# Financial competence and expectations formation: evidence from Australia[*]

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## Abstract

We study the financial competence of Australian retirement savers using self-assessed and quantified measures. Responses to financial literacy questions show large variation and compare poorly with some international surveys. Basic and sophisticated financial literacy vary significantly with most demographics, self-assessed financial competence, income, superannuation accumulation and net worth. General numeracy scores are largely constant across gender, age, higher education and income. Financial competence also significantly affects expectations of stock market performance. Using a discrete choice model, we show that individuals with a higher understanding of risk, diversification and financial assets are more likely to assign a probability to future financial crises rather than expressing uncertainty.

# I Introduction

Retirement savings systems that outsource government provision to private financial institutions and individuals depend on ordinary people possessing the skills needed to manage their financial responsibilities well. Evidence is mounting that many households in both the developed and developing world do not (OECD, 2006, 2008). Australian surveys confirm international findings: Australians exhibit uneven financial competence (Financial Literacy Foundation, 2007; Citi Australia, 2010) and a poor understanding of risk management, investment and superannuation (ANZ 2008). In addition, the retirement provision task is complicated by the inherently long planning horizon, the fact that retirement is experienced only once (for most people) and that common shocks limit the extent of social learning (Campbell *et al.* 2011). Failures of financial literacy leading to avoidable financial mistakes may have contributed to the recent financial crisis and are used as evidence in favour of financial market regulation (Akerlof & Shiller 2009; Campbell *et al.* 2011).

On the other hand, existing research into retirement savings behaviour shows that personal financial skills, retirement planning and retirement income outcomes are strongly complementary (Lusardi & Mitchell, 2009; van Rooij *et al.* 2009). Higher levels of financial literacy are associated with increased stock market participation (Yoong, 2010; van Rooij *et al.* 2011), higher private retirement saving (Bucher-Koenen, 2009), greater portfolio diversification (Guiso & Jappelli, 2008) and increased wealth holdings (Lusardi & Mitchell, 2007), although the direction of causality is not clear (Hung *et al.* 2009, Gustman *et al.* 2010). Similarly, poor numeracy has been shown to predict aspects of financial inefficiency such as low savings, mortgage defaults and mistakes using credit cards (Banks & Oldfield 2007, Gerardi et al. 2010, Agarwal & Mazumder 2011). The superannuation savings of the majority of Australians are held in individual defined contribution accounts where decisions about asset allocation, contributions and drawdown are passed onto members.

Consequently, ensuring financial competence is more imperative here than in many developed economies where public defined benefit systems remain the foundation of retirement provision.

Here we make two contributions to research into financial competence. First we present a comprehensive measure of numeracy and financial literacy in Australia using international-standard questions (Gerardi et al. 2010; Lusardi & Mitchell, 2009) in a survey of 1200 retirement savers, illustrating and testing the relationships between financial skills and an array of demographic and economic indicators. These results can be compared directly with outcomes from other countries while also establishing a benchmark for future surveys of the Australian population. Second, while existing research demonstrates the links between aspects of planning and financial literacy, we are aware of no studies linking personal financial skills with expectations formation. This issue is particularly important to defined contribution fund members deciding on rebalancing strategies after the sharp shocks to asset markets in 2007-2009. Using responses to questions about future share market shocks and recovery, we model the relationship between financial literacy and expectations formation after a severe financial shock and thus shed light on how financial competence either helps or hinders the ability to form plans and make decisions.

The Australian retirement savings (superannuation) system has both high coverage (almost all employees hold accounts) and high regulatory complexity. In Section II below we discuss the myriad of choices available to superannuation fund members and illustrate the confusing array of regulations over compulsory and voluntary contributions which highlights the need for financial competence. Navigating these rules to one's best advantage requires both basic skills and acquired knowledge.

In our May 2010 survey, detailed in Section III, we collected responses to 14 standard questions measuring numeracy skills and financial knowledge, as background to a discrete choice experiment testing risk perception. Responses showed consistently

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high numeracy, but varying financial literacy. Most subjects grasped numeracy and money illusion questions but around one quarter found questions on inflation and compound interest difficult, and just under half struggled with the concept of time value of money. Subjects also had some difficulties understanding risk, return and diversification, with only one third of respondents answering all questions correctly.

To further gauge the importance of different features of financial competence we constructed indices summarising ability and knowledge in numeracy, basic financial literacy (simple and compound interest, time value of money and money illusion), and sophisticated financial literacy (diversification, features of financial securities, risk and return). Distinguishing between these three measures gives new insight into the connections between socio-economic characteristics, financial competence and personal retirement wealth (Section IV). Numeracy, which is more closely linked with cognition, and the sophisticated financial literacy index score, which depends more on acquired knowledge, show distinct relationships with age, gender, education, superannuation accumulation, and share market expectations.

The ability to assign risk and define time horizons is essential to all financial decisions involving risky asset markets, including portfolio optimisation. We surveyed superannuation account holders while the Australian share market was still in post-Global Financial Crisis recovery. Using multinomial logit estimation of responses to questions on the likelihood of another severe share market decline in the near future, we demonstrate that financial literacy has implications for expectations formation. In particular, more literate respondents assigned probabilities to a future shock rather than expressing a lack of knowledge of probabilities, while respondents who had recently consulted a financial adviser were likely to be more optimistic about both recovery time and the probability of future shocks.

The final section reviews these and other findings. It outlines tentative conclusions about the differences between numeracy and financial literacy, the connection

between financial literacy, financial advice and expectations formation and discusses the implications for the current public policy debate.

## II Background

Under Australia's Superannuation Guarantee, all working Australians aged 18-65 who earn at least 8% of average earnings participate in the mandatory retirement savings system. Employers make a minimum contribution of 9% (soon increasing to 12%) of earnings on behalf of employees into a privately managed, (commonly) defined contribution, superannuation account. From that point on, retirement savers have the responsibility for a succession of decisions relating to superannuation fund, investment option, voluntary contributions, and account management.

Individuals can choose the superannuation fund into which the employer contributions are placed, and in most cases can also choose from a menu of investment options. Default superannuation funds and investment choices are provided for those retirement savers who fail to, or choose not to, make these decisions. Choice of fund and investment option matters. Funds are differentiated by governance structures and fees, while investment options differ by risk/return trade-offs. Fund members are also responsible for maintaining contact with their superannuation fund and consolidating accounts as they move between jobs. Inattention may result in multiple accounts with duplication of account charges, or 'lost' accounts, where all contact between a member and their retirement accumulation is severed.

Complementary voluntary contributions are encouraged through concessionary but complicated tax provisions with rules differing by contribution type. Voluntary employer contributions (above the mandatory minimum) are tax deductible to the employer and taxed at 15% (a significant tax saving for middle and high income earners); voluntary personal contributions are paid out of after-tax income, but then accumulate free of tax; so-called 'salary sacrifice' contributions are paid by employees

but treated as employer contributions for tax purposes; and low income earners can access matching government co-contributions of up to $1,000 AUD per annum (Bateman & Kingston 2010). This complex menu of concessionary tax provisions provides incentives to increase retirement wealth above the level reached by the mandatory Superannuation Guarantee alone.

However, survey and fund level regulatory data suggest variable take-up of opportunities to increase retirement wealth. Few superannuation fund members exercise fund choice, fund consolidation is infrequent with an average of three accounts per member, and almost 6 million superannuation accounts (20% of accounts and 1% of assets) are considered 'lost' (APRA 2011, Shorten 2011). And, while 46% of assets subject to investment choice accumulate in default (generally balanced) options, this translates to 80% of fund members, of which only around 25% actively chose that option (Super System Review 2010, APRA 2011).

Turning to voluntary contributions, the Australian Bureau of Statistics superannuation survey shows mixed take-up of various concessions (ABS 2008). Less than one third of fund members receiving employer contributions make additional voluntary contributions. Of these, around 36% make (voluntary) salary sacrifice contributions (giving them an average total contribution rate of 17.8% earnings), around 50% make voluntary personal contributions (providing an average total rate of 17.2% earnings) and around 14% make both salary sacrifice and voluntary personal contributions (achieving an average total rate of 34.8% earnings). Contribution rates do matter for retirement income adequacy. Under reasonable assumptions, the retirement accumulation from the mandatory 9% employer contribution over a 35 year working life funds a lifetime annuity of around 45% of pre retirement income for a typical male retiree. An additional voluntary 6% personal contribution (for 35 years) would increase the retirement replacement rate to 80%, while an additional 15% salary sacrifice contribution over the final 10 years of working life would provide a replacement

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rate of around 60%.

Since even choices as fundamental as contribution rates require the navigation of complex tax provisions, and fund and investment choices require some understanding of risk, return and diversification, it is likely that the financial capability of Australian retirement savers plays a key role in enabling retirement income adequacy. In section IV we graph various measures of financial competence against demographics and economic welfare measures. Next we discuss the survey respondents who comprise our estimation sample.

## III Survey Design and Data

### (i) Sample and Survey Structure

We sampled 1220 individuals over the age of 18, who hold a current retirement savings account, from the PureProfile online web panel of over 600,000 Australians. PureProfile filtered the sample to ensure that genders were equally represented and that the age distribution did not deviate far from population proportions. Of this sample, 1199 fully completed the survey and were paid a flat rate of $3AUD by PureProfile.

Our customised survey was designed to investigate the interrelated effects of information presentation, numeracy and financial skills, demographics and market perceptions. The survey was conducted in the second half of May 2010 as a four-part questionnaire including:

- Introductory questions about subjects' retirement savings, including the name of their superannuation fund and the aggregate amount in their superannuation accounts;

- 14 questions to measure numeracy skills and financial literacy as well as questions to elicit self-assessed knowledge of finance, access to financial education, use of financial advice and confidence in stock market recovery;

- A hypothetical asset allocation task for retirement savings; and

- Demographic questions relating to marital status, work status, occupation, industry/business, education, income, assets, household make-up and number in household.

The entire survey is available at http://survey.confirmit.com/wix/p1250911674.aspx. While part of the survey asked subjects to make hypothetical investment decisions, our focus here is on the relationship between demographics, accumulations, financial market expectations and financial capability. Analysis of other aspects of the survey including the hypothetical asset allocation task is discussed in Bateman *et al.* (2010) and Bateman *et al.* (2011).

Table 1 compares the full sample with Australian population demographics, and in most respects the match is satisfactory. We over-sample workers compared with the general population as a consequence of requiring respondents to hold superannuation accounts. Education levels are also generally higher in the survey sample, again at least partly due to age and account-holder restrictions. Self-reported household income matches the population reasonably well but individual net worth may be under-reported in the sample.


## (ii) Measuring Numeracy and Financial Literacy

### Prior Financial Knowledge and Perceptions

We began the survey by asking questions to assess respondents' prior financial knowledge (see Appendix I, P1 to P6) and perceptions of stock market movements (Appendix I, S1 to S3). Specifically, respondents were asked to report the name of their superannuation fund (P1) and the total amount in their superannuation account(s) (P2); to self assess their understanding of finance on a scale of 1 (very low) to 7 (very high) (P3); to report current (and prior) access to financial education at school (P4) and in the workplace (P5), and to indicate the extent to which they use financial

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advice (P6). Responses are reported in Table 2.

Four out of five respondents knew the name of their superannuation fund and estimates of account balances are plausible when compared with Australian Bureau of Statistics survey data (ABS, 2008). Survey respondents report fairly modest balances, with 70% at $80,000 or less. Most (88%) respondents had not paid for financial advice in previous 12 months and self-assessed understanding of finance was high, (particularly for males). More than 80% of respondents reported at least an average understanding of finance; 35% of respondents reported at least some financial education at school, but only 30% reported access to workplace financial education.

Additional questions on expectations of the prospect of another equity market crash in the near and distant future (S1, S2), and prospects of recovery (S3), indicate widespread perceptions ranging from 'nearly impossible' to 'likely', with a large minority of respondents answering 'don't know' or 'refuse to answer'. Views on the likelihood of another equity market crash in the near future were also diffuse, and around 20% of respondents could not assign a single probability to the prospect. A similar proportion could not assign a specific time to recovery of share prices. Modelling reported in section IV below suggests that uncertainty is closely linked with low financial literacy.

