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An Experimental Survey of Investment Decisions for Retirement Savings*

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ABSTRACT

We conducted a choice experiment to investigate whether retirement savers follow simple portfolio theory when choosing investments. We modeled experimental survey data on 693 participants using a scale-adjusted version of the latent class choice model. Results show that underlying variability in response was explained by age and "risk profile" score, and that preferences varied with income and age. Younger individuals were conventionally risk averse but older, higher income individuals may react positively to both higher returns and increasing risk, when risk is presented as widening ranges of possible outcomes. Respondents tended to choose among a few similar investments options. Findings should assist regulators and providers to target assistance to "at risk" retirement savers.

An Experimental Survey of Investment Decisions for Retirement Savings

As retirement income systems around the world switch from defined benefit arrangements toward privately-managed accumulation plans, decision making responsibility has been transferred from plan sponsors and governments to individual members. Pension plan participants must decide how their assets will be allocated across menus of investments. Asset allocation decisions govern the growth rate and volatility of accumulations and are a key determinant of retirement welfare. In line with this global trend, more investment choice is being offered by 401(k) plans in the US, Swedish retirement savers choose from a menu of over 750 mutual funds and Australian pension providers offer a choice of between 1 and 2,000 investment funds (Australian Prudential Regulation Authority 2009). More choice can improve the welfare of the well-informed, but complex choice menus challenge the less financially sophisticated. Some people respond by delegating decisions to financial planners or financial institutions, potentially exposing themselves to conflicts of interest, while many others pass into standardized "default" options. Decision makers may behave non-rationally when confronted by complex financial problems, or when given apparently relevant, but actually unimportant, information (Agnew and Szykman 2005; Benartzi and Thaler 2007; Choi, Laibson and Madrian 2008). Yet these choices can have large impacts on individual welfare (Brennan and Torous 1999; Benartzi and Thaler 2001, 2002), as well as fiscal sustainability and financial markets. Further, long planning horizons may mean that the consequences of not choosing well surface many years after the decisions, possibly too late for correction.

To date, studies of investment choice by retirement savers have addressed behavioral factors that may affect choice of investment option(s) and the impacts of personal and

demographic characteristics. However, many questions on how retirement savings choices are actually made remain open.

Choice architecture has been shown to matter to investment decisions in ways not anticipated by theory, particularly when decision makers are unsophisticated (Benartzi, Peleg and Thaler 2007). For example, the number and types of options are important to participation rates (Huberman, Iyengar and Jiang 2007), overall asset allocation (Benartzi and Thaler 2001; Huberman and Jiang 2006; Morrin et al. 2008), asset class weighting (Karlsson, Massa and Simonov 2006; Brown, Liang and Weisbenner 2007) and final exposure to employer stock (Mitchell, Utkus and Yang 2005). Further, investors may rely on irrelevant material, a problem that may not be helped by simplification (Choi, Laibson and Madrian 2008; Beshears et al. 2008).

Demographics are also relevant, but the evidence on specific factors, such as age and education, is mixed. Empirically, Ameriks and Zeldes (2004) found that American households do not decrease the proportion of wealth held in stocks as they age, Clark-Murphy and Gerrans (2004) reported that young people tend to choose low risk/low return options, while Clark and Strauss (2008) and Watson and McNaughton (2007) found that risk tolerance falls with age. Investment experience and financial literacy increase the likelihood of participation in retirement saving plans (Agnew et al. 2007; Lusardi and Mitchell 2007) and individuals with below-average financial knowledge may become “overwhelmed” by making investment decisions and default (Agnew and Szykman 2005).[1]

Standard finance theory (mean-variance analysis) predicts that, when choosing investments, the retirement saver reduces his/her exposure to risky portfolios as his/her aversion to risk increases and prefers higher expected returns net of fees, at any given level of risk. Here we tested these predictions for retirement saving asset allocation decisions, while also assessing the influence of demographic and personal characteristics. We designed and implemented a discrete choice experiment to learn how retirement savers respond to variations in the key summary portfolio characteristics (i.e., expected returns, fees and portfolio volatility).

In March 2007, we surveyed around 700 men and women aged 18 to 65, asking them to allocate a contribution to one of six pension funds. Subjects also answered questions about demographics and personal circumstances, and completed a standard financial planners' questionnaire to screen underlying risk tolerance. We used responses to estimate a scale-adjusted version of the latent class choice model, simultaneously identifying groups of retirement savers who showed similar preferences for risk and return (preference classes) and groups whose responses exhibited similar degrees of variability (scale classes). We then predicted marginal effects of variations in net expected returns (gross returns less fees) and risk (portfolio volatilities) on investment choice.

In the next section we describe the experimental design and associated choice task and the characteristics of the sample. We then describe the estimated model and give a summary of the results. We conclude with a discussion of policy implications and an agenda for future research.

