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# Australian Household Asset Portfolio Diversification

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*This paper examines the impact of demographic, socioeconomic and risk aversion factors on diversification in Australian household asset portfolios using Wave 6 of the Household, Income and Labour Dynamics in Australia (HILDA) Survey. Household assets are categorised as home and other property, superannuation, equity and cash investment, business assets, bank accounts, life insurance, trust funds and collectibles. The characteristics examined include family structure and composition, the source and level of income, age, gender, and attitudes towards financial risk taking. The diversification measures comprise a naïve index, a Hirschman–Herfindahl concentration index, a Shannon entropy index, absolute and relative benchmark indexes, and a market index. Tobit models are used to identify the source and magnitude of the factors associated with diversification. The results indicate that Australian household portfolios have very low levels of asset diversification and that the factors analysed exert a major impact. Importantly, the behaviour observed in household portfolios appears to bear little relation to the central predictions of classic portfolio theory.*

**JEL Codes:** C23, C25, D14, and G11

## 1. Introduction

By analogy with corporate finance, household finance asks how we can use financial decisions to attain certain objectives. However, households have features that make the direct transfer of the tools of corporate finance to a household setting difficult. For instance, households must plan over long (but finite and uncertain) horizons, they have important non-traded assets (notably their own human capital), they hold mostly illiquid assets (especially housing), and they face constraints on their ability to borrow and to engage in short selling. Further, many household assets have consumption properties (like housing and vehicles), households may have strong desires for intergenerational transfer, and they are subject to complex taxation, high market entry costs, demanding information requirements, and transaction costs.

One area of particular interest is household asset portfolio diversification. This is clearly important because, among other things, financial advisors need to be aware of household risk preferences in order to customise advice and financial system regulators must be cognisant of household exposures in the event of adverse macroeconomic shocks. For example, in Australia there have been substantial changes in the composition of household portfolios over time. In particular, in recent years there has been a substantial increase in the sector's relative holdings of market-linked financial assets, particularly equities and superannuation, thereby increasing household exposure to financial market volatility (RBA 2004; Heady, Marks & Wooden 2005). Concomitantly, there has been a decline in the relative shares of safe assets (like bank deposits) held by households. Rebalancing across assets will then change household portfolio returns and risk, ultimately affecting household consumption decisions and welfare.

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The purpose of this paper is twofold. First, evaluate the diversification of Australian household asset portfolios using a variety of measures suited to the nature of the available survey data. Second, examine the demographic, socioeconomic, and financial determinants of household asset portfolio diversification. The paper itself is divided into four main areas. Section 2 provides a brief review of the literature. Section 3 explains the measurement of diversification and the specification of the explanatory variables, respectively. Section 4 presents the results. The paper ends with some concluding remarks and directions for future research in Section 5.

## 2. Literature Review

In a number of national contexts, there has already been examination of household asset portfolio diversification (more precisely, individual asset concentration) on the pretext that we need to control for the demographic and socioeconomic profile of households when analysing their portfolio decisions. For instance, in the US, Bertaut and Starr-McCluer (2000) and Campbell (2006) use the Federal Reserve's *Survey of Consumer Finances*. In France, Arrondel and Lebfevre (2001) employ the *French National Institute for Statistics and Economic Studies Survey* and in the Netherlands, Hochguertal Alessie and Van Soest (1997) and Alessie, Hochguertel and Van Soest (2000) examine the *Dutch Collective Bank Study*. Similarly, Guiso and Japelli (2000) employ the Bank of Italy *Survey of Household Income and Wealth* and Banks and Smith (2000) consider the *Financial Research Survey* in the UK.

Finally, in Germany, Borsch-Supan and Eymann (2000) analyse the *Income and Expenditure Survey* while Barasinka, Schäfer and Stephan (2008) use the *German Socioeconomic Panel*. Unfortunately, none of this existing work throws any useful light on the Australian context as it is only relatively recently in Australia that researchers interested in household portfolio diversification have had access to sufficiently detailed longitudinal surveys of household financial behaviour. Moreover, without exception the measures of asset portfolio diversification used in these past studies were limited to the proportion of assets held in a particular asset or asset risk class. They therefore ignored a number of more suitable measures of diversification found in the broader economics literature.

