Financial Risk Attitudes and Macroeconomic Factors: Evidence from the HILDA Survey

Tracey West [1] and Andrew Worthington [2]

[1] PhD student, Griffith Business School, Griffith University, Nathan, QLD 4111, Australia
Tel:+61-7-55528539; Email t.west@griffith.edu.au

[2] Professor, Griffith Business School, Griffith University, Nathan, QLD 4111, Australia
Tel:+61-7-37354273; Fax: +61-7-37351739; Email: a.worthington@griffith.edu.au

Abstract. In this paper, we use panel data from the 2001–10 Household, Income and Labour Dynamics in Australia (HILDA) survey to investigate changes in the attitudes to financial risk of Australian households, particularly in response to changes in the macroeconomic environment. This is an important area of research because knowledge of the risk tolerance of individuals has important implications for, among other things, household financial planning and monetary and regulatory policy. Ordered logit analyses are performed to test changes in risk tolerance, after controlling for changing respondent, household and macroeconomic characteristics. While the macroeconomic indicators used generally lacked significance given the relatively short sample period, descriptive analysis of financial risk attitudes showed that over the ten-year period, individuals that reevaluated their attitude to financial risk-taking were more likely to reduce their tolerance for financial risk. .

Keywords: Risk attitudes, Risk aversion, Household, Income and Labour Dynamics in Australia (HILDA) survey, Ordered logit

EFM Classification: 370, 720, 770

1. Introduction

The division of individual asset portfolios between risky and riskless assets has already been the subject of a voluminous theoretical and empirical literature. However, while investment professionals have long been aware of the importance of risk for long-term wealth growth, individuals may not be so well aware, and this has important implications for their ability to accumulate wealth. This is because risk-averse individuals are more likely to limit their portfolios to relatively safe assets, such as saving accounts and government bonds, whereas individuals with less aversion to risk will also include risky assets in their portfolios, such as stocks. Importantly, in the long run, risk and returns exhibit a known positive relationship, and so riskier assets tend to provide higher returns than less risky assets (Yao, 2011). Consequently, financial risk-taking can be wealth accumulating in good economic times.

Apart from innate demographic, socioeconomic and behavioural factors, , individuals may change their attitude to financial risk-taking in response to changes in general economic or market conditions. For example, the recency effect posits that the most recent market conditions have the greatest impact on individual memory, and consequently, market perceptions (Miller and Campbell, 1959). Evidence also suggests that individuals may be unduly influenced by recent historical returns when making investment choices (Clark-Murphy, Gerrans and Speelman, 2009). In addition, regret theory may help explain momentum in markets. For instance, when stock market prices are rising, momentum investors speculate that prices will continue to move higher. In effect, risk tolerance for momentum investors increases as prices increase because the fear of missing out on continued gains (i.e., regret) outweighs the potential psychic and economic benefits of moving against the trend (Grable, Lytton and O'Neill, 2004).

In contrast, when prices move down, the herding instinct can cause investors to sell into the trend. This effectively shows that certain investors wish to minimize losses and avoid the regret associated with holding a security as it falls in value. Importantly, such bias may produce suboptimal results over the longer term, as it may cause investors to increase their risk tolerance in good economic climates, leading to additional risk asset holdings, and conversely, lead investors to sell their riskier assets in poorer economic climates as risk aversion rises.

This study investigates changes in household risk tolerance levels over time using the Household, Income and Labour Dynamics in Australia (HILDA) survey and proposes several explanations for the changes observed. As far as the authors are aware, no previous study has

considered the time-variance in the HILDA financial risk tolerance measure. This is important work for several reasons, all of which depend at their root on degree of financial risk aversion in the Australian population. First, retirement of the Australian baby boomer population raises increasing concerns about the extent to which mature-age Australians now have, and may have in the future, a capacity for financial self-reliance during retirement and the resulting government budget burden for those that have not accumulated sufficient wealth is an ongoing concern for public policy. However, wealth does not only infer benefits for retirement in that it provides general economic security for adverse conditions, including periods of unemployment and ill health. It also enables households to gain access to credit for future investment, i.e. human capital or asset accumulation. In addition, the benefits afforded from investments in wealth-generating assets, such as cash income or capital appreciation, also contribute to the quality of life and standard of living of households. Lastly, this study complements existing research on the changes to financial risk tolerance in other countries, such as the US (see Yao, Hanna and Lindamood, 2004 and Yao and Curl, 2011), and provide valuable insights into financial education and investment advice in Australia.

The remainder of the paper is divided into five main areas. Section 2 briefly reviews the literature on the analysis of the determinants of risk aversion. Section 3 explains the empirical methodology and data employed in the analysis. Section 4 discusses variable specification and Section 5 presents the results. Section 5 contains some brief concluding remarks.

2. Literature Review

Past studies have employed a variety of methods to measure individual aversion to risk. Problematically, individual risk aversion is a personal trait that is inherently unobservable. As a consequence, some studies infer risk tolerance from individual stock holdings (Paas, Bijmolt and Vermunt, 2007 and Wang and Hanna, 2007) or from the risk profile of held superannuation accounts (Olivares, Diaz and Besser, 2008 and Watson and McNaughton, 2007). Others utilise household survey panel data that include a question on the individual attitudes to financial risk. Conventionally, these questions can comprise either hypothetical scenarios about income gambles (such as the US Health and Retirement Survey) or a scaled question about willingness to take risk (including the US Survey of Consumer Finances, German Socioeconomic Panel and the Australian HILDA Survey). While there are issues as to whether respondents properly understand the scaled questions, and there may be

measurement error because individuals potentially select a different response over time, even though they may not have changed their actual risk preference, respondent preferences still provide important information (Yao and Curl, 2011).

An extensive literature also investigates the determinants of risk aversion. These determinants include demographic, socioeconomic and attitudinal factors. In particular, studies that have assessed the impact of lifecycle factors, such as age, education, income, wealth, marital status, and household structure, on risk aversion have highlighted important relationships related to the lifecycle. In brief, as individuals move through their lifecycle, they typically move from completing education and beginning working life to raising a family. These early stages typically entail relatively lower incomes and larger financial commitments, such as mortgages and the costs association with raising children. Conversely, as individuals approach the later stages of their lifecycles, they tend to have relatively higher incomes and commensurately lower financial commitments with the reduction in mortgage payments and child costs.

The typical lifecycle phase therefore implies a positive correlation between aging and wealth accumulation. In addition, factors that contribute to increasing incomes, such as higher levels of education, also positively correlate with wealth, while household structure factors, such having children, may have a negative impact on wealth. Thus the relationship between wealth and risk aversion is an important key to understanding the relationships between risk aversion and its determining factors. Empirically, the findings of existing studies are mixed. The most common finding is that risk aversion has been found to decrease as wealth increases for wealthy individuals (Morin and Suarez, 1983; Bellante and Saba, 1986; Riley and Chow, 1992), although some studies have also found that risk aversion increases as wealth rises for less wealthy individuals (Siegel and Hoban, 1982; Morin and Suarez, 1983). Some studies also identify constant relative risk aversion (Friend and Blume, 1975). It seems, therefore, that there are behaviourial changes in relation to risk attitude at each tail of the wealth distribution. At a higher bound, once a certain level of financial security is reached, individuals believe they can tolerate addition financial risk, whereas at the lower bound, individuals with negligible wealth tolerate financial risk, but as they accumulate savings, they are less inclined to tolerate risk. The middle of the wealth distribution, therefore, is generally risk averse.