METHOD

We outlined a simple portfolio choice experiment in the style of Louviere, Hensher and Swait (2000), based on the prediction that retirement savers will maximize risk-adjusted expected returns when presented with choices over alternative investments. The choice experiment let us hold the economic and regulatory environment constant and impose attribute variability on the respondents. This experiment was hypothetical and largely inconsequential and while we cannot formally check results against behavior here, we can point to the body of multi-disciplinary studies (surveyed in Louviere, Hensher and Swait 2000, Chapter 13) that demonstrate empirical consistency of stated and revealed preferences under the Random Utility framework.

Experimental Design and Presentation

In our experiment, each subject was "given" (a hypothetical) $1,000 to invest toward their retirement and asked to allocate it to one of six portfolios offered by a pension fund. Five of these investment portfolios differed by the proportion of stocks (commonly called "shares" in Australia) and cash (i.e., 100% cash/0% stocks, 75/25, 50/50, 25/75 and 0/100) while the sixth was a Retirement Savings Account (RSA). The RSA is a pension product similar to a bank account, paying a fixed net interest rate typically below that offered by a cash fund. Each subject was presented with a treatment made up of (gross) return, fees and risk, designed to represent a typical retirement savings investment choice menu. Fees and risk varied over four levels for each investment option.

Theoretical Background

The expected utility V_i of a risk averse investor, *i*, choosing a portfolio for a fixed single time horizon is increasing in expected portfolio return, μ_i, and decreasing in scaled portfolio variance (risk), σ_i^2,

$$V_i = \mu_i - \eta_i \sigma_i^2 \quad (1)$$

where η_i is a risk parameter, which increases with risk aversion. The investor's choices reveal his or her most (highest V_i) and least preferred (lowest V_i) portfolios.

In the experiment, we presented risk as a range of best and worst case scenarios for final wealth, so total portfolio risk, σ_i^2, varied as these ranges of terminal wealth values expanded and contracted. Wider ranges for terminal wealth, and hence more risk, coincided with higher allocations to stocks. The returns attribute varied with management fees and asset allocation. Portfolios with more stocks had higher underlying expected returns but higher average fees because growth (high risk) asset funds are more expensive than cash. We adjusted returns and risk for inflation and explained to survey participants that all amounts were expressed in current (2007) dollars.

Utility for each of the cash and stock portfolios can be written as a function of alternative-specific return and variance. Further, each cash/stock portfolio can be compared with the constant choice offered in every choice set, the Retirement Savings Account. There were no fees on the Retirement Savings Account and its real risk was zero. Hence, the difference in utility between cash/stock options and the Retirement Savings Account depends on the return to the portfolio relative to the return to the Retirement Savings Account less the

option-specific management fee. The risk of the portfolio depends on the returns variability and co-movement of the cash and stock components.

Thus, we had two explanatory variables: net return, which was excess return over the (risk free) return to the RSA net of fees, and portfolio variance. Net return varies with fees, and portfolio variance varies with the ranges of best and worst case outcomes; both depend on the proportion of stocks relative to cash in each portfolio.

Presentation of Choices

We began the web-based survey by explaining the background of the investment choice experiment to each subject.[2] Using a fractional factorial design for the choice sets, based on the L^{MA} approach in Louviere, Hensher and Swait (2000), we presented each subject with 16 tables of the six investment options each with fees and risk varying over four levels. We asked subjects to nominate which option they would be "most likely" to choose and which they would be "least likely" to choose (best and worst options). Table 1 shows an example of a choice set. The attribute levels for each of the "risks" and "fees" are illustrated in Table 2.

[Insert Tables 1 and 2 about here]

The risk levels were ranges of inflation-adjusted values of the $1,000 investment after 10 years, derived from empirical distributions of terminal wealth values, bootstrapped from historical returns to real-world versions of cash/stock portfolios. The four levels were the

extreme minimum and maximum of each distribution and the 5-95th, 10-90th and 20-80th quantile ranges.[3]

Ranges over final period wealth are not the usual way that risk is described to individual retirement savers. A typical prospectus for a pension fund might comment that "higher returns are usually associated with higher risk," and then offer some discussion about the probability of experiencing negative returns over a specific time period for a given exposure to risky assets. The range measure we used in the experiment, on the other hand, shows extreme upside as well as downside outcomes and does not remove non-normality in the data (skewness and kurtosis).

Actual fee structures in Australian retail retirement saving products generally are very complex, often decrease as account balances rise and frequently are negotiable between the superannuation provider, or their agent, and the customer.[4] Here we used a single "Investment management fee" calibrated to the level of investment-specific fees charged by retail providers of pension products, with four levels for each of the six types of portfolios.[5] This structure captures the higher fees charged by managers of growth assets.

Sample

Our sample was 693 individuals aged 18 to 65 selected by PureProfile, an online web panel provider that maintains a panel of over 300,000 Australian households, recruited to match key demographics of the population such as gender, education, age and income. Panelists were invited to participate in the survey by email or by selective invitation on the

PureProfile web site. They were informed that the survey was part of a university research project. Our initial (population representative) sample of 819 panelists was reduced to 693 when we omitted the responses of 121 participants who did not report household income and a further 5 participants with otherwise uninformative responses.[6] PureProfile paid respondents who viewed and validly completed the entire survey a nominal sum of $4.20 AUD (around $3.50 USD).