## IV Results

The survey included three sets of questions to measure numeracy and financial literacy skills (Appendix I). The numeracy questions (Appendix I, Q1 to Q5) are designed to test concepts such as fractions, percentages, division, multiplication and simple probability (Gerardi *et al.*, 2010). Responses to Q1 to Q4 are reported in Table 3.[1] Most respondents answered numeracy questions correctly, although 17% scored at

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[1] Q5 simply re-expresses the 10% probability in Q2 as 'one in ten'. We included Q5 as a control to inform the risk-framing and investment choice section of the survey, which is not discussed here. Around 1% of respondents answered Q2 and Q5 differently.

least one incorrect response (Table 3A). The highest proportion of incorrect answers (8.4%) was for Q3, which asked respondents to calculate the full price of a car which had been discounted by one third.

Following the well established practice of U.S. panel surveys (Rand American Life Panel (ALP) and the Health and Retirement Survey (HRS)), and the Dutch Household Survey, the financial literacy questions are in two parts (Lusardi & Mitchell 2009; van Rooij *et al.* 2011, 2009).[2] One set of questions (Appendix I, Q6 to Q10) aims to assess basic financial literacy. Concepts tested include numeracy, compound interest, inflation, time value of money and money illusion. The second set (Appendix I, Q11 to Q14) aims to measure the more sophisticated concepts relevant to the asset allocation decisions commonly required for retirement saving. These test concepts such as the differences between bonds and stocks and the impact of risk diversification. For some questions we adapted the standard international wording to Australian terminology and practices.

Results for the financial literacy questions were more variable (Tables 4 and 5). The respondents did well in the numeracy and money illusion questions (88.4% and 86.8% correct), but only 78.4% correctly answered the inflation question and only 72% the compound interest calculation; 45% of the sample could not provide the correct answer to the question testing understanding of time value of money (Table 4A). While most appeared to have a sound grasp of basic financial literacy concepts, only 36.5% could correctly answer all basic financial literacy questions (Table 4B). Table 4C breaks down responses by demographic type: a higher percentage of males than females provide the correct answer to all five basic financial literacy questions, and the proportion of correct answers increases with post-school education and personal income.

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[2]The American Life Panel is an internet survey of Americans over the age of 18 where members are offered financial incentives to answer regular surveys. The Health and Retirement Study is a bi-annual, nationally representative longitudinal study of 22,000 Americans over the age of 50. The Dutch Household survey draws on the CentERpanel, a weekly internet survey of over 2,000 households.

Answers to the sophisticated financial literacy questions suggested some difficulties understanding the concepts of risk, return and diversification (Table 5A). 76.9% of respondents correctly answered that shares (compared to bonds and savings accounts) display the highest fluctuations over time (Q13), but 35.7% could not correctly answer that shares are normally riskier than bonds (Q11). Only 55.2% knew that shares normally give the highest return over the long term (Q12) and 26.6% did not understand the benefits of diversification (Q14). Overall, only 35.5% of respondents correctly answered all sophisticated financial literacy questions (Table 5B).

Responses to the sophisticated financial literacy questions varied more by gender, age, education and income. Across all four sophisticated financial literacy questions, males performed better than females and older respondents better than younger. And while those with high incomes (in excess of $800AUD per week) performed better across the board, around 20% of higher income earners could not correctly answer the 'risk diversification' question (Table 5C). The proportion of correct answers again increased with post-school education, particularly university education, and with higher incomes. These patterns match up with international findings: Lusardi and Mitchell (2011) report that women in many developed countries have lower financial literacy than men and that education raises the rate of correct responses while not perfectly proxying for financial literacy.

Overall, the responses to the financial literacy questions indicate heterogeneity in financial capabilities among Australian retirement savers. Similar heterogeneity was found in responses to the same questions by a sample from the Rand American Life Panel (ALP). However, as reported in Table 6, the ALP sample recorded a significantly higher proportion of correct answers in all except the compound interest and diversification questions (Q10 and Q14). We can also compare international survey responses to questions Q6 (numeracy) and Q7 (inflation): the percentage correct on Q6 was higher for Australia than comparable scores for the National Financial Capa-

bility Survey in the US, the New Zealand ANZ-Retirement Commission survey; the German SAVE and the Dutch Central Bank survey, whereas for inflation, Australian responses were not significantly different from the European surveys, lower than the New Zealand responses and higher than the US-NFCS.[3]

## (i) Numeracy and Financial Literacy Index Construction

Most existing studies of retirement savings and planning have included either numeracy and basic financial literacy questions (Gerardi *et al.* 2010) or basic and sophisticated financial literacy questions (van Rooij *et al.* 2009; Lusardi & Mitchell 2009 ) but not all three. Numeracy questions are closer linked with cognition (Banks 2010), while basic literacy skills relate to common economic decisions (such as inflation and simple interest calculations) and sophisticated literacy skills measure more specialised financial knowledge of financial securities, risk and diversification. Including all three categories allows investigation of any significant differences between these skillsets at different demographic categories and variation in their association with economic outcomes.

There are many possible approaches to grouping and summarising responses. Here we create an indicator variable for each question which assigns one to a correct answer and zero to other answers ('incorrect', 'do not know' and 'refuse to answer'). Summing these indicators for each individual's responses to the numeracy (Q1-Q5), basic financial literacy (Q4-Q10) and sophisticated financial literacy (Q11-Q14) questions makes three totals per respondent that we then standardise using the sample means and standard deviations to make three indices.[4]  Figure 1 graphs the sam-

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[3]The majority of international surveys include three common questions: Q6, Q7 and a third question designed to gauge knowledge of diversification by asking respondents to rate the relative riskiness of single company stock against a mutual fund. Since Australian superannuation funds are precluded from over-investment in employer stock and do not describe share portfolios as 'mutual funds', we did not include this question in the survey but measured knowledge of diversification using the asset-class focused question Q14.

[4]Several existing studies used factor analysis to aggregate responses to these quiz questions (Lusardi and Mitchell, 2009; van Rooij, Lusardi and Alessie, 2009), so we conducted a two-stage

ple distributions of each index, showing that the distributions are negatively skewed with modes at the highest scores. In the next section we use these three indices to graph the relationship between financial competence and an array of characteristics of Australian retirement savers.

## (ii) Financial Competence and General Demographics

Figure 2 shows five sets of graphs covering demographics (2a), employment status (2b), education and self-assessed financial competence (2c), wealth, income and superannuation accumulation (2d), and share market expectations (2e). The vertical axis in each graph measures the average of the numeracy, basic and financial literacy index scores. For most graphs, all 1199 respondents who completed the survey are counted in the horizontal axis categories but in some graphs (such as some wealth categories) respondents who refused to answer, and very sparsely populated groups (such as respondents over 75 years of age) are omitted. Where the horizontal axis gives a natural ordering, we display lines, where the solid dark line graphs average numeracy scores, the dashed line graphs average basic literacy scores and the light solid line graphs sophisticated literacy scores. Where there is no natural order in the horizontal axis categories, we show bars, where the black bar is average numeracy, the grey bar is average basic literacy and the pale bar is average sophisticated literacy.

For each graph we test four sets of restrictions and report results in Table 7. First we test the restrictions that in a regression of the numeracy index scores (and basic

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exploratory principal components analysis to evaluate the best economically-representative basis for all responses. We began with a principal component analysis of the correlation matrix of all 14 recoded responses, retaining the (three) factors with eigenvalues larger than one, and applied a varimax rotation to obtain factor loadings that closely aligned with the *a priori* classification of the questions. With the exception of question nine, the factor analysis preserved the original groupings of numeracy, basic financial literacy and sophisticated financial literacy questions. We then split the 14 instruments into six numeracy questions, four basic literacy questions and four sophisticated literacy and conducted another principal component analysis: for each subset, finding that only one factor had an eigenvalue larger than one in each case, and that the corresponding eigenvector was nearly proportional to a vector of unities. We concluded that summing scores for each subset of questions and standardising would preserve information and proceeded with this simpler method, retaining the original classifications.

and sophisticated financial literacy scores) on a constant and indicator variables for $(n-1)$ of $n$ horizontal axis categories, the coefficients on the indicators are jointly zero. These three standard F-tests indicate significant change in average numeracy or literacy score as the horizontal axis category varies. Secondly, we look for overall differences between the three indices by conducting joint Wald tests of equality (at each horizontal axis category) of the coefficients of the three regressions.

An important feature of the relationship between financial competence and age and gender (2a, first row) are the differences between numeracy and the other two financial literacy measures. For gender and age, numeracy does not vary significantly across the sample but the financial literacy factors scores do, supporting an interpretation of numeracy scores as a proxy for cognition rather than specialised financial knowledge. Male respondents score better, on average, than female respondents on the basic and sophisticated indices. Sophisticated financial literacy scores rise with age and basic literacy peaks in middle age. These patterns are partly evident in earlier U.S. and U.K. studies which showed that declining cognition at older ages may affect ability to answer some questions (Banks & Oldfield 2007), whereas knowledge acquisition tends to continue (Lusardi & Mitchell, 2009). Our use of three separate indices helps clarify these different effects. Further, numeracy varies significantly by marital status and number of dependents (second row), where people who live alone tend to score poorly and individuals with a high number of dependents score high, but the Wald statistic indicates that the joint test of equality of the three indices cannot be rejected for marital status and dependents.

Figure 2b has three panels which graph financial competence by employment status, occupation category and industry. Sophisticated literacy varies significantly across the employment categories where the unemployed have lower average scores, but numeracy and basic literacy are largely flat (first row, first panel). Variations by occupation (first row, second panel) are significant for all three indices, with labour-

ers showing markedly lower average scores. By industry or business sector (second row) numeracy is constant whereas basic and sophisticated indices vary significantly, tending higher for those in the finance sector and lower for the real estate and agricultural sectors. These patterns suggest that respondents are more likely to continue to acquire financial knowledge in their workplaces, and more likely to do so if their work has financial connections.

Figure 2c shows financial competence by school and post school education, workplace financial education, self-assessed understanding of finance and financial advice. We cannot reject the null hypothesis of constant numeracy scores at all levels of school education and post-school education (first row), and while basic and sophisticated financial literacy are not constant across education categories, neither are the scores monotonically increasing as years of education rise. Basic and sophisticated indices do increase significantly with the amount of schooling actually spent on economics and finance (second row, first panel).

Two more results from this set of graphs are notable. First, self-assessed understanding of finance (second row, second panel) generally increases with basic literacy scores and more sharply with sophisticated literacy, confirming international findings of positive correlation between self-assessed understanding and scores from financial literacy tests (van Rooij *et al.* 2009; Lusardi & Mitchell 2009). However, respondents who rate themselves as having an average understanding actually score worse than average on the literacy quizzes, exhibiting the overconfidence in self-assessment that is common in survey responses (see, for example, Agnew & Szykman 2005). (The self-assessment question comes before the financial literacy questions in this survey, so responses should not be affected by respondents' feelings about how well or badly they answered.) Second, people who did not pay for financial advice in the past 12 months (the majority of respondents) averaged high on sophisticated financial literacy but low on the other two measures and the difference between the three indices

is significant.

Graphs of income in Figure 2d further highlight the contrast between numeracy and the financial literacy indices. Lusardi and Mitchell (2007, 2009) present evidence that people with higher financial literacy are more likely to plan for retirement, and that retirement planning is a strong predictor of wealth, and retirement savings in particular. However they note that 'there are several channels through which literacy might affect a key outcome such as retirement saving' (Lusardi & Mitchell 2009, p10). Gerardi *et al.* (2010) show that mortgage delinquency rates are higher among borrowers with poor numerical ability (using the same measure of numeracy we use here) and Banks and Oldfield (2007) link poor numeracy with low savings. We find that average numeracy does not vary significantly by personal income (first row, first panel), and only marginally by household income (first row, second panel). And while there are significant fluctuations in average numeracy across the wealth categories of superannuation accumulation and individual net worth (second row), there are no obvious trends. Average scores for basic and sophisticated financial literacy are higher at the top of the wealth and income distribution than at the bottom, but do not rise smoothly; positive association is strongest between sophisticated financial literacy and household income and superannuation account balance.