It is then not surprising given the correlation between wealth, income and education, that increasing income and education levels have been found to be positively associated with the

willingness to take risk (Jianakoplos and Bernasek, 2008; Bajtelsmit, 1999; Riley and Chow, 1992). Intuitively, higher incomes lead to greater disposable income and financial literacy because of learning to make long-term decisions enabled by employment and earnings. For example, the results of recent research have found that individuals with precautionary savings (defined as financial assets >3 months of income) have a higher tolerance for risk (see Sung and Hanna, 1996; Yao, Gutter and Hanna, 2005; and Gutter and Fontes, 2006). The proportion of total wealth held in homeownership may also proxy liquidity. For example, Brimmer (1988) found that Blacks in the US displayed higher proportions of homeownership to total wealth, which limited their ability to invest in riskier, potentially higher-yielding assets.

Higher incomes may also enable individuals to invest in education. Higher levels of education, such as a university degree, are also linked to higher future incomes (Psacharaopoulos, 1988). Thus education and income are positively correlated, and so may similarly impact upon risk aversion. Some researchers postulate that higher levels of education may be particularly important for facilitating a higher tolerance for financial risk-taking, as it leads individuals to acquire skills in gathering and processing information about financial markets (Lusardi and Mitchell, 2007). However, not all studies concur. For example, Jianakoplos and Bernasek (1998) found that predicted risky assets for single men, single women and married couples decreased with the level of education.

Generally, most studies find that risk aversion tends to increase with age (Morin and Suarez, 1983; Bellante and Saba, 1986; Palsson, 1996; Olivares, Diaz and Besser, 2008). However, there are some subtle nuances in this relationship. For example, Bellante and Saba (1986) conclude that the 35–44 year age group is less risk averse than the youngest category. They also found that risk aversion increases significantly beyond 45 years of age. However, when they controlled for human capital (defined as the discounted present value of future earnings), they found that relative risk aversion decreased with age. Similarly, Halek and Eisenhauer (2001) reported that risk tolerance increased with age before 65 years of age and thereafter decreased.

However, most of these studies are cross-sectional, and therefore are unable to make inference about how individual risk aversion changes over time. Longitudinal studies, like Yao and Curl (2011), find the age effect consistent with previous studies, that is, that risk tolerance declines with age. However, they also found that risk tolerance declines over time for individuals. This ageing effect has important implications for the financial planning

industry, as planners should periodically revise their clients' risk preference. Ageing may also positively correlate with health issues, in that uncertainty surrounding these issues will influence risk tolerance (Yao, Hanna and Lindamood, 2004). For example, Yao, Hanna and Lindamood (2004) found that individuals that perceived themselves to be in good health were more likely to take risks.

The effects of age on risk aversion are further complicated by the possibility of cohort effects. For example, the observation that a baby boomer couple carries a higher risk portfolio than their parents of the same age. Potentially, this could be because of their age or the increased financial conservatism of cohort experiencing the post-depression era. For instance, Malmendier and Nagel (2011) confirm that individuals that have experienced generally low stock market returns throughout their lives have a lower willingness to assume financial risk. In addition, Jianakoplos and Bernasek (2006) find that in the US, younger cohort harbour lower expectations of receiving social security benefits, perceive less likelihood of receiving defined benefit pensions, and enjoy poorer job security in comparison with older cohorts, and this encourages them to reduce the amount of financial risk taken. In addition, it is natural to consider that periods of high economic growth makes it easy for households (as it does for firms) in a given cohort to take greater financial risks, while adverse economic periods, like the global financial crisis, may induce aversion to risk taking and a corresponding increase in savings rates (Fukuda, 2009).

Anecdotal evidence of the relationship between risk aversion and gender suggests that women are more risk averse than men. A number of studies have confirmed this finding, even when controlling for the effects of other individual characteristics, such as age, education, and wealth (Jianakoplos and Bernasek, 1998; Sunden and Surette, 1998; Riley and Chow, 1992; Palsson, 1996; and, Olivares, Diaz and Besser, 2008). In addition, Riley and Chow (1992) found that widowed and separated women were more risk averse than married women, who in turn were more risk averse that women that had never married. Love (2010) also found that while women respond to divorce by choosing less risky investment options, men tended to move towards riskier investment options. Married couples and couples with children are also more likely to be risk averse (Fratantoni, 1998; Euwals, Emann and Borsch-Supan, 2004).

Homeownership may indirectly impact individual's attitude to financial risk-taking. Because of the prominent role played by residential property in most household portfolios, and given the associated credit constraint and the effect of home ownership on consumption and saving,

investment in other financial assets may be 'crowded out' (Cocco, 2005; Yao and Zhang, 2005). For example, Fratantoni (1998) find that a high mortgage payment to income ratio leads to a 15% decrease in the share of risky financial assets in portfolios, which he asserted may explain the stockholding puzzle as a typical homeowner in the US is a homeowner with a mortgage commitment. Becker and Shabani (2010) also conclude that households with a mortgage are 10% less likely to own stocks and 37% less likely to own bonds compared to similar households with no mortgage debt, and that 26% of households should forgo equity market participation on account of the high interest rates they pay on debt.

A few studies have examined the risk attitudes of people of different nationalities and even religion. Some empirical research, for instance, has found Germans are generally risk adverse (Werwatz, Belitz, Kim, Schmidt-Ehmke and Vosskamp, 2006) while Zinkhan and Karande (1991) found that Spanish MBA students were less risk averse than other MBA students. Using the US Survey of Consumer Finances, Halek and Eisenhauer (2001) found that Blacks and Hispanics were more risk tolerant than Whites, while Brumagim and Wu (2005) compared the responses to financial risk-taking scenarios of participants in China and the US, and found that the Chinese subjects consistently demonstrated risk-seeking preferences. Lastly, Bartke and Schwarze (2008) found that religious faith has a strong influence on an individual risk propensity, with individuals with a religious affiliation significantly less risk-tolerant than atheists, Muslims and Protestants also exhibited relatively higher risk aversion.

Conventional wisdom also asserts that relatively risk-averse individuals are less likely to be self-employed, as entrepreneurship involves making risky decisions. In fact, some studies have found that risk tolerance is a significant determinant of being self-employed (Polkovnichenko, 2005; Hartog, Ferrer-i-Carbonell and Jonker, 2002; Yao, Hanna and Lindamood, 2004). However, others have found wealth to be a more significant determinant than risk tolerance (Kan and Tsai, 2006). When examining their business owner asset portfolios, however, it is evident that they tend to hold less of their wealth in stocks than other similarly wealthy households, perhaps because of the greater background income risk they faced (Heaton and Lucas, 1997, 2000).

Finally, studies on the influence of stock market returns on financial risk tolerance generally conclude a positive association. In 2004, Yao, Hanna and Lindamood used the US Survey of Consumer Finances over the period 1983 to 2001 and found that financial risk tolerance tends to increase when stock returns increase and decrease when stock returns decrease. Yao and Curl (2011) used the US Health and Retirement Study over the period 1992 to 2006 and

found identical results, while Grable, Lytton and O'Neill (2004) used an internet-based survey of investors and found that risk tolerance scores were higher after stock market increases and lower after stock market falls. Shefrin (2000) likewise reported that risk-tolerance levels of institutional investors and financial advisors and market return changes were positively related and Loewenstein, O'Donoghue and Rabin (2003) concluded that individual preferences change over time, and that recent stock market price changes have the greatest impact on subsequent risk-tolerance levels.

Malmendier and Nagel (2011) examines whether low stock market returns or low bond market returns experienced during their lives affect an individual's participation in the respective markets. Using the US Survey of Consumer Finances (SCF) between 1960 and 2007, they calculate the annual real returns of the stock market and long-term government bonds at each SCF survey date and find that household risk taking is strongly related to experienced returns. In brief, households that have experienced higher stock market returns express greater willingness to take on financial risk, participate in the stock market, and conditional on participation, invest more liquid assets in stock. Similarly, households that have experienced higher bond returns are more likely to participate in the bond market. Interestingly, they found that the memory of events such as the Great Depression dissipates over time, and does not fully coincide with risk aversion for that generation, although the memory can last for a considerable period of time. Again using the SCF (as along with the Panel Study of Income Dynamics), Bilias, Georgarakos and Haliassos (2009) conclude that falls in the stock market generally encouraged people to remain out of the market, rather than just temporarily get out.