Fortunately, the Household, Income and Labour Dynamics in Australia (HILDA) Survey used in this analysis now provides data that is well suited to the analysis of the composition of household asset portfolios along with information on household demographic and socioeconomic characteristics. In addition, we are able to use this detailed data to construct a number of alternative measures of portfolio diversification that are well suited to actual household behaviour.

## 3. Methodology

The basic model in this study is that the household environment, including the external environment, demographic and socioeconomic background and characteristics and financial experiences and attributes shape household financial decisions, including those concerning portfolio diversification. This approach is consistent with the methods used in the existing literature discussed in Section 2. The data used is from the Household, Income, and Labour Dynamics in Australia (HILDA) Survey (2009). This is the most comprehensive and largest dataset on Australian household financial data currently available. The data in this study concerning household wealth is from Wave 6 of the survey, which directed a series of questions on household wealth to the

household member knowing most about the household's finances. Watson (2009) provides further details on the wealth module itself.

The survey includes 11 household assets (in $000s): (i) bank accounts (BNK), (ii) home assets (HOM), (iii) other property assets (OTH), (iv) superannuation (SPR), (v) equity investments (EQI), (vi) cash investments (CSH), (vii) life insurance (LFE), (viii) trust funds (TST), (ix) business assets (BUS), (x) vehicles (VEH), and (xi) collectibles (COL). This taxonomy is similar to comparable overseas studies.

Table 1 provides selected descriptive statistics on the distributional properties of the 11 assets in the sample by asset holding and non-asset holding households. Importantly, while very few households hold no assets, relatively few hold more than several assets, and almost none hold all assets. This is consistent with the international evidence, including amongst others Haliassos et al. (2001) in Cyprus, Böorsch-Supan and Eymann (2002) in Germany, and Polkovnichenko (2005) and Campbell (2006) in the US.

**Table 1: Household asset statistics**

| | All households | | | | | Asset-holding households | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Number | Mean | Std. dev. | Skewness | Kurtosis | Number | Mean | Std. dev. | Skewness | Kurtosis | Proportion |
| BNK | 7058 | 27.924 | 78.650 | 7.998 | 84.985 | 6862 | 28.721 | 79.622 | 7.900 | 82.845 | 0.972 |
| HOM | 7058 | 296.639 | 414.946 | 6.217 | 68.499 | 4607 | 454.456 | 438.254 | 7.124 | 73.897 | 0.653 |
| OTH | 7058 | 124.847 | 623.665 | 14.158 | 235.135 | 1437 | 613.203 | 1269.569 | 7.048 | 53.583 | 0.204 |
| SPR | 7058 | 112.092 | 235.822 | 5.674 | 45.988 | 5537 | 142.883 | 257.858 | 5.195 | 38.115 | 0.784 |
| EQI | 7058 | 51.006 | 270.072 | 11.064 | 143.320 | 2659 | 135.390 | 426.877 | 6.844 | 53.669 | 0.377 |
| CSH | 7058 | 2.410 | 33.414 | 21.798 | 526.758 | 166 | 102.477 | 193.486 | 3.148 | 9.416 | 0.024 |
| LFE | 7058 | 7.940 | 63.539 | 13.168 | 195.872 | 551 | 101.701 | 205.545 | 3.540 | 12.709 | 0.078 |
| TST | 7058 | 11.277 | 136.503 | 17.241 | 319.092 | 243 | 12.861 | 95.965 | 8.321 | 69.764 | 0.034 |
| BUS | 7058 | 52.954 | 333.761 | 10.210 | 120.491 | 883 | 423.268 | 856.958 | 3.457 | 12.695 | 0.125 |
| VEH | 7058 | 22.238 | 37.266 | 8.561 | 118.318 | 6289 | 24.957 | 38.610 | 8.452 | 112.752 | 0.891 |
| COL | 7058 | 3.440 | 28.287 | 23.302 | 649.396 | 987 | 24.598 | 72.151 | 9.161 | 96.564 | 0.140 |