Demographic and Personal Characteristics

Descriptive statistics for demographic and personal characteristics are summarized in Table 3. The sample was evenly divided by gender both in aggregate and by age profile, with half the sample aged between 25 and 44 years. Around two-thirds of respondents were partnered (married/de facto or living with a partner) and 42.1% had children up to 18 years of age. The majority of respondents had a post-secondary-school qualification (including the equivalent of a college or higher degree, college diploma or vocational-technical qualification) and were full-time workers. Almost a third classified their employment as professional or management. Reported annual household incomes among the sample of participants were in line with the cross-sectional household income distribution of the Australian population. Around 60% of the sample reported income slightly below the Australian Bureau of Statistics measure of 60th percentile household income in 2007-08 and close to 90% below the 90th percentile.

[Insert Table 3 about here]

In terms of real and financial assets, a majority owned a home and almost all owned cars, also reflecting population patterns. Fewer than 20% had an investment property, but most (64.5%) held non-retirement financial investments or savings. Most of the others were considering investing. Close to 40% owned stocks (shares), with a similar number considering purchasing them so most respondents were familiar with this asset class. Savings accounts were held by almost everyone, and large minorities invested in stocks, real estate/property and mutual (managed) funds. More sophisticated securities and derivatives were held by only a few.

Attitudes to Risk

Respondents also completed a risk-tolerance questionnaire designed by a major financial services firm, which generated a "risk score." We report results of the risk-tolerance questionnaire with caution since, like many such financial planning tools, it has not been formally tested for validity (Yook and Everett 2003).[7] The questionnaire did not discriminate very finely, classifying 77% of respondents as "balanced," but the individual risk scores showed more variation and were relevant to the estimated model. Other questions related to risk attitudes, such as insurance coverage, were not statistically significant, although around 70% of respondents bought home insurance and/or car insurance (78.2% did) and had some "no-claim bonus" (a reduction in premium to reward people who do not file claims).[8]

ESTIMATED MODELS

Here we modeled choices using a latent class (finite mixture) model that allows for heterogeneous preferences and innate variability among discrete classes of individuals. Conventional conditional logit models restrict the preferences of individuals to be homogeneous over the sample, subject to independent and identically distributed random errors. It is well-known that unobserved heterogeneity among individuals can bias the estimated coefficients of the McFadden's (1974) fixed effects conditional logit model.

The model assumed that the random utility of choosing investment option *j* for individual *i* is

$$U_{ij} = V_{ij} + \varepsilon_{ij} \tag{2}$$

where ε_{ij} is independent and identically distributed extreme value with variance $\pi^2/6\lambda^2$, which depends on the scale parameter, λ. The probability that individual *i* chooses investment option *j* depends on a comparison between the utilities of the various options in the choice set and can be shown to equal

$$P_{ij} = \frac{\exp \lambda \beta_j ' x_{ij}}{\sum_j \exp \lambda \beta_j ' x_{ij}} \tag{3}$$

where x_{ij} are the attributes of option *j* presented to individual *i* and β_j are preference parameters.

Standard finite mixture models, including latent class models, allow preference parameters β_j to vary between latent classes of investors but restrict the scale parameter λ to

be equal to one for all classes, which may confound differences in preferences with differences in underlying variability (Louviere and Eagle 2006). To avoid this confound, we estimated latent classes for both preferences (investment choices) and scale (choice variability) that were functions of demographic covariates, identifying types of people most likely to exhibit the tastes of a particular class and who show more or less overall variability in response (choice consistency) using the method of Magidson and Vermunt (2005).

Our method also removed the restriction of independence of irrelevant alternatives which treats all choice alternatives as proportionately substitutable. This assumption will not hold in a choice problem like ours where alternative investments are obviously substitutable to different degrees.

RESULTS

Observed Choices

The choice experiment, conducted in March 2007, generated 11,168 "most likely" and "least likely" choices (Table 4). The higher the weighting to stocks, the more likely an option was chosen as "best." The RSA and 100% cash options accounted for only 7% of best choices, whereas 63% were allocated to the options with 75% or more in stocks. Consistent with this taste for higher equity-asset weights, the Retirement Savings Account and 100% cash options were most commonly chosen as "worst."

[Insert Table 4 about here]

Fitted Model

We fitted the latent class model (Latent GOLD software version 4.5; Magidson and Vermunt 2005) to the "most likely" choices, using demographic and personal characteristics to select classes for innate individual variability and underlying preferences. We estimated models for increasing numbers of latent scale and preference classes, selecting the preferred model using the Bayesian Schwartz information criteria (BIC), which rewards improved fit but penalizes additional parameters. All demographic characteristics in Table 3 were systematically screened for relevance at this stage. For brevity, we only report results for the best model here. Overall fit was good. Table 4 compares observed and predicted choice frequencies.

