure future in my job" with answers ranging from 1 [Totally Disagree] to 7 [Totally Agree]. The binary variable is set to 1 (Worried) if the original variable is less than the midpoint 4 and 0 (Not Worried) otherwise. It is relatively common to have job insecurity worries, 31 per cent of the pooled sample do (Table 2). Male and female HH's are similarly likely (81 and 83 per cent, respectively) to be not worried about their future

employment in time *t* (2006) given that they were not worried in period *t-1* (2002) [7], with male HHs being slightly more likely to remain worried about the future security of their job (39 versus 35 per cent for males and females, respectively), as shown in Table A2 of the Appendix.

The between and within variations of this job insecurity measure are similar across the two genders. The between summary indicates that 41.6 per cent of the male HH's were worried at least once about their future employment in the two waves (36.2 per cent of the female HH were). The within summary indicates that 78.6 per cent of the male HH's who were ever worried about their future employment, were always worried about their future employment. The percentage rises to 87.2 per cent in the female HH case (see Table A3 in the Appendix).

Risk associated with health status can be seen both as a source of income risk as well as source of expenditure risk. Even though Australia provides access to public health care, in practice there are indirect costs that would reasonably be expected to arise in the case of a negative health shock. The health variable is based on a self-assessed measure ranging from 1 to 5, which is recoded as a binary variable indicating whether or not the individual reports that they have poor health status. Some one in ten heads of households report they have poor health status (Table 2).

Committed expenditure risk is measured in terms of the burden of main residence mortgages and rent on household disposable income (i.e. mortgage and rent ratios). As discussed above, housing is an important long-term asset (especially for the middle-class) that also delivers housing services to owners. Housing is also an illiquid asset and it is costly for homeowners to adjust housing services consumption in response to economic shocks. Illiquidity may have serious implications for both homeowners and non-homeowners including discouraging homeownership, and/or financial risk-taking by homeowners (Fratantoni, 2001; Cocco, 2005; Shore and Sinai, 2010; Davidoff, 2006).

Housing plays an additional role as it can be used as collateral to facilitate borrowing and borrowing constraints are an important feature of household finance. In an inter-temporal setting, the households' future consumption is determined not only by their wealth and investment opportunities, but also by future net income if they are borrowing constrained. Moreover, borrowing constraints vary across the age distribution: they are typically more binding for young households than for older households (who may have already accumulated retirement savings). The modelling of asset diversification clearly requires liquidity

[7] Given two states *i* and *j* and two time periods, the probability of transitioning from one state (*i)* to another (*j*) can be expressed as $p_{ij} = Pr\{X_t = j \mid X_{t-1} = i\}$.

constraints to be taken into account. Liquidity constraints are proxied here by information obtained from the following survey question: *Suppose you had only one week to raise $2000 for an emergency. Which of the following best describes how hard it would be for you to get that money?* Liquidity constraints are captured in this context by a binary indicator set equal to 1 if the individual responded that they "could not raise emergency funds" and 0 otherwise.

Other explanatory characteristics

Measures of risk (although major influences on savings allocations) are not the only likely determinants of financial risk exposure. Other household characteristics such as income (household disposable income); net worth (the difference between all assets and debts held by the household); age; educational attainment; occupation; industry; region of residence; and social interaction may also be significant determinants (Campbell 2006).

Considering the demographic measures in more detail, the average household head in the pooled sample is 41.5 years old, 69 per cent of them are coupled, and two thirds of households have a dependent child present (Table 2). Heckman and Robb (1985) and Ameriks and Zeldes (2004) argue that portfolio choice should be affected by time effects, age effects and cohort effects; however these effects, in particular cohort effects, cannot be easily disentangled[8]. In common with much of the literature (see Heaton and Lucas, 2000) cohort effects are set to zero here enabling the estimation of age effects.

According to Guiso *et al.* (2005) and Haliassos and Bertaut (1995) education is an able predictor of equity ownership as ignorance and misperceptions constitute a barrier to stockholding that can be overcome by education and the free acquisition of information. Education is also a measure of human capital. Furthermore, more educated households can diversify their portfolios more efficiently and expect to earn higher returns per unit of risk when they decide to participate in financial markets[9]. There are considerable numbers of Australian households where the head has secondary or lower level education (some 36 per cent, see Table 2), with only 26 per cent having tertiary level qualifications.

Social interaction would be expected to facilitate transferral and effective sharing of information which may be an important determinant in assets distribution (Hong *et al.*, 2004;

[8] At a given time t, a person born in year b, is a_t years old, namely, $a_t=t-b$. Therefore, it is not possible to separately identify a_t, t, and b. Even with highly detailed panel data, the data structure could be fit equally well just using (a_t, t), (a_t, b) or (t, b). Cohort effects are the most problematic to capture. Cohort effects could in principle capture the effect of different labour market experiences on the human to financial wealth ratio of each cohort at different ages.

[9] A large component of wealth for most households is human capital, which is non-tradable. The human capital literature has started to treat education as a risky investment chosen jointly with risky financial assets (see Palacios-Huerta, 2003). As reported in Heaton and Lucas (2000) and Campbell and Viceira (2001), this background risk increases risk aversion and may result in the household investing more cautiously, partially offsetting the relationship between education and diversification.

Guiso *et al.*, 2005). More informed individuals have better chances to form correct expectations of financial markets and consequently to behave more efficiently. Social interaction is measured from the respondent reporting his/her satisfaction to the statement "*I feel part of my local community*". The levels of satisfaction range from 0 (totally dissatisfied) to 10 (totally satisfied). If the level of satisfaction is over the mid-point 5, the binary variable is set equal to 1 and the household is interpreted as socially interacting.[10]

Table 2 also reports the geographical distribution of the selected households across the two waves. Even though there is some movement across the different regions, the household distribution is generally constant across years. The occupation and industry distributions also remain fairly stable across the two genders. Male HH's are more likely to be managers, technicians, machinery operators and drivers. In contrast, female HH's occupy more professional, clerical and administrative occupations. The majority of male HH's are employed in the manufacturing, construction and transportation industries, whereas most of female HH's are employed in the health care and education sectors.