The primary analytical technique is to specify measures of diversification calculated using these assets as dependent variables in regressions with household demographic, socioeconomic and financial characteristics as predictors. Markowitz (1952) portfolio theory states that a portfolio is fully diversified if it has minimum risk (variance) at a given level of return, or equivalently, maximum return at a given level of risk. Unfortunately, the concept of mean–variance efficiency is unlikely to apply to household asset portfolios. Here we follow the work on industry diversification in bank loan portfolios, as recently exemplified by Kamp et al. (2007), as both streams of research rely on insufficiently detailed data at the unit level.

Let $X_i^{m,t}$ be the nominal investment of household *m* at time *t* in asset *i* with *i* = 1, . . . , *n* where $x_i^{m,t}$ is the proportion of total wealth invested:

$$x_i^{m,t} = \frac{X_i^{m,t}}{\sum_{j=1}^{n} X_i^{m,t}} \tag{1}$$

Using these values, we calculate eight measures of diversification: three using information on the number or shares of wealth in household assets, two with reference to a benchmark portfolio, and one in terms of the risk profile of the chosen asset concentration. The first measure of diversification represents a naïvely-invested

portfolio that only takes into account the number of assets held by the household (Barasinska, Schäfer & Stephan 2008):

$$D_p(x) = 1/n_i \tag{2}$$

where $n$ is the number of asset classes held by the $i$th household and $D_p$ lies in the interval [1/$n$,1]. Where the household holds all assets, perfect naïve diversification is then $1/n$ and perfect concentration is one. The second measure of diversification is a Hirschman–Herfindahl index concentration measure ($D_h$):

$$D_h(x) = \sum_{i=1}^{n} x_i^2 \tag{3}$$

This measure is also distributed in the interval [1/$n$,1] where perfect concentration is equal to 1 when all wealth is invested in a single asset and perfect diversification 1/$n$ when wealth is invested equally across all assets. The third measure of diversification is a Shannon entropy index ($D_s$):

$$D_s(x) = - \sum_{i=1}^{n} x_i \bullet \ln(1/x_i) \tag{4}$$

where $D_s$ is distributed in the interval [–ln($n$),0] such that perfect concentration is equal to 0 when all wealth is held in a single asset and perfect diversification is expressed by –ln($n$).

The next two measures of diversification quantify the distance between the household's asset portfolio $x$ and a benchmark asset portfolio $y$. The first of these relative measures, the sum of absolute differences ($D_a$) is:

$$D_a(x,y) = \frac{1}{2} \sum_{i=1}^{n} |x_i - y_i| \tag{5}$$

Where $y_i$ is the proportion of wealth held in the benchmark portfolio. We can then interpret $D_a$ as being the proportion of the household's portfolio $x$ that would have to rearranged to achieve the benchmark portfolio. The second measure $D_r$ is the absolute relative difference:

$$D_r(x,y) = \frac{1}{n} \sum_{i=1}^{n} \frac{|x_i - y_i|}{x_i + y_i} \tag{6}$$

The key difference is that $D_r$ includes relative differences and thereby takes account of the relative size of the assets when calculating the deviation. The final measure of diversification concerns risk concentration. We measure diversification (concentration) here by the proportion of household assets held in financial assets (BNK, SPR, EQI, CSH. LFE, TST). Table 2 provides selected descriptive statistics of the diversification measures. All five measures are consistent in that increasing (decreasing) values are associated with more concentrated (diversified) portfolios.