The three graphs in the final set (2e) interact financial competence scores with responses to three survey questions relating to recovery from the financial crisis. To our knowledge, no existing studies consider the links between financial competence and expectations, so in the next section we evaluate these graphs and explore the relationship between respondent characteristics and expectations using a discrete choice model.

## (iii) Financial Competence and Crisis Expectations

The global financial crisis of 2007-2009 created difficulties for many retirement savers. Defined contribution account balances were reduced by falling asset values and interest rates, and many fund members close to retirement reviewed their labour force participation plans (OECD 2009). It is natural to question how the crisis may also have impacted on future investment patterns and influenced attitudes towards investment in risky asset markets. Part of our survey addressed respondents' views, on the likelihood of another large stock market crash and expectations of time to recovery from current market prices back to pre-crisis peaks. We can use these responses to evaluate the role of financial literacy in expectations formation after a large negative investment shock. In particular, we assess whether financial literacy is significantly linked to optimistic or pessimistic views on financial crisis and recovery, and/or with historically plausible expectations of future returns.

We assessed expectations of future shocks and share market recovery via three questions. Two of these questions describe a recent sharp fall in share prices and the ask how likely is it that share prices will suffer another similar sized loss in the next five (25) years. Responses to question S1 and S2 fell into seven categories, with each category attributing increasing probability to another sharp stock market decline within the next five years and then separate categories for 'Don't know' and 'Refuse to answer'. The respondents could assign probabilities ranging from 'Nearly impossible- less than a one in a hundred chance' to 'Likely - a greater than one in two chance'. The third question asks respondents to choose a time from the present until share prices recover their pre-crisis peaks. The survey ran in late May 2010, so respondent expectations relate to the Australian share market over the period from mid 2010 to 2015.

The graphs in Figure 2e show that low financial competence is associated with two extreme responses to these questions: extreme optimism and uncertainty ('Don't

know'). Respondents with poor numeracy are especially likely to fall into these categories but poor sophisticated financial literacy is also associated with choosing 'Don't know' (uncertainty). Higher average numeracy and literacy scores are associated with short-term optimism and long-term pessimism about the likelihood of large share market declines. In all three panels, we can reject the restrictions of constancy along the lines and equality between the lines (Table 7). Our finding that poor financial literacy is linked to both unwarranted optimism and uncertainty matches recent research into retirement preparation and pension expectations in the Netherlands. Alessie et al. (2011) observe that Dutch respondents with lower financial literacy have difficulty forming realistic expectations of retirement replacement rates and are uncertain of what age to retire.

To further investigate the connections between competence and expectations, we model respondents' subjective evaluations of the likelihood of another severe stock market decline within the next five years (S1) in a standard multinomial logit estimation.[5] We include age, gender, family structure, superannuation accumulation, gross household income, employment status, post-school education, use of paid financial advice, numeracy and the two financial literacy scores, as possible covariates. We tested all covariates in preliminary modelling and (stepwise) dropped insignificant covariates to arrive at the preferred model reported here.

Table 8 reports odds ratios for the multinomial logit estimation of respondents' expectations, where the reference category is 'Don't know/refuse to answer'.[6] For the category 'nearly impossible', for example, the odds ratio for the sophisticated financial literacy score is 1.971, meaning that increasing the literacy index score by one (i.e., one standard deviation) raises the odds of choosing 'Nearly impossible' over 'Don't know/refuse to answer' by 97%. Similarly, the odds of choosing 'very unlikely' relative to the reference category almost triple for each one unit increase in

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[5]Modelling of responses to S2 showed similar results and we report only those for S1 for brevity.
[6]We combine these two categories because the number of respondents selecting 'refuse to answer' was too few to model separately.

sophisticated financial literacy, increasing by 185%.

Results in Table 8 show that respondents with higher sophisticated financial literacy are significantly more likely to attribute a specific probability to another crash rather than expressing ignorance or uncertainty by choosing 'don't know'. All ratios along the last row of Table 8 suggest increases in odds of 80% and higher when sophisticated literacy increases by one standard deviation. Further, the increases in odds are largest for the optimistic categories that describe another crash as 'very unlikely' or 'unlikely'. As respondents' numeracy declines, the odds of choosing the extremely optimistic category of 'nearly impossible' over 'don't know' decrease significantly, whereas declines in basic literacy have the reverse effect.

Higher education, particularly university education, has a similar impact to higher sophisticated literacy, reducing the odds of selecting 'don't know' in favour of specific probabilities. Older ages tends towards pessimism, creating a 26% reduction in the odds of 'nearly impossible', but a significant increase in the odds of 'toss-up' and 'likely'.[7]

Even stronger is the effect of having paid for financial advice in the past 12 months. Existing research indicates that solicited financial advice tends to be followed by those who select it, and results in portfolios that include significant exposure to equities (Hung and Yoong 2010). Relative to respondents who had not purchased advice and conditioning on financial literacy, we find this group are more than 300% more likely to assess the risk of another crash as 'nearly impossible' or 'unlikely' than the reference category, while generally steering strongly away from uncertainty. (People may be seeking financial advice specifically to reduce uncertainty about such rare events.) Further, fee structures for financial advisers in Australia can create incentives to encourage clients into growth asset classes. Advisers may receive higher commissions from product providers if they can shepherd clients into growth asset funds which

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[7]Respondents who would not reveal gross household income earlier in the survey were also more likely to choose 'don't know' here.

charge higher management fees. Asset-based fee structures also offer higher payments to advisers if clients are encouraged to increase contributions and/or tilted towards high return (high risk) allocations (Kingston, 2009; Commonwealth of Australia 2009, ch. 6). Professional advice may therefore encourage both higher certainty and equity market optimism among clients.

Overall, older age, better financial competence, accessing professional advice and higher education reduce uncertainty in favour of risk quantification. The ability to form a firm view on equity price risk may aid portfolio reallocation decisions among retirement savers and reduce inertia, although one can always be confidently mistaken. Earlier work on investment choices by survey respondents (Bateman *et al.* 2011) shows that, after controlling for other demographics and the risk and return of investment options, respondents who choose 'don't know/refuse to answer' in response to S1 also choose low-risk, low-return allocations for their retirement savings. Hence, respondents who are less uncertain about risky asset markets, but more capable of assigning a specific probability to rare events, are also more likely to choose higher risk/return asset allocations, which has long-term implications for retirement accumulations.

The ability of more literate and educated subjects to assign a probability to re-current crisis links with Epstein's (1999) definition of ambiguity averse behaviour as 'not probabilistically sophisticated' and Halevy's (2007) experimental evidence that experimental subjects who could not reduce compound lotteries to a single bet were more likely to show ambiguity aversion. It may also be a help towards action: Dow and Werlang (1992) show that uncertainty over probability (ambiguity) can create intervals in the price ranges of financial assets within which agents do not trade.

We also model expectations of recovery from that crisis using responses to question S3: how long might the share market take to recover from May 2010 levels to pre-crisis peaks? Possible answers include: 'Within 12 months'; 'Within 2 years'; 'Within

5 years'; 'Within 10 years'; 'Don't know'; and 'Refuse to answer'. A respondent who projects the historical real rate of return to the Australian stock market index (around 4% p.a.), but does not expect mean reversion, might select a 10 year horizon to recovery. A respondent thinking of recovery of nominal value, with 2-3% price inflation incorporated into equity returns, might choose a 5 year horizon.

Odds ratios for the estimated MNL model reported in Table 9 show that the effect of sophisticated financial literacy in this context is similar to the previous model; higher sophisticated literacy scores are linked to specific risk assessment rather than uncertainty. Odds ratios in the last row of Table 9 indicate that a one standard deviation increase in sophisticated financial literacy doubles the odds of choosing a specific time-frame over expressing uncertainty. As financial literacy increases, respondents are more likely to select 'within 5 years', which is consistent with recovery of nominal value at historical rates of return, although the odds of this choice are not much stronger than several others. Consulting a financial adviser dramatically increases the odds of selecting 'within 12 months' as the recovery period - a 219% increase - and the odds of 'within 5 years' by 104%. These results confirm that taking financial advice is positively associated with optimism.

## V Conclusions

Our sample of 1200 Australian retirement savers (superannuation fund members) shows a high degree of heterogeneity in tests of numeracy and financial literacy, and compares poorly on most counts with a similar international sample from the Rand American Life Panel (ALP). Australian survey respondents appear to have a better grasp of the impact of compounding and an equal understanding of diversification,but a weaker knowledge of the time value of money, the risk and return features of financial assets such as bonds and shares, and inflation. However rates of correct responses to numeracy and inflation questions were comparable with results from New Zealand,

Germany and the Netherlands.

Graphical analysis of indices of numeracy, and basic and sophisticated financial literacy on key demographics confirm that both basic and sophisticated financial competence increase with age, post-school education and income, and are greater for males than females, whereas numeracy scores tend to be flat across gender, ages, several education measures and personal income. Self-assessed financial understanding increases with basic and sophisticated financial knowledge, but most strongly with sophisticated financial literacy. Retirement accumulation and personal net worth tend also to rise with literacy. These results confirm international findings (Lusardi and Mitchell 2011).

Tests for equality between sets of average scores by index are rejected for 13 of the 20 demographics, attitudes and economic outcomes reported here, and most failures to reject are for household structure or work-related characteristics. There are significant differences in age, gender, most education measures, most income and wealth measures and share market expectations, confirming the value in studying numeracy and financial knowledge-based skills separately.

Sophisticated financial knowledge is also a significant predictor of the ability to quantify risks, as opposed to maintaining uncertainty. As sophisticated financial literacy increases, so do the odds that a consumer chooses to assign a numerical likelihood to events such as a repeat of the stock market crisis in the near term, and can express a numerical time-frame for asset price recovery. Higher education has similar effects, whereas taking professional financial advice seems to shift consumers towards both confidence and (possibly unwarranted) optimism. This ability to assign risk and define time horizons is essential to all fundamental financial decisions involving risky asset markets, including portfolio optimization.

While the snapshot we present here of the financial literacy landscape in Australia does not establish causality, our results associate better knowledge with higher aver-

age retirement accumulations and subjectively evaluated financial competence. The need to improve overall levels of financial competence is gaining prominence globally with recent initiatives including the Federal Literacy and Education Commission in the United States, the Consumer Financial Education Body (United Kingdom) and the Financial Literacy Board (Australia). In 2010, the G20 Summit in Seoul endorsed nine 'Principles of Innovative Financial Inclusion', which, require, *inter alia*, member countries to establish programs or policies aiming to 'develop financial literacy and financial capability' (G20 Financial Inclusion Experts Group 2010). However, the current Australian policy framework features a lack of integration. The recent MySuper regime regulates default funds and investments for the mandatory contributions of individuals who prefer to delegate these decisions (Commonwealth of Australia, 2010, Super System Review 2010) but initiates no plans to build the financial skills needed for many complementary decisions, such as planning voluntary contribution and retirement benefits, or the fundamental responsibility for account management. Since the mandatory retirement savings system (Superannuation Guarantee), along with myriad other financial structures, depends on efficient individual decision making, we can support initiatives to improve financial competence, while shedding some light on the types of information that seem to best aid decision making.

# *Appendix I.*

*Numeracy and Financial Literacy Questions*

## *Numeracy*

Q1: In a sale, a shop is selling all items at half price. Before the sale, a sofa costs $300. How much will it cost in the sale? (Answers: $150; $300; $600; Do not know; Refuse to answer.)

Q2: If the chance of getting a disease is 10 per cent, how many people out of 1,000 would be expected to get the disease? (Answers: 10; 100; 1000; Do not know; Refuse to answer.)

Q3: A second hand car dealer is selling a car for $6,000. This is two-thirds of what it cost new. How much did the car cost new? (Answers: $4,000; $6,600; $9,000; Do not know; Refuse to answer.)