4. Results

The results can be seen to be broadly consistent qualitatively across the three models as shown in Table 4, however, there are notable examples of significant differences.

Considering the results in more detail, richer households, both in terms of disposable income and in terms of their net worth, are more likely to decide to diversify their asset holdings (column 3)[11] and to have a higher degree of asset diversification (columns 1, 2 and 4) in accordance with finance theory predictions. Analogously, households with liquidity constraints are less likely to have more extensive assets diversification and they are also less likely to diversify at all. Short term (up to 12 month) health and job insecurity concerns were predicted to be related to asset under-diversification. The results support these priors in both cases across all three models. And, compared to single person households, couples are found to be more likely to have more diverse asset holdings. The last parameter estimate reported in Table 4 refers to the time measure that is consistently statistically significant; households choosing to diversify and the extent of their asset holding diversification increased between 2002 and 2006.

[10] The HILDA survey includes more than one potential measure of social interaction which we found to have less explanatory power, these measures include "satisfaction with the neighbourhood in which you live"; "how often get together socially with friends/relatives not living with you"; and 'I seem to have a lot of friends'. These variables appear to be capturing an active social life rather than being related to sharing financial information. The measure of social interaction that we include in our estimation better captures the idea conveyed by the model and is more consistent with the literature.

[11] As discussed above, equation (1) models whether or not *not* to diversify, so the reported coefficients for the participation equation (reported in column 3) are rescaled by -1 to allow for intuitive interpretation; the discussion that follows, is therefore also conducted in terms of whether or not to diversify.

Differences in reported results in column 3 (choosing to diversify) and column 4 (the extent of diversification) of Table 4 indicate that some of the explanatory variables are having differential impacts on the selection than the level decision. For example, households with a higher mortgage ratio (i.e. households with a heavier mortgage burden) are found to have less extensive assets diversification. However, the mortgage ratio is not statistically significant in the selection equation.

Using the ZIB model to separate the choice of diversifying from the extent of diversification also reveals different interpretations of risk attitudes. Results for the Tobit and Fractional Logit model would suggest a positive (negative) relationship between being risk loving (averse) and asset holding diversification. Results from the ZIB estimation reveal an insignificant relationship once the choice to diversify is allowed for. A similar pattern is found with rent ratios.

Considering the demographic variables, all the estimated models suggest a quadratic relationship between the distribution of asset holding and age (see columns 1, 2 and 4). The turning points with respect to age are approximately 60 years in each estimate. Having crossed the turning points, it is less likely that the households will increase the extent of their asset holding diversification. Whilst qualitatively similar, the decision to participate in asset holding diversification (column 3) is actually not found to be significantly related to age: neither the level nor the quadratic are significantly different from zero in the selection equation.

The presence of dependent children is associated with being more likely to choose to participate in diversification but not found to be significantly related to the distribution of household asset holding[12] in any of the three models, this is perhaps unsurprising as children are not likely to be directly involved in this diversification.

Considering the potentially important relationship between education and asset diversification (the omitted category is less than secondary school education), there is evidence that completing secondary education is associated with greater diversification in the ZIB model (column 4) but the findings are generally not significant in the other models. Post-secondary education is generally found to have a statistically significant association with asset diversification at conventional confidence levels[13]. For those with tertiary qualifications, however, the relationship with the decision to participate is not significant. It would appear that higher levels of education are associated with more diversification but not necessarily

[12] This issue was further analysed by including interactive measures between couples with and without dependent children; they were not found to be significantly relevant at conventional confidence levels.
[13] We also considered a more detailed approximation to actual years of education and found no significant association with asset diversification.

being more likely to choose to diversify. The consistency of these findings may be constrained by the general nature of the education measure being considered. In particular, specific education of financial markets may be required in order to take appropriate assets diversification decisions. Nevertheless, it is reasonable to conclude that post-secondary education is associated with greater asset holding diversification in Australian households.

A further interesting result is the positive relationship found between social interaction and diversification. Comparing results across all four columns implies that social interaction facilitates asset holding diversification but it is not related to the participation decision of whether or not to diversify at all. A similar result to that found for the tertiary educated.

Finally, regional identifiers are included in the analysis primarily as control measures, they are found to have a jointly significant relationship with diversification (participation and distribution).

5. Robustness considerations.

We may wish to consider how robust the results are to some of the modelling assumptions imposed in the analysis. Here we present discussion of three of the more pertinent of these.

(a) Superannuation.

As discussed above, superannuation is a mandatory retirement scheme in Australia since its introduction at the national level in 1992. Employees are also allowed to make voluntary contributions and many may choose to do so, especially those approaching retirement. Furthermore, holders of superannuation assets might evaluate the present value of their expected future pay-outs and adjust their current portfolios according. For these reasons, superannuation is now considered as a choice variable here. The models whose estimates are presented in Table 4 were re-estimated including superannuation, and directly comparable results are provided in Table A4 of the Appendix. The results show few significant differences, however, noteworthy exceptions apply to the relationships with age and risk aversion. We suspect strong cohort effects to be occurring with superannuation; younger workers have a greater proportion of their wage related income associated with mandatory superannuation savings whilst older workers have a greater incentive to make voluntary payments. This may also help to explain the insignificant findings for job insecurity, mortgage ratio or social interaction with the extent of asset diversification. The full effect of mandatory superannuation on the decision to diversify asset holdings and on the extent of this

diversification in Australia will become clearer over time as a greater proportion of the population are equally subject to the legislation. We recommend this for future investigation.

(b) Weighting.

The HILDA survey sample grows through time as the number of joiners exceeds the number of drop-outs. The joiners are selected so as to keep the socio-demographic composition of the sample unchanged (Summerfield *et al*, 2013). The analyses presented in this paper focusses on a very particular subset of the survey respondents, however, it may be the case that asset diversification is associated with non-inclusion in the survey. For example, Boheim and Taylor (2000) argue that homelessness (and being subsequently less likely to be included as a survey respondent) is particularly pertinent when investments in housing is being analysed.