Scale Classes - Variance Heterogeneity

Variance heterogeneity in the estimated model was explained by age and the risk score from the risk questionnaire. The best model had two scale classes, one that exhibited 3.43 times more variability in underlying response than the other. The high variability group (52% of the sample) was more likely to be younger with a lower risk score, while the low variability group was older (Table 5). No other demographic/personal covariates were significant.

[Insert Table 5 about here]

Latent Classes - Preference Heterogeneity

We found seven latent preference classes where class membership was a function of a constant, an indicator for age and an indicator for low household income (<40K). Other

demographic and experience covariates were not significant when included as predictors in the estimation. Table 6 summarizes estimation results for the multinomial logit latent class model.

[Insert Table 6 about here]

Members of classes 2 and 7 were likely to be younger and members of classes 3, 4 and 5 were likely to be older. Household income was relevant to four classes: classes 1 and 6 where low incomes were prevalent and classes 4 and 5 where higher incomes were prevalent. Classes 4 and 5 were both characterized by both income (high) and age (old).

Posterior predictions of preference and scale class membership are shown in the bottom three rows of Table 6. The smallest preference group was class 6 (13 members) and the largest was class 5, with 237 members. High and low variance groups were fairly evenly distributed across the preference groupings.

Estimated Preferences

We used preference parameters for each class to estimate the probability that the members of a particular preference and scale group would choose a particular investment option. The predictions for the high variability groups are in Figure 1. Results for the low variability group were similar but showed probability more concentrated at the most preferred option for each preference group.

[Insert Figure 1 about here]

Each class favored one particular investment option, with distinct patterns by income and age. The low-income groups had conservative tastes, choosing 100% cash (class 1) and the

Retirement Savings Account (class 6) most often but also favoring nearby choices, such as the 75:25 portfolio. The older high-income group (class 4) was most likely to prefer 25:75 cash to stocks and neighboring options. Members of class 3, who were older but of no particular income range, preferred options with equal proportions of cash and stocks, which perhaps is regret minimization, or a (1/n) tendency to allocate equally between asset classes. Two different groups preferred the 100% allocation to stocks: class 5 who were older and high-income, and class 7, who were generally very young. Despite some common portfolio choices, these two groups had very different responses to risk and we examined the difference between these two groups further below.

Marginal Effects

Marginal changes in choice probabilities with respect to changes in net return and portfolio variance for the high variability group are in Table 7. (Estimated preference parameters for the low variability group were the same but marginal effects varied somewhat in size, but not in sign or significance.) Each cell in the top half of the table shows the predicted changes in the likelihood that any investment option (by class) was chosen as best in response to a one percentage point (100 basis point) increase in its own net annual return. Similarly, each cell in the bottom half of the table shows changes in choice probabilities of each investment option (by class) for a five percentage point (500 basis point) increase in its own annual volatility.

[Insert Table 7 about here]

Marginal effects differed by scale and class. Members of class 1, who were low income, responded negatively to higher returns and had no significant response to risk. Class 2 members, who were very young, tended to favor high cash weights, preferred higher returns and disliked risk, implying that this group behaved consistently with standard portfolio theory. Similar behavior is seen in class 3, who appeared to prefer higher returns, but responded negatively to higher variance in options riskier than their favored 50:50 position, indicating regret minimization, or possibly following a 1/n rule over cash and stocks.

Classes 4 and 5, both of which were dominated by the over-45 year olds and higher income members, were risk-loving. The probability of choosing portfolios with the highest stock weights rose quite strongly for these classes as the range of possible terminal wealth values widened. This risk-loving behavior contrasts with younger members in class 7, who were willing to invest in the 100% stocks option, but responded negatively to increasing risk.

Cross Effects

The structure of the latent class model also allowed us to estimate cross effects; that is, we could measure the change in probability of choosing an investment option given a change in net return or variance displayed for one of the other investment options. Table 8 sets out a subset of these cross effects; it shows changes in probability of choosing the most preferred investment option for each class (shaded cell) for a one percentage point (100 basis point) increase in annual net return to each other investment option or a five percentage point (500 basis point) increase in annual volatility of other investment options. Only significant cross effects are shown.

[Insert Table 8 about here]

Respondents treated side-by-side options as substitutes. For example, we noted that members of preference class 4 (mainly older, high income respondents) tended to prefer higher returns and more risk, and were more likely to choose the 25:75 cash to stocks weighting than other options. Looking down the relevant column in Table 8 shows that members of class 4 regarded the 50:50 portfolio as a substitute for their most preferred investment option, lowering their probability of choosing the 25:75 portfolio when the 50:50 portfolio net return increased (-0.06 change in probability) and when the 50:50 portfolio variance increased (-0.13 change in probability).

This substitution effect with the next-nearest portfolio was evident for preference classes 2-5 and 7. There also were significant negative variance cross effects for classes 3, 4 and 5, showing that these respondents were more likely to move away from their most commonly chosen option if the variance of nearby investment options rose. The only other option with significant variance cross effects is class 7 which showed significant positive variance (risk averse) cross effects with the adjacent 25:75 option.