**Table 2: Diversification measure statistics**

| Statistic | $D_p$ | $D_h$ | $D_s$ | $D_a$ | $D_r$ | $D_m$ |
|---|---|---|---|---|---|---|
| Mean | 0.280 | 0.578 | -0.760 | 0.457 | 0.697 | 0.367 |
| Std. deviation | 0.163 | 0.213 | 0.387 | 0.189 | 0.108 | 0.316 |
| 25$^{th}$ percentile | 0.200 | 0.412 | -1.037 | 0.322 | 0.621 | 0.105 |
| 50$^{th}$ percentile | 0.250 | 0.532 | -0.788 | 0.420 | 0.694 | 0.263 |
| 75$^{th}$ percentile | 0.333 | 0.734 | -0.496 | 0.551 | 0.781 | 0.578 |

The next set of information comprises the explanatory variables specified in the Tobit regression models. Our basic hypothesis is that these socioeconomic and demographic characteristics of Australian households determine the level of household asset diversification as previously defined. The coding and descriptive statistics for these variables are included in Table 3. The first set of six variables relate to the demographic characteristics of the household and the principal respondent. The first variable is the number of persons in the household (HSH) as an indicator of size. Generally, an increase in the size of the household suggests an increase in the level and diversity of human capital and the development of investment needs, interests and abilities not encountered in a smaller household. We hypothesise a negative coefficient.

The second variable is the proportion of children in the household (PCH) (Hochguertal, Alessie & Van Soest 1997; Cobb-Clark & Hildebrand 2009). While children imply an increase in the need for many forms of asset investment (especially those with consumption properties), including home property, vehicles, life insurance, and trust funds, the need for human capital investment (children's education) and their high expenditure needs reduces the resources available for investment elsewhere. We hypothesise a positive coefficient indicating that households with a high proportion of children hold less-diversified portfolios.

The next two variables concern the sex (FEM) and age (AGE) of the principal household respondent. To start with, a typical hypothesis is that females may lack financial skills through education and experience (Hochguertal, Alessie & Van Soest 1997; Jianakoplos & Bernasek 1998; Worthington 2006, 2007, 2008). This would suggest that households with a female respondent might hold less-diversified portfolios and we hypothesise a positive coefficient for FEM.

In terms of respondent age (AGE), the lifecycle hypothesis commonly used to support a hump-shaped accumulation of wealthy over an individual's lifetime has some applicability to diversification in that portfolios will increase in complexity and risk during the working years and simplify and become less risky with retirement (Andersson 2001; Banks & Smith 2002; McCarthy 2004; Cobb-Clark & Hildebrand 2009). At the same time, older households may better meet the needs of information-intensive assets, like own-business, collectibles and equity investment.

**Table 3: Explanatory variable definitions and statistics**

| Variable | Definition | Mean | Std. dev. |
|---|---|---|---|
| HSH | Number of persons in household | 2.448 | 1.407 |
| PCH | Proportion of children in household | 0.128 | 0.215 |
| FEM | 1 if female responding to most questions in household; 0 otherwise | 0.490 | 0.500 |
| AGE | Age in years of person responding to most questions in household | 47.955 | 17.689 |
| CPC | Couples with children aged < 15 years; 0 otherwise | 0.224 | 0.417 |
| LPC | Lone parents with children aged < 15 years; 0 otherwise | 0.056 | 0.229 |
| GRI | Gross income in $ thousands | 72.399 | 68.710 |
| PWS | Proportion of wage and salary income | 0.575 | 0.488 |
| PBZ | Proportion of business income | 0.058 | 0.422 |
| PIN | Proportion of investment income | 0.061 | 0.201 |
| PPP | Proportion of private pensions and transfer income | 0.045 | 0.148 |
| AST | Total assets | 709.700 | 1267.586 |
| HRS | 1 if takes substantial risks expecting substantial returns; 0 otherwise | 0.014 | 0.119 |
| MRS | 1 if takes above-average risks expecting above-average returns; 0 otherwise | 0.056 | 0.230 |
| RAV | 1 if not willing to take financial risks; 0 otherwise | 0.341 | 0.474 |
| NSC | 1 if never has any spare cash; 0 otherwise | 0.156 | 0.363 |

Moreover, the housing owned by many older households may overcome the borrowing constraints facing younger households and a number of studies have already considered the interrelationships between housing and other areas of investment (Bruekner 1997; Frantantoni 1998; Arrondel & Lefebvre 2001; Flavin & Yamashita 2002; Cocco 2005). We hypothesise a negative coefficient indicating that older households have more diversified portfolios.