The potential presence of non-response bias in the sub-sample chosen for analysis here is tested using the variable addition test proposed by Verbeek and Nijman (1992). The results of this test for the ZIB model (see penultimate row of Table 4) suggests a potential problem of systematic non-response: households remaining in the sample are apparently more likely to decide to diversify compared to the households dropping out. Inverse Probability Weighted (IPW) estimators are used to correct for (potential) attrition bias in these sample estimates (Robins et al. 1995; Fitzgerald et al. 1998, 1999; Wooldridge 2002, 2010). This IPW approach is attractive since the generated weights can be applied in the context of the non-linear models used here.

Once again, the estimation procedures discussed for the results presented in Table 4 were replicated however this time with the use of the inverse probability weights. Comparable results are provided in Table A5 of the Appendix. They show very little difference in the results, most of the changes occur with larger standard errors reported for the Tobit model results (for example, with measures of education, job insecurity, and risk measures). In each case, the results remain qualitatively similar but are no longer significant at standard confidence intervals. Unsurprisingly, the rent ratio becomes positive and significant. Nevertheless, the lack of substantive differences in the results reported for the ZIB model does not support the use of the IPW estimators in this case.

(c) Matched HH sample analysis.

The attrition issue can be further considered by constraining the sample of interest to be only those households where the head of household (HH) remains the same in both time periods, we call this the matched HH sample. The unconstrained pooled sample consists of 9803 observations, as discussed above, this is a sample with 4517 households in 2002 and 4566

households in 2006. The matched HH pooled sample consists of 5944 observations, 2972 households in each wave, The descriptive statistics in Table 2 suggest that the matched HH pooled sample tends (on average) to have slightly higher proportions of couple households, to be older, have a male full-time employed HH with tertiary education, and to register less job insecurity. These differences with the unconstrained pooled sample are, however, not significant at standard confidence levels. Table 4 presents results for analysis of the unconstrained pooled sample, directly comparable results for the matched HH pooled sample are presented in Table A6 of the Appendix. Once again, the results can be seen to show very little significant differences. This finding is perhaps not surprising when the distribution of asset holdings across households reveals the matched HH sample to (on average) hold higher wealth but with greater variance than the unconstrained pooled sample (comparing panels 1 and 2 of Table 3). Indeed, the only difference of note in the results is the increased standard errors associated with poor health and job insecurity, resulting in insignificant associations with these variables and asset holding diversification.

6. Conclusion

This work combines recent literature on the modelling of proportions with the growing body of research concerning household financial decisions and asset allocations to analyse the determinants of Australian households' saving allocations. In particular, the recently developed Zero-Inflated Beta model (Cook et al., 2008) is used to jointly estimate the asset distribution decision (i.e. whether or not to diversify) with the decision of how much to diversify. Our findings support the use of this model over the more restricted Fractional Logit or Tobit models. We find significant differences in the decision to choose to diversify asset holdings from the extent of the diversification of asset holdings.

Australian households, where the head of the household is employed, are found to be more likely to participate in asset holding diversification if the household type is a couple, has dependent children, has greater net worth or higher household equivalized income. They are less likely to choose to diversify their assets if they face liquidity constraints, have poor health, insecure job prospects or are generally risk averse.

Household asset holding diversification, given participation, is found to be significantly related to the head of the household being older, coupled, having post-secondary education and engaging in more social interaction. As households become richer (having greater net worth, higher income, lower liquidity constraints, or lower committed mortgage expenditure) they also spread their asset holdings over a more diversified portfolio.

We find that short term concerns over job security or health are associated with less participation in, as well as a lower extent of, asset holding diversification.

From a policy perspective, a further interesting finding is the insignificance of the relationship between lower general education levels (secondary and less than secondary) and asset diversification. Studies for other countries suggest that households appear to be aware of only a subset of available stocks and that information about the availability of assets is channelled through relevant learning and social networks (Guiso *et al.* 2002; Campbell 2006). This apparent ineffective information conduit in Australia not only affects the decision of whether or not to diversify, but also affects the extent of asset diversification. Our findings clearly suggest a role for asset suppliers to further advertise the financial instruments they offer in Australia.

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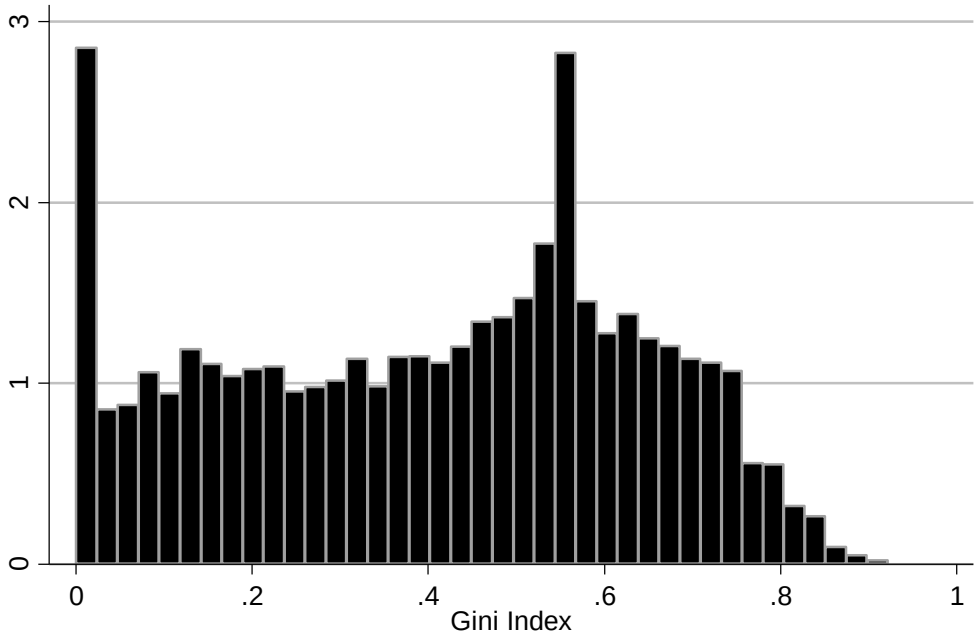
Figure 1: Gini Index Distribution - Unbalanced Sample



HILDA Survey - Waves 2 and 6 (Pooled).