In Australia, the research on risk tolerance is very limited. In early work, Hallahan, Faff and McKenzie (2004) use a psychometric attitude test composed of 25 questions compiled by ProQuest and a sample of individuals mostly sourced from the clients of financial planners. They find that gender, income and wealth are significantly positively associated with financial risk tolerance and a negative relationship between risk tolerance and age and marital status. The study also found that the response to the self-assessed risk tolerance question accorded with the risk tolerance score, although there was a tendency to underestimate risk tolerance. Australian researchers have also shown some targeted interest in gender differences in risk tolerance. For example, both Jefferson and Ong (2010) and Austen, Jefferson and Ong (2010) use the HILDA Survey for 2006 and find that single women's asset portfolios tend to be less diversified than single men, which according to portfolio theory,

implies a higher risk preference, though this does not necessarily consider the liquidity constraints single women face. Watson and McNaughton (2007) also examined the risk preferences of women and men in the Australian university sector's superannuation fund, finding that women generally choose more conservative investment strategies than their male counterparts.

When examining the existing research on financial risk tolerance and aversion, a number of salient points emerge. First, a large share of the work has been undertaken in the US. While there are studies outside the US, there are very few studies in Australia that contribute to our knowledge on individual attitudes to financial risk-taking. Secondly, most studies focus on the relationships between demographic and socioeconomic characteristics and risk aversion, with fewer studies examining the effect of the market experiences of individuals. Finally, although an increasing number of studies employ longitudinal data in their respective analyses, few consider how individuals transition between the various levels or categories of financial risk attitudes. It is with these considerations in mind that the present study is undertaken.

3. Research Method and Data

This study uses longitudinal data from 2001 to 2010 from the HILDA survey, which is funded by the Australian Government through the Department of Families, Housing, Community Services and Indigenous Affairs with the Melbourne Institute of Applied Economic and Social Research at the University of Melbourne responsible for the design and management of the survey. The panel data is recognisably of very high quality and aims to follow 13,969 people interviewed in Wave 1 across 7,682 households) throughout their lives. The HILDA sample is made increasingly complex by the need to track members of participant households as they leave and join new households that are then added to the sample. For example, in 2010, the survey re-interviewed 9,002 people (6,727 households) (Summerfield, Dunn, Freidin, Hahn, Ittak, Kecmanovic, Li, Macalalad, Watson, Wilkins and Wooden, 2011).

For the descriptive analysis, a balanced panel is used and data are weighted using the appropriate weight to adjust for non-response bias such that results are well representative of the Australian population. For the multivariate analysis, an unbalanced panel is used and data are not weighted given that weighting regression analyses when the weights are endogenous is suspect for hypothesis testing (Deaton, 1997).

The dependent variable in this analysis is the attitude to financial risk-taking. The following question appears in the HILDA self-completion questionnaire, which is administered to every member of the household aged 15 years or more that also completed a person questionnaire, and for which the interviewer collects later:

> "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. I take substantial financial risks expecting to earn substantial returns
> 2. I take above-average financial risks expecting to earn above-average returns
> 3. I take average financial risks expecting average returns
> 4. I am not willing to take any financial risks
> 5. I never have any spare cash"

A number of adjustments are made to this raw variable before the analysis itself. First, persons responding with (5) are excluded from the analysis (8,520 responses) because it is questionable as to how this option relates to financial risk-taking, and would significantly bias results if it were to be interpreted as being not willing to take financial risks and therefore combined with option (4). It is worth noting that this question is identical to that of the US Survey of Consumer Finances, with the exception of the inclusion of option (5) in the HILDA survey. This leaves 62,740 person-year observations.

Second, this question was included in the survey in 2001, 2002, 2003 and 2004 (corresponding Waves 1, 2, 3, and 4), and thereafter biannually in 2006, 2008 and 2010 (Waves 6, 8 and 10). For the ordered logit analysis, the missing observation for financial risk-taking (2005, 2007 and 2009) is imputed using a lag, i.e. if the respondent chose option (3) in 2004, then option (3) was imputed in 2005. However, we omit this imputation for f the descriptive analysis, leaving 40,360 observations for the balanced panel of responses to options (1) to (4).

Third, the benefit of the ordered logit model is that it implies a ranking. With the question in its current form, the ordered logit would imply moving from being significantly less risk averse (I take substantial financial risks) to being risk averse (I am not willing to take any financial risks). To make better conceptual sense of the findings, the responses have been recoded to reverse this order, so that the interpretation is from being risk averse through to taking substantial financial risks. The distribution of responses for the original and recoded attitude to financial risk taking is provided in Table 1. The recoded responses are abbreviated as 'No Risk', 'Average Risk', 'Above-Average Risk' and 'Substantial Risk'.

<TABLE 1 HERE>

As mentioned, an ordered logit model is employed is this study, with each respondent's attitude to financial risk as the dependent variable in a regression with demographic and socioeconomic characteristics and market variables as predictors. This analytical technique is appropriate as the dependent variable is discrete (i.e. it can only take values of 1, 2, 3 or 4), and it takes into account its ordinal nature, that is, risk aversion increases as we move from 1 to 4 through 2 and 3 (Worthington, 2006). An alternative would have been to use a multinomial logistic model, but if used when the response variable is ordinal, information is discarded as it ignores the ordered aspect of the outcome (Cameron and Trivedi, 2009). In an ordered logit, an underlying score is estimated as a linear function of the independent variables and a set of cutpoints (Cameron and Trivedi, 2009), and the probability of observing outcome *i* corresponds to the probability that the estimated linear function plus random error is within the range of the cutpoints estimated for the outcome:

$$\Pr(outcome_j = i) = \Pr\left(k_{i-1} < \beta_1 x_{1j} + \beta_2 x_{2j} + \cdots + \beta_k x_{kj} + u_j \leq k_i\right)$$

(1) where u_j is assumed to be logistically distributed in the ordered logit, x_{kj} is a vector of control variables with estimated coefficients $\beta_1, \beta_2, \ldots \beta_k$, and cutpoints $k_1, k_2, \ldots k_{k-1}$, where k is the number of possible outcomes, k_0 is taken as $-\infty$, and k_k is taken as $+\infty$. The estimated coefficients β and the cutpoint parameters are obtained by maximising the log-likelihood. The sign of the estimated coefficients can be immediately interpreted as determining whether or not the dependent variable increases with the regressor (Cameron and Trivedi, 2009). Predicted probabilities and marginal effects are also calculated.

The control variables in the ordered logit regression model comprise demographic and socio-economic and market variables. The demographic and socioeconomic characteristics are generally comparable to those employed in earlier studies of financial risk-taking. We use publicly available market data to establish the link between financial risk-taking and changes in the market.

We include twelve demographic and socioeconomic characteristic variables. The demographic variables include the age of the respondent (a series of dummy variables for age categories), age-squared, education of the respondent (a series of dummy variables for educational levels), religious affiliation (a series of dummy variables for religious categories), gender/marital status of the respondent (dummy variables for four gender/marital status combinations), presence of children under 15 years of age (dummy variable), employment

status of the respondent (dummy variable for self-employed), home-ownership (dummy variable), health status of respondent (a series of dummy variables for health status) and ethnicity (series of dummy variables for country of birth). For the age category, gender and homeownership variables, imputation is required for 2001 values, as these three variables were not included in the first survey. A lag for the 2002 value is imputed for 2001. Similarly, religious affiliation was only included in 2004 and 2007. It is assumed that religious affiliation is relatively static (at least in the short term), and so the responses for the missing years are filled in with the responses from 2004 and 2007.