DISCUSSION

Our experimental survey results showed that the reaction of retirement savers to risk and return attributes differed significantly across our sample and was related to age and income level, while underlying variability (scale) was determined largely by the risk score from a screening questionnaire and age. In addition, respondents typically compared nearby

investment options when deciding on their most-preferred choice, and displayed cross effects consistent with their taste for net returns and their degree of risk aversion.

Young and low-income retirement savers were generally risk averse, and the most conservative investor groups were predominantly populated by the younger respondents. However we observed several groups made up of the very young and poor for whom preserving capital seemed to be a major concern and who also seemed susceptible to higher fees. It may be that these groups are inexperienced and have low financial literacy, and/or have low or particularly risky human capital to protect. Indeed, recent industry research confirms that many young investors exhibit unrealistic investment expectations, choosing conservative portfolios while anticipating high minimum rates of return, a disconnect that researchers attribute to inexperience (Hobbs 2009).

By contrast, older and higher-income retirement savers appeared more likely to react positively to increasing ranges of possible investment outcomes. There are a number of possible drivers for this counter-theoretical result: this group may be financially secure, still have large and valuable supplies of low risk human capital, be eligible for a defined benefit pension at retirement and/or have up to 20 years remaining in the work force and therefore a strong motive to leverage toward higher risk exposure in their financial asset portfolio. Since we limited the alternatives in our hypothetical choice menu to “long only” investments (as do retirement saving investment choice menus around the world), this group may be finding the 100% stocks portfolio a binding constraint and prefer more risk than we offered.

On the other hand, this group may be exhibiting overconfidence or optimism and underestimating the probability of low or high returns despite the information provided in the choice experiment on ranges of outcomes (Kahneman and Riepe 1998). If these choices represent recklessness or miscalculation of risk, they may be a real concern for policymakers as the retirement welfare of older members of defined contribution funds can be vulnerable to large negative shocks around the end of working life and early in retirement, as recent events in financial markets have shown.

Further, many participants prefer narrow regions in the portfolio space, mainly comparing two or three close alternatives. And a large minority of participants prefers the "bet each way," or possibly a 1/n approach, staying close to 50:50 allocations. Such investors would be likely to appreciate an investment menu that includes an equally-weighted portfolio. Nonetheless, a wide range of asset weights is needed to satisfy the range of preferences we observed here, rather than a large number of very similar alternatives.

We note that our ability to identify investment decisions as poor or appropriate is limited by our knowledge of respondents' background wealth and portfolio allocation, health status and bequest intentions, a problem we will address in future work with more comprehensive data. A further limitation is that some participants may view the contribution amount of $1,000 as small relative to wealth or income, and judge that speculation is optimal (Shefrin and Statman 2000). Similarly, participants may view the contribution as a "windfall" and therefore part of a different "mental account" to current income (Shefrin and Thaler 1988). These issues can be partially addressed in future research by calibrating the quantum of the

"hypothetical" contribution to actual contributions made by participants and their underlying pension assets.

In addition, respondents could have extrapolated exuberant stock market conditions of March 2007, favoring excessive risk. However, results from a repeat experiment in October 2008, following sharp declines in equity markets, showed consistently strong preference for risky investment choices despite a gloomy outlook (Bateman et al. 2009).

Despite limitations, these findings have important implications for policymakers, regulators and financial service providers who aim to assist individuals making complex retirement savings investment decisions. Policy responses could include a combination of financial literacy programs, improved disclosure requirements and better industry practices for the design and presentation of investment choice menus. For example, financial literacy programs should target the young and risk-tolerant members of our estimated high variability scale class and the group of very young and poorer retirement savers who appeared overly conservative in their investment choices. Under mandatory private retirement saving arrangements these "at risk" groups can be easily identified. Further, a short checklist for assessing actual investment choices against the risk/return features of non-retirement saving assets, human capital characteristics and health could identify retirement savers who may have made inappropriate investment choices. This would be more difficult under voluntary arrangements, as many "at risk" groups do not participate.

Providers should take care about how they present basic investment information. Australian pension funds must provide Product Disclosure Statements (PDS) summarizing

benefits, risks, costs, commissions, significant characteristics, dispute resolution, taxation implications and cooling off arrangements. However a typical PDS is long and complex, often over 200 pages. Many retirement savers have responded by choosing "not to choose:" more than 50% of pension assets in Australia are accumulating in "default" investment options. Regulators are pressing for simplified and short product disclosure documents.

Finally, descriptions of investment risk in communications to account holders should be explored further. The prevalent practice of describing risk as the probability of experiencing a negative return over a fixed time period ignores the range of "up-side" that seemed important to a large number of our survey participants, and also fails to convey the size (rather than the frequency) of possible negative returns. Descriptions of risk should be tied to consumers' own measures of retirement welfare, connecting with income or consumption security. We plan to investigate this connection and the variation of other key presentation features in future research.

ENDNOTES

[1] Many studies find that women have lower risk tolerance than men and/or are less likely to include risky assets in their portfolios (see, among others, Grable 2000; Hallahan, Faff and McKenzie 2003; Gerrans and Clark-Murphy 2004; Christiansen, Joensen and Rangvid 2006; and Clark and Strauss 2008). We did not find significant variation by gender.