Table 1. Variables Definitions

Socio-Demographic Variables	
Age	Age last birthday at June 30th.
State	New South Wales; Victoria; Queensland; South Australia; Western Australia; Tasmania; Northern Territory; or the Australian Capital Territory.
Section of State	Urban (major urban or other urban area), Rural (bounded rural locality or rural balance)
Gender	Binary indicator variables denoting gender.
Household Composition	
Dependent-children	'Are there any children less than 15 years of age living in the household?' [1yes - 2no].
House-property type	Own/currently paying off mortgage; Rent (or pay board); Involved in a rent-buy scheme; or Live here rent free.
Household-structure	Coupled types (Couple with child aged < 15; Couple with dependent students (no child aged < 15); Couple with no dependent child (no child aged < 15 or dependent students); Couple without children). Single types (Lone parent with child aged < 15; Lone parent with dependent students (no child aged < 15); Lone parent with no dependent child (no child aged < 15 or dependent students; Lone person).
Household-size	Number of in-scope persons in household.
Equivalence scale household size	1 plus 0.5 for each adult other than the head of the household and 0.3 for each child
Social Interaction	
Community	Feeling part of your local community: 0 [Totally dissatisfied] – 10 [Totally satisfied].
Social interaction	1[Community>5] – 0[Otherwise].
Education	
Less than secondary	Year 11 and below
Secondary	Certificate I or II; Certificate not defined; or Year 12.
Other post-school qualification	Advanced Diploma, Diploma; Certificate III or IV
Tertiary	Postgraduate degree - Masters or Doctorate; Graduate Diploma, Graduate Certificate; Bachelor or Honours degree.
Health	
Health	1 Excellent; 2 Very good; 3 Good; 4 Fair; 5 Poor.
Poor Health	1[Health > 3] – 0[otherwise].
Employment	
Hours-main	Hours per week usually worked in main job.
Industry	Current main job industry. 1-digit ANZSIC: Agriculture, Forestry and Fishing; Mining; Manufacturing; Electricity, Gas, Water and Waste Services; Construction; Wholesale Trade; Retail Trade; Accommodation and Food Services; Transport, Postal and Warehousing; Information Media and Telecommunications; Financial and Insurance Services; Rental, Hiring and Real Estate Services; Professional, Scientific and Technical Services; Administrative and Support Services; Public Administration and Safety; Education and Training; Health Care and Social Assistance; Arts and Recreation Services; or Other Services.
Occupation	Occupation 1-digit ASCO: Managers; Professionals; Technicians and Trades Workers; Community and Personal Service Workers; Clerical and Administrative Workers; Sales Workers; Machinery Operators and Drivers; or Labourers.
Job Insecurity	
Secure-future	I have a secure future in my job: 1 [Strongly disagree] – 7 [Strongly agree].
Job Insecurity	1 [secure-future <4] – 0[otherwise].
Financial - Income Related	
Household-disposable-income	Household financial year disposable income individual estimate ($2006)
Equivalized household income	Disposable income adjusted for an equivalence scale to correct the different households size and composition ($2006)
Household-gross-income	Household financial year gross income ($2006) (excl. windfall)
Household-taxes	Household financial year taxes - total ($2006)
Household-windfall	Household financial year windfall income (excl resident parent transfers) ($2006).
Individual-wage	Individual current weekly gross wages & salary - main job ($2006).
Worth	Difference between all the assets and the debts.
Equity Investments	Shares, managed funds (mutual funds) and real estate investment trusts.
Cash Investments	Government bonds, corporate bonds, debentures, certificates of deposit, mortgage-backed securities.
Trust Funds	These include children's trust funds but exclude property trusts.
Life Insurance	Life insurance excluding policies paid on death.
Risky Assets	Equity investments.
Liquidity constrained	1[HH cannot raise $2,000 at short notice for an emergency] – 0[Otherwise].
Mortgage/Rent ratios	Denominator given by total household disposable income.
Risk lover/averse	'Which of the following statements comes closest to describing the amount of financial risk that you are willing to take with your spare cash? That is, cash used for savings or investment.'; 1[(Not willing to take financial risks)/(takes above-average risks expecting above-average returns)] – 0[Otherwise].

Source: HILDA Dataset, Waves 2 and 6.

Table 2. Descriptive Statistics (2006 prices)