The final two demographic variables are dummy variables for couples with children (CPC) and lone parents with children (LPC) households. To a certain extent, CPC provides a similar proxy to the proportion of children in a household except that it more accurately defines the household composition (Hochguertal, Alessie & Van Soest 1997). Generally, CPC households are typically younger working families actively engaged in building their asset portfolio, especially those assets expected to deliver services over time (like housing and vehicles). In contrast, LPC households often suffer a disadvantage in the composition of their asset portfolios because of their less-diverse human capital, ongoing workforce constraints, and the impact of the factors sometimes responsible for their creation (especially separation and divorce). Single parent households are especially at risk from a lack of financial access and understanding (Worthington 2006). We hypothesise negative and positive coefficients for CPC and LPC, respectively.

The next set of six variables concern the socioeconomic characteristics of the household. First, gross annual income (GRI) is used as a proxy for the resources available for investment, and thereby the ability to overcome barriers to asset market entry, along with an indirect proxy for education. For example, Worthington (2006) has linked income with many aspects of financial access and understanding. The next four variables comprise the proportion of household income from wages and salaries (PWS), business (PBZ), investments (PIN), and private pensions and transfers (PPP). The omitted category is the proportions of income from public and foreign pensions and transfers. These variables all follow the argument that there is a strong relationship between the sources of household income (as proxies for financial abilities, knowledge, and constraints) and the composition of their asset portfolios.

For example, the largest component of household wealth is usually (non-tradable and unhedgeable) labour income. On one hand, this may lead households to invest more cautiously; on the other, the flexibility to increase labour supply may increase their willingness to engage in financial risks (Bodie Merton & Samuelson 1992; King & Leape 1998; Alessie, Hochguertel & Van Soest 2002; Campbell 2006). Similarly, Gentry and Hubbard (2004) argue that entrepreneurial (business) investors have extremely concentrated portfolios with most wealth held in the form of business assets. The final socioeconomic variable is the total assets of the household (AST). Typically, the argument is that the increase in assets is associated with increasingly diversified portfolios (Hochguertal, Alessie & Van Soest 1997; King & Leape 1998; Guiso & Japelli 2002; Banks & Smith 2002; McCarthy 2004). A negative coefficient is then hypothesised when the diversification measures are regressed against household assets.

The final set of four variables concern the self-declared level of risk aversion of the principal respondent for each household. Theory would suggest that investors with higher risk aversion would maintain more diversified portfolios to minimise the variance of returns (Barasinksa 2008). Conversely, King and Leape (1998) suggest that risk-averse individuals are more likely to limit their portfolios to relatively safe assets, like

bank accounts and government bonds, and this necessarily implies less diversification. We use dummy variables (in increasing order of risk aversion) to indicate if the respondent is highly risk-seeking (HRS), moderately risk-seeking (MRS), and risk-avoiding (RAV).

## 4. Discussion

Table 4 provides the estimated coefficients, standard errors and p-values of the parameters for the Tobit regressions. Also included is the log-likelihood ratio statistic as a test of the null hypothesis that all slope coefficients are zero and Wald chi-squared statistics of the null hypotheses that the demographic (upper panel), socioeconomic (middle panel) and risk attitude (lower panel) coefficients are jointly insignificant. As shown, all of the models are highly significant, as are the joint coefficients, with the exception of risk attitudes in the model where $D_m$ is the regressand.