The socioeconomic variables include the level of annual household income and the ratio of financial assets to total assets. Annual household income is the household financial year disposable income, adjusted to constant 2001 dollars by multiplying the income reported by the ratio of the 2001 Consumer Price Index (CPI) to the CPI of the income year. Wealth is included in the model as net worth (total assets less total debts) of the household. Households were asked for estimates of the values of various assets and debts in the 'Wealth Module' conducted in Waves 2, 6 and 10 of the HILDA survey (2002, 2006 and 2010, respectively). Total assets include both financial assets (equity investments, cash investments, trusts, bank accounts, redeemable insurance policies, superannuation accounts), and nonfinancial assets (estimated values of the home, other property, collectibles, businesses and vehicles). Total debt comprises property debt, business debt, credit card debt, HECs debt and other debt, and from Wave 6 onwards, overdue household bills. To preserve confidentiality, HILDA apply a weighted mean to households within wealth thresholds. Accordingly, net worth is a series of dummy variables for these wealth thresholds. While other studies employ net worth as a wealth variable, they also include variations such as including human capital and excluding homes and vehicles (Friend and Blume, 1975; Morin and Suarez, 1983). This is a topic for future research.

We particularly focus on whether individuals differ in their willingness to take financial risks depending on changes in general market conditions. Accordingly, we include six indicators of market conditions and consumer confidence. The first indicator is the ASX 200 Price Index from the Australian Securities Exchange (ASX). Financial literature postulates that stock prices reflect the entire set of value-relevant information available to investors, including economic forecasts (Chia, Czernkowski and Loftus, 1997). Evidence has also been found to support that people use movements in stock prices as a leading indicator of future economic activity (Otoo, 1999). The next two indicators are the official cash rate target and

10-year Australian government bond rates from the Reserve Bank of Australia. Changes in the cash rate provide important signals about the state of the economy and the monetary policy response, and receive widespread news coverage. This is because, in Australia, banks traditionally pass on cash rate changes to their variable mortgage rates, which in turn directly impact the financial commitments of mortgage holder. Similarly, public news announcements have been shown to significantly impact the price of 10-year government bonds, so changes in bond rates also provide useful information about the economy (Balduzzi, Elton and Green, 2001).

Both the unemployment rate and the CPI are from the Australian Bureau of Statistics, both representing indicators of the state of the economy with natural links to consumer spending and confidence. Lastly, the Roy Morgan Consumer Confidence Rating compiled by Roy Morgan Research (a weekly telephone interview of approximately 1,000 respondents, with responses to five questions about future financial expectations) is used to proxy retail consumer/investor confidence, with an increase rise in the index indicating an increase in consumer confidence. Variation in consumer confidence indexes have been particularly shown to be affected by labour market conditions, inflation and stock prices, with just four lags of these variables and the index itself explaining nearly 90 percent of the variation (Garner, 2002). Therefore, the Roy Morgan Consumer Confidence Rating is included to reflect the persistence of these past events in attitudes to the market. Tests for collinearity of the market variables produces Variance Inflation Factor (VIF) ratings of 10.02 for the Cash Rate, 19.08 for the ASX200, 33.85 for the Unemployment Rate, 2.65 for the Roy Morgan Consumer Confidence Rating, 3.84 for the CPI and 2.42 for the Government Bond rates. While some suggest that VIF values greater than 10 may warrant further examination, O'Brien (2007) says that automatically questioning the results of studies when the VIF is greater than 10 or even 30 is inappropriate. Thus, all of the variables are included in the analysis, even though three of the VIFs are very high. The age, income, education and wealth variables were tested for collinearity and reported low VIFs (all less than 1.2).

<TABLE 2 HERE>

Table 2 provides the hypothesised signs and descriptive statistics of the coefficients for all parameters. The model used in this paper is:

$$\Pr(risk\ aversion_j = i) = \Pr\ (k_{i-1} < \beta_1 age\ category\ dummy + \beta_2 age\ squared + \beta_3 education\ dummy + \beta_4 religious\ affiliation\ dummy + \beta_5 gender\ /\ marital\ status\ combinations\ dummy + \beta_6 household\ status\ dummy + \beta_7 employment\ status\ dummy + \beta_8 children\ under\ 15\ dummy + \beta_9 self -$$

$$employed\ dummy + \beta_{10} household\ ownership\ dummy + \beta_{11} country\ of\ birth\ dummy + \beta_{12} self-assessed\ health\ dummy + \beta_{13} annual\ household\ income + \beta_{14} net\ worth + \beta_{15} ASX200\ Price\ Index + \beta_{16} Cash\ Rate\ Target + \beta_{17} 10yr\ Australian\ Govt\ Bond\ Rates + \beta_{18} unemployment\ rate + \beta_{19} CPI + \beta_{20} Roy\ Morgan\ Consumer\ Confidence\ Rating + u_j \leq k_i \quad (2)$$

4. Empirical Findings

4.1 Descriptive Results

For discrete response data, it is possible to examine the spells of time which respondents spend in the different categories. For longitudinal data, these observations correspond to the survey waves (and years). In order to examine the transition of respondents between the various categories of attitudes to financial risk-taking over the ten-year period, a lag is generated. Thus, we lose the values for the first lag (2001). In addition, a second lag of the financial risk attitude is generated for years 2006, 2008 and 2010, to represent transition between categories in these later years (because of the financial risk attitude being omitted from the 2005, 2007 and 2009 surveys). For example, if the respondent chose 'Average Risk' in 2008, this is also the value in 2010. We utilise a balanced panel. The results are reported in Table 3.

<TABLE 3 HERE>

Table 3 shows that of those respondents that had chosen 'No Risk' anytime during the ten-year sample period, 76.44 per cent choose 'No Risk' again in the next period, i.e. 76.44 per cent remain in the 'No Risk' category over the ten year period. However, 21.87 percent of respondents that chose 'No Risk' in one period transitioned to choosing 'Average Risk' in the next period, and 1.11 percent and 0.58 percent transitioned to 'Above-Average Risk' and 'Substantial Risk' respectively. Similarly, while 70.59 percent of observations that were ever in 'Average Risk' for one period remained at 'Average Risk' for the next period, 21.73 percent transitioned to 'No Risk'. This indicates that there is flexibility between these two categories of financial risk-taking in both directions and of approximately equal proportions.

For respondents that had chosen 'Above-Average Risk' for one period during the survey, 45.44 percent remain in that category for the next period, although 42.21 percent transitioned to 'Average Risk'. Such a high transition rate may reflect some measurement error because of the subjectivity of the description, i.e. what is real difference between 'Average' risk-

taking and 'Above-Average' risk-taking, and because respondents may be inconsistent in their responses over time. Nonetheless, there is no such large transition from those that chose 'Average Risk' in previous periods to 'Above-Average Risk' in the next period, i.e. there is less transition up the risk tolerance scale, and there is a definite preference for down-grading risk tolerance. This is supported by the transition for the 'Substantial Risk' category, where 31.19 percent remain in the category, but 29.68 percent transition down the scale to 'Above-Average Risk', a further 25.33 percent transition further down to 'Average Risk', and 13.80 percent transition even further down to defining themselves as taking 'No Risk'.

Calculating variations to the attitude to financial risk response over time for each individual and between different individuals provides some insight into whether this risk preference is stable over time for individuals and whether individuals differ significantly in their risk preferences. The variation for within individuals is 37.8 percent, calculated as the difference between the actual response and the individuals mean response in all time periods. The variation between different individuals is 62.2 percent, calculated as the difference between the individual mean and the overall mean in all time periods. Therefore, most of the variation in attitudes to financial risk arises, much as expected, to differences in the characteristics of individuals. However, the relatively large percentage of within variation shows that risk preferences should not be assumed to be fixed for individuals across all periods. For example, in a relatively short ten years, 37.7 percent of individuals varied their response by from their mean response.