	Wave2		*Wave6*		*Pooled*		*Matched HH*	
Household	Mean	S. Dev	Mean	S. Dev	Mean	S. Dev	Mean	S. Dev
Household Structure Couple	0.7	0.46	0.68	0.47	0.69	0.46	0.73	0.45
Household Structure Single	0.3	0.46	0.32	0.47	0.31	0.46	0.27	0.45
Male Head of Household	0.77	0.42	0.76	0.43	0.76	0.43	0.83	0.38
Presence of Dependent Children	0.71	1.06	0.61	0.97	0.66	1.02	0.75	1.06
Household Size	2.85	1.45	2.74	1.43	2.8	1.44	2.91	1.45
Equivalence scale household size	1.78	0.58	1.75	0.59	1.77	0.58	1.81	0.58
Liquidity constrained	0.15	0.36	0.12	0.33	0.14	0.34	0.11	0.31
Mortgage ratio	0.01	0.02	0.01	0.02	0.01	0.02	0.01	0.02
Rent Ratio	0.01	0.02	0.01	0.02	0.01	0.02	0.005	0.02
Head of Household								
Employed Full-Time	0.82	0.38	0.82	0.38	0.82	0.38	0.86	0.34
Ave Hourly Wage	31.03	23.93	32.86	24.46	31.95	24.21	33.44	24.49
Age (Years)	41.32	10.66	41.58	11.32	41.45	11	42.67	9.84
Job Insecurity Opinion	0.33	0.47	0.29	0.45	0.31	0.46	0.28	0.45
Poor health	0.09	0.28	0.1	0.29	0.09	0.29	0.09	0.29
Risk averse	0.27	0.45	0.29	0.45	0.28	0.45	0.27	0.45
Risk lover	0.11	0.31	0.11	0.32	0.11	0.31	0.12	0.33
Social interaction	0.7	0.46	0.73	0.45	0.71	0.45	0.73	0.44
Education								
Less than secondary	0.24	0.43	0.21	0.41	0.22	0.42	0.21	0.41
Secondary	0.14	0.35	0.14	0.35	0.14	0.35	0.13	0.33
Other post-school qualification	0.36	0.48	0.38	0.48	0.37	0.48	0.38	0.49
Tertiary	0.26	0.44	0.27	0.44	0.26	0.44	0.28	0.45
Location								
In rural areas								
New South Wales	0.04	0.2	0.04	0.2	0.04	0.2	0.04	0.2
Victoria	0.04	0.19	0.04	0.19	0.04	0.19	0.04	0.19
Queensland	0.04	0.18	0.04	0.19	0.04	0.19	0.04	0.19
South Australia	0.02	0.13	0.02	0.12	0.02	0.13	0.02	0.13
Western Australia	0.01	0.12	0.01	0.12	0.01	0.12	0.02	0.12
Tasmania	0.01	0.07	0.01	0.09	0.01	0.08	0.01	0.08
Northern Territory	0.001	0.03	0.001	0.03	0.001	0.03	0.001	0.02
Australian Capital Territory	0.00	0.00	0.0002	0.01	0.0001	0.01	0.00	0.00
In urban areas								
New South Wales	0.26	0.44	0.25	0.44	0.26	0.44	0.25	0.43
Victoria	0.21	0.41	0.2	0.4	0.21	0.41	0.21	0.41
Queensland	0.17	0.37	0.17	0.38	0.17	0.38	0.17	0.37
South Australia	0.07	0.26	0.07	0.26	0.07	0.26	0.07	0.26
Western Australia	0.09	0.29	0.09	0.28	0.09	0.28	0.09	0.28
Tasmania	0.02	0.14	0.02	0.14	0.02	0.14	0.02	0.15
Northern Territory	0.01	0.08	0.01	0.09	0.01	0.08	0.01	0.08
Australian Capital Territory	0.02	0.14	0.02	0.15	0.02	0.14	0.02	0.14

Table 2. Descriptive Statistics continued (2006 prices).

	Wave2		*Wave6*		*Pooled*		*Matched HH*	
	Mean	S. Dev	Mean	S. Dev	Mean	S. Dev	Mean	S. Dev
Occupation								
Managers	0.17	0.37	0.16	0.37	0.17	0.37	0.19	0.39
Professionals	0.23	0.42	0.23	0.42	0.23	0.42	0.24	0.43
Technicians and Trades	0.18	0.38	0.18	0.38	0.18	0.38	0.18	0.39
Community-Personal Service	0.07	0.26	0.09	0.28	0.08	0.27	0.07	0.25
Clerical-Administrative	0.11	0.31	0.11	0.32	0.11	0.32	0.11	0.31
Sales	0.05	0.22	0.06	0.23	0.05	0.23	0.04	0.21
Machinery Operators and Drivers	0.09	0.29	0.09	0.28	0.09	0.28	0.10	0.30
Labourers	0.09	0.29	0.09	0.28	0.09	0.29	0.08	0.26
Industry								
Agriculture-Fishing-Forestry	0.05	0.23	0.04	0.21	0.05	0.22	0.05	0.21
Mining	0.02	0.14	0.02	0.14	0.02	0.14	0.02	0.15
Manufacturing	0.14	0.35	0.12	0.33	0.13	0.34	0.14	0.34
Electricity-Gas Supply	0.01	0.12	0.01	0.10	0.01	0.11	0.01	0.11
Construction	0.09	0.29	0.10	0.30	0.09	0.29	0.10	0.30
Wholesale Trade	0.04	0.20	0.04	0.19	0.04	0.19	0.04	0.19
Retail Trade	0.06	0.24	0.07	0.26	0.07	0.25	0.06	0.24
Accommodation-Restaurants	0.04	0.20	0.04	0.20	0.04	0.20	0.03	0.18
Transport	0.06	0.24	0.06	0.24	0.06	0.24	0.06	0.25
Communication	0.03	0.16	0.03	0.17	0.03	0.16	0.03	0.17
Finance	0.03	0.18	0.04	0.19	0.03	0.18	0.03	0.18
Rental-Hiring-Real Estate	0.01	0.11	0.02	0.12	0.01	0.12	0.01	0.12
Professional-Scientific-Technical	0.07	0.26	0.07	0.26	0.07	0.26	0.07	0.26
Administrative-Support	0.03	0.16	0.02	0.15	0.03	0.16	0.02	0.14
Public Administration	0.08	0.27	0.08	0.27	0.08	0.27	0.08	0.28
Education-Training	0.08	0.27	0.08	0.28	0.08	0.28	0.09	0.28
Health Care	0.09	0.28	0.10	0.29	0.09	0.29	0.08	0.28
Recreation Services	0.02	0.14	0.02	0.13	0.02	0.14	0.02	0.13
Other	0.04	0.19	0.04	0.20	0.04	0.20	0.04	0.20
Total Observations	4517		4566		9083		5944	

HILDA Dataset – Pooled Sample (Wave 2 and Wave 6)

Table 3. Asset Holdings, Income and Wealth (2006 prices).