Consider first the model predicting diversification as measured by the number of assets in the household portfolio (columns 2, 3 and 4). The significantly negative estimated coefficients for HSH, AGE, CPC, PWS, PBZ, PIN, PPP and MRS indicate that larger and older households, couples with children, households drawing larger portions of their income from wages and salaries, business assets, investment and private pensions and transfers, and moderately risk-taking households tend to hold more diversified portfolios. However, households with a greater proportion of children (PCH), those with higher incomes (GRI) and assets (AST), and those stating they never have any spare cash for financial risk-taking (NSC) hold more concentrated portfolios, as indicated by the significant positive coefficients.

**Table 4: Parameter estimates and statistics**

| | $D_p$ | | | $D_h$ | | | $D_s$ | | |
|---|---|---|---|---|---|---|---|---|---|
| Variable | Coef. | Std. error | p-value | Coef. | Std. error | p-value | Coef. | Std. error | p-value |
| CONS. | 0.589 | 0.015 | <0.001 | 0.837 | 0.016 | <0.001 | –0.184 | 0.027 | <0.001 |
| HSH | –0.024 | 0.002 | <0.001 | –0.022 | 0.002 | <0.001 | –0.051 | 0.004 | <0.001 |
| PCH | 0.064 | 0.018 | <0.001 | 0.067 | 0.029 | 0.022 | 0.177 | 0.051 | <0.001 |
| FEM | 0.004 | 0.003 | 0.188 | 0.009 | 0.005 | 0.059 | 0.015 | 0.008 | 0.059 |
| AGE | –0.002 | 0.001 | <0.001 | –0.001 | 0.001 | <0.001 | –0.002 | 0.001 | 0.001 |
| CPC | –0.031 | 0.008 | <0.001 | 0.002 | 0.013 | 0.903 | –0.022 | 0.023 | 0.326 |
| LPC | 0.006 | 0.011 | 0.574 | 0.031 | 0.018 | 0.080 | 0.020 | 0.030 | 0.514 |
| GRI | 0.001 | 0.001 | 0.086 | –0.003 | 0.001 | <0.001 | –0.007 | 0.001 | <0.001 |
| PWS | –0.210 | 0.010 | <0.001 | –0.215 | 0.011 | <0.001 | –0.423 | 0.018 | <0.001 |
| PBZ | –0.183 | 0.012 | <0.001 | –0.205 | 0.014 | <0.001 | –0.412 | 0.024 | <0.001 |
| PIN | –0.205 | 0.020 | <0.001 | –0.296 | 0.028 | <0.001 | –0.584 | 0.053 | <0.001 |
| PPP | –0.236 | 0.011 | <0.001 | –0.289 | 0.016 | <0.001 | –0.556 | 0.029 | <0.001 |
| AST | 0.001 | 0.001 | <0.001 | 0.001 | 0.001 | <0.001 | 0.001 | 0.001 | <0.001 |
| HRS | –0.010 | 0.012 | 0.432 | –0.004 | 0.019 | 0.818 | –0.027 | 0.038 | 0.483 |
| MRS | –0.019 | 0.005 | <0.001 | –0.025 | 0.009 | 0.007 | –0.055 | 0.018 | 0.002 |