These findings show that, while we would expect risk attitudes to differ between individuals due to their different characteristics and experiences, a relatively high proportion of individuals revise their own risk attitude over time. Over the 10 year period included in this study, there was a definite preference for down-grading the level of risk tolerance. This has significant implications for financial planners, as individuals may declare a higher tolerance for risk initially, and may revise their risk tolerance downwards over time, perhaps because of changes in the lifecycle or macroeconomic factors. The investment strategy adopted based on the risk preference declared initial consultation, may not be suitable for extended periods of time.

4.2 Ordered Logit Results

The estimated coefficients, standard errors and marginal effects of the ordered logit regression are provided in Table 4.

To account for the complex survey design, the standard errors are calculated using the Jack-knife method. In addition, the 10-year Treasury Bond rate was rejected from the model because of high collinearity. The F-test rejected the null hypothesis that all slope coefficients are zero with 12 degrees of freedom at the 0.01 percent level, meaning that the model is appropriate for predicting attitude to financial risk of the sample population. Further, separate Wald tests of the six macroeconomic variables and the demographic and socioeconomic characteristic variables indicate that the coefficients are not simultaneously equal to zero, meaning that including both sets of variables create a statistically significant improvement in the fit of the model.

<TABLE 4 HERE>

The sign of the coefficient estimate can be immediately interpreted as determining whether risk tolerance increases with the regressor. If the coefficient is positive, then an increase in the independent variable necessarily decreases the probability of being in the lowest category ('No Risk'), and increases the probability of being in the highest category ('Substantial Risk') (Cameron and Trivedi, 2010). The estimated coefficients for 16 variables are significant at the ten percent level or lower. The estimated coefficients indicate that having an educational attainment of a bachelor's degree and above, being self-employed, being in very good or excellent health, and having a net wealth over $1 million contributes to having a greater likelihood of a higher level of risk tolerance (positive coefficients).

On the other hand, being under 25 years of age, having a vocational qualification or an educational attainment to Year 11 or lower, being female (single or married), having children in the household under 15, and having a net wealth of under $499,999 have a greater likelihood of a low level of financial risk-taking (negative coefficients). The direction and significance of these variables is in concordance with the literature. Households with low levels of disposable income, such as younger households that are completing their studies or starting their working careers, households that have reduced employment opportunities due to their low level of education, households with the expense of rearing young children, and females who are often not high income earners for various reasons, are perhaps consuming most of their budget, leaving little to satisfy savings motives. The reduced savings, and perhaps low levels of financial literacy, leave respondents with these characteristics unlikely

to consider risk-taking behaviour. Meanwhile, it is those households with more resources and less pressure on the household budget, such as being in good health, which are able to afford variability in asset returns.

Interestingly, the CPI is the only one of the market coefficients to be statistically significant, albeit at the ten percent level. Increases in the CPI result in an increased likelihood of being in lower risk categories, i.e. as the price of consumables rises, there is uncertainty about the future which reduces risk-taking behaviour. Reasons for the lack of significance of the remaining market indicators could be misspecification of the model or the indicator, or simply because individuals may not immediately re-evaluate their attitudes to financial risk-taking. Considering the within variation of 37.7 percent, individuals are apt to re-evaluate their attitude to financial risk. In addition, the transition of survey respondents between risk categories shows a greater likelihood of a downward revision in risk attitude over the period 2001 to 2010, which is not unexpected given the global financial conditions from 2007 onwards. For example, of those respondents that had chosen the 'Average Risk' category previously, approximately 21 percent re-evaluated to a lower risk category, and only about 7 percent transitioned to a higher risk category. Similarly, of those respondents that chose the 'Above-Average Risk' category in a previous period, approximately 48 percent revised their preference to a lower risk category while only 6 percent revised to a higher risk category.

The lack of significance of the market factors in this study suggest that it is lifecycle factors that determine this change in risk attitude, not market conditions. However, it is unlikely that the demographic and socioeconomic characteristics of households have changed so rapidly and so consistently across the sample. That said, it may take factors time for individuals to respond to changes in the market environment, so one direction for future research may be to incorporate lags and/or a longer sample period.

Calculating the predicted probabilities shows that the model had an absolute improvement (in terms of correct predictions) of 1.94 percent, and a relative improvement (in terms of incorrect predictions) of 1.31 percent. For the risk tolerance categories, based on the demographic and socioeconomic characteristics and macroeconomic variables included, the model under-predicts respondents choosing the 'No Risk' category by 2.22 percent, 'Above-Average Risk' by 14.41 percent and 'Substantial Risk' by 20.90 percent. Conversely, the model over-predicts 'Average Risk' by 5.70 percent. This implies that the model is very good at predicting risk aversion, but it is less accurate for higher levels of risk tolerance. The life cycle characteristics included in this model therefore do not adequately capture the

characteristics of households whom choose the 'Above-Average Risk' or 'Substantial Risk' categories with enough predictive power. Further research is required to refine the model, although these characteristics may be unobservable.

To facilitate further comparability, marginal effects are calculated. The marginal effect measures the effect on the conditional mean of the probability of each category of attitude to financial risk of a change in one of the regressors. For categorical variables, the marginal effect shows how the attitude to financial risk changes as the categorical variable changes from 0 to 1, holding all other variables at their means. For the continuous variables, it measures the instantaneous rate of change, which may or may not be close to the effect on the effect on the attitude to financial risk category of a one unit increase in the regressor, and the standard normal density function is used.

Consider the Under 25 years age category. Being in this category decreases the probability of being in the highest category of attitude to financial risk by 0.5 percent, being in the 'Above-Average Risk' category by 2.1 percent, and being in the 'Average Risk' category by 5.2 percent. There is a 7.8 percent probability of being in the 'No Risk' category. By comparison, a university education increases the probability of being in the 'Average-Risk' category by 6.5 percent, the 'Above-Average Risk' category by 3.6 percent, and the 'Substantial Risk' category by 0.9 percent, and lowers the probability of being in the 'No Risk' category by 11 percent. Being female also increases the probability of being in the 'No Risk' category, by 19.3 percent for single females and by 15.3 percent for married females, whereas being a married (single) female reduces the probability of being in the 'Average Risk' category by 10.5 (13.4) percent, in the 'Above-Average Risk' category by 3.9 (4.7) percent, and in the 'Substantial Risk' category by 0.9 (1.1) percent.

Increasing wealth also increases the probability of financial risk tolerance. Being in the net wealth category of above $1,500,000 ($1,000,000–$1,499,999) decreases the probability of being in the 'No Risk' category by 12.4 (9.4) percent. The probability of financial risk tolerance in these higher net wealth categories increases by 6.6 (5.3) percent for 'Average Risk', 4.6 (3.3) percent for 'Above-Average Risk' and 1.2 (0.8) percent for 'Substantial Risk' for the above $1,500,000 ($1,000,000–$1,499,999) net wealth category. From the marginal effects in Table 4, it appears that being in the two highest net wealth categories, having a university education, being self-employed and being affiliated with a religion other than Christian has the most positive effect on being in the highest risk tolerance category. Conversely, being female (single or married), being in the lowest wealth category, having an

educational attainment of year 11 or lower, and being under 25 years has the greatest impact on being risk averse.