	Mean	Sd	10th	25th	50th	75th	90th	99th
(1) Pooled								
Equity Investments ($'000)	37.52	201.32	0	0	0	8.94	60	686
Cash Investments ($'000)	1.52	24.58	0	0	0	0	0	22.35
Trust Funds ($'000)	12.32	137.13	0	0	0	0	0	300
Total Bank Account ($'000)	24.17	72.29	0.26	1.44	5.59	19.03	55	285
Life Insurance ($'000)	8.99	61.62	0	0	0	0	3	223.49
Home Value ($'000)	284.57	364.39	0	0	230.19	400	614.59	1500
Other Properties Value ($'000)	107.27	460.89	0	0	0	0	330	1300
Businesses Value ($'000)	70.28	385.88	0	0	0	0	67.05	1676.17
Vehicles Value ($'000)	25.56	38.54	2	7.82	17	32	53.64	150
Collectibles ($'000)	3.94	29.29	0	0	0	0	5.59	70
Total Superannuation ($'000)	120.85	210.9	3.59	15.64	48	134.09	331	930
Income ($'000)	67.73	43.82	27.68	41.18	61	83.96	111.19	211.19
Equivalised Income ($'000)	39.25	23.7	18.73	25.46	34.83	47.74	63.6	118
Net Worth ($'000)	562.35	995.57	14.03	86.71	307.47	671.5	1229.41	5046
Total Financial Assets ($'000)	203.82	409.15	8.86	27.16	78.65	219	500	1710
Risky Asset Ratio (%)	0.22	0.33	0	0	0	0.4	0.83	1
Mortgage ratio	0.01	0.02	0	0	0	0.01	0.02	0.06
Rent ratio	0.01	0.02	0	0	0	0.01	0.02	0.05
	Mean	Sd	10th	25th	50th	75th	90th	99th
(2) Matched HH								
Equity Investments ($'000)	39.56	210.01	0	0	0	11.17	65	700
Cash Investments ($'000)	1.59	25.58	0	0	0	0	0	22.35
Trust Funds ($'000)	13.13	144.82	0	0	0	0	0	325
Total Bank Account ($'000)	24.48	70.88	0.34	1.68	6.05	20	55.87	284.39
Life Insurance ($'000)	9.6	64.31	0	0	0	0	5.59	223.49
Home Value ($'000)	313.84	368.48	0	30.84	268.66	430.77	650	1500
Other Properties Value ($'000)	115.19	476.78	0	0	0	0	350	1300
Businesses Value ($'000)	76.7	397.27	0	0	0	0	100	1750
Vehicles Value ($'000)	26.65	37.69	3	8.94	19	33.52	55	148.62
Collectibles ($'000)	3.77	26.5	0	0	0	0	5.59	70
Total Superannuation ($'000)	136.32	223.64	6.7	22.35	60.34	156.44	357.58	972.18
Income ($'000)	71.42	44.12	30.99	45.84	64.99	86.89	113.56	222.16
Equivalised Income ($'000)	40.83	24.29	20.34	27	36.24	48.96	65.06	121.12
Net Worth ($'000)	611.41	1031.08	32.77	137.95	362.04	723.52	1282.82	5004.1
Total Financial Assets ($'000)	222.92	432.51	13.75	36.32	93.48	243.18	520.19	2053
Risky Asset Ratio (%)	0.24	0.34	0	0	0	0.46	0.85	1
Mortgage ratio	0.01	0.02	0	0	0	0.02	0.03	0.06
Rent ratio	0.005	0.02	0	0	0	0	0.02	0.04

HILDA Dataset – Pooled Sample (Wave 2 and Wave 6); Pooled sample 9083 observations, Matched HH sample 5944 observations. .

Table 4. Parameter Estimates Pooled Sample

	Tobit	Fractional Logit	Zero-Inflated Beta	
			Selection Eq.†	Asset Distrib.
Age	0.007***	0.028***	0.023	0.023***
	(0.00)	(0.01)	(0.04)	(0.01)
Age^2	-0.0001***	-0.0002***	0.0002	-0.0002**
	(0.00)	(0.00)	(0.00)	(0.00)
Household structure (omitted category; single person)				
Couple	0.053***	0.200***	1.255***	0.137***
	(0.01)	(0.03)	(0.15)	(0.03)
Dep. children	-0.002	-0.01	0.281***	-0.015
	(0.00)	(0.01)	(0.10)	(0.01)
Education (omitted category; less than secondary)				
Tertiary	0.022***	0.091***	0.117	0.119***
	(0.01)	(0.03)	(0.20)	(0.03)
Other post-school qualification	0.024***	0.095***	0.347**	0.110***
	(0.01)	(0.03)	(0.17)	(0.03)
Secondary	0.009	0.039	-0.010	0.081**
	(0.01)	(0.04)	(0.18)	(0.04)
Eq. income	0.014***	0.054***	0.166***	0.053***
	(0.00)	(0.01)	(0.05)	(0.01)
Eq. income^2	-0.0004***	-0.002***	0.014**	-0.002***
	(0.00)	(0.00)	(0.01)	(0.00)
Net worth	0.031***	0.117***	2.947***	0.090***
	(0.01)	(0.03)	(0.50)	(0.03)
Net worth^2	-0.002***	-0.009***	-0.216***	-0.008***
	(0.00)	(0.00)	(0.04)	(0.00)
Liquidity constrained	-0.117***	-0.509***	-0.702***	-0.484***
	(0.01)	(0.04)	(0.14)	(0.04)
Poor health	-0.023**	-0.091**	-0.419**	-0.086**
	(0.01)	(0.04)	(0.17)	(0.04)
Job insecurity	-0.011*	-0.041*	-0.256**	-0.042*
	(0.01)	(0.02)	(0.12)	(0.02)
Mortgage ratio	-0.355**	-1.837**	6.472	-1.922**
	(0.17)	(0.78)	(4.82)	(0.77)
Rent ratio	-0.467**	-2.690**	0.241	-2.03
	(0.21)	(1.35)	(1.78)	(1.35)
Attitude towards risk (omitted category; Risk neutral)				
Risk averse	-0.010*	-0.050**	0.248*	-0.038
	(0.01)	(0.02)	(0.13)	(0.02)
Risk lover	0.016**	0.065**	0.341	0.038
	(0.01)	(0.03)	(0.26)	(0.03)
Social interaction	0.014***	0.063***	-0.083	0.076***
	(0.01)	(0.02)	(0.12)	(0.02)
Time	0.036***	0.146***	0.222*	0.148***
	(0.00)	(0.02)	(0.12)	(0.02)
Constant	0.125***	-1.507***	0.639	-1.349***
	(0.04)	(0.16)	(0.76)	(0.17)
Phi				1.350***
				(0.01)
Non response bias	0.33	0.40	3.92**	0.36
Observations	*9083*			