[2] The background text is available as an appendix to Bateman et al (2009) http://www.censoc.uts.edu.au/researchoutput/BILST_May09.pdf.

[3] Return and risk attributes for each option were bootstrapped from a sample of monthly time series running from July 1986 to March 2006 of the JP Morgan Australian Cash 12 months total return index (DataStream JPAU12L~A$), end-month and the Australia-DS Market total return index (DataStream TOTMKAU(RI)), end-month. We deflated using the ABS Private Consumption Deflator, quarterly, linearly interpolated to monthly frequency. Bootstrapped monthly returns were accumulated to 10 year gross returns.

[4] Fees are typical of those from Product Disclosure Statements (PDS) of major Australian retail superannuation funds. The major types of fees on retail accumulation accounts could include: contribution fees; management or investment fees; administration or member fees; switching fees; and ongoing payments to financial advisers.

[5] Fee ranges used here were the least and highest fees charged on Conservative, Moderately Conservative, Balanced, Moderately Aggressive, and Aggressive investment funds offered for

accounts under $100,000 in the AMP Flexible Lifetime Super Product Disclosure Statement, Part 2, Issue 3, 3 September 2005.

[6] Our tests suggest that leaving out these respondents does not introduce bias but estimation for the full sample of 819 respondents appears less efficient.

[7] The instrument is published (with disclaimers) as a self-administered questionnaire in conjunction with product disclosure statements for AMP's retail superannuation products at

https://www.amp.com.au/wps/amp/au/FileProxy?vigurl=/vgn-ext-templating/fileMetadataInterface?ids=c3e21bfd94922210VgnVCM10000083d20d0aRCRD.

[8] We aimed to identify respondents who voluntarily insure cars and houses against accidental loss. Insurance against losses to third parties due to car accidents is compulsory in Australia; however, in common speech this is called "third party" or "green slip" insurance and the term "car insurance" usually means comprehensive non-compulsory accident insurance. Positive responses on home insurance included mortgagees (who must insure) as well as the voluntarily insured. The higher proportion of positive responses to the question on home insurance (68.8%) compared with those who reported owning their own homes (53.9%) is likely due to a narrow interpretation of "homeownership" by some, i.e., interpreting "home ownership" as being mortgage-free, or that renters who own investment properties hold home insurance but do not classify themselves as "homeowners," or confusion with home contents insurance.

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TABLE 1:
Choice Set Template

	Investment options for you to consider for a $1,000 contribution					
	100% cash	75% cash 25% shares[a]	50% cash 50% shares	25% cash 75% shares	100% shares	Retirement Savings Account
Key Features after 10 years						
Likely worst case accumulation	$1450	$1500	$1550	$1700	$600	$1140
Expected (average) accumulation	$1675	$1950	$2250	$2550	$2800	$1140
Likely best case accumulation	$2000	$2450	$3150	$3500	$15800	$1140
Investment management fee (%)	1.75%	1.95%	2.20%	2.40%	2.20%	0%
1. Which investment option would you be most likely to choose? (tick one)	☐	☐	☐	☐	☐	☐
2. Which investment option would you be least likely to choose? (tick one)	☐	☐	☐	☐	☐	☐

a. Equity securities or stocks are commonly called "shares" in Australia.

TABLE 2:

Attribute Levels

Key Features		100% cash	75% cash 25% stocks	50% cash 50% stocks	25% cash 75% stocks	100% stocks	Retirement Savings Account
Risk Range of terminal wealth values	1	1450-2000	1300-3050	1100-4000	800-8400	600-15800	1140
	2	1500-1850	1500-2450	1350-3400	1200-4700	1000-6250	1140
	3	1550-1800	1600-2350	1550-3150	1400-4100	1300-5350	1140
	4	1600-1750	1700-2200	1750-2800	1700-3500	1700-4300	1140
'Average'		1675 (5.3%)	1950 (6.9%)	2250 (8.4%)	2550 (9.8%)	2800 (10.8%)	1140 (1.3%)
Investment management fees	1	1.75%	1.90%	1.85%	2.25%	2.20%	0%
	2	2.00%	1.95%	2.00%	2.30%	2.30%	0%
	3	2.10%	2.10%	2.20%	2.35%	2.40%	0%
	4	2.20%	2.15%	2.30%	2.40%	2.60%	0%

TABLE 3:

Demographic and Personal Characteristics of the Sample (n = 693)