5. Discussion and Future Research

This study uses descriptive methods and ordered logit models to investigate the duration and factors that determine the attitude to financial risk-taking of Australians. Investigation of the transition between categories of attitude to financial risk-taking shows that over the period 2001 to 2010, there is less transition up the risk tolerance scale (i.e. increased risk tolerance), and there is a definite preference for down-grading risk tolerance. Put differently, Australians have become less tolerant of financial risk in the past decade. Respondents also exhibited a greater tendency to remain in the categories of lowest risk-tolerance (76.44 percent for the 'No Risk' category and 70.59 percent for the 'Average Risk' category) over time, in comparison to only 45.44 percent of respondents remaining in the 'Above-Average Risk' category and 31.19 percent remaining in the 'Substantial Risk' category. In addition, we found that while most of the variation in attitude to financial risk-taking arises from the differing demographic and socioeconomic characteristics of individuals, the relatively large percentage of within variation shows that risk preference should not be assumed to be fixed for individuals across time. In the short time period of ten years, individuals varied their response by 37.7 percent from their mean response.

The ordered logit analysis shows that attitudes to financial risk-taking in Australia vary strongly according to certain demographic and socioeconomic characteristics. A higher likelihood of risk tolerance is indicated by having a bachelor's degree and above, being self-employed, being in very good or excellent health and having a net wealth of over $1 million. Conversely, a higher likelihood of risk aversion is associated with being young (under 25 years), having an educational qualification of Year 11 or lower, being female, having children in the household and being in the lowest net wealth category. Marginal effects show that being in the highest net wealth category has the greatest positive effect on being in the highest risk tolerance category. Conversely, being female (single or married) has the greatest impact on being risk averse. These results provide important information to industry and public policymakers as to where financial education programs can best be targeted.

This study attempted to examine whether individuals differ in their willingness to take financial risks in response to the macroeconomic environment. Six indicators of market

performance and consumer confidence were included in the model to determine their relevance to attitudes to financial risk. However, none of the macroeconomic indicators as specified were shown to exert a significant influence. One possible reason for this result is that the study tested the recency effect, that is, that individuals use recent information to formulate their preferences for risk-taking. According, the observations for the economic indicators were taken in the previous month to the survey field work start date. Perhaps individuals may take some time to re-evaluate their attitude to financial risk-taking in response to changes in the market. In addition, this study specified the macroeconomic indicators as their index levels. It is possible that individuals may derive more information about the state of the economy by the magnitude of the change. Nonetheless, the results of this study still suggest that individual demographic, socioeconomic and financial characteristics are far more influential on attitudes of financial risk-taking than overall market conditions.

Directions for future research include additional investigation into the factors that contribute to individual's attitude to financial risk-taking being re-evaluated. A dynamic model of attitude to financial risk would also provide insight into the effect of past attitudes on current attitudes and the persistence of respondent attitudes. It would also be interesting to investigate the linkage between high net worth individuals and higher risk tolerance. Insight into the nature of this relationship would contribute to financial planning and wealth accumulation strategies. Another extension could focus on comparing the results of the attitudinal measure of risk tolerance with other measures of risk tolerance, such as those based on portfolio composition or scenario-type surveys. For the financial planning and superannuation sectors, studies of this nature help to ensure that individuals are comfortable with their portfolio risk, and for public policy these studies provide segments of the population to target about wealth accumulation education.

Acknowledgements

The sample data used in this paper were extracted from the HILDA data using the Add-On package PanelWhiz v3.0 (Nov 2010) for Stata, written by Dr. John P. Haisken-DeNew (john@panelwhiz.eu). Haisken-DeNew and Hahn (2010) describe PanelWhiz in detail The PanelWhiz generated DO file and any Panelwhiz Plugins are available upon request. Any data or computational errors in this paper are our own.

References

Austen, S., T. Jefferson, and R. Ong, 2010. Gender Comparisons of Asset and Debt Portfolios in Australia, *Paper prepared for the 39th Australian Conference of Economists* Sydney.
Bajtelsmit, V. L., 1999. Evidence of Risk Aversion in the Health and Retirement Study, *Unpublished manuscript*, 1-27.
Balduzzi, P., E. J. Elton, and T. C. Green, 2001. Economic News and Bond Prices: Evidence from the U.S. Treasury Market, *Journal of Financial and Quantitative Analysis* 36, 523-543.
Bartke, S., and R. Schwarze, 2008. Risk-Averse by Nation or by Religion? Some Insights on the Determinants of Individual Risk Attitudes, *SOEP Papers on Multidisciplinary Panel Data Research* 131, 1-18.
Becker, T. A., and R. Shabani, 2010. Outstanding Debt and the Household Portfolio, *The Review of Financial Studies* 23, 2900-2934.
Bellante, D., and R. P. Saba, 1986. Human Capital and Life-Cycle Effects on Risk Aversion, *Journal of Financial Research* 9, 41.
Bilias, Y., D. Georgarakos, and M. Haliassos, 2010. Portfolio Inertia and Stock Market Fluctuations, *Journal of Money, Credit, and Banking* 42, 715-742.
Brimmer, A. F., 1988. Income, Wealth, and Investment Behavior in the Black Community, *American Economic Review* 78, 151-155.
Brumagim, A. L., and X. Wu, 2005. An Examination of Cross-cultural Differences in Attitudes Towards Risk: Testing Prospect Theory in the People's Republic of China, *Multinational Business Review* 13, 67-86.
Cameron, A. C., and P. K. Trivedi, 2009. *Microeconometrics: Methods and Applications*(Cambridge University Press, Melbourne).
Chia, Y. K., R. Czernkowski, and J. Loftus, 1997. The Association of Aggregate and Disaggregated Earnings with Annual Stock Returns, *Accounting and Finance* 37, 111-128.
Clark-Murphy, M., P. Gerrans, and C. Speelman, 2009. Return Chasing as a Driver in Individual Retirement Savings Investment Choices: Evidence from Australia, *Journal of Family and Economic Issues* 30, 4-19.
Cocco, J., 2005. Portfolio Choice in the Presence of Housing, *The Review of Financial Studies* 18, 535-567.
Deaton, A., 1997. *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*(John Hopkins University Press, Baltimore).
Euwals, R., A. Eymann, and A. Borsch-Supan, 2004. Who Determines Household Savings for Old Age? Evidence from Dutch Panel Data, *Journal of Economic Psychology* 25, 195-211.
Fratantoni, M. C., 1998. Homeownership and Investment in Risky Assets, *Journal of Urban Economics* 44, 27-42.
Friend, I., and M. E. Blume, 1975. The Demand for Risky Assets, *American Economic Review* 65, 900-922.
Fukuda, K., 2009. A Cohort Analysis of Equity Shares in Japanese Household Financial Assets, *Journal of Financial Econometrics* November, 1-27.
Garner, A., 2002. Consumer Confidence After September 11, *Federal Reserve Bank of Kansas City Economic Review* Second Quarter, 1-21.
Grable, J., R. Lytton, and B. O'Neill, 2004. Projection Bias and Financial Risk Tolerance, *Journal of Behavioral Finance* 5, 142-147.
Gutter, M. S., and A. Fontes, 2006. Racial Differences in Risky Asset Ownership: A Two-Stage Model of the Investment Decision-Making Process, *Financial Counselling and Planning* 17, 64-78.
Haisken-DeNew, J. P., and M. Hahn, 2010. PanelWhiz: Efficient Data Extraction of Complex Panel Data Sets-An Example Using the German SOEP, *Journal of Applied Social Science Studies* 130, 643-654.
Halek, M., and J. Eisenhauer, 2001. Demography of Risk Aversion, *Journal of Risk and Insurance* 68, 1-24.
Hallahan, T., R. Faff, and M. McKenzie, 2004. An Empirical Investigation of Personal Financial Risk Tolerance, *Financial Services Review* 13, 57-78.
Heaton, J., and D. Lucas, 1997. Market Frictions, Savings Behavior, and Portfolio Choice, *Macroeconomic Dynamics* 1, 76-101.
Heaton, J., and D. Lucas, 2000a. Portfolio Choice in the Presence of Background Risk, *The Economic Journal* 110, 1-26.
Jefferson, T., and R. Ong, 2010. Profiling Gender Differentials in Asset and Debt Portfolios in Australia, *Centre for Research in Applied Economics Working Paper Series* 201004, 1-18.
Jianakoplos, N. A., and A. Bernasek, 1998. Are Women More Risk Averse?, *Economic Inquiry* 36, 620-630.
Jianakoplos, N. A., and A. Bernasek, 2006. Financial Risk Taking by Age and Birth Cohort, *Southern Economic Journal* 72, 981-1001.
Jianakoplos, N. A., and A. Bernasek, 2008. Family Financial Risk Taking When the Wife Earns More, *Journal of Family and Economic Issues* 29, 289-306.
Kan, K., and W.-D. Tsai, 2006. Entrepreneurship and Risk Aversion, *Small Business Economics* 26, 465-474.
Loewenstein, G., T. O'Donoghue, and M. Rabin, 2003. Projection Bias in Predicting Future Utility, *The Quarterly Journal of Economics* 118, 1209-1248.