Q4: If 5 independent, unrelated people all have the winning numbers in the lottery and the prize is $2 million, how much will each of them get? (Answers: $40,000; $400,000; $500,000; Do not know; Refuse to answer.)

Q5: If there is a 1 in 10 chance of getting a disease, how many people out of 1,000 would be expected to get the disease? (Answers: 10; 100; 1000; Do not know; Refuse to answer.)

## *Basic Financial Literacy*

Q6: Numeracy. Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow? (Answers: More than $102; Exactly $102; Less than $102; Do not know; Refuse to answer.)

Q7: Inflation. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account? (Answers: More than today; Exactly the same; Less than today; Do not know; Refuse to answer.)

Q8: Time value of money. Assume a friend inherits $10,000 today and his sibling inherits $10,000 three years from now. In three years, who is richer because of the inheritance? (Answers: My friend; His sibling; They are equally rich; Do not know; Refuse to answer.)

Q9: Money Illusion. Suppose that in the year 2020, your income has doubled and prices of all goods have doubled too. In 2020, how much will you be able to buy with your income? (Answers: More than today; Exactly the same; Less than today; Do not know; Refuse to answer.)

Q10: Compound interest. Suppose you had $100 in a savings account and the interest rate is 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total? (Answers: More than $200; Exactly $200; Less than $200; Do not know; Refuse to answer.)

### Sophisticated Financial Literacy (Understanding bonds and stocks)

Q11: Risky assets. Is the following statement true or false? Shares are normally riskier than bonds. (Answers: True; False; Do not know; Refuse to answer.)

Q12: Long period returns. Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return? (Answers: Bonds; Savings accounts; Shares; Do not know; Refuse to answer.

Q13: Volatility. Normally, which asset displays the highest fluctuations over time? (Answers: Bonds; Savings accounts; Shares; Do not know; Refuse to answer.)

Q14: Risk diversification. When an investor spreads his money among different assets, does the risk of losing money? (Answers: Increase; Decrease; Stay the same; Do not know; Refuse to answer.)

### Preliminary Superannuation Questions

P1: Which fund manages your main superannuation account in Australia? (Responses: Please specify name of fund; Don't know.)

P2: Which of the following ranges best describes the total amount you currently have in all your superannuation accounts in Australia? (Responses: 13 ranges from 'Under $10,000 to $5,000,000 or over.)

P3: On a scale of 1 to 7, where 1 means very low and 7 means very high, how would you assess your understanding of finance?

P4: How much of your financial education was devoted to financial education, such as commerce, business studies, finance or economics? (Responses: A lot; Some; A little; Hardly at all.)

P5: Did any of the firms you have worked for (including your current employer) offer financial education programs, for example retirement seminars? (Responses: Yes; No; Not applicable.)

P6: Have you paid for professional financial advice about your superannuation over the past twelve months? (Responses: Yes; No.)

### Share Market Recovery Questions

In the global financial crisis that began in late 2007 Australian shares lost about half their value before they began to recover. Since then, they have recovered about half the value they lost and are worth about 75% of what they were at the market's high in September 2007.

S1: How likely is it that Australian share prices will suffer another similar sized loss in the next 5 years? (Answers: Nearly impossible (Chance of this happening is 1 in 100 or less); Very unlikely (Chance of this happening is higher than 1 in 100 but less than 1 in 10); Unlikely (Chances of this happening are between 1 in 10 and 1 in 2); Toss-up (Chance is about 1 in 2); Likely (Chance is greater than 1 in 2); Don't know; Refuse to answer.)

S2: How likely is it that Australian share prices will suffer another similar sized loss in the next 25 years? (Answers: Nearly impossible (Chance of this happening is 1 in 100 or less); Very unlikely (Chance of this happening is higher than 1 in 100 but less than 1 in 10); Unlikely (Chances of this happening are between 1 in 10 and 1 in 2); Toss-up (Chance is about 1 in 2); Likely (Chance is greater than 1 in 2); Don't know; Refuse to answer.)

S3: Since the crisis Australian share prices have recovered about half the value they lost. How long do you think it will take for them to fully recover? (Answers: Within 12 months; Within 2 years; Within 5 years; Within 10 years; Don't know; Refuse to answer.)

## *Appendix II*

*Variable Definitions*

Age – indicator variable where 2=18-24 years; 3=25-34 years; 4=35-44 years; 5=45-54 years; 6=55-64 years; 7=65-74 years; and 8=75 years and over.

Gender – indicator variable where 1=female, 0=male.

More than one dependent – indicator variable based on responses to 'How many people in your family, beside yourself, do you fully or partially support financially?', where 1= 2, 3, 4, or 5 or more; 0 otherwise.

Employed – indicator where 1=employed (full time or part time); 0 otherwise.

Post-school vocational training - indicator variable where 1= tertiary diploma or trade certificate; 0 otherwise.

Post-school bachelor degree or higher - indicator variable where 1=bachelor degree, graduate diploma and/or post graduate degree; 0 otherwise.

Numeracy index score: standardised sums of indicators for responses to numeracy questions Q1, 2, 3, 4, 5 ; recoded 1 for correct and 0 for incorrect/'don't know'/'refuse to answer'.

Basic financial literacy index score - standardised sums of indicators for responses to literacy questions Q6, 7, 8, 9 and 10; recoded 1 for correct and 0 for incorrect/'don't know'/'refuse to answer'.

Sophisticated financial literacy index score - standardised sums of indicators for responses to literacy questions Q11, 12, 13 and 14; recoded 1 for correct and 0 for incorrect/'don't know'/'refuse to answer'.

Paid for financial advice – response to 'Have you paid for professional financial advice about your superannuation over the past twelve months?'; 1=yes; 0=no.

Gross weekly household income – response to the question, 'Which one of the following categories best describes your annual total household gross income (before tax)?' where 1= Under $18,199, 2=$18,200-$72,799, 3=$72,800-$129,999, and 4= Over $130,000.

Gross weekly household income (prefer not to answer) – response to the question, 'Which one of the following categories best describes your annual total household gross income (before tax)?' where 1= 'prefer not to answer'; 0 otherwise.

Log superannuation accumulation – response to 'Which of the following ranges best describes the total amount you currently have in all your superannuation accounts in Australia?'; the natural log of midpoint of ranges: Under $10,000; $10,000 - $19,999; $20,000 - $39,999; $40,000 - $59,999; $60,000 -

$79,999; $80,000 - $99,999; $100,000 - $149,999; $150,000 - $199,999; $200,000 - $299,999; $300,000 - $499,999; $500,000 - $999,999; $1,000,000 - $4,999,999; and $5,000,000 or over. No respondents selected the highest category.

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## TABLE 1: SURVEY SAMPLE DEMOGRAPHIC CHARACTERISTICS [a]

| | Survey respondent population (%) | General Australian population (%) | | Survey respondent population (%) | General Australian population (%) |
|---|---|---|---|---|---|
| *Gender* | | | *Industry* | | |
| Male | 49.9 | 50.1 | Agriculture, forestry & fishing | 0.98 | 3.17 |
| Female | 50.1 | 49.9 | Mining | 2.07 | 1.21 |
| *Age (as % of 18-65 year pop'n)* | | | Manufacturing | 4.79 | 10.74 |
| 18-34 years | 35.8 | 37.4 | Electricity, gas, water & waste services | 1.20 | 1.01 |
| 35-54 years | 43.2 | 43.6 | Construction | 5.01 | 8.00 |
| 55-65 years | 21.1 | 18.9 | Wholesale trade | 2.18 | 4.47 |
| *Marital status* | | | Retail trade | 9.80 | 11.65 |
| Not living with long term partner | 42.94 | 46.72 | Accommodation & food services | 3.70 | 6.49 |
| Married or living with long term partner | 57.06 | 53.28 | Transport, postal & warehousing | 4.79 | 4.82 |
| *Work status* | | | Information media & telecommunications | 5.45 | 1.99 |
| Employed full-time | 51.72 | 40.79 | Financial & insurance services | 7.19 | 3.93 |
| Employed part-time | 23.52 | 18.79 | Rental, hiring & real estate services | 1.20 | 1.74 |
| Unemployed | 3.44 | 3.53 | Professional, scientific & technical services | 6.86 | 6.79 |
| Not in the labour force | 21.31 | 36.89 | Administrative & support services | 5.56 | 3.23 |
| *Occupation* | | | Public administration & safety | 3.70 | 6.86 |
| Clerical and administrative worker | 20.81 | 15.00 | Education & training | 11.22 | 7.87 |
| Community and personal service worker | 3.59 | 8.81 | Health care & social assistance | 11.55 | 10.78 |
| Labourer | 5.66 | 10.46 | Arts & recreation services | 0.98 | 1.44 |
| Machinery operators and drivers | 3.49 | 6.64 | Other services | 11.76 | 3.81 |
| Manager | 10.89 | 13.21 | | | |
| Professional | 31.15 | 19.84 | | | |
| Sales worker | 7.63 | 9.84 | | | |
| Technicians and trades worker | 7.41 | 14.38 | | | |
| Other | 9.37 | 1.82 | | | |

| High School completion | | | Household composition | | |
|---|---|---|---|---|---|
| Year 12 or equivalent | 70.49 | 46.87 | Couple family with no children | 25.49 | 25.67 |
| Year 11 or equivalent | 9.10 | 11.08 | Couple family with children | 37.46 | 31.20 |
| Year 10 or equivalent | 17.13 | 25.36 | One parent family | 6.48 | 10.87 |
| Year 9 or equivalent | 2.13 | 7.74 | Other family household | 3.44 | 1.18 |
| Year 8 or below | 1.07 | 7.98 | Single person household | 13.77 | 23.38 |
| Did not go to school | 0.08 | 0.96 | Group household (i.e. shared) | 13.36 | 7.68 |
| *Highest non-school qualification* | | | *Number of people living in household* | | |
| Postgraduate or equivalent | 13.59 | 6.58 | 1 | 10.98 | 24.36 |
| Graduate Diploma and Graduate Certificate from University or equivalent | 8.43 | 3.64 | 2 | 34.67 | 34.10 |
| Bachelor Degree or equivalent | 30.77 | 29.33 | 3 | 22.95 | 15.79 |
| Advanced Diploma and Diploma from University/TAFE equivalent | 20.65 | 18.01 | 4 | 19.92 | 15.73 |
| Certificate or equivalent | 26.55 | 42.43 | 5 | 7.62 | 6.88 |
| *Annual total household gross income (before tax)* | | | 6 or more | 3.85 | 3.13 |
| Less than $18,200 pa (i.e. $350 a week) | 3.28 | 4.72 | *Number of people in family fully/partially financially supported [b]* | | |
| $18,200-$72,799 pa (i.e.$499-1,399  a week) | 34.33 | 39.49 | None | 45.66 | 50.18 |
| $72,800-$129,999 pa (i.e. $1,400-$2,499 a week) | 31.64 | 28.44 | 1 | 23.28 | 17.24 |
| $130,000 pa (i.e. $2,500 a week) or more | 16.88 | 14.93 | 2 or more | 31.06 | 32.58 |
| Prefer not to answer | 13.87 | 12.42[a] | *Net wealth (individual)* | | |
| | | | Under $10,000 | 13.93 | - |
| | | | $10,000 - $99,999 | 27.54 | 18.21 |
| | | | $100,000 - $999,999 | 35.00 | 62.44 |
| | | | $1,000,000 or over | 6.80 | 19.35 |
| | | | Prefer not to answer | 16.72 | - |

Notes: a  Source for population statistics: Australian Bureau of Statistics Census of Population and Housing & Household Wealth and Wealth Distribution, Australia, 2005-2006. The survey sample of 1220 is taken from the PureProfile web panel of 600,000 Australians and filtered to ensure that respondents were over 18 and current holders of a superannuation account. Sampling ensured that genders and age proportions were reasonably close to the Australian population.