Characteristic	% sample
Gender	
Female	48.1
Male	51.9
Age	
18-24 years	12.1
25-34 years	31.0
35-44 years	22.9
45-54 years	20.3
55-64 years	13.3
65 years and over	0.3
Marital status	
Single	27.1
Living with partner	9.5
Married/de facto	55.0
Widowed	1.4
Separated/divorced	6.9
Children <18 years	41.8
Age of children	
0-2 years	30.0
3-5 years	24.1
6-9 years	29.3
10-14 years	40.6
15-18 years	29.3
Education	
Some Secondary	7.3
4 years Secondary	11.4
High School Graduate	17.3
Technical-Vocational	20.2
College (undergraduate)	27.1
Other college	6.2
Postgraduate	10.4
Employment	
Full-time	53.8
Part-time	21.1
Not working	21.1
Full-time student	4.0
Occupation	
Professional	25.0
Manager	9.7
Administrator	9.5
Small business owner	6.1
Sales	5.8
Clerical/service	12.34
Transport	2.0
Labourer	3.2
Tradesperson	3.9
Home duties	11.1

Characteristic	% sample
Household income	
Less than $20,000	5.5
$20,001-$40,000	12.7
$40,001-$60,000	17.8
$60,001-$90,000	24.4
$90,001-$120,000	16.5
$120,001-150,000	11.1
$150,001-$180,000	4.8
$180,001-$210,000	3.2
$210,001-$240,000	1.0
Over $240,000	3.2
Type of residence	
House	75.1
Duplex	1.3
Semi-detached	1.8
Apartment/condominium	17.0
Townhouse	4.8
Home owner (Yes)	55.3
Automobile (car) owner (Yes)	87.8
Own Investment property (Yes)	19.2
Non-retirement investments	
Yes	66.4
No, but considering	26.0
No, not interested	7.6
Non-retirement stock investment	
Yes	43.2
No, but considering	40.1
No, not interested	16.7
Ownership of financial assets	
Real estate/property	21.7
Stocks/shares	42.3
Futures	2.2
IPOs	4.0
Warrants	1.1
Mutual funds	20.6
Commodities	1.4
Savings accounts	78.5
Other	11.1
Risk Score	
Conservative investors	2.0
Moderately conservative	17.3
Balanced investors	77.2
Moderately aggressive	3.5
Aggressive investors	0.0
Internet banking (yes)	89.8
Internet shopping (yes)	70.4
Internet auctions (yes)	60.8

Retired	7.4	**Internet gambling (yes)**	10.1
Unemployed	4.0	**Home insurance(yes)**	68.5
		Automobile (car) insurance(yes)	78.2
		Insurance[b] – premium bonus(yes)	71.4

a. A 'no-claim' or premium bonus is a premium reduction automatically made to purchasers of automobile (car) accident insurance who do not file claims over a fixed period.

TABLE 4:
Observed and Predicted Most Likely and Least Likely Choices

	Investment option						
	100% cash	**75:25**	**50:50**	**25:75**	**100% stocks**	**RSA**	**Total**
"Most likely"							
Total count:	588	1192	2082	3405	3713	188	11168
Proportions:							
observed	0.05	0.11	0.19	0.30	0.33	0.02	1.0
predicted	0.05	0.11	0.19	0.30	0.33	0.02	1.0
"Least likely"							
Total count:	1661	434	480	637	1367	6589	11168
Proportions:							
observed	0.15	0.04	0.04	0.06	0.12	0.59	1.0

TABLE 5:
Multinomial Logit Estimates of Scale Factor Classes

	Class 1, λ = 1	**Class 2, λ = 3.43***
	Coefficient	Coefficient
Intercept	0.6928*	-0.6928*
Age: under 24	0.0892	-0.0892
Age: 25-44	0.0273	-0.0273
Age: 45-65	-0.1165*	0.1165*
Risk Score (/100)	-1.936*	1.936*
Membership as % of sample	52	48

Note: Estimation results of the probability that an individual is a member of each scale class where higher values of λ indicate less variability.