Love, D. A., 2010. The Effects of Marital Status and Children on Savings and Portfolio Choice, *The Review of Financial Studies* 23, 385-432.
Lusardi, A., and O. S. Mitchell, 2007. Baby Boomer Retirement Security: The Roles of Planning, Financial Literacy, and Housing Wealth, *Journal of Monetary Economics* 54, 205-224.
Malmendier, U., and S. Nagel, 2011. Depression Babies: Do Macroeconomic Experiences Affect Risk Taking, *The Quarterly Journal of Economics* 126, 373-416.
Miller, N., and D. T. Campbell, 1959. Recency and Primacy in Persuasion as a Function of the Timing of Speeches and Measurement, *Journal of Abnormal and Social Psychology* 59, 1-9.
Morin, R.-A., and A. F. Suarez, 1983. Risk Aversion Revisited, *The Journal of Finance* 38, 1201-1216.
O'Brien, R., 2007. A Caution Regarding Rules of Thumb for Variance Inflation Factors, *Quality & Quantity* 41, 673-690.
Olivares, J. A., D. Diaz, and M. Besser, 2008. *Gender and Portfolio Choice: Are Women More Risk Averse When Selecting Pension Funds?*(Nevada).
Otoo, M. W., 1999. *Consumer Sentiment and the Stock Market*(Board of Governors of the Federal Reserve-Industrial Output Section, Washington).
Paas, L. J., T. H. A. Bijmolt, and J. K. Vermunt, 2007. Acquisition Patterns of Financial Products: A Longitudinal Investigation, *Journal of Economic Psychology* 28, 229-241.
Palsson, A.-M., 1996. Does the Degree of Relative Risk Aversion Vary With Household Characteristics, *Journal of Economic Psychology* 17, 771-787.
Polkovnichenko, V., 2005. Household Portfolio Diversification: A Case for Rank-Dependent Preferences, *The Review of Financial Studies* 18, 1467-1502.
Psacharopoulos, G., 1988. Education and Development: A Review, *World Bank Research Observer* 3, 99-116.
Riley, W. B., and K. V. Chow, 1992. Asset Allocation and Individual Risk Aversion, *Financial Analysts Journal* 48, 32-37.
Shefrin, H., 2000. *Beyond Greed and Fear: Understanding Behavioural Finance and the Psychology of Investing*(Harvard Business School Press, Cambridge, MA.).
Siegel, F. W., and J. P. Hoban, Jr., 1982. Relative Risk Aversion Revisited, *The Review of Economics and Statistics* 64, 481-487.
Summerfield, M., R. Dunn, S. Freidin, M. Hahn, P. Ittak, M. Kecmanovic, N. Li, N. Macalalad, N. Watson, R. Wilkins, and M. Wooden, 2011. *HILDA User Manual-Release 10*(University of Melbourne).
Sunden, A. E., and B. J. Surette, 1998. Gender Differences in the Allocation of Assets in Retirement Savings Plans, *American Economic Review* 88, 207-211.
Sung, J., and S. Hanna, 1996. Factors Related to Risk Tolerance, *Financial Counseling and Planning* 7, 11-20.
Wang, C., and S. D. Hanna, 2007. The Risk Tolerance and Stock Ownership of Business Owning Households, *Journal of Financial Counseling and Planning* 18, 3-18.
Watson, J., and M. McNaughton, 2007. Gender Differences in Risk Aversion and Expected Retirement Benefits, *Financial Analysts Journal* 63, 52-62.
Werwatz, A., H. Belitz, T. Kim, J. Schmidt-Ehmke, and R. Vosskamp, 2006. *Innovations Indicator Germany: Bericht 2005*(Berlin).
Worthington, A. C., 2006. Predicting Financial Literacy in Australia, *Financial Services Review* 15, 59-79.
Yao, R., 2011. Market Returns Affect Risk Tolerance, *Corporate Finance Review* 15, 5-9.
Yao, R., and A. Curl, 2011. Do Market Returns Influence Risk Tolerance? Evidence from Panel Data, *Journal of Family and Economic Issues* 32, 532-544.
Yao, R., M. S. Gutter, and S. Hanna, 2005. The Financial Risk Tolerance of Blacks, Hispanics and Whites, *Financial Counselling and Planning* 16, 51-62.
Yao, R., S. Hanna, and S. Lindamood, 2004. Changes in Financial Risk Tolerance, 1983-2001, *Financial Services Review* 13, 249-266.
Yao, R., and H. H. Zhang, 2005. Optimal Consumption and Portfolio Choices with Risky Housing and Borrowing Constraints, *The Review of Financial Studies* 18, 197-239.
Zinkhan, G. M., and K. W. Karande, 1991. Cultural and Gender Differences in Risk-Taking Behavior Among American and Spanish Decision Makers, *Journal of Social Psychology* 131, 741-742.

Table 1
Frequency of Responses to Attitude to Financial Risk Question in HILDA Survey

Original coding in survey	Recoding for regression analysis	2001	2002	2003	2004	2006	2008	2010	Total
[-] Refused/Not stated/No Self Complete Questionnaire	Omitted	1,124	1,165	1,182	1,167	1,483	1,838	1,750	9,709
		8%	9%	9%	9%	11%	14%	13%	11%
[1] Takes substantial risks expecting substantial returns	[4] Substantial Risk	201	181	161	185	209	201	188	1,326
		1%	1%	1%	1%	2%	2%	1%	1%
[2] Takes above-average risks expecting above-average returns	[3] Above-Average Risk	769	736	707	690	739	646	662	4,949
		6%	6%	6%	6%	6%	5%	5%	5%
[3] Takes average financial risks expecting average returns	[2] Average Risk	4,350	4,101	4,073	4,097	3,963	3,835	4,056	28,475
		31%	31%	32%	33%	31%	30%	30%	31%
[4] Not willing to take financial risks	[1] No Risk	4,725	4,527	4,404	4,344	4,526	4,328	4,881	31,735
		34%	35%	35%	35%	35%	34%	36%	35%
[5] Never has any spare cash	Omitted	2,800	2,331	2,201	1,925	1,985	1,937	1,989	15,168
		20%	18%	17%	16%	15%	15%	15%	17%
Total		13,969	13,041	12,728	12,408	12,905	12,785	13,526	91,363
		100%	100%	100%	100%	100%	100%	100%	100%

Table 2
Expected signs and statistics of parameters

Parameter	Expected Sign	Mean	Standard Deviation
Age Category			
Under 25	-	0.066	0.249
25-34 years[#]	+	0.173	0.378
35-44 years	+	0.284	0.451
45-54 years	+	0.289	0.453
55-64 years	+	0.155	0.362
Over 65 years	-	0.032	0.177
Age-Squared	+	2,008.072	1,050.229
Education Category			
Bachelor's degree and above	+	0.295	0.456
Vocational qualification	-	0.341	0.474
Year 12[#]	-	0.140	0.347
Year 11	-	0.224	0.417
Marital Status/ Gender			
Married Female	-	0.290	0.454
Married Male[#]	+	0.327	0.469
Single Female	-	0.201	0.401
Single Male	+	0.182	0.386
Household Status			
Presence of Children Under 15	-	0.577	0.494
Employment Type			
Self-Employed	+	0.117	0.321
Employee[#]	-	0.878	0.328
Housing Tenure			
Homeownership	-	0.771	0.420
Renter[#]	+	0.229	0.420
Country of Birth			
Oceania[#]	-	0.831	0.375
Europe	-	0.098	0.297
Asia	+	0.042	0.200
Other	-	0.030	0.170
Health			
Excellent Health	+	0.118	0.322
Very Good Health	+	0.401	0.490
Good Health[#]	-	0.365	0.481
Fair Health	-	0.093	0.291
Poor Health	-	0.008	0.091

[#] denotes the reference category.