# TABLE 2: RETIREMENT SAVING CHARACTERISTICS

| | Survey respondent population (%) | | Survey respondent population (%) |
|---|---|---|---|
| *Knows superannuation fund* | | *Workplace financial education programs offered* | |
| Yes | 80.2 | Yes | 24.3 |
| No | 19.8 | No | 69.7 |
| *Amount in superannuation account(s)* | | NA | 6.0 |
| Under $20,000 | 35.9 | *Paid for financial advice about superannuation over past 12 months* | |
| $20,000 - $79,999 | 35.0 | Yes | 11.8 |
| $80,000 - $499,999 | 26.6 | No | 88.2 |
| $500,000 or over | 2.5 | *Assessment that the market will suffer the same or an even greater loss in value sometime in the next 5 years?* | |
| *Understanding of finance?* | | Nearly impossible (Chance of this happening is 1 in 100 or less) | 2.3 |
| 1 (very low) | 3.7 | Very unlikely (Chance of this happening is higher than 1 in 100 but less than 1 in 10) | 13.0 |
| 2 | 5.9 | Unlikely (Chances of this happening are between 1 in 10 and 1 in 2) | 24.1 |
| 3 | 10.1 | Toss-up (Chance is about 1 in 2) | 24.2 |
| 4 (about average) | 39.1 | Likely (Chance is greater than 1 in 2) | 16.3 |
| 5 | 23.2 | Don't know/ Refuse to answer | 19.2 |
| 6 | 13.7 | *Time for Australian share prices to fully recover* | |
| 7 (very high) | 4.3 | Within 12 months | 3.8 |
| *Education devoted to financial education (e.g ., commerce, business studies, finance, economics)?* | | Within 2 years | 30.2 |
| A lot | 9.1 | Within 5 years | 36.9 |
| Some | 26.6 | Within 10 years | 9.9 |
| A little | 25.5 | Don't know/ Refuse to answer | 19.2 |
| Hardly at all | 38.8 | | |

Notes: See notes to Table 1 on survey sample. Table shows responses to survey questions on retirement savings and share market expectations (reproduced in Appendix I). The entire survey is available at http://survey.confirmit.com/wix/p1250911674.aspx.

## TABLE 3: NUMERACY QUESTIONS

3A: PERCENT CORRECT BY NUMERACY QUESTION

|  | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| Correct | 96.1% | 95.8% | 91.6% | 92.9% |

3B: SUMMARY OF RESPONSES TO ALL NUMERACY QUESTIONS

|  | None | One | Two | Three | Four | Mean |
|---|---|---|---|---|---|---|
| Correct | 0.7% | 1.0% | 2.5% | 12.6% | 83.1% | 3.8 |

3C: PER CENT CORRECT BY NUMERACY QUESTION AND DEMOGRAPHICS

|  |  | Q1(%) | Q2(%) | Q3(%) | Q4(%) |
|---|---|---|---|---|---|
| Gender | Male | 94.9 | 95.4 | 92.0 | 94.9 |
|  | Female | 97.2 | 96.2 | 91.3 | 90.8 |
| Age | 18-34 years | 95.6 | 96.5 | 92.8 | 92.4 |
|  | 35-54 years | 96.4 | 94.8 | 92.5 | 93.9 |
|  | 55-65 years | 96.2 | 96.6 | 87.9 | 91.7 |
| Living with long term partner | Yes | 96.3 | 96.2 | 91.6 | 93.1 |
|  | No | 95.4 | 94.9 | 91.6 | 92.0 |
| Number of dependents | None | 98.4 | 97.1 | 93.7 | 93.5 |
|  | 1 | 93.3 | 95.1 | 89.4 | 93.3 |
|  | more than 1 | 94.7 | 94.5 | 90.2 | 91.6 |
| Gross weekly personal income range | under $400 | 97.8 | 95.6 | 91.6 | 92.5 |
|  | $400-$799 | 96.4 | 95.6 | 92.3 | 93.4 |
|  | $800-$1,599 | 96.1 | 96.6 | 92.5 | 93.5 |
|  | $1,600-$1,999 | 92.4 | 92.4 | 88.6 | 91.1 |
|  | over $2,000 | 98.6 | 94.2 | 97.1 | 97.1 |
|  | Prefer not to answer | 92.7 | 96.3 | 86.0 | 88.2 |
| Work status | Employed | 95.9 | 95.3 | 91.9 | 93.6 |
|  | Not employed | 96.3 | 97.0 | 90.6 | 90.3 |
| Education | No post school qualification | 96.6 | 94.4 | 91.0 | 91.4 |
|  | Post school vocational training | 98.4 | 96.1 | 91.6 | 93.4 |
|  | Post school bachelor degree or higher | 93.5 | 96.2 | 91.9 | 92.9 |

Notes: Table shows proportion of correct responses in aggregate and by demographic characteristics to numeracy questions (Appendix I, Q1 to Q4), designed to test concepts such as fractions, percentages, division, multiplication and simple probability. See notes to Table 1 for survey sample characteristics.

## TABLE 4: BASIC FINANCIAL LITERACY QUESTIONS

4A: PERCENT CORRECT BY BASIC LITERACY QUESTION

| | Numeracy (Q6) | Inflation (Q7) | Time value of money (Q8) | Inflation/ Money Illusion (Q9) | Compound Interest (Q10) |
|---|---|---|---|---|---|
| Correct | 88.4% | 78.4% | 55.2% | 86.8% | 72.0% |

4B: SUMMARY OF RESPONSES TO ALL BASIC LITERACY QUESTIONS

| | None | One | Two | Three | Four | Five | Mean |
|---|---|---|---|---|---|---|---|
| Correct | 1.6% | 4.6% | 8.9% | 17.8% | 30.7% | 36.5% | 3.81 |

4C: PERCENT CORRECT BY BASIC FINANCIAL LITERACY QUESTION AND DEMOGRAPHICS

| | | Numeracy (Q6) (%) | Inflation (Q7) (%) | Time value of money (Q8) (%) | Inflation /Money Illusion (Q9) (%) | Compound Interest (Q10) (%) |
|---|---|---|---|---|---|---|
| Gender | Male | 90.7 | 83.3 | 58.7 | 87.2 | 75.7 |
| | Female | 86.2 | 73.6 | 51.6 | 86.4 | 68.2 |
| Age | 18-34 years | 87.8 | 69.1 | 48.7 | 90.5 | 70.7 |
| | 35-54 years | 89.8 | 83.1 | 57.9 | 85.2 | 72.0 |
| | 55-65 years | 86.8 | 84.5 | 60.4 | 83.8 | 74.0 |
| Living with long term partner | Yes | 89.8 | 80.1 | 56.0 | 86.7 | 72.8 |
| | No | 85.8 | 75.2 | 52.8 | 86.8 | 69.9 |
| Number of dependents | None | 87.6 | 77.4 | 54.6 | 89.2 | 72.0 |
| | 1 | 89.8 | 82.4 | 56.0 | 86.3 | 73.9 |
| | more than 1 | 88.7 | 77.0 | 55.4 | 83.6 | 70.4 |
| Gross weekly personal income range | under $400 | 89.4 | 75.2 | 49.1 | 88.5 | 69.9 |
| | $400-$799 | 86.9 | 74.5 | 53.3 | 86.1 | 71.2 |
| | $800-$1,599 | 88.4 | 80.5 | 57.6 | 87.2 | 70.8 |
| | $1,600-$1,999 | 91.1 | 87.3 | 54.4 | 87.3 | 81.0 |
| | over $2,000 | 98.6 | 89.9 | 71.0 | 89.9 | 88.4 |
| | Prefer not to answer | 83.1 | 74.3 | 51.5 | 81.6 | 65.4 |
| Work status | Employed | 89.1 | 78.6 | 55.4 | 86.1 | 72.5 |
| | Not employed | 86.2 | 77.9 | 53.4 | 88.6 | 69.8 |
| Education | No post school qualification | 82.0 | 73.7 | 47.7 | 85.7 | 67.7 |
| | Post school vocational training | 88.4 | 79.2 | 52.1 | 87.2 | 68.3 |
| | Post school bachelor degree or higher | 91.9 | 80.2 | 61.2 | 86.9 | 77.2 |

Notes: Table shows proportion of correct responses in aggregate and by demographic characteristics to basic financial literacy questions (Appendix I, Q6 to Q10). See notes to Table 1 for survey sample characteristics.

## TABLE 5: SOPHISTICATED FINANCIAL LITERACY QUESTIONS

5A: PERCENT CORRECT BY SOPHISTICATED LITERACY QUESTION

| | Risky assets (Q11) | Long period returns (Q12) | Volatility (Q13) | Diversification (Q14) |
|---|---|---|---|---|
| Correct | 64.3% | 55.2% | 76.9% | 73.4% |

5B: SUMMARY OF RESPONSES TO ALL SOPHISTICATED LITERACY QUESTIONS

| | None | One | Two | Three | Four | Mean |
|---|---|---|---|---|---|---|
| Correct | 8.4% | 11.3% | 18.0% | 26.9% | 35.5% | 2.7 |

5C: PERCENT CORRECT BY SOPHISTICATED FINANCIAL LITERACY QUESTION AND DEMOGRAPHICS

| | | Risky assets (Q11) (%) | Long period returns (Q12) (%) | Volatility (Q13) (%) | Diversification (Q14) (%) |
|---|---|---|---|---|---|
| Gender | Male | 68.9 | 61.1 | 80.0 | 76.7 |
| | Female | 59.8 | 49.2 | 73.8 | 70.2 |
| Age | 18-34 years | 58.7 | 48.3 | 73.4 | 68.4 |
| | 35-54 years | 62.8 | 56.9 | 76.4 | 75.3 |
| | 55-65 years | 76.6 | 63.0 | 83.4 | 78.1 |
| Living with long term partner | Yes | 63.8 | 57.8 | 76.8 | 76.4 |
| | No | 64.8 | 49.4 | 76.4 | 67.5 |
| Number of dependents | None | 63.6 | 54.8 | 78.5 | 73.1 |
| | 1 | 64.8 | 56.7 | 77.5 | 73.9 |
| | more than 1 | 65.2 | 54.6 | 74.1 | 73.6 |
| Gross weekly personal income range | under $400 | 58.4 | 46.5 | 72.1 | 68.1 |
| | $400-$799 | 63.5 | 50.4 | 75.6 | 66.0 |
| | $800-$1,599 | 63.4 | 59.0 | 77.6 | 77.6 |
| | $1,600-$1,999 | 73.4 | 72.2 | 86.1 | 84.8 |
| | over $2,000 | 81.2 | 75.4 | 89.7 | 85.5 |
| | Prefer not to answer | 63.2 | 44.9 | 71.3 | 70.6 |
| Work status | Employed | 64.9 | 56.1 | 76.6 | 74.9 |
| | Not employed | 67.7 | 51.3 | 76.9 | 68.5 |
| Education | No post school qualification | 60.9 | 52.3 | 74.8 | 67.3 |
| | Post school vocational training | 59.6 | 51.6 | 74.7 | 69.9 |
| | Post school bachelor degree or higher | 69.9 | 59.2 | 79.4 | 79.6 |

Notes: Table shows proportion of correct responses in aggregate and by demographic characteristics to sophisticated financial literacy questions (Appendix I, Q11 to Q14). See notes to Table 1 for survey sample characteristics.

TABLE 6: INTERNATIONAL COMPARISON OF FINANCIAL LITERACY RESPONSES
(per cent of respondents correct)

| | Basic financial literacy questions | | | | | Sophisticated Financial Literacy Questions | | | | |
| | Numeracy (Q6) | Inflation (Q7) | Time value of money (Q8) | Inflation/Money illusion (Q9) | Compound Interest (Q10) | Risky assets (Q11) | Long period returns (Q12) | Volatility (Q13) | Diversification (Q14) |
|---|---|---|---|---|---|---|---|---|---|
| Australia [a.] | 88.4% | 78.4% | 54.9% | 86.7% | 71.8% | 64.1% | 54.9% | 76.7% | 73.3% |
| US – ALP [b.] | **91.8%** | **87.1%** | **73.8%** | **78.4%** | **69.0%** | **80.2%** | **62.3%** | **88.3%** | 74.9% |
| US – NFCS [c.] | **64.9%** | **64.3%** | - | - | - | - | - | - | - |
| New Zealand [d.] | **86%** | **81%** | - | - | - | - | - | - | - |
| Germany [e.] | **82.4%** | 78.4% | - | - | - | - | - | - | - |
| Netherlands [f.] | **84.8%** | 76.9% | - | - | - | - | - | - | - |

Notes: Table shows percentages of survey respondents answering financial literacy question correctly from international surveys. Australian survey responses are significantly different from percentages in bold typeface at the 5% level.