| RAV | 0.004 | 0.004 | 0.315 | 0.021 | 0.005 | <0.001 | 0.041 | 0.009 | <0.001 |
| NSC | 0.034 | 0.006 | <0.001 | 0.073 | 0.008 | <0.001 | 0.157 | 0.012 | <0.001 |
| *ln*LR | 2961.840 | – | <0.001 | 2519.130 | – | <0.001 | 3471.521 | – | <0.001 |
| $\chi$2 D | 584.965 | – | <0.001 | 145.877 | – | <0.001 | 275.694 | – | <0.001 |
| $\chi$2 SE | 2091.015 | – | <0.001 | 1644.214 | – | <0.001 | 2372.652 | – | <0.001 |
| $\chi$2 RA | 59.856 | – | <0.001 | 131.823 | – | <0.001 | 210.667 | – | <0.001 |
| | $D_a$ | | | $D_r$ | | | $D_m$ | | |
| CONS. | 0.888 | 0.013 | 0.001 | 0.888 | 0.013 | 0.001 | 0.888 | 0.013 | 0.001 |
| HSH | –0.028 | 0.002 | 0.001 | –0.028 | 0.002 | 0.001 | –0.028 | 0.002 | 0.001 |
| PCH | 0.075 | 0.026 | 0.004 | 0.075 | 0.026 | 0.004 | 0.075 | 0.026 | 0.004 |
| FEM | 0.003 | 0.004 | 0.388 | 0.003 | 0.004 | 0.388 | 0.003 | 0.004 | 0.388 |
| AGE | –0.004 | 0.001 | <0.001 | –0.004 | 0.001 | <0.001 | –0.004 | 0.001 | <0.001 |
| CPC | –0.047 | 0.011 | <0.001 | –0.047 | 0.011 | <0.001 | –0.047 | 0.011 | <0.001 |
| LPC | –0.002 | 0.016 | 0.889 | –0.002 | 0.016 | 0.889 | –0.002 | 0.016 | 0.889 |
| GRI | –0.002 | 0.001 | 0.001 | –0.002 | 0.001 | 0.001 | –0.002 | 0.001 | 0.001 |
| PWS | –0.219 | 0.009 | 0.001 | –0.219 | 0.009 | 0.001 | –0.219 | 0.009 | 0.001 |
| PBZ | –0.166 | 0.011 | 0.001 | –0.166 | 0.011 | 0.001 | –0.166 | 0.011 | 0.001 |
| PIN | –0.122 | 0.019 | 0.001 | –0.122 | 0.019 | 0.001 | –0.122 | 0.019 | 0.001 |
| PPP | –0.260 | 0.014 | 0.001 | –0.260 | 0.014 | 0.001 | –0.260 | 0.014 | 0.001 |
| AST | 0.001 | 0.001 | 0.053 | 0.001 | 0.001 | 0.053 | 0.001 | 0.001 | 0.053 |
| HRS | 0.031 | 0.018 | 0.075 | 0.031 | 0.018 | 0.075 | 0.031 | 0.018 | 0.075 |
| MRS | 0.011 | 0.009 | 0.213 | 0.011 | 0.009 | 0.213 | 0.011 | 0.009 | 0.213 |
| RAV | 0.010 | 0.004 | 0.022 | 0.010 | 0.004 | 0.022 | 0.010 | 0.004 | 0.022 |
| NSC | 0.042 | 0.006 | 0.001 | 0.042 | 0.006 | 0.001 | 0.042 | 0.006 | 0.001 |
| *ln*LR | 2709.929 | – | <0.001 | 2709.929 | – | <0.001 | 2709.929 | – | <0.001 |
| $\chi$2 D | 1280.486 | – | <0.001 | 1280.486 | – | <0.001 | 1280.486 | – | <0.001 |
| $\chi$2 SE | 1605.986 | – | <0.001 | 1605.986 | – | <0.001 | 1605.986 | – | <0.001 |
| $\chi$2 RA | 55.374 | – | <0.001 | 55.374 | – | <0.001 | 55.374 | – | <0.001 |