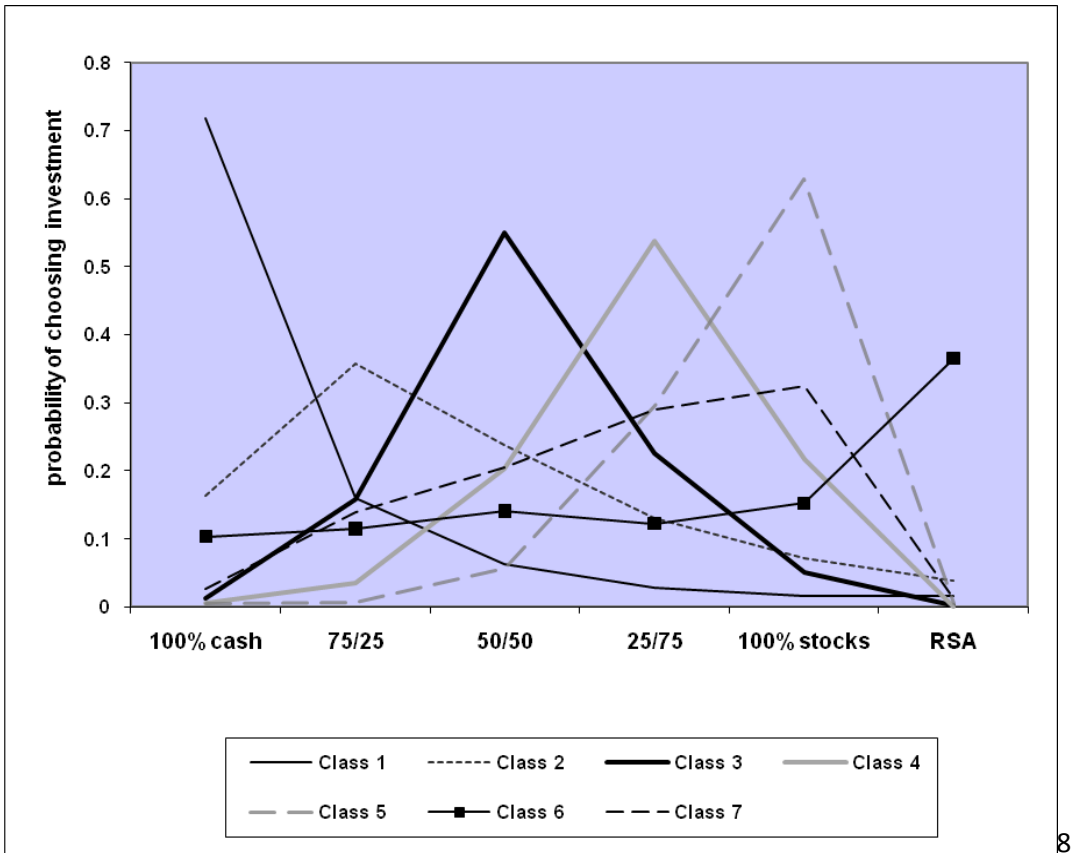
**p<0.1*.

TABLE 6:
Multinomial Logit Estimates of Preference Classes

	Estimated Coefficient						
	Class 1	***Class 2***	***Class 3***	***Class 4***	***Class 5***	***Class 6***	***Class 7***
Intercept	-0.8875*	0.5667*	0.1966	0.5359*	1.0446*	-1.4101*	-0.0461
Age: under 24	0.2489	0.3638*	-0.4382*	-0.3535	-0.3153*	0.0412	0.4531*
Age: 25-44	0.0337	-0.5147*	0.1903	0.0044	0.1089	0.1127	0.0647
Age: 45-65	-0.2826	0.1509	0.2478	0.3491*	0.2064	-0.1539	-0.5178*
Income≤40k	0.336*	-0.099	-0.0695	-0.3114*	-0.2357*	0.5366*	-0.1569
Income>40k	-0.336*	0.099	0.0695	0.3114*	0.2357*	-0.5366*	0.1569
Membership % of sample	3%	16%	14%	21%	34%	2%	10%
Members by scale class							
High variability (class 1)	11	64	58	76	104	6	35
Low variability (class 2)	12	44	39	72	133	7	32

Note: Estimation results of the probability that an individual is a member of each preference class. *$p<0.1$.

FIGURE 1:
Investment Choice Probabilities by Preference Class



Note: Graphs show estimated average probability of choice of investment option from the menu of possibilities for each preference class where scale parameter λ=1 (that is the high variability group). Results for the second scale group show the same preferred option but a higher concentration of probability at the most preferred option and are not separately reported.

TABLE 7:
Marginal Change in Choice Probability

	Significant Marginal effect, λ = 1						
	Class 1	***Class 2***	***Class 3***	***Class 4***	***Class 5***	***Class 6***	***Class 7***
Attribute							
net return							
100% cash	**-0.55**	0.12				-0.23	
75:25 c/s		**0.10**	0.35	-0.15	-0.03		
50:50 c/s		0.07		0.08	0. 03	0.26	0.07
25:75 c/s							0.27
100% stocks		0.09	0.11				
Variance							
100% cash						2.34	
75:25 c/s			0.14	0.14			
50:50 c/s				0.19	0.06		-0.18
25:75 c/s		-0.04	-0.04	**0.10**	0.08		-0.22
100% stocks				0.08	**0.11**		**-0.21**

Note: Significant marginal effects are reported, with the marginal changes relating to the most probable investment option for each preference class in bold typeface. Marginal effects significant at the 10% level or less are shown. Results for the second scale group are very similar and are not reported separately here.

TABLE 8:
Marginal Change in Choice Probability, Cross effects

	Significant Marginal effect λ = 1						
	Class 1	***Class 2***	***Class 3***	***Class 4***	***Class 5***	***Class 6***	***Class 7***
Attribute							
net return							
100% cash		-0.05				0.09	
75:25 c/s			-0.23	0.08	0.02		
50:50 c/s		-0.03		-0.06	-0.02	-0.11	-0.05
25:75 c/s							-0.04
100% stocks		-0.04	-0.07				
RSA							
Variance							
100% cash						-0.38	
75:25 c/s			-0.09	-0.08			
50:50 c/s				-0.13	-0.04		0.07
25:75 c/s			0.03		-0.08		0.10
100% stocks				-0.06			
RSA							

Note: Shaded cells indicate most commonly chosen option for each preference class. Marginal effects significant at the 10% level or less are shown. Results for the second scale group are very similar and are not reported separately here.