Data Sources:

a. CenSoc-UNSW survey of 1199 superannuation account holders, May 2010.
b. American Life Panel (ALP) (Lusardi and Mitchell, 2009).
c. National Financial Capability Study (NFCS) (Lusardi , 2011).
d. ANZ-New Zealand Retirement  Commission Financial Knowledge Survey (Retirement Commission 2009)
e. SAVE 2009 survey (Bucher-Koenen and Lusardi, 2011) .
f. Dutch Central Bank Household Survey (Alessie, van Rooij and Lusardi, 2011)

TABLE 7: VARIATION WITHIN AND BETWEEN FINANCIAL COMPETENCE INDICES

| | F-test | | | Wald test |
|---|---|---|---|---|
| Horizontal axis category: | Numeracy | Basic literacy | Sophisticated literacy | Joint equality |
| Gender | 0.781 | 17.282*** | 20.234*** | 7.897* |
| Age | 0.920 | 1.900* | 5.784*** | 26.933*** |
| Marital status | 2.344** | 2.137** | 1.491 | 11.904 |
| Number of dependents | 3.148*** | 0.767 | 1.843 | 12.913 |
| Employment status | 0.638 | 1.693 | 3.230** | 4.502 |
| Occupation | 2.575*** | 3.162*** | 4.364*** | 17.975 |
| Industry/business | 0.784 | 2.049*** | 3.174*** | 32.930 |
| Highest school education | 0.481 | 5.027*** | 9.722*** | 6.701 |
| Highest post school education | 1.330 | 5.779*** | 4.839*** | 18.048* |
| Extent of finance education at school | 2.030 | 4.886*** | 16.646*** | 33.773*** |
| Self-assessed financial understanding | 4.125*** | 12.656*** | 29.722*** | 43.209*** |
| Offer of workplace financial education | 6.821*** | 8.391*** | 26.221*** | 24.661*** |
| Financial advice | 16.427*** | 4.380** | 3.298* | 17.808*** |
| Personal income | 0.585 | 3.299*** | 5.859*** | 34.559** |
| Household income | 1.202 | 3.413*** | 4.080*** | 21.492 |
| Superannuation accumulation | 1.885** | 3.349*** | 7.103*** | 49.194*** |
| Individual net worth | 2.124** | 6.168*** | 12.029*** | 39.200*** |
| Share market crash (5 years) | 5.629*** | 14.092*** | 38.472*** | 58.049*** |
| Share market crash (25 years) | 8.081*** | 17.630*** | 39.058*** | 50.722*** |
| Share market recovery | 5.621*** | 12.723*** | 33.091*** | 46.820*** |

Notes: First three columns report F-statistics for the test of the restriction that in a regression of the numeracy (basic; sophisticated) index on a constant and indicator variables for (n-1) of n horizontal axis categories, the coefficients on the indicators are jointly zero. Final column reports Wald statistic for test that the constants and coefficients of the three regressions, at each horizontal axis category, are equal. *p<10%,**p<5%, ***p<1%.

TABLE 8: EFFECT OF FINANCIAL LITERACY ON STOCK MARKET EXPECTATIONS - MULTINOMIAL LOGIT ESTIMATION

'In the global financial crisis that began in late 2007 Australian shares lost about half their value before they began to recover.  Since then, they have recovered about half the value they lost and are worth about 75% of what they were at the market's high in September 2007. How likely is it that Australian share prices will suffer another similar sized loss in the next 5 years?'

| Observations: 1199 | Odds Ratios | | | | |
|---|---|---|---|---|---|
| Response category: | Nearly impossible | Very unlikely | Unlikely | Toss-up | Likely |
| Age | 0.743* | 1.095 | 1.039 | 1.170* | 1.290* |
| Gender (1= female) | 0.439* | 0.732 | 0.639* | 0.827 | 0.794 |
| More than one dependent | 1.272 | 0.888 | 0.833 | 0.698* | 1.167 |
| Gross household income | 0.789 | 0.732* | 1.075 | 0.867 | 0.877 |
| Gross household income (prefer not to answer) | 0.216 | 0.172* | 0.552 | 0.451* | 0.351* |
| Employed | 2.122 | 1.486 | 1.291 | 1.425 | 1.744* |
| Post school vocational training | 0.911 | 1.509 | 1.414 | 1.682* | 1.840* |
| Post school bachelor degree or higher | 1.740 | 2.233* | 1.896* | 1.793* | 1.767* |
| Paid for financial advice in past year | 4.092* | 2.097* | 4.019* | 3.009* | 2.669* |
| Numeracy index score | 0.547* | 0.997 | 1.191 | 1.107 | 1.086 |
| Basic literacy index score | 2.218* | 1.239 | 1.238* | 0.996 | 0.893 |
| Sophisticated index score | 1.971* | 2.856* | 2.496* | 1.842* | 1.792* |
| Pseudo-$R^2$ | | | | | 0.078 |
| $\chi^2(60)$ | | | | | 308.96 |

Notes: Table shows odds ratios from multinomial logit estimation of response category membership to question above. Odds ratios give the change in odds of choosing the named response category relative to the reference category, 'Don't know/refuse to answer' when the relevant covariate increases by one. For example, the odds of choosing 'Nearly impossible' over 'don't know /refuse to answer' increase by 27.2% for respondents who support more than one dependent relative to those who do not, other things equal. Detailed variable definitions are in Appendix II. *p<10%

TABLE 9: EFFECT OF FINANCIAL LITERACY ON STOCK MARKET EXPECTATIONS - MULTINOMIAL LOGIT ESTIMATION

Since the crisis Australian share prices have recovered about half the value they lost. How long do you think it will take for them to fully recover?

| Observations: 1199 | Odds Ratios | | | |
| --- | --- | --- | --- | --- |
| Response category | Within 12 months | Within 2 years | Within 5 years | Within 10 years |
| Age | 0.871 | 0.948 | 0.827* | 0.896 |
| More than one dependent | 0.885 | 0.973 | 0.895 | 2.105* |
| Log superannuation accumulation | 0.895 | 1.022 | 1.157* | 0.872 |
| Gross household income (prefer not to answer) | 0.967 | 0.492* | 0.522* | 0.536* |
| Paid for financial advice in past year | 3.199* | 1.710 | 2.044* | 1.814 |
| Numeracy index score | 0.633* | 0.932 | 0.948 | 0.879 |
| Basic literacy index score | 1.303 | 1.375* | 1.203* | 1.127 |
| Sophisticated literacy index score | 2.069* | 2.017* | 2.106* | 1.963* |
| Pseudo-$R^2$ | | | | 0.059 |
| $\chi^2(32)$ | | | | 199.07 |

Notes: Table shows odds ratios from multinomial logit estimation of response category membership to question above. Odds ratios give the change in odds of choosing the named response category relative to the reference category, 'Don't know/refuse to answer' when the relevant covariate increases by one. For example, the odds of choosing 'Within 12 months' over 'don't know /refuse to answer' decrease by 11.5% for respondents who support more than one dependent relative to those who do not, other things equal. Detailed variable definitions are in Appendix II. *p<10%

# FIGURE 1: HISTOGRAMS FOR NUMERACY AND FINANCIAL LITERACY INDICES, SURVEY SAMPLE.
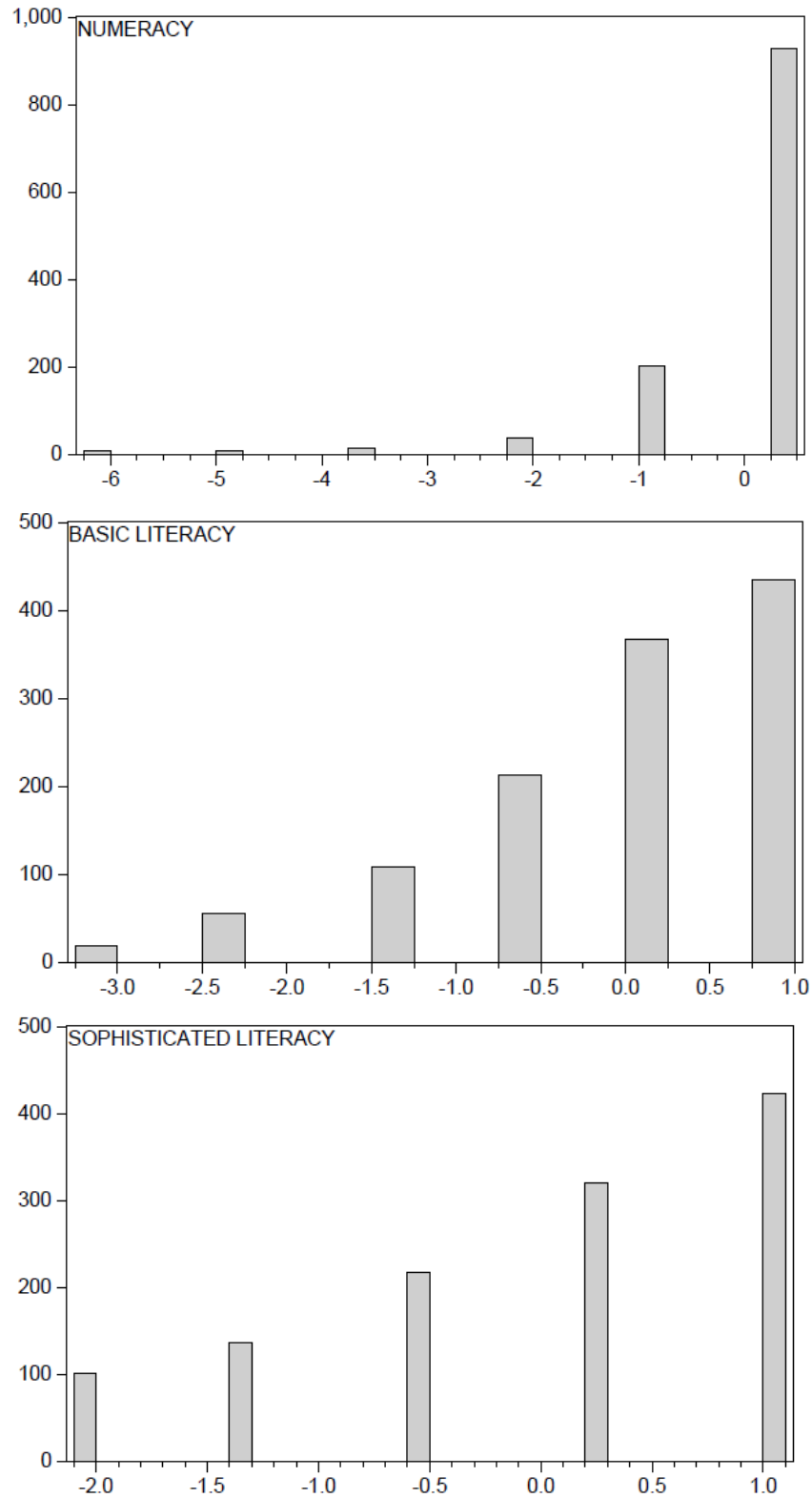


Notes: Figure shows histograms of standardised sums of correct individual responses to questions evaluating numeracy (Q1-Q5), basic financial literacy (Q6-Q10) and sophisticated financial literacy (Q11-Q14). Observations: 1199.