Table 2 ***continued***

Expected signs and statistics of parameters

Parameter	Expected Sign	Mean	Standard Deviation
Religious Affiliation			
Christianity[#]	-	0.658	0.475
Other Religion	-	0.045	0.206
Atheist	+	0.298	0.457
Annual Household Income	+	66,676.890	42,887.380
Net Wealth			
Under $499,999	-	0.517	0.500
$500,000-$999,999[#]	+	0.222	0.415
$1,000,000-$1,499,999	+	0.073	0.260
Above $1,500,000	+	0.083	0.276
Macroeconomic Indicators			
Cash Rate	-	5.231	1.116
ASX200	+	4,330.598	933.238
10yr Treasury Bond Rate	-	5.666	0.408
Unemployment Rate	-	5.231	0.670
CPI	-	154.041	11.314
Roy Morgan Consumer Confidence Rating	+	118.767	10.334

[#] denotes the reference category.

Table 3

Transition Table

	Financial Risk Attitude				
Lagged Financial Risk Attitude	**No Risk**	**Average Risk**	**Above-Average Risk**	**Substantial Risk**	**Total**
No Risk	10,381	2,970	151	79	13,581
	76.44%	21.87%	1.11%	0.58%	100%
Average Risk	3,146	10,221	987	125	14,479
	21.73%	70.59%	6.82%	0.86%	100%
Above-Average Risk	151	1,033	1,112	151	2,447
	6.17%	42.21%	45.44%	6.17%	100%
Substantial Risk	73	134	157	165	529
	13.80%	25.33%	29.68%	31.19%	100%
Total	13,751	14,358	2,407	520	31,036
	44.31%	46.26%	7.76%	1.68%	100%

Table 4
Ordered Logit Parameter Estimates and Marginal Effects

			Marginal Effect on Predicted Probability				
Parameter	**Coefficient Estimate**	**Jack-knife Std. Err.**	**Change**	**No Risk**	**Average Risk**	**Above-Average Risk**	**Substantial Risk**
Age Category							
Under 25	-0.320 ***	0.096	0 to 1	0.078	-0.052	-0.021	-0.005
25-34 years[#]							
35-44 years	0.085	0.072	0 to 1	-0.020	0.013	0.006	0.001
45-54 years	0.100	0.112	0 to 1	-0.024	0.015	0.007	0.002
55-64 years	0.022	0.159	0 to 1	-0.005	0.003	0.002	<0.001
Over 65 years	-0.146	0.267	0 to 1	0.036	-0.024	-0.010	-0.002
Age-Squared	<0.001 *	0.000	Marginal	<0.001	<0.001	<0.001	<0.001
Education Category							
Bachelor's degree and above	0.470 ***	0.076	0 to 1	-0.110	0.065	0.036	0.009
Vocational Qualification	-0.132 *	0.077	0 to 1	0.032	-0.020	-0.009	-0.002
Year 12[#]							
Year 11	-0.366 ***	0.075	0 to 1	0.089	-0.060	-0.024	-0.006
Marital Status/ Gender							
Married Female	-0.628 ***	0.058	0 to 1	0.153	-0.105	-0.039	-0.009
Married Male[#]							
Single Female	-0.790 ***	0.076	0 to 1	0.193	-0.134	-0.047	-0.011
Single Male	-0.067	0.080	0 to 1	0.016	-0.010	-0.005	-0.001
Household Status							
Presence of Children Under 15	-0.257 ***	0.047	0 to 1	0.061	-0.039	-0.018	-0.005
Employment Type							
Self-Employed	0.322 ***	0.066	0 to 1	-0.075	0.044	0.025	0.006
Employee[#]							
Housing Tenure							
Homeownership	0.087	0.062	0 to 1	-0.021	0.013	0.006	0.001
Renter[#]							
Country of Birth							
Oceania[#]							
Europe	-0.115	0.087	0 to 1	0.028	-0.018	-0.008	-0.002
Asia	-0.025	0.112	0 to 1	0.006	-0.004	-0.002	<0.001
Other	-0.129	0.183	0 to 1	0.031	-0.020	-0.008	-0.002
Health							
Excellent Health	0.261 ***	0.065	0 to 1	-0.061	0.037	0.020	0.005
Very Good Health	0.132 ***	0.039	0 to 1	-0.032	0.020	0.009	0.002
Good Health[#]							
Fair Health	-0.077	0.083	0 to 1	0.019	-0.012	-0.005	-0.001
Poor Health	-0.207	0.208	0 to 1	0.051	-0.034	-0.014	-0.003

Notes:
*p<0.10, **p<0.05, ***p<0.01,
[#] denotes the reference category.
Marginal effects indicate the effect of each outcome on the probability of being in a given risk category; the standard normal density function is used for the continuous variables; the marginal effects for the dummy variables are analysed by comparing the probabilities that result when the variable takes it's two different values with those that occur with the other variables held at their sample means; probabilities for all categories sum to zero.

Table 4 ***continued***
Ordered Logit Parameter Estimates and Marginal Effects

			Marginal Effect on Predicted Probability				
Parameter	**Coefficient Estimate**	**Jack-knife Std. Err.**	**Change**	**No Risk**	**Average Risk**	**Above-Average Risk**	**Substantial Risk**
Religious Affiliation							
Christianity[#]							
Other Religion	0.308	0.239	0 to 1	-0.071	0.041	0.024	0.006
Atheist	0.071	0.058	0 to 1	-0.017	0.010	0.005	0.001
Annual Household Income	<0.001 ***	<0.001	Marginal	<0.001	<0.001	<0.001	<0.001
Net Wealth							
Under $499,999	-0.376 ***	0.054	0 to 1	0.090	-0.057	-0.026	-0.006
$500,000-$999,999[#]							
$1,000,000-$1,499,999	0.408 ***	0.095	0 to 1	-0.094	0.053	0.033	0.008
Above $1,500,000	0.552 ***	0.073	0 to 1	-0.124	0.066	0.046	0.012
Macroeconomic Indicators							
Cash Rate	-0.117	0.401	Marginal	0.028	-0.017	-0.008	-0.002
ASX200	<0.001	0.000	Marginal	<0.001	<0.001	<0.001	<0.001
10-year Treasury Bond Rate	Omitted		Marginal				
Unemployment Rate	-0.227	0.700	Marginal	0.054	-0.034	-0.016	-0.004
CPI	-0.015 *	0.008	Marginal	0.004	-0.002	-0.001	0.000
Roy Morgan Consumer Confidence Rating	-0.005	0.015	Marginal	0.001	-0.001	<0.001	<0.001

Notes:
*p<0.10, **p<0.05, ***p<0.01,
[#] denotes the reference category.
Marginal effects indicate the effect of each outcome on the probability of being in a given risk category; the standard normal density function is used for the continuous variables; the marginal effects for the dummy variables are analysed by comparing the probabilities that result when the variable takes it's two different values with those that occur with the other variables held at their sample means; probabilities for all categories sum to zero.