HILDA Dataset – Pooled Sample (Wave 2 and Wave 6). Significance Levels: 10% (*), 5% (**), 1%(***).† coefficients are rescaled by -1 to allow for intuitive interpretation. Regional indicators included in all models. Reset Tests: Tobit: (Prob>F=0.44); Fractional Logit: (P>Chi2=0.08); – ZIB: (P>Chi2=0.61)

Appendix

Table A1. Employment Status by Gender (Column Percentage)

	Wave2		*Wave6*		
	Male	*Female*	*Male*	*Female*	*All*
Employed Full Time	88.9	59.4	88.7	61.9	82.09
Employed Part Time	11.1	40.6	11.3	38.1	17.91
Total	3464	1053	3449	1117	9083

HILDA Dataset – Pooled Sample (Wave 2 and Wave 6); 9083 observations.

Table A2. Job Insecurity Transition Probabilities

	Male		*Female*	
	Not Worried	Worried	Not Worried	Worried
Not Worried	0.81	0.19	0.83	0.17
Worried	0.61	0.39	0.65	0.35

HILDA Dataset – Pooled Sample (Wave 2 and Wave 6); 9083 observations.

Table A3. Within/Between Future Employment Worry

		Overall Percent	Between Percent	Within Percent
Male	Not Worried	68.84	76.21	88.31
	Worried	31.16	41.61	78.59
	Total	100	117.82	84.88
Female	Not Worried	70.09	73.11	93.64
	Worried	29.91	36.19	87.15
	Total	100	109.31	91.49

HILDA Dataset – Pooled Sample (Wave 2 and Wave 6); 9083 observations.

Table A4. Parameter Estimates Pooled Sample (including superannuation)

	Tobit	Fractional Logit	Zero-Inflated Beta	
			Selection Eq.†	Asset Distrib.
Age	-0.003*	-0.013*	0.036	-0.011
	(0.00)	(0.01)	(0.12)	(0.01)
Age^2	0.00003	0.0001	-0.001	0.0001
	(0.00)	(0.00)	(0.00)	(0.00)
Household structure (omitted category; single person)				
Couple	0.041***	0.163***	1.861***	0.185***
	(0.01)	(0.02)	(0.71)	(0.02)
Dep. children	-0.001	-0.004	-0.175	0
	(0.00)	(0.01)	(0.29)	(0.01)
Education (omitted category; less than secondary)				
Tertiary	0.018***	0.074***	17.447***	0.085***
	(0.01)	(0.03)	(0.82)	(0.03)
Other post-school qualification	0.022***	0.090***	-0.028	0.100***
	(0.01)	(0.03)	(0.44)	(0.03)
Secondary	0.002	0.009	0.049	0.016
	(0.01)	(0.03)	(0.48)	(0.04)
Eq. income	0.012***	0.048***	-0.134	0.054***
	(0.00)	(0.01)	(0.65)	(0.01)
Eq. income^2	-0.0003**	-0.001**	0.241	-0.001**
	(0.00)	(0.00)	(0.18)	(0.00)
Net worth	-0.003	-0.013	20.746**	-0.028
	(0.01)	(0.02)	(9.60)	(0.02)
Net worth^2	0.0001	0.001	16.805	0.001
	(0.00)	(0.00)	(42.18)	(0.00)
Liquidity constrained	-0.079***	-0.316***	-0.990**	-0.340***
	(0.01)	(0.03)	(0.38)	(0.03)
Poor health	-0.017**	-0.070**	0.034	-0.100***
	(0.01)	(0.03)	(0.52)	(0.04)
Job insecurity	-0.001	-0.004	-0.899**	-0.002
	(0.00)	(0.02)	(0.39)	(0.02)
Mortgage ratio	-0.178	-0.768	24.512	-0.43
	(0.14)	(0.57)	(19.28)	(0.57)
Rent ratio	-0.439**	-1.908**	0.955	-1.919**
	(0.17)	(0.86)	(2.03)	(0.89)
Attitude towards risk (omitted category; Risk neutral)				
Risk averse	-0.007	-0.028	0.447	-0.013
	(0.00)	(0.02)	(0.41)	(0.02)
Risk lover	0.024***	0.096***	15.874***	0.092***
	(0.01)	(0.03)	(0.41)	(0.03)
Social interaction	-0.005	-0.021	-0.200	-0.015
	(0.00)	(0.02)	(0.39)	(0.02)
Time	0.028***	0.111***	0.143	0.110***
	(0.00)	(0.02)	(0.37)	(0.02)
Constant	0.522***	0.104	2.114	-0.02
	(0.03)	(0.1)	(2.2)	(0.1)
Phi				1.630***
				(0.02)
Observations	*9083*			

HILDA Dataset – Pooled Sample (Wave 2 and Wave 6). Significance Levels: 10% (*), 5% (**), 1%(***).† coefficients are rescaled by -1 to allow for intuitive interpretation. Regional indicators included in all models. Reset Tests: Tobit: (Prob>F=0.47); Fractional Logit: (P>Chi2=0.10); – ZIB: (P>Chi2=0.22)

Table A5. Parameter Estimates Pooled Sample (I.P.W. Non-Response Bias Corrected)