**Figure 2a: Average financial competence index scores by demographic category**
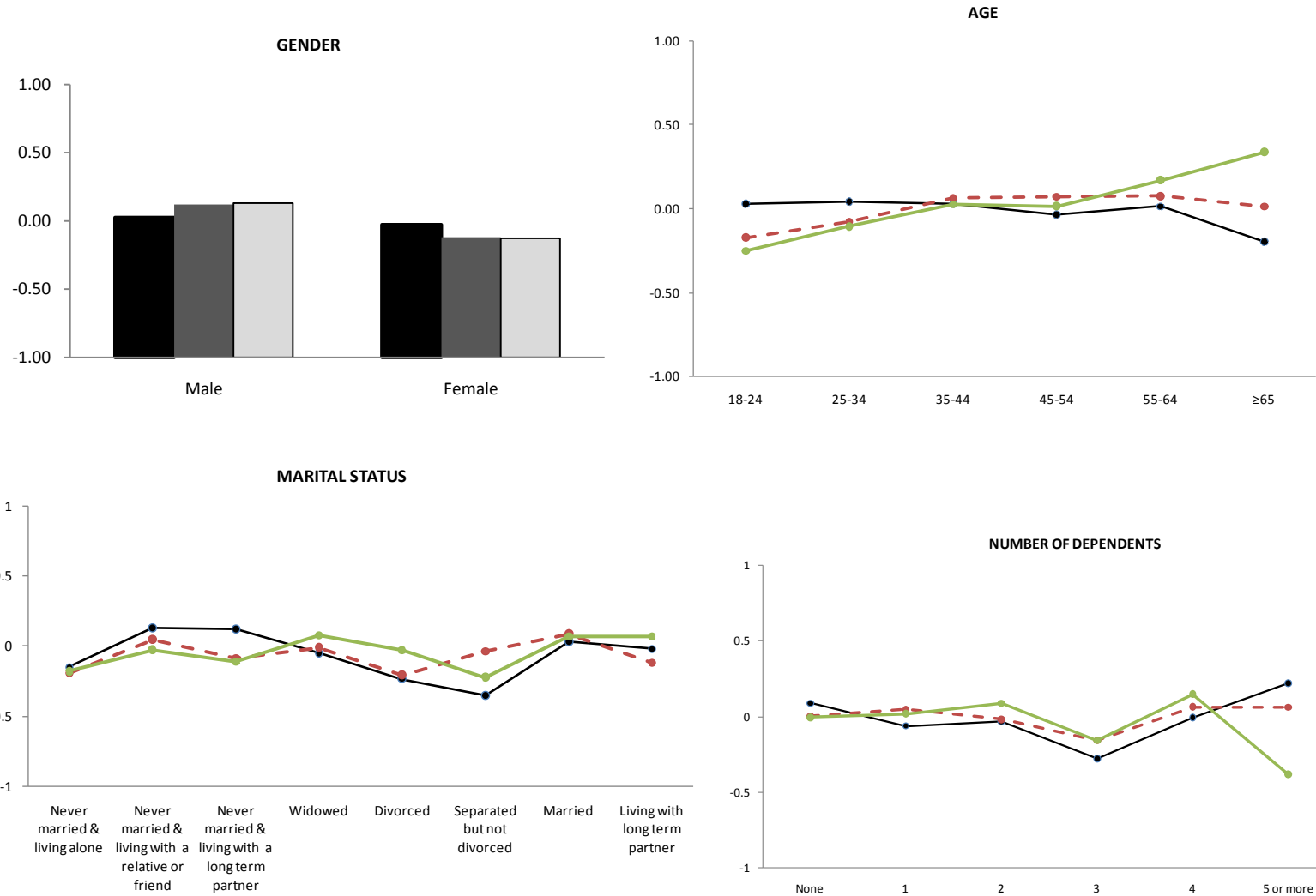


**GENDER**

**AGE**

**MARITAL STATUS**

**NUMBER OF DEPENDENTS**

Note: Vertical axis shows standardised numeracy and financial literacy scores. Responses to numeracy (Q1-Q5), basic literacy (Q6-Q10) and sophisticated literacy (Q11-Q14) questions are recoded as correct (=1) and incorrect ('incorrect', don't know; and 'refuse to answer'=0), summed and standardised. The thin dark solid line (or black bar) represents average standardised numeracy scores, the dashed line (or dark gray bar) represents average basic financial literacy and the thick light solid line (or pale bar) represents average sophisticated financial literacy scores, for each horizontal axis category.

**Figure 2b: Average financial competence index scores by employment category**
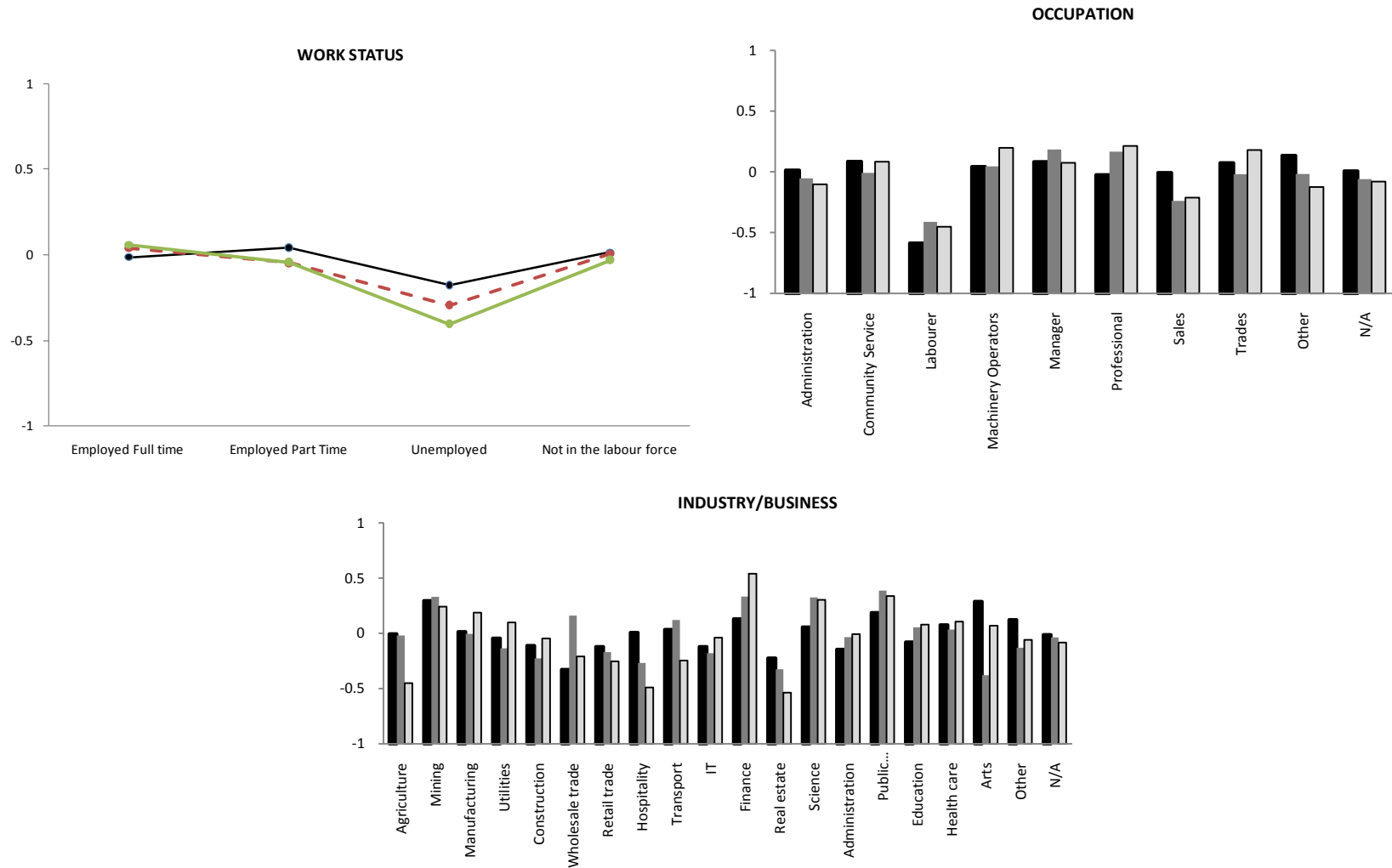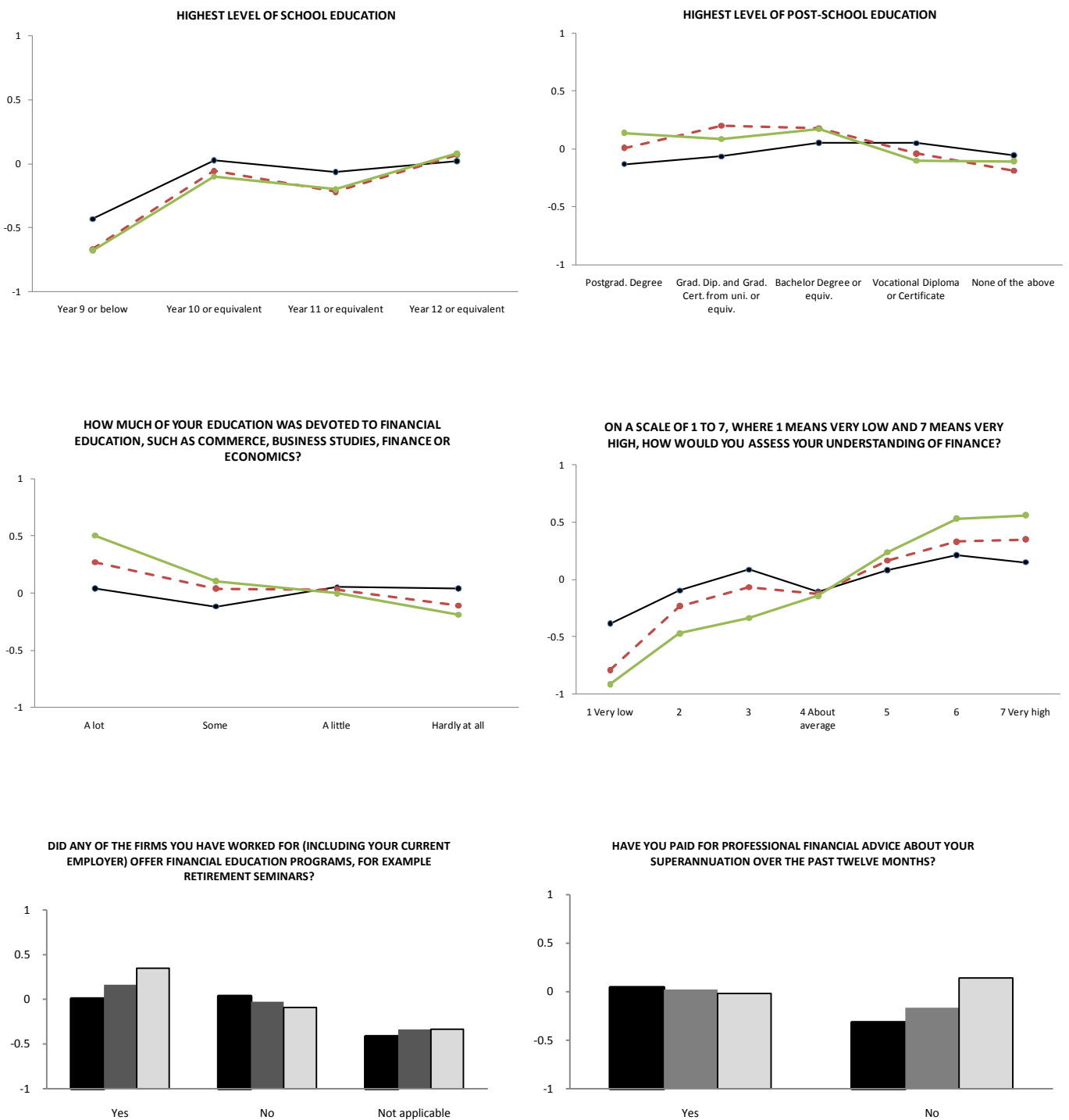


Note: Vertical axis shows standardised numeracy and financial literacy scores. Responses to numeracy (Q1-Q5), basic literacy (Q6-Q10) and sophisticated literacy (Q11-Q14) questions are recoded as correct (=1) and incorrect ('incorrect', don't know; and 'refuse to answer'=0), summed and standardised. The thin dark solid line (or black bar) represents average standardised numeracy scores, the dashed line (or dark gray bar) represents average basic financial literacy and the thick light solid line (or pale bar) represents average sophisticated financial literacy scores, for each horizontal axis category.