Further, the value of the constant (0.589) gives the expected level of household diversification across the population after controlling for the set of explanatory factors and stochastic error. Comparing this with the mean value of $D_p$ from Table 2 (0.280) illustrates that the typical household asset portfolio is substantially more concentrated than simple descriptive statistics would at first suggest: 1.73 assets per portfolio in the base household as against the 3.57 assets indicated in Table 2. Based on the magnitudes of the coefficients, the major impacts on portfolio diversification as measured are the proportions of income from wages and salaries (PWS) and private

pensions and transfers (PPP), while the least effect arises from gross income (GRI) and assets (AST).

Next, consider the model where the dependent variable is the Hirschman–Herfindal measure of diversification (columns 5, 6 and 7). This more accurately reflects the attempts at diversification by households as it accounts for the share of assets invested. In most cases, the signs and magnitudes of the estimated coefficients are consistent with the former model, with the exception of FEM, CPC, LPC, and RAV. Taken together, these indicate that female and lone parent with children households and those unwilling to take financial risks hold less-diversified (more concentrated portfolios) while couples with children no longer significantly impact upon household diversification. The changes in the levels of significance are very similar to the model where the Shannon entropy index of diversification (Ds) serves as the dependent variable (columns 8, 9, and 10). Once again, the mean levels of Dh and Ds (0.578 and -0.760) are substantially lower (more diversified) than their expected value from the Tobit models (0.837 and -0.184) (more concentrated), yet again illustrating the major impact demographic, socioeconomic and risk attitude factors have on the observed level of diversification (about 31 percent in both cases)

Columns 11, 12, and 13 provide the estimated coefficients, standard errors and level of significance for the model where the absolute deviation from the benchmark portfolio is the dependent variable. As shown, the typical household asset portfolio requires an adjustment of 88.8 percent in order to attain the benchmark portfolio. However, less adjustment is required in overall percentage terms for large households (HSH), older households (AGE), couples with children, those with higher income (GRI) and those sourcing higher proportions of theiur incomes from wages and salaries (PWS), business interests (PBZ), investments (PIN) and private pensions and transfers (PPP).

Likewise, more adjustment is required for households with a greater proportion of children (PCH), those with more assets (AST), and highly risk-seeking (HRS) and risk-avoiding (RAV) households. Interestingly, the magnitude of GRI AST are still positive, though very small, suggesting that higher income and wealthier households hold marginally more concentrated portfolios. The regression where the relative difference in benchmark diversification is the dependent variable (columns 14, 15 and 16) has similar signs and magnitudes, but given the expected level of diversification indicated by the constant (0.924) is higher (than 0.888), implies that even greater changes are required to achieve the benchmark portfolio when asset size is taken into account.

The final model in Table 4 is when the share of market assets is the dependent variable. In general, the signs and levels of significance of the estimated coefficients differ quite markedly from the earlier models. In the sample, the typical household will hold 61.3 percent of its assets in market assets. However, the share is higher for higher incomes (GRI) and assets (AST) and with greater portions of their income from investments (PIN) and private pensions and transfers (PPP) and lower for larger (HSH) and older (AGE) households or households comprising couples (CPC) and lone parents (LPC) with children. Very interestingly, risk attitudes have no effect, individually or jointly, on the holding of market-related assets, unlike the other five measures of diversification. Moreover, the typical household after controlling for demographic, socioeconomic and risk attitude factors and stochastic error is substantially more concentrated in market assets than the mean household is. This

suggests that aggregate sector wide measures substantially underestimate the exposure of the typical Australian household to market risk.

## 5. Conclusion

The present study uses Tobit models to investigate the impact of demographic, socioeconomic and financial characteristics on new measures of Australian household asset portfolio diversification. To start with, we have shown that portfolio diversification varies strongly according to demographic and socioeconomic characteristics and risk attitudes. All other things being equal, larger households, older households, households composed of couples and children, and households drawing larger portions of their income from wages and salaries, business interests, investments and private pensions and transfers have more diversified portfolios. Moderately risk-taking households also tend to hold more diversified portfolios. However, households with a greater proportion of children and lone parent households tend to have more concentrated portfolios, along with risk-avoiding households and those with insufficient spare cash. Wealthier and higher income households also hold less-diversified portfolios, but the effect is very small.

One major finding is that the demographic, socioeconomic and risk attitude factors that so persuasively impact upon our heuristic measures of diversification bear little relation to the factors influencing the proportion of assets held in market assets (bank accounts, superannuation, equity and cash investments, life insurance and trust funds). This would suggest that the need (or requirement) to hold substantial portions of household wealth in financial assets offsets or counters the efforts of households seeking risk-minimisation through diversification. The most conspicuous contributor, at least in the HILDA survey, is superannuation and, to a lesser extent, equity investment. Fortunately, in most Australian households large non-financial holdings in home property balance (at least in terms of implied diversification) the impact of superannuation as the largest financial asset; however, this does not apply equally to all households (especially younger households).

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