	Tobit	Fractional Logit	Zero-Inflated Beta	
			Selection Eq.†	Asset Distrib.
Age	0.009***	0.040***	0.007	0.049***
	(0.00)	(0.01)	(0.05)	(0.01)
Age^2	-0.0001***	-0.0004***	0.0001	-0.001***
	(0.00)	(0.00)	(0.00)	(0.00)
Household structure (omitted category; single person)				
Couple	0.051***	0.216***	1.300***	0.197***
	(0.01)	(0.03)	(0.16)	(0.04)
Dep. children	-0.003	-0.013	0.343***	-0.023
	(0.00)	(0.01)	(0.11)	(0.02)
Education (omitted category; less than secondary)				
Tertiary	0.018*	0.074*	0.134	0.119**
	(0.01)	(0.04)	(0.23)	(0.05)
Other post-school qualification	0.018**	0.074**	0.262	0.106**
	(0.01)	(0.04)	(0.19)	(0.05)
Secondary	0.012	0.051	0.104	0.104*
	(0.01)	(0.04)	(0.21)	(0.06)
Eq. income	0.012***	0.048***	0.195***	0.060***
	(0.00)	(0.01)	(0.05)	(0.02)
Eq. income^2	-0.0003*	-0.001*	0.015**	-0.002**
	(0.00)	(0.00)	(0.01)	(0.00)
Net worth	0.026***	0.103***	3.127***	0.085**
	(0.01)	(0.03)	(0.54)	(0.04)
Net worth^2	-0.002**	-0.006**	-0.219***	-0.005
	(0.00)	(0.00)	(0.04)	(0.00)
Liquidity constrained	-0.112***	-0.512***	-0.716***	-0.643***
	(0.01)	(0.04)	(0.16)	(0.07)
Poor health	-0.018*	-0.076*	-0.372*	-0.097*
	(0.01)	(0.04)	(0.20)	(0.06)
Job insecurity	-0.015**	-0.063**	-0.381***	-0.087**
	(0.01)	(0.03)	(0.14)	(0.04)
Mortgage ratio	-0.321	-1.414	12.470**	-2.724*
	(0.21)	(0.94)	(5.79)	(1.45)
Rent ratio	0.197***	0.834***	13.086***	1.093***
	(0.02)	(0.11)	(1.55)	(0.15)
Attitude towards risk (omitted category; Risk neutral)				
Risk averse	-0.015**	-0.066**	0.276*	-0.086**
	(0.01)	(0.03)	(0.16)	(0.04)
Risk lover	0.012	0.048	0.271	0.016
	(0.01)	(0.04)	(0.29)	(0.06)
Social interaction	0.020***	0.088***	-0.126	0.140***
	(0.01)	(0.03)	(0.14)	(0.04)
Time	0.036***	0.150***	0.206*	0.194***
	(0.00)	(0.02)	(0.12)	(0.03)
Constant	0.093**	-1.735***	0.62	-2.076***
	(0.04)	(0.19)	(0.86)	(0.27)
Phi				3.062***
				(0.82)
Observations	9083			

HILDA Dataset – Pooled Sample (Wave 2 and Wave 6). Significance Levels: 10% (*), 5% (**), 1%(***).† coefficients are rescaled by -1 to allow for intuitive interpretation. Regional indicators included in all models. Reset Tests: Tobit: (Prob>F=0.90); Fractional Logit: (P>Chi2=0.63); – ZIB: (P>Chi2=0.85)

Table A6. Parameter Estimates (matched sample)

	Tobit	Fractional Logit	Zero-Inflated Beta	
			Selection Eq.†	Asset Distrib.
Age	0.008***	0.033***	0.077	0.029**
	(0.00)	(0.01)	(0.07)	(0.01)
Age^2	-0.0001**	-0.0003**	-0.001	-0.0002*
	(0.00)	(0.00)	(0.00)	(0.00)
Household structure (omitted category; single person)				
Couple	0.037***	0.141***	1.152***	0.108***
	(0.01)	(0.03)	(0.22)	(0.04)
Dep. children	-0.001	-0.006	0.261*	-0.012
	(0.00)	(0.02)	(0.15)	(0.02)
Education (omitted category; less than secondary)				
Tertiary	0.026**	0.104**	0.294	0.131***
	(0.01)	(0.04)	(0.30)	(0.04)
Other post-school qualification	0.032***	0.131***	0.372	0.145***
	(0.01)	(0.04)	(0.25)	(0.04)
Secondary	0.019	0.075	0.36	0.095*
	(0.01)	(0.05)	(0.31)	(0.05)
Eq. income	0.010***	0.042***	0.083	0.046***
	(0.00)	(0.01)	(0.06)	(0.01)
Eq. income^2	-0.0004***	-0.001**	0.008	-0.002***
	(0.00)	(0.00)	(0.01)	(0.00)
Net worth	0.027***	0.104***	2.244***	0.074**
	(0.01)	(0.03)	(0.57)	(0.03)
Net worth^2	-0.002***	-0.007**	-0.163***	-0.005*
	(0.00)	(0.00)	(0.04)	(0.00)
Liquidity constrained	-0.118***	-0.500***	-0.966***	-0.466***
	(0.01)	(0.05)	(0.23)	(0.05)
Poor health	-0.015	-0.061	-0.307	-0.079
	(0.01)	(0.05)	(0.28)	(0.05)
Job insecurity	-0.005	-0.017	-0.482**	-0.012
	(0.01)	(0.03)	(0.19)	(0.03)
Mortgage ratio	-0.525***	-2.474***	3.95	-2.420***
	(0.19)	(0.92)	(5.70)	(0.93)
Rent ratio	-0.42	-2.226	0.893	-2.691
	(0.30)	(1.76)	(2.23)	(2.49)
Attitude towards risk (omitted category; Risk neutral)				
Risk averse	-0.017**	-0.075**	0.306	-0.073**
	(0.01)	(0.03)	(0.21)	(0.03)
Risk lover	0.015	0.06	0.452	0.038
	(0.01)	(0.04)	(0.40)	(0.04)
Social interaction	0.020***	0.083***	-0.013	0.097***
	(0.01)	(0.03)	(0.19)	(0.03)
Time	0.040***	0.160***	0.307*	0.160***
	(0.01)	(0.02)	(0.17)	(0.02)
Constant	0.116**	-1.553***	0.068	-1.464***
	(0.06)	(0.24)	(1.46)	(0.25)
Phi				1.372***
				(0.02)
Observations	5944			

HILDA Dataset – Pooled Sample (Wave 2 and Wave 6). Significance Levels: 10% (*), 5% (**), 1%(***).† coefficients are rescaled by -1 to allow for intuitive interpretation. Regional indicators included in all models. Reset Tests: Tobit: (Prob>F=0.17); Fractional Logit: (P>Chi2=0.33); – ZIB: (P>Chi2=0.13)