**Figure 2c.: Average financial competence index scores: education, self-assessed competence and financial advice**



HIGHEST LEVEL OF SCHOOL EDUCATION

HIGHEST LEVEL OF POST-SCHOOL EDUCATION

HOW MUCH OF YOUR EDUCATION WAS DEVOTED TO FINANCIAL EDUCATION, SUCH AS COMMERCE, BUSINESS STUDIES, FINANCE OR ECONOMICS?

ON A SCALE OF 1 TO 7, WHERE 1 MEANS VERY LOW AND 7 MEANS VERY HIGH, HOW WOULD YOU ASSESS YOUR UNDERSTANDING OF FINANCE?

DID ANY OF THE FIRMS YOU HAVE WORKED FOR (INCLUDING YOUR CURRENT EMPLOYER) OFFER FINANCIAL EDUCATION PROGRAMS, FOR EXAMPLE RETIREMENT SEMINARS?

HAVE YOU PAID FOR PROFESSIONAL FINANCIAL ADVICE ABOUT YOUR SUPERANNUATION OVER THE PAST TWELVE MONTHS?
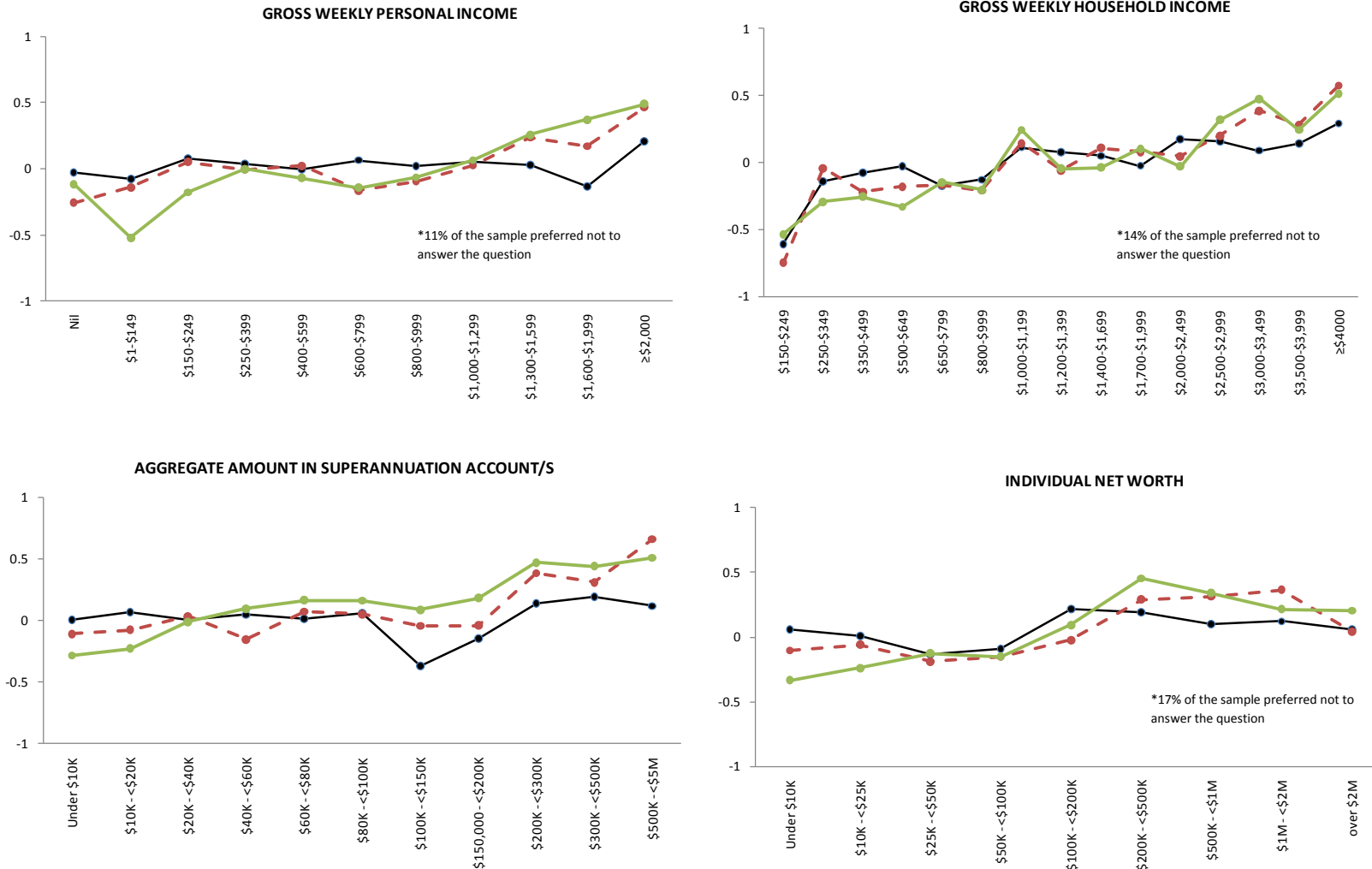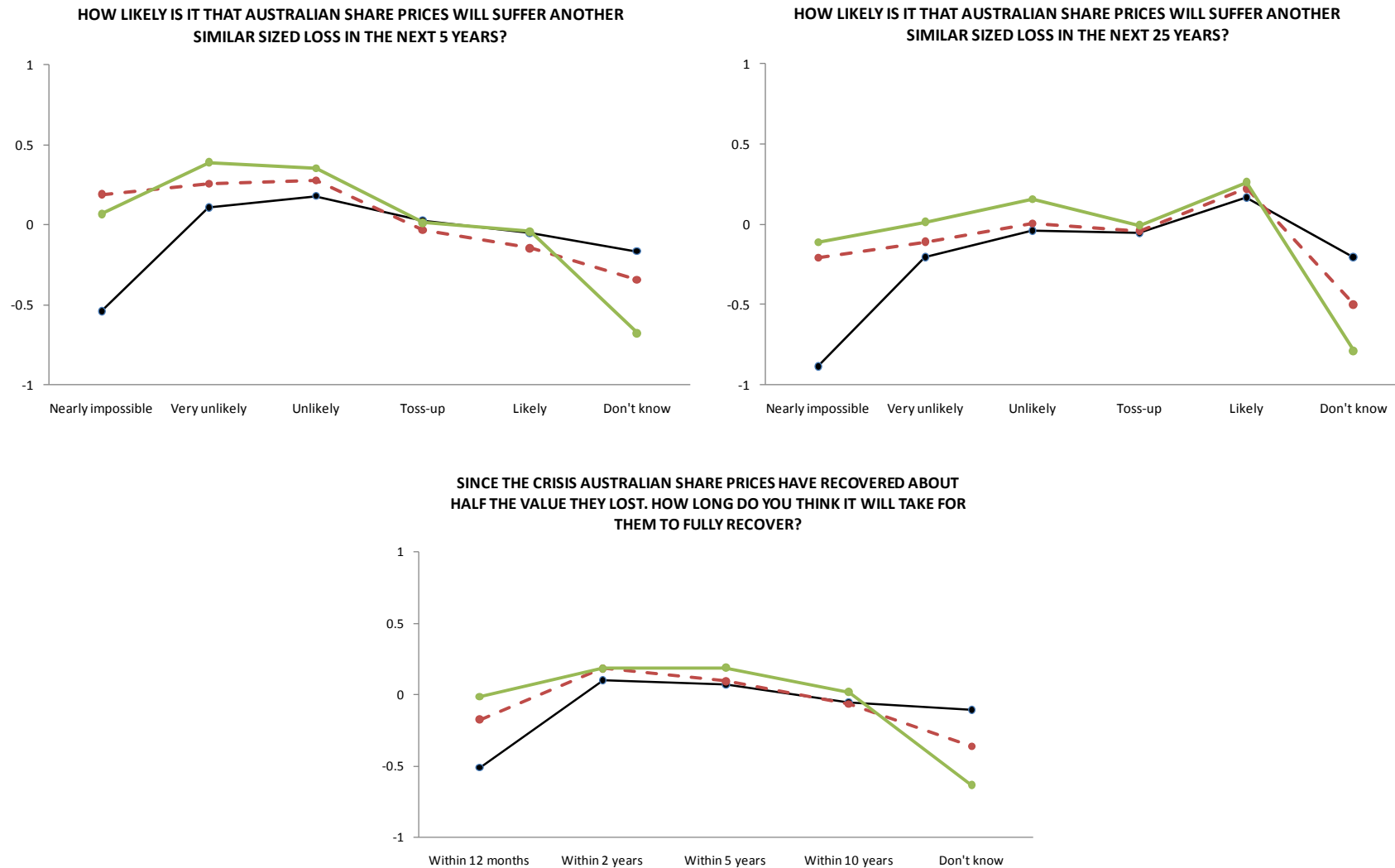
Note: Vertical axis shows standardised numeracy and financial literacy scores. Responses to numeracy (Q1-Q5), basic literacy (Q6-Q10) and sophisticated literacy (Q11-Q14) questions are recoded as correct (=1) and incorrect ('incorrect', don't know; and 'refuse to answer'=0), summed and standardised. The thin dark solid line (or black bar) represents average standardised numeracy scores, the dashed line (or dark gray bar) represents average basic financial literacy and the thick light solid line (or pale bar) represents average sophisticated financial literacy scores, for each horizontal axis category.

**Figure 2d: Average financial competence index scores by income and wealth category**



GROSS WEEKLY PERSONAL INCOME

*11% of the sample preferred not to answer the question

GROSS WEEKLY HOUSEHOLD INCOME

*14% of the sample preferred not to answer the question

AGGREGATE AMOUNT IN SUPERANNUATION ACCOUNT/S

INDIVIDUAL NET WORTH

*17% of the sample preferred not to answer the question

Note: Vertical axis shows standardised numeracy and financial literacy scores. Responses to numeracy (Q1-Q5), basic literacy (Q6-Q10) and sophisticated literacy (Q11-Q14) questions are recoded as correct (=1) and incorrect ('incorrect', don't know; and 'refuse to answer'=0), summed and standardised. The thin dark solid line (or black bar) represents average standardised numeracy scores, the dashed line (or dark gray bar) represents average basic financial literacy and the thick light solid line (or pale bar) represents average sophisticated financial literacy scores, for each horizontal axis category.

**Figure 2e: Average financial competence index scores by share market expectation category**

HOW LIKELY IS IT THAT AUSTRALIAN SHARE PRICES WILL SUFFER ANOTHER SIMILAR SIZED LOSS IN THE NEXT 5 YEARS?

HOW LIKELY IS IT THAT AUSTRALIAN SHARE PRICES WILL SUFFER ANOTHER SIMILAR SIZED LOSS IN THE NEXT 25 YEARS?

SINCE THE CRISIS AUSTRALIAN SHARE PRICES HAVE RECOVERED ABOUT HALF THE VALUE THEY LOST. HOW LONG DO YOU THINK IT WILL TAKE FOR THEM TO FULLY RECOVER?

Note: Vertical axis shows standardised numeracy and financial literacy scores. Responses to numeracy (Q1-Q5), basic literacy (Q6-Q10) and sophisticated literacy (Q11-Q14) questions are recoded as correct (=1) and incorrect ('incorrect', don't know; and 'refuse to answer'=0), summed and standardised. The thin dark solid line (or black bar) represents average standardised numeracy scores, the dashed line (or dark gray bar) represents average basic financial literacy and the thick light solid line (or pale bar) represents average sophisticated financial literacy scores, for each horizontal